Density – 2023 IGCSE 0625 Physics

1. Nov/2023/Paper_ 0625/11/No.5

A student has a bottle of cooking oil.

She determines the density of the cooking oil.

Which apparatus does she need?

	balance	measuring cylinder	ruler	thermometer
A	✓	✓	✓	✓
B	✓	✓	✓	✗
C	✓	✓	✗	✗
D	✓	✗	✗	✗

key
✓ = needed
✗ = not needed

$\rho = \frac{m}{V}$

Mass – use balance

Volume – use measuring cylinder.

– Ruler and thermometer not used for density determination.

2. Nov/2023/Paper_ 0625/12/No.5

Which equation is correct?

A density = mass × volume

B density = weight × volume

C mass = density × volume

D weight = density × volume

$\rho = \frac{m}{V}$

$m = \rho \times V$

$V = \frac{m}{\rho}$

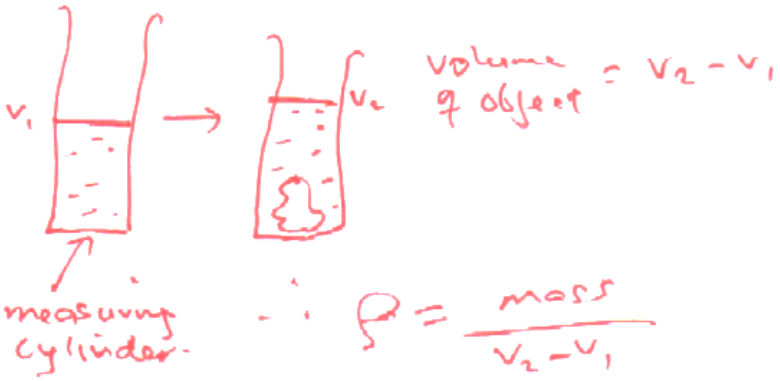
3. Nov/2023/Paper_ 0625/13/No.5

A student carries out an experiment to determine the density of an irregularly shaped solid. The solid is placed on a balance and a reading is taken. The solid is then immersed in a liquid in a measuring cylinder.

Which values should be used in the calculation?

	value from measuring cylinder	value from balance
A ✓	increase in reading after immersion of the solid	mass
B	increase in reading after immersion of the solid	weight
C	reading after immersion of the solid	mass
D	reading after immersion of the solid	weight

$\rho = \frac{m}{V}$



4. Nov/2023/Paper_ 0625/22/No.4

A plastic ball has a mass of 4.0 g and a volume of 20 cm^3.

There is a crack in the ball's surface.

The ball is placed in a bath of water. Water leaks into the ball without changing the volume of the ball and eventually the ball sinks.

The density of water = 1.0 g / cm^3.

mass = $\rho \times V$
$= 1.0 \times 20$
$= 20$ g of water + ball

$\therefore m_w = 20 - 4$
$= 16$ g

Which mass of water has entered the ball when the top of the ball is first level with the water surface?

A 5.0 g B ✓ 16 g C 20 g D 24 g

5. Nov/2023/Paper_ 0625/31/No.2(a)

The mass of a solid metal cylinder is 400 g and its volume is 52 cm^3.

(a) Calculate the density of the metal. Include the unit.

$\rho = \frac{m}{V}$

$= \frac{400\,g}{52\,cm^3}$

$= 7.7\,g/cm^3$

density = $7.7\ g/cm^3$ [4]

6. Nov/2023/Paper_ 0625/33/No.3(b, c)

The mass of a glass bottle is 0.18 kg.

(b) The bottle contains 2.7 kg of cooking oil. The density of the cooking oil is 0.92 g/cm^3.

Calculate the volume of the cooking oil.

$V = \frac{m}{\rho}$

$= \frac{2.7 \times 1000}{0.92}$

$V = 2934\ cm^3$

$\approx 2900\ cm^3$

volume = ... 2900 ..... cm^3 [4]

(c) A cookery student pours some cooking oil into a glass bowl containing water, as shown in Fig. 3.1.

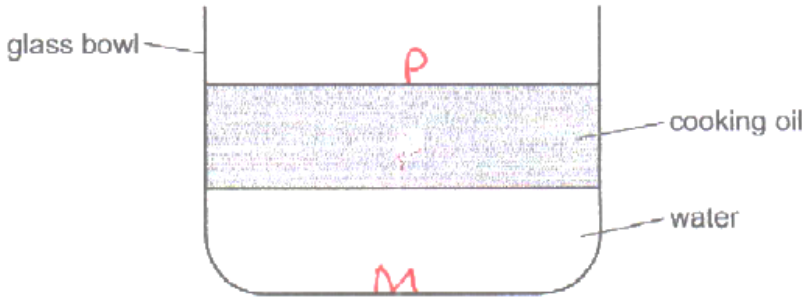


Fig. 3.1

The student accidently drops a plastic spoon and a metal spoon into the bowl.
The densities of the spoons and liquids are shown in Table 3.1.

Table 3.1

material	density / g/cm^3
plastic spoon	0.76
metal spoon	8.7
cooking oil	0.92
water	1.0

- Plastic spoon will float on the oil
- Metal spoon will sink to bottom of water.

On Fig. 3.1, label a suggested position for each spoon after each has fallen into the bowl.

Use the letter P to label the position of the plastic spoon and the letter M to label the position of the metal spoon. [2]

7. Nov/2023/Paper_ 0625/43/No.1

(a) Oil of density 0.80 g/cm^3 is poured gently onto the surface of water of density 1.0 g/cm^3. The oil and the water do **not** mix.

Describe and explain the final position of the oil relative to the water.

description oil stays on the surface of water.

explanation oil density is lower than that of water so it will float on wate

[2]

(b) An irregularly shaped solid object has a density of 2.7 g/cm^3.

(i) Describe a method to measure the volume of the irregularly shaped solid object.

- Measure initial of water in measuring cylinder, then immerse the object.
- Subtract the final volume of water and the initial volume.

[2]

(ii) The volume of the object is 83 cm^3.

Calculate the mass of the object.

$\rho = \frac{m}{V}$

$m = \rho \times V$

$= 2.7\ g/cm^3 \times 83\ cm^3$

$= 224.1$

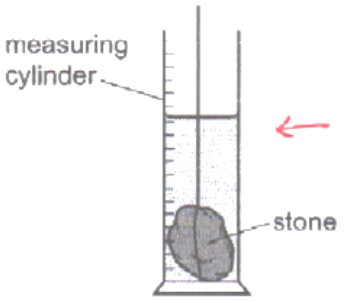
$\approx 220\ g$

mass = 220 g [3]

[Total: 7]

8. June/2023/Paper_0625/11/No.6

A student determines the density of an irregularly shaped stone. The stone is slowly lowered into a measuring cylinder partly filled with water.



← Volume of Irregular Stone = $V_2 - V_1$

V_1 = volume of water before stone is submerged

V_2 = volume after stone is submerged.

Which other apparatus does the student need to calculate the density of the irregularly shaped stone?

A ✓ a balance

B a thermometer

C a metre rule

D a stop-watch

$\rho = \frac{m}{V}$

- To determine density, mass of stone is also required.
- Mass is measured using a balance

9. June/2023/Paper_0625/12/No.5

Which two quantities must be known to determine the density of a material?

A mass and area

B ✓ mass and volume

C weight and area

D weight and volume

$\rho = \frac{m}{V}$

$\text{density} = \frac{\text{mass}}{\text{volume}}$

- So mass of object and its volume are required to calculate objects density.

10. June/2023/Paper_0625/13/No.5

A measuring cylinder containing 50 cm^3 of water is put on a balance.

A solid object is put in the cylinder and the water level rises to 75 cm^3.

What is the density of the object?

A 0.80 g/cm^3 B 2.4 g/cm^3 C 2.8 g/cm^3 D 8.4 g/cm^3

$\rho = \frac{m}{V}$

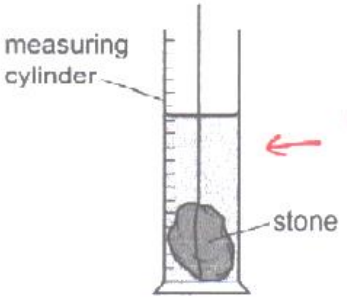
$m = 210g - 150g$
$= 60g$

$V = 75\,cm^3 - 50\,cm^3$
$= 25\,cm^3$

$\rho = \frac{60g}{25\,cm^3}$
$= 2.4\,g/cm^3$

11. June/2023/Paper_0625/21/No.6

A student determines the density of an irregularly shaped stone. The stone is slowly lowered into a measuring cylinder partly filled with water.



← This method determine volume of stone by displacement method.

Which other apparatus does the student need to calculate the density of the irregularly shaped stone?

A a balance
B a thermometer
C a metre rule
D a stop-watch

density = $\frac{mass}{volume}$

So mass of the stone is measured using a balance.

12. June/2023/Paper_0625/22/No.6

Which two quantities must be known to determine the density of a material?

A mass and area

B mass and volume ✓

C weight and area

D weight and volume

$\rho = \frac{m}{V}$

– mass and volume of the substance.

13. June/2023/Paper_0625/32/No.1(b)

A student measures the diameter of some identical steel balls. Fig. 1.1 shows the arrangement she uses.

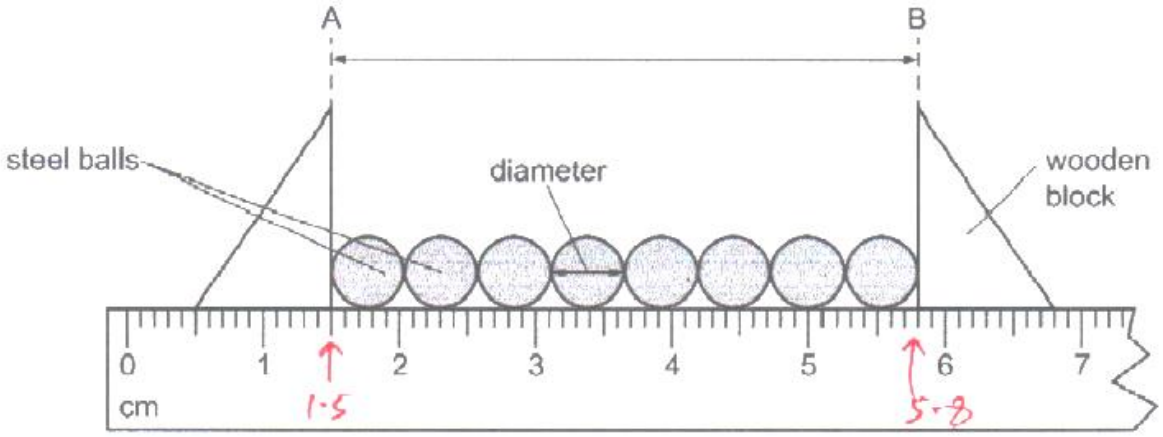


Fig. 1.1 (not to scale)

(b) The mass of some steel balls is 54 g and the total volume of these steel balls is 6.9 cm^3.

Calculate the density of the steel.

$\rho = \frac{m}{V}$

$= \frac{54\,g}{6{\cdot}9\,cm^3}$

$= 7{\cdot}8\,g/cm^3$

density of steel = 7·8 g/cm^3 [3]

[Total: 7]

Electricity – 2023 IGCSE 0625 Physics

1. Nov/2023/Paper_ 0625/11/No.26

Which statement about a voltmeter is correct?

A It has a scale which is marked in amperes (A).
B It must be connected in series in a circuit.
C ✓ It measures potential difference (p.d.).
D It must have three terminals.

- Voltmeter measures voltage eg p.d - emf.
- Usually connected parallel a device in circuit

2. Nov/2023/Paper_ 0625/11/No.27

How does the resistance of a metallic wire change:

- as its length increases
- as its cross-sectional area decreases?

$R = \frac{\rho \times l}{A}$

- Long resistor has more resistance
- A thicker resistance has lower resistance.

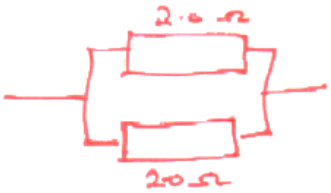
	resistance as length increases	resistance as cross-sectional area decreases
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D ✓	increases	increases

3. Nov/2023/Paper_ 0625/11/No.29

Two 2.0 Ω resistors are connected in parallel.

What is the combined resistance of the resistors?

A ✓ less than 2.0 Ω
B exactly 2.0 Ω
C more than 2.0 Ω, but less than 4.0 Ω
D exactly 4.0 Ω



$R_T = \frac{2 \times 2}{2+2}$

$= \frac{4\Omega}{4}$

$= 1\Omega$

1.0 Ω is less than 2.0 Ω.

4. Nov/2023/Paper_ 0625/11/No.30

An electric heater is plugged into the mains supply using a fused plug.

The current in the heater is 10 A. ← fuse rating to higher than 10 A.

The cable attached to the heater is rated at 15 A.

A fuse with less rating will blow immediately

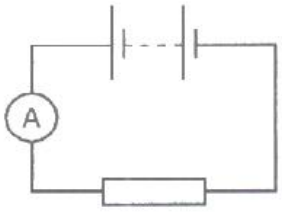
The fuses available are rated at 1.0 A, 3.0 A, 5.0 A and 13 A.

Which fuse should be used?

A 1.0 A B 3.0 A C 5.0 A (D) ✓ 13 A

5. Nov/2023/Paper_ 0625/12/No.25

A battery is connected to an ammeter and a resistor.



The ammeter reading is 0.20 A.

An electrical insulator is connected in parallel with the resistor.

What is the ammeter reading?

A 0 A

B between 0 A and 0.20 A

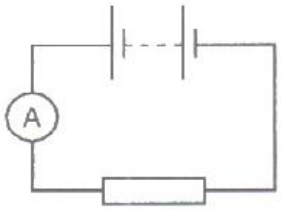
(C) ✓ 0.20 A

D greater than 0.20 A

Insulator will allow no current to pass through, so does not affect the overall circuit resistance, so same value of current flows.

6. Nov/2023/Paper_ 0625/12/No.25

A battery is connected to an ammeter and a resistor.



The ammeter reading is 0.20 A.

An electrical insulator is connected in parallel with the resistor.

What is the ammeter reading?

A 0 A

B between 0 A and 0.20 A

C 0.20 A ✓

D greater than 0.20 A

Insulator will allow no current to pass through, so does not affect the overall circuit resistance, so same value of current flows.

7. Nov/2023/Paper_ 0625/12/No.26

Which unit is used to measure electromotive force (e.m.f.)?

A ampere ← current

B joule ← energy

C volt ✓

D watt ← power.

↑ voltage, unit is volts.

8. Nov/2023/Paper_ 0625/12/No.27

Which equation is correct for resistance R, potential difference (p.d.) V and current I?

A $R = \frac{V}{I}$ ✓ B $R = V + I$ C $R = \frac{I}{V}$ D $R = V \times I$

$V = IR$

$R = \frac{V}{I}$

9. Nov/2023/Paper_ 0625/12/No.29

In which heating system circuit would thermistors **not** be useful?

A to keep different rooms at different temperatures

B to turn an alarm on if the system overheats

C to turn a heating system off at a particular temperature

D ✓ to turn a heating system on when a sound is detected

- Thermistor is a temp dependant resistor.
- Can be used as a sensor for temp variations.

10. Nov/2023/Paper_ 0625/12/No.30

Which statement is correct?

A A fuse is included in a circuit to prevent the current becoming too high.

B A fuse should be connected to the neutral wire in a plug. ← live wire

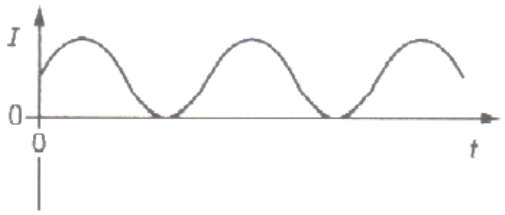
C An electric circuit will only work if it includes a fuse. ← not necessarily

D An earth wire is needed to prevent the fuse blowing. ← Earth wire used to prevent metal casing devising becoming live.

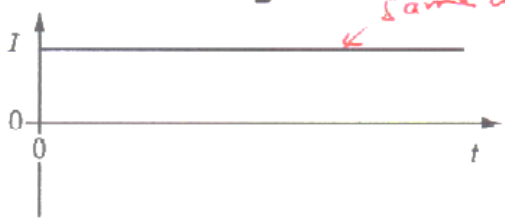
11. Nov/2023/Paper_ 0625/12/No.31

Which graph of current I against time t represents an alternating current (a.c.)?

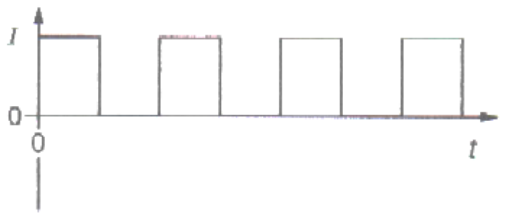
A



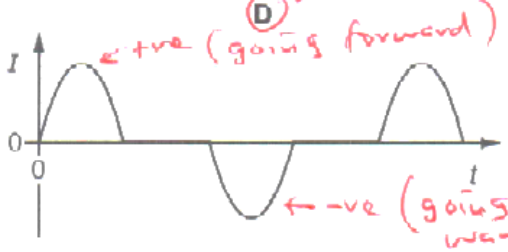
B



C



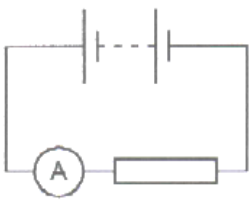
D



12. Nov/2023/Paper_ 0625/13/No.25

A student uses an ammeter to measure the current in a resistor. He considers three different circuits, as shown.

1



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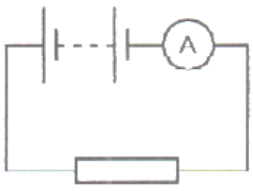
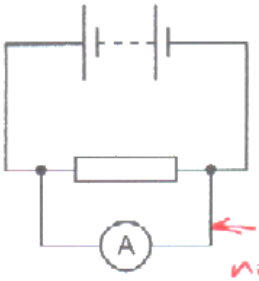


3



Ammeter is to be connected in Series with resistor

← this is not correct

In which of the circuits does the ammeter measure the current in the resistor?

A 1, 2 and 3 B 1 and 2 only C 1 only D 3 only

13. Nov/2023/Paper_ 0625/13/No.26

Which substances both contain large concentrations of free electrons?

A aluminium and glass

B copper and water

C copper and nylon

D silver and gold ✓

↑ metals have the largest number of electrons, referred to as a sea of delocalised electrons

14. Nov/2023/Paper_ 0625/13/No.27

What is the unit of resistance?

A ampere ← current

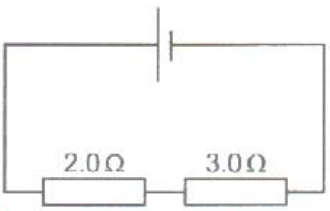
B ohm ✓

C volt ← p.d or emf (voltage)

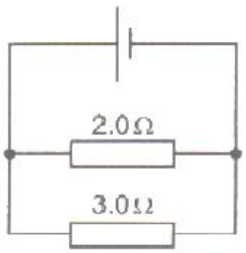
D watt ← Power.

15. Nov/2023/Paper_ 0625/13/No.29

Resistors of resistance 2.0Ω and 3.0Ω are connected in two different circuits.



$R_T = 2 + 3 = 5.0\ \Omega$



$R_T = \frac{2 \times 3}{2 + 3}$

$= \frac{6}{5}$

$= 1.2\ \Omega$

What is the total resistance in each circuit?

	series	parallel
A	less than 2.0Ω	less than 2.0Ω
B	less than 2.0Ω	greater than 3.0Ω
C ✓	greater than 3.0Ω ✓	less than 2.0Ω ✓
D	greater than 3.0Ω	greater than 3.0Ω

16. Nov/2023/Paper_ 0625/13/No.30

The current in an electrical heater is 5.0 A.

The heater is connected to the mains by a flexible cable that can carry a current of up to 15 A.
The mains circuit can carry a current of up to 30 A.

Different fuses are available to protect the heater's cable.

Which fuse is the most suitable?

A 4.0 A B 10 A ✓ C 20 A D 40 A

heater current = 5.0 A
So fuse rating to above 5.0 A but not too high.

17. Nov/2023/Paper_ 0625/21/No.26

Which statement about a voltmeter is correct?

A It has a scale which is marked in amperes (A).

B It must be connected in series in a circuit.

C ✓ It measures potential difference (p.d.).

D It must have three terminals.

Voltmeter connected in parallel will measure voltage (p.d, emf) across a device.

18. Nov/2023/Paper_ 0625/21/No.27

A wire has a resistance of 8.0 Ω.

A second wire of the same material has twice the length and twice the cross-sectional area.

What is the resistance of the second wire?

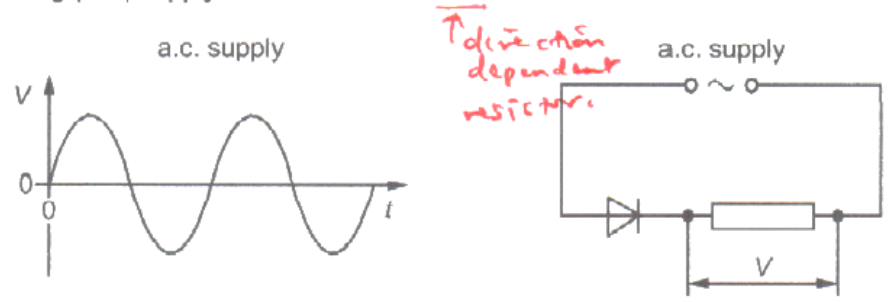
$R = \frac{\rho \times l}{A}$; $R_2 = \frac{\rho \times 2l}{2A} = \frac{\rho \times l}{A}$ | $\therefore R_2 = R$

$= 0.8\ \Omega$

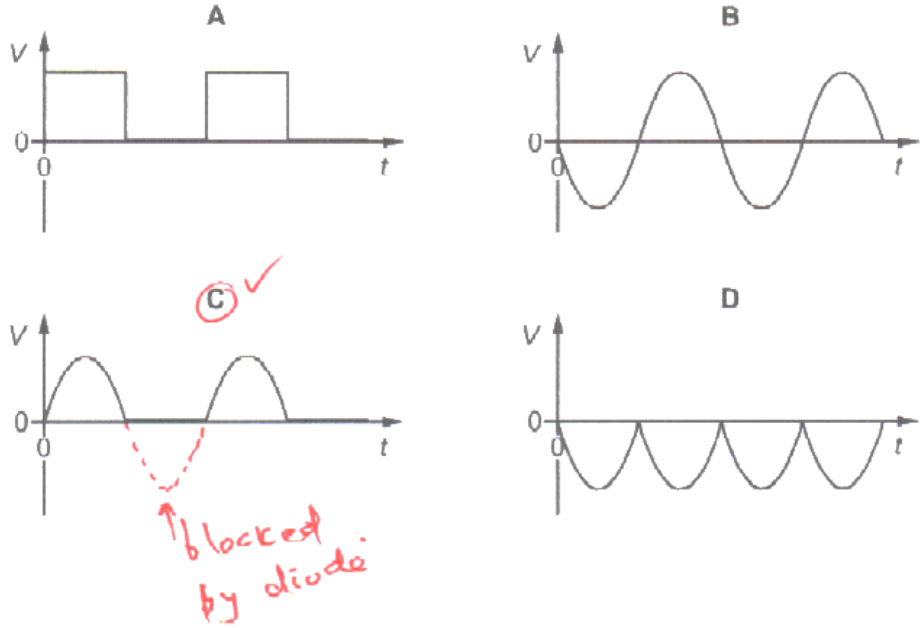
A 4.0 Ω B 8.0 Ω ✓ C 16 Ω D 32 Ω

19. Nov/2023/Paper_ 0625/21/No.29

An alternating (a.c.) supply is connected to a diode and a resistor in series.



Which graph shows how the potential difference V across the resistor varies with time t?

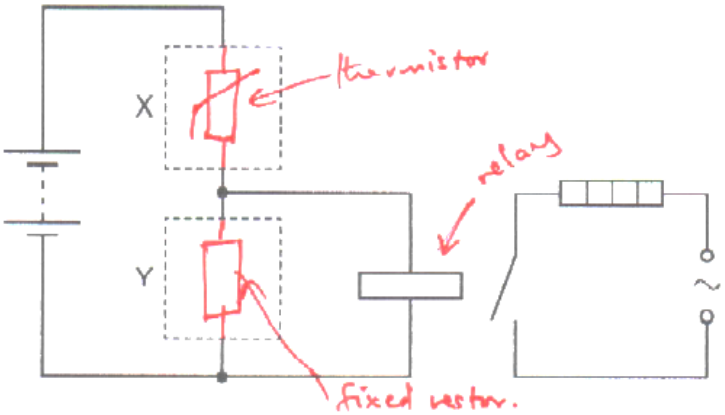


- The diode will block the black ward (reverse) flow of alternating voltage and only allow the forward flow.

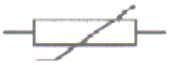
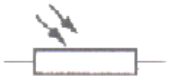
20. Nov/2023/Paper_ 0625/21/No.30

The diagram shows a circuit used to switch on a heater when the temperature drops below a certain value.

↑ thermistor is required

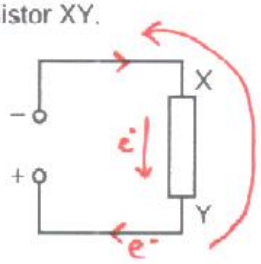


Which row shows the components that should be connected at X and at Y?

	X	Y
A		
B ✓		
C		
D		

21. Nov/2023/Paper_ 0625/22/No.25

A power source is connected to a resistor XY.



Conventional current

In which directions are the conventional current and the flow of free electrons through the resistor?

	conventional current	free electron flow
A	X to Y	X to Y
B	X to Y	Y to X
C	Y to X	X to Y
D	Y to X	Y to X

- Electrons flow from -ve to the terminals of the power source.
- Conventional current flow is from +ve to -ve.

22. Nov/2023/Paper_ 0625/22/No.26

Which unit is used to measure electromotive force (e.m.f.)?

A ampere ← current unit

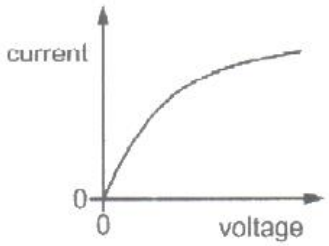
B joule ← energy unit

C volt ✓

D watt ← power unit

23. Nov/2023/Paper_ 0625/22/No.27

The graph shows the current–voltage characteristic for a filament lamp.



$R = \frac{V}{I}$

$R \propto V$

Which statement describes how the resistance of the lamp changes as the voltage increases?

A The resistance decreases to zero.

B The resistance decreases, but not to zero.

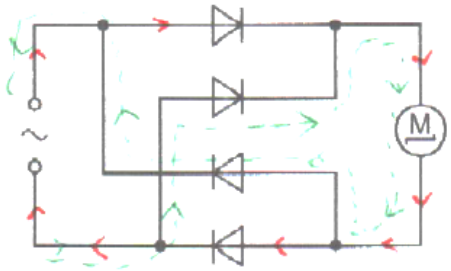
C The resistance increases. ✓

D The resistance remains constant.

As voltage increases, resistance will increase but current decreases.

24. Nov/2023/Paper_ 0625/22/No.29

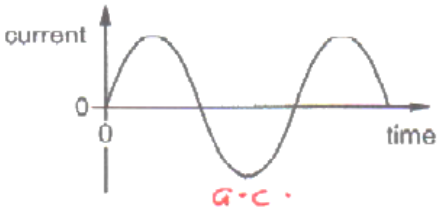
The circuit diagram shows a circuit used to run a d.c. motor from an a.c. supply.



- Diodes in the circuit converts a.c to d.c
- So current flow in one direction but it will be varying, will not be constant

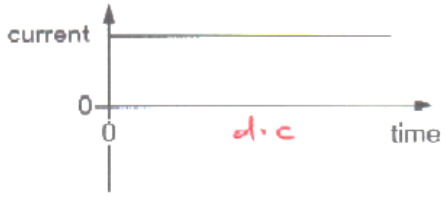
Which graph shows the current in the motor?

A



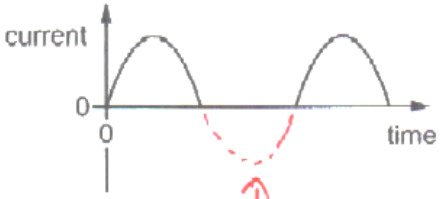
a.c.

B



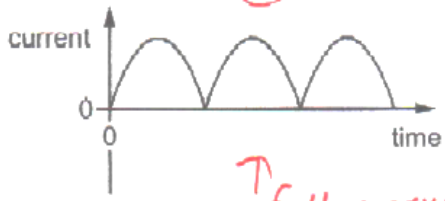
d.c

C



this uses only on diode to achieve $\frac{1}{2}$ wave rectification

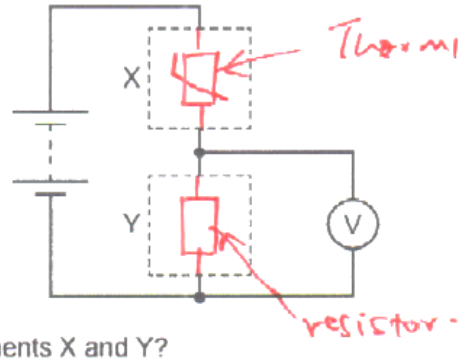
D ✓



full-wave rectification

25. Nov/2023/Paper_ 0625/22/No.30

The circuit shown can be completed by inserting components at X and at Y. The completed circuit is a potential divider in which the potential difference across component Y increases when the temperature increases.

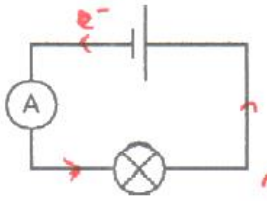


Which row shows the components X and Y?

	X	Y
A	light-dependent resistor	resistor
B	resistor	light-dependent resistor
C	resistor	thermistor
D ✓	thermistor	resistor

26. Nov/2023/Paper_ 0625/23/No.25

The diagram shows an electric circuit.



Electrons flow from -ve terminal of the cell to positive terminal
anti-clockwise

In which direction do free electrons flow around this circuit and what quantity does the ammeter measure?

	direction of electron flow	quantity measured by the ammeter
A ✓	anticlockwise	charge passing each point in the circuit per unit time
B	anticlockwise	total charge passing through the ammeter
C	clockwise	charge passing each point in the circuit per unit time
D	clockwise	total charge passing through the ammeter

measures current flowing in the circuit

$Q = I \times t$

$I = \frac{Q}{t}$

$I = \frac{\text{charge}}{\text{time}}$

27. Nov/2023/Paper_ 0625/23/No.26

Which substances both contain large concentrations of free electrons?

A aluminium and glass

B copper and water

C copper and nylon

D ✓ silver and gold ← All metals have a sea of delocalised electrons.

28. Nov/2023/Paper_ 0625/23/No.27

A resistance wire of length L melts and has to be replaced with a wire of the same material and the same resistance. The only wire available has twice the diameter of the broken wire.

Which length of this wire should be used?

A $\frac{L}{4}$ B $\frac{L}{2}$ C $2L$ D ✓ $4L$

$R = \frac{\rho L}{A} = \frac{\rho L}{\pi d^2}$

At $2d$, Area, $A = \pi\left(\frac{d}{2}\right)^2 = \frac{\pi d^2}{4}$

$R = \frac{\rho L_2}{\frac{\pi d^2}{4}}$

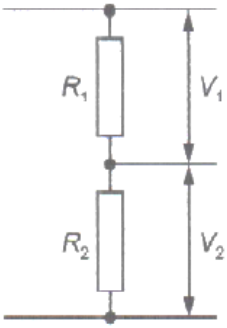
Equalise for same resistance

$\frac{\rho L_2}{\frac{\pi d^2}{4}} = \frac{\rho L}{\pi d^2}$

$L_2 = 4L$

29. Nov/2023/Paper_ 0625/23/No.29

Two resistors, with resistances R_1 and R_2, are used as a potential divider.



What is the relationship between R_1, R_2 and potential differences V_1 and V_2?

A $R_1 \times R_2 = V_1 \times V_2$

B $R_1 \times V_1 = R_2 \times V_2$

C $\frac{R_1}{R_2} = V_1 \times V_2$

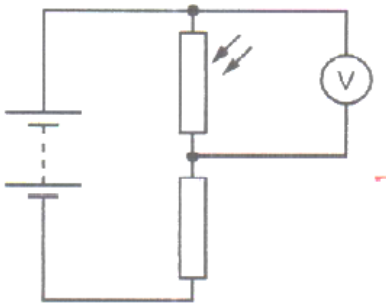
D ✓ $\frac{R_1}{R_2} = \frac{V_1}{V_2}$

The ratio of resistors is equal to ratio of p.d

$\therefore \frac{R_1}{R_2} = \frac{V_1}{V_2}$.

30. Nov/2023/Paper_ 0625/23/No.30

The diagram shows a light-dependent resistor (LDR) connected in a potential divider circuit.



- At bright light the LDR resistance decreases.
- Since $V = IR$, then when R decreases, voltage V will also decrease.

The brightness of the light falling on the LDR is increased.

Which row shows what happens to the resistance of the LDR and what happens to the reading on the voltmeter?

Same current I flows.
So $V \propto R$
V is proportional to R.

	resistance of LDR	reading on voltmeter
A ✓	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

31. Nov/2023/Paper_ 0625/23/No.31

A simple a.c. generator has a coil rotating in a magnetic field.

What happens to the peak electromotive force (e.m.f.) and to the frequency of the a.c. output when the coil is rotated faster?

	peak e.m.f.	frequency
A ✓	greater	greater
B	greater	no change
C	no change	greater
D	no change	no change

- At faster rotation, more emf will be induced, so peak is greater
- Frequency is number of rotations in a second.
- So more rotation will occur when speed is faster.

32. Nov/2023/Paper_ 0625/31/No.6(b)

Fig. 6.1 shows four wind turbines.

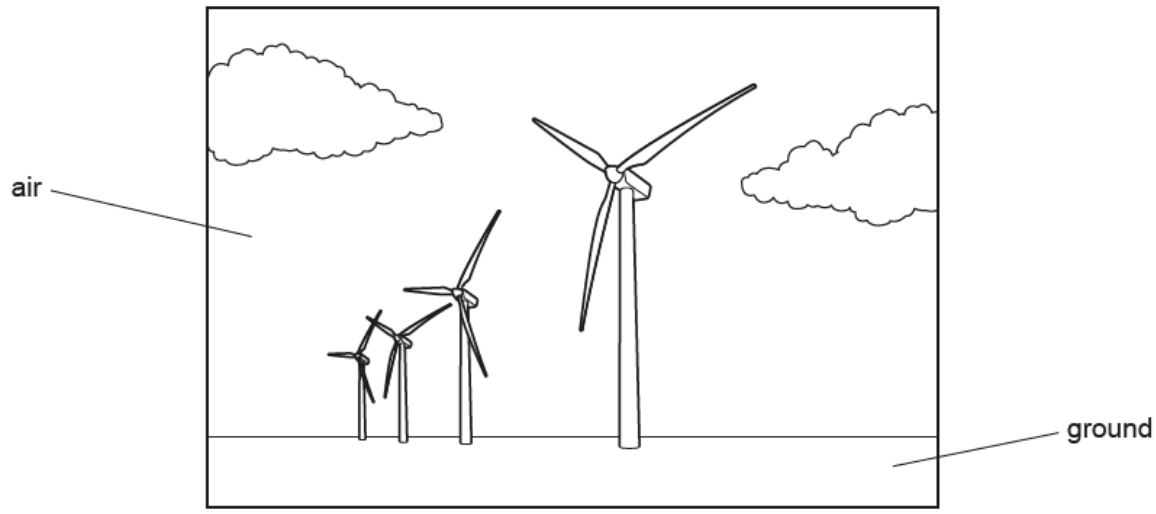


Fig. 6.1

(b) The electrical power output of a wind turbine is 624 kW. The output current is 520 A.

Calculate the output voltage of the wind turbine.

$P = V \times I$; $V = \frac{624 \times 10^3 W}{520 A}$

$V = \frac{P}{I}$; $= 1200 V$

output voltage = 1200 V [4]

(c) For transmission, the output voltage is increased to 132 kV.

State **two** advantages of transmitting electrical power at high voltage.

1 Thinner cables can be used so reducing cost gains

2 Lower current, so reduces power losses during transmission [2]

33. Nov/2023/Paper_ 0625/31/No.8

Fig. 8.1 shows a solenoid (long coil of wire) connected in a circuit. When the switch is closed, there is a large current in the circuit.

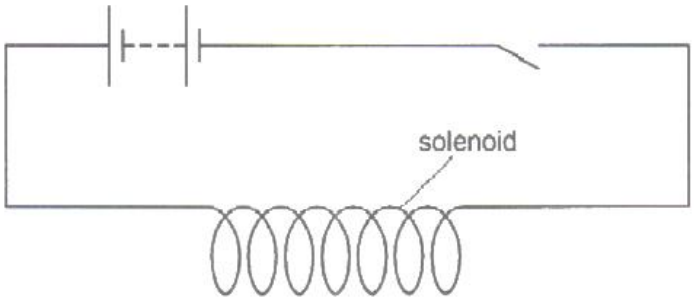


Fig. 8.1

(a) Describe an experiment to identify the pattern **and** direction of the magnetic field around the solenoid.

You may draw on Fig. 8.1 as part of your description.

- Place a sheet of paper over the Solenoid.
- Sprinkle iron fillings over the sheet of paper.
- Tap the paper to cause the filling to rearrange. [3]

(b) A solenoid P is placed close to another solenoid Q. Solenoid Q is connected to a sensitive voltmeter.
The arrangement is shown in Fig. 8.2.

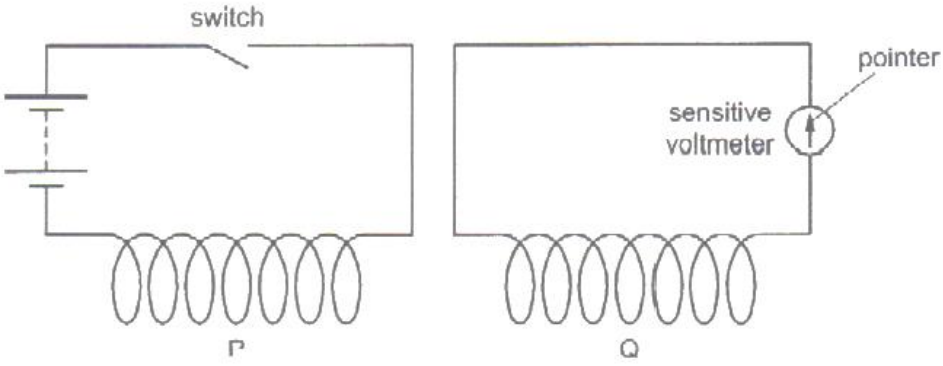


Fig. 8.2

Describe and explain what happens when the switch is closed.

- The pointer in voltmeter deflects and returns to zero again
- Current in P cause a changing magnetic field which linker to coil Q.
- This induces emf in Q, but when current in P is steady, the pointer returns to zero. [4]

[Total: 7]

34. Nov/2023/Paper_ 0625/31/No.9

A student investigates an electric circuit. Fig. 9.1 shows the student's circuit.

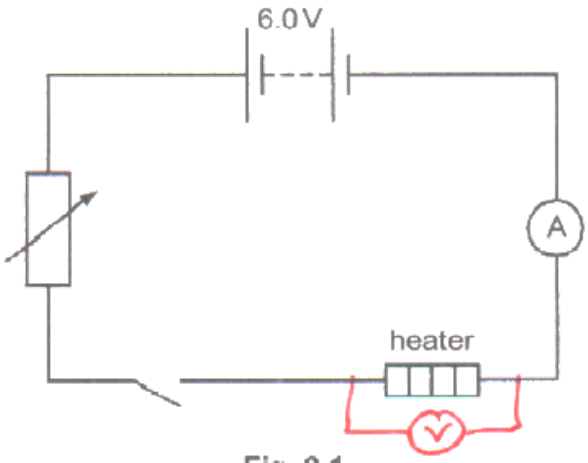


Fig. 9.1

(a) (i) Describe the purpose of the variable resistor in Fig. 9.1.

to change the current in the circuit flowing through the heater. [1]

(ii) The student uses cells with an electromotive force (e.m.f.) of 1.5V.

Determine the number of cells needed for the 6.0V battery in Fig. 9.1.

$\frac{6.0}{1.5}$ = 4 cells

number of cells needed = 4 [1]

(iii) The student connects another component to measure the potential difference (p.d.) across the heater.

On Fig. 9.1, draw the electrical symbol and connections for this component. [2]

(b) The p.d. across the heater is 4.0V. The current in the heater is 1.6A.

Calculate the energy transferred electrically by the heater in 40s.

$E = V \times I \times t$

$= 4 \times 1.6 \times 40$

$= 260\,J$

energy transferred = 260 J [3]

[Total: 7]

35. Nov/2023/Paper_ 0625/32/No.9

Fig. 9.1 shows an electric water heater. The heater is connected to the mains electrical supply.

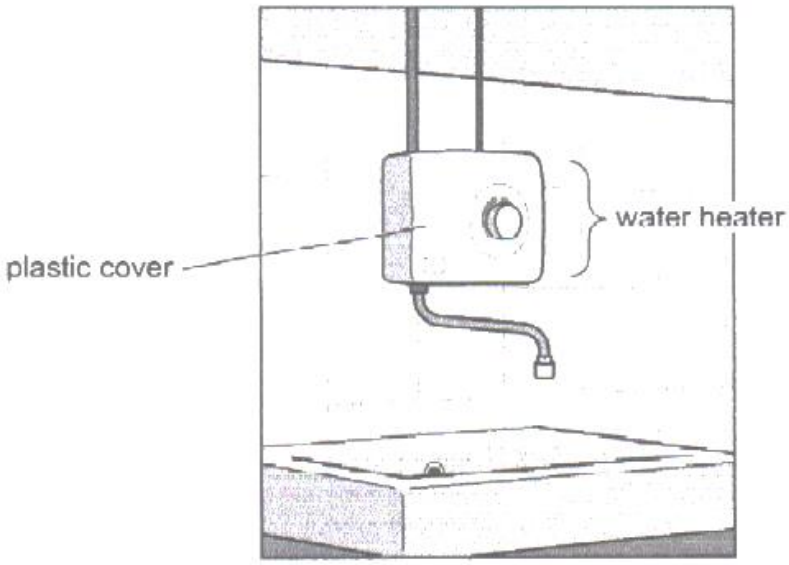


Fig. 9.1

Fig. 9.2 shows the electrical safety label for the heater.

Water Heater Model xxxxxx1
230 V (volts)
720 W (watts)
Disconnect from the mains supply before removing the plastic cover.

Fig. 9.2

(a) (i) Explain why the safety label states, 'Disconnect from the mains supply before removing the plastic cover.'

to prevent the risk of electric shock when a person touches. [1]

(ii) The heater is switched on.

Calculate the current in the heater. Use the information in Fig. 9.2.

$P = V \times I$

$I = \frac{P}{V}$

$= \frac{720\ W}{230\ V}$

$= 3.1\ A$

current = ... 3.1 ..... A [3]

(b) Table 9.1 shows some electrical meter readings for the water heater.

Table 9.1

date	meter reading / kWh
1st October	3771
31st October	3797

Electrical energy costs 18 cents per kWh.

Calculate the cost of using the heater from 1st October until 31st October.

$3797 - 3771 = 26\ kWh$

$Cost = 18 \times 26$

$= 468\ cents$

cost = ... 468 ..... cents [3]

[Total: 7]

36. Nov/2023/Paper_ 0625/33/No.7

Two identical resistors, R_1 and R_2, are connected to a 24 V battery, as shown in Fig. 7.1.

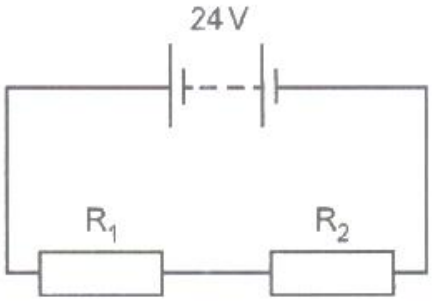


Fig. 7.1

The value of each resistor is 50 Ω.

(a) Calculate the combined resistance of R_1 and R_2 when they are connected as shown in Fig. 7.1.

$R_T = 50 + 50$
$= 100\ \Omega$

combined resistance = 100 Ω [1]

(b) Show that the current in the circuit is approximately 0.25 A.

$I = \frac{V}{R}$
$= \frac{24}{100}$
$= 0.24\ A$

$I = 0.24\ A$ ⇒

[3]

(c) Determine the potential difference (p.d.) across R_1.

$\frac{24}{2} = 12\ V$

Both share the p.d equally.

p.d. = 12 V [1]

(d) Calculate the power transferred in R_1.

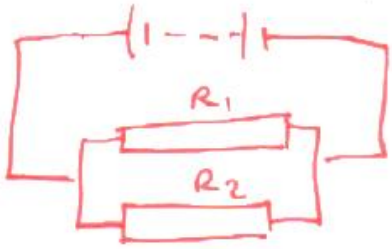
$P = V \times I$
$= 12V \times 0.24A$
$= 2.88W$

$P \simeq 2.9W$

power = 2.9 W [3]

(e) A student connects R_1, R_2 and the battery to make a different circuit. The resistors R_1 and R_2 are connected so their combined resistance is as small as possible.

Draw a circuit diagram to show how R_1 and R_2 are connected to the battery.



$R_T = \frac{50 \times 50}{50 + 50}$
$= 25\Omega$

[1]

[Total: 9]

37. Nov/2023/Paper_ 0625/41/No.8

A cylinder is made of modelling clay. The modelling clay is an electrical conductor.

Fig. 8.1 shows the cylinder.

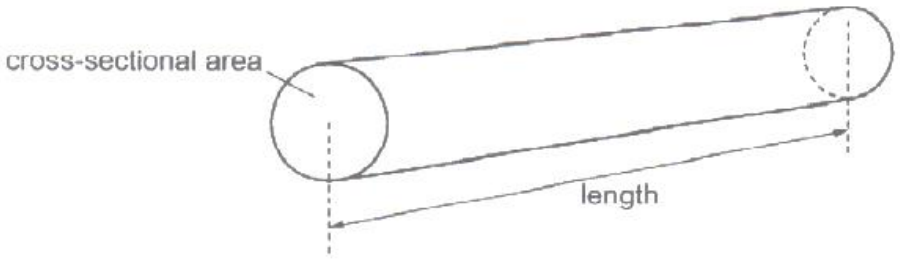


Fig. 8.1

The cylinder is connected into a circuit.

Fig. 8.2 shows that the circuit also includes a battery of electromotive force (e.m.f.) 9.0V and a resistor P.

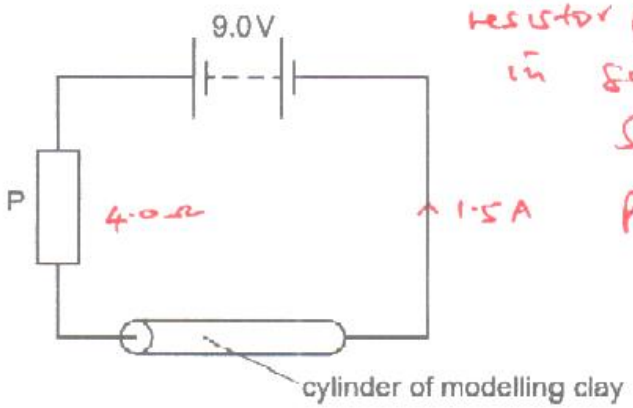


Fig. 8.2

resistor P and cylinder are in series, so they share the 9.0V

P:

$V = I \times R$

$= 1.5 \times 4$

$= 6.0V$

∴ Voltage across the cylinder

$= 9.0 - 6.0$

$= 3.0V$.

The resistance of P is 4.0Ω. The current in P is 1.5A.

(a) Calculate:

(i) the magnitude X of the charge that flows through P in 600 s

$Q = I \times t$

$= 1.5 \times 600$

$= 900\,C$

$X =$ 900 C [2]

(ii) the resistance of the cylinder of modelling clay.

$R = \frac{V}{I}$

$= \frac{3.0\,V}{1.5\,A}$

$= 2.0\,\Omega$

resistance = 2.0 Ω [3]

(b) The cylinder is removed from the circuit and replaced with a new cylinder made of the same modelling clay.

The new cylinder is twice the length and has half the cross-sectional area of the first cylinder.

Calculate the time that it now takes for a charge of magnitude X to flow through resistor P.

$R = \frac{\rho \times l}{A}$

$\therefore R = \frac{\rho \times 2l}{\frac{1}{2}A}$

$R = \frac{4\rho l}{A}$

$\therefore$ Resistance is 4 times greater

$\Rightarrow R = 4 \times 2.0\,\Omega$

$= 8.0\,\Omega$

Total resistance = 8.0 + 4.0 = 12.

$I = \frac{9.0}{12} = 0.75\,A$

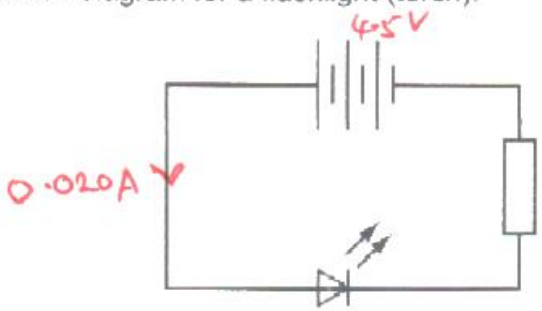
$t = \frac{Q}{I} = \frac{900\,C}{0.75\,A} = 1200\,s$

time = 1200 s [4]

[Total: 9]

38. Nov/2023/Paper_ 0625/42/No.6

Fig. 6.1 shows the circuit diagram for a flashlight (torch).



p.d = 0.02 x 60
= 1.2V

Fig. 6.1

The electromotive force (e.m.f.) of the battery is 4.5V. The circuit contains a 60Ω fixed resistor. The current in the light-emitting diode (LED) is 0.020A.

(a) Calculate the potential difference (p.d.) across the LED.

p.d across 60Ω resistor
= 1.2V

p.d across LED = 4.5 - 1.2
= 3.3V

p.d. = 3.3V [2]

(b) Explain why the LED does **not** light up if the battery is reversed.

- LED is a diode and only allow current in one direction [1]

(c) The chemical energy stored in the battery is 1050J.

Show that the flashlight operates for approximately 3h.

$E = V I t$

$E = 4.5 \times 0.02 \times t$

$t = \frac{1050\ J}{(4.5 \times 0.02 \times 3600)} = 3.2$ hours

3 x 3600 = 10,800 s

[2]

(d) Calculate the total charge that flows through the LED in 3600 s.

$Q = I \times t$

$= 0.02 \times 3600$

$= 72\ C$

charge = 72 C [2]

[Total: 7]

39. Nov/2023/Paper_ 0625/43/No.6

(a) On Fig. 6.1, sketch the current–voltage graph of a filament lamp and explain its shape.

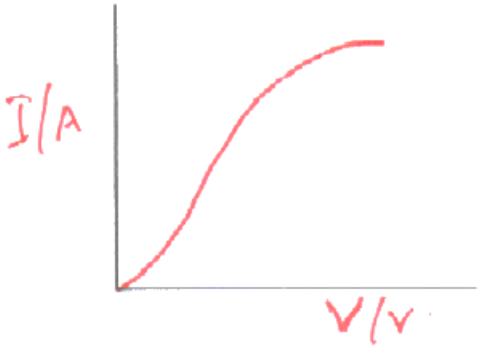


Fig. 6.1

explanation ..... As current increases, the temp will increase, so resistance increases, thus more voltage required for current increase. [3]

(b) Fig. 6.2 shows an electric circuit.

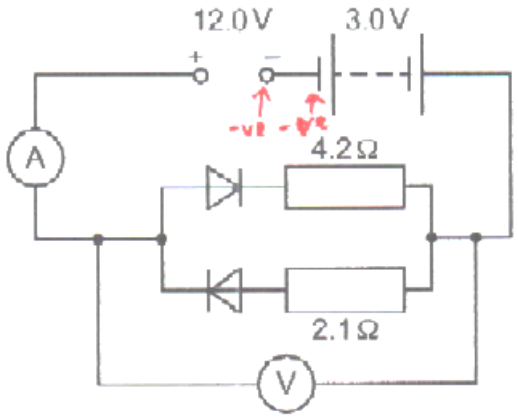


Fig. 6.2

A negative terminal of the 12.0V is connected to a negative terminal of cell 3.0V

(i) Calculate the reading on the voltmeter.

∴ Voltage = 12.0 − 3.0

= 9.0 V

voltmeter reading = ... 9.0 V ..... [2]

(ii) Calculate the current in the 4.2Ω resistor.

$I = \frac{V}{R}$

$= \frac{9.0}{4.2}$

$= 2.14\ A$

$\simeq 2.1\ A$

current = 2.1 A [2]

(iii) Determine the current in the 2.1Ω resistor.

Diode in 2.1Ω is reverse biased, so no current flow through 2.1Ω resistor

$I = 0\ A$

current = 0 A [1]

(iv) Determine the reading on the ammeter.

Current through ammeter is same as that through the 4.2Ω resistor

ammeter reading = 2.1 A [1]

(v) Calculate the electrical power transferred in the 4.2Ω resistor.

$P = V \times I$

$= 9.0 \times 2.1$

$= 18.9\ W$

$\simeq 19\ W$

power = 19 W [2]

[Total: 11]

40. June/2023/Paper_0625/11/No.25

Which particles move to cause a current in a copper wire?

A copper atoms

B ✓ electrons from the copper atoms

C protons from the copper nuclei

D neutrons from the copper nuclei

- Current is the flow of electrons through conductor (eg copper)
- only electrons and protons are charged particles.
- Neutrons are not charged.
- Both protons and neutrons are located inside the nucleus, and so cannot move since they are held tightly by strong nuclear force.

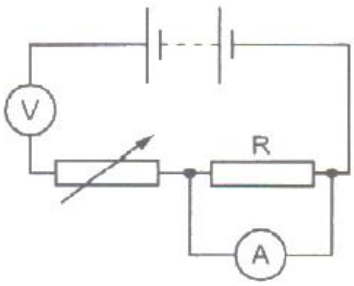
41. June/2023/Paper_0625/11/No.26

Four students draw a circuit diagram of the apparatus used to measure the resistance of resistor R.

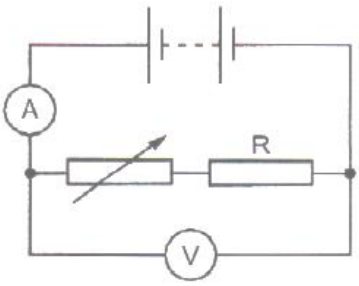
$R = \frac{V}{I}$

Which circuit is correct?

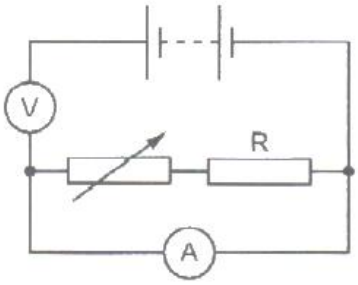
A



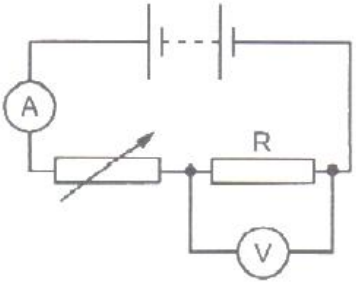
B



C



(D) ✓



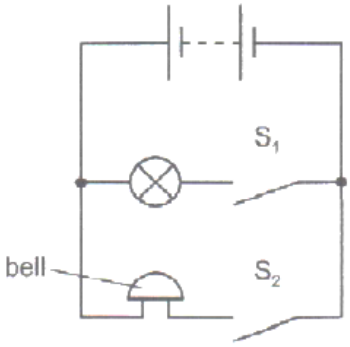
- Voltage is measured across the resistor
- Current I is measured through the resistor

$\therefore R = \frac{V}{I}$.

42. June/2023/Paper_0625/11/No.27

The battery on a bicycle is connected in parallel to its lamp and bell.

The circuit includes two switches, S_1 and S_2.



The cyclist closes S_1 to light the lamp.

She then also closes S_2 to sound the bell.

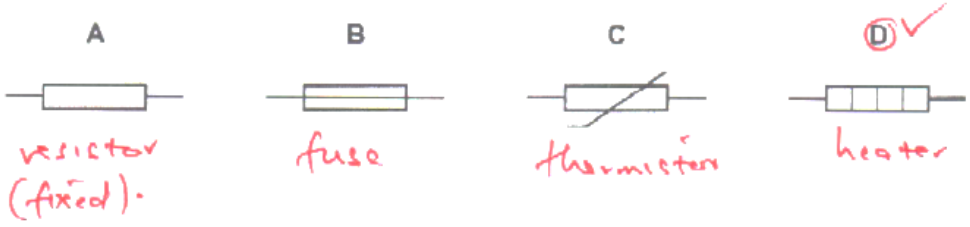
What happens to the current in the battery and the power output from the battery when the cyclist closes S_2?

	current in the battery	power output from the battery
A ✓	increases	increases
B	increases	stays the same
C	stays the same	increases
D	stays the same	stays the same

- Parallel lamp and bell both combined have ↓ lower resistance
- So current in battery increases since resistance has reduced
- Since $P = V \times I$, hence power also increases.

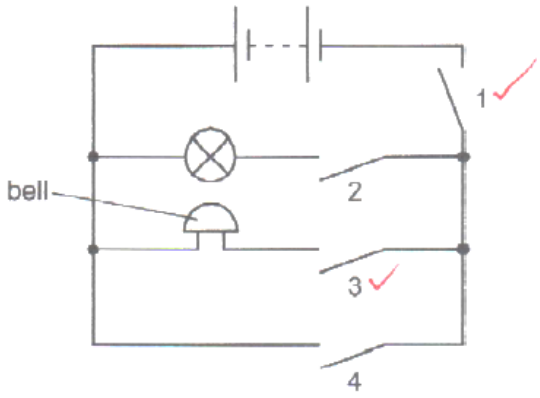
43. June/2023/Paper_0625/11/No.28

Which symbol represents an electric heater?



44. June/2023/Paper_0625/11/No.29

A student connects the circuit shown.



Which switches must be closed for the bell to ring without lighting the lamp?

A 1 and 2 only B 1 and 3 only C 1, 3 and 4 D 2, 3 and 4

45. June/2023/Paper_0625/11/No.30

A double-insulated electrical appliance must be connected safely to the electricity supply.

Which statement is correct?

A It must be connected with a fuse and an earth wire.

B It can be connected with a fuse only.

C It can be connected with an earth wire only.

D It does not need a fuse or an earth wire.

double-insulated appliance has a plastic casing, so no need of earth wire

46. June/2023/Paper_0625/12/No.25

Which statement about electric current in a conductor is correct?

A In a d.c. circuit, the electric current gradually decreases along the conductor.

B In a d.c. circuit, the free electrons flow back and forth.

C In an a.c. circuit, the electric current remains exactly the same all the time.

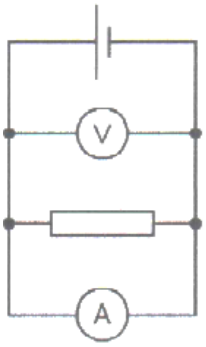
D In an a.c. circuit, the flow of charge changes direction continually.

↑ alternating current flows forward and backwards.

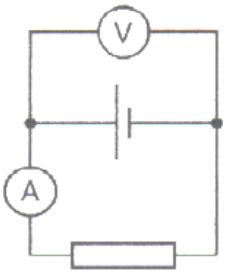
47. June/2023/Paper_0625/12/No.26

Which circuit can be used to measure the resistance of a resistor?

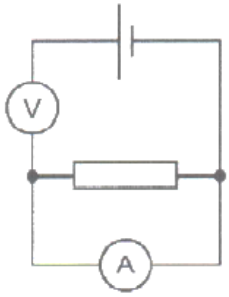
A



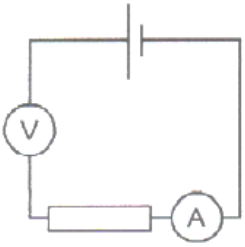
B



C



D



$R = \frac{V}{I}$

V across the resistor
I through the resistor.

48. June/2023/Paper_0625/12/No.27

A lamp rated 12 V, 2.0 A is switched on for 60 s.

How much energy is transferred?

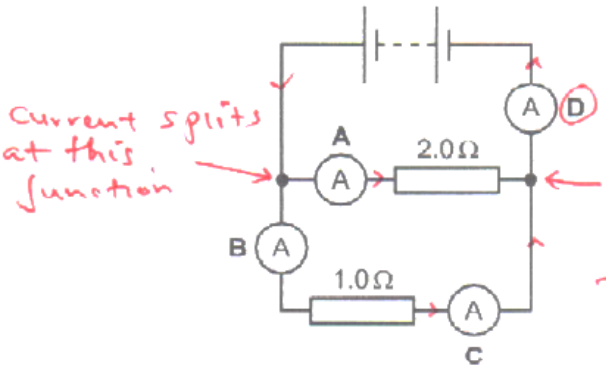
A 0.40 J B 10 J C 360 J D 1400 J ✓

$E = VIt$
$= 12 \times 2 \times 60$
$= 1440$ J

49. June/2023/Paper_0625/12/No.28

The circuit diagram shows a battery connected to two resistors. Four labelled ammeters are connected into the circuit.

Which ammeter shows the largest reading?



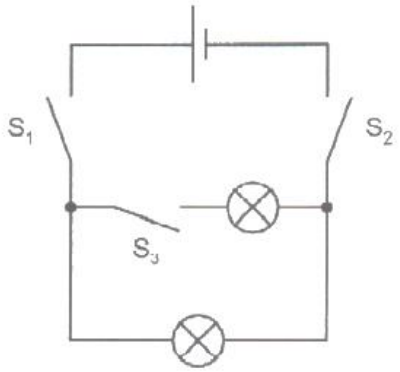
Current splits at this junction

current joins again at this junction

- So ammeter D has the most current flowing through it.

50. June/2023/Paper_0625/12/No.29

Two lamps are connected in parallel.



Which switches must be closed so that both lamps light?

A S_1 and S_2 only

B S_1 and S_3 only

C S_2 and S_3 only

D ✓ S_1, S_2 and S_3

All the switches must be on for both lamps to light.

51. June/2023/Paper_0625/13/No.25

A power supply of electromotive force (e.m.f.) 12 V is connected across a 3 Ω resistor.

Which ammeter is most suitable to measure the current in the resistor?

A an ammeter with a range 0–0.5 A

B an ammeter with a range 0–1 A

C ✓ an ammeter with a range 0–5 A

D an ammeter with a range 0–50 A

$I = \frac{V}{R}$

$= \frac{12\,V}{3\,\Omega}$

$= 4\,A$

52. June/2023/Paper_0625/13/No.26

The cost of electrical energy is $0.25 for each unit of 1 kWh. A 2200 W heater is switched on for 48 minutes.

What is the cost of this use?

A ✓ $0.44 B $0.55 C $26 D $440

$P = \frac{E}{t}$ $E = P \times t$

$t = \frac{48}{60} = 0.8\,h$

$E = 2200\,W \times 0.8\,h$

$= 2.2\,kW \times 0.8\,h$

$= 1.76\,kWh$

$Cost = 1.76 \times 0.25$

$= 0.44$

53. June/2023/Paper_0625/13/No.27

The diagram shows six different electrical circuit components.

Which circuit symbol is **not** present in the diagram?

A resistor

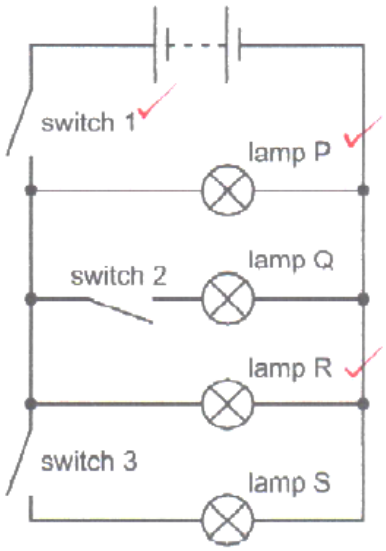
B voltmeter

C generator

D thermistor

54. June/2023/Paper_0625/13/No.28

The circuit shown contains three switches and four lamps P, Q, R and S.



Which switches must be closed to light only lamps P and R?

A switch 1 only

B switch 1 and switch 2

C switch 1 and switch 3

D switch 2 and switch 3

closing switch 1 will light both P and R since they do not each have independent switch.

55. June/2023/Paper_0625/13/No.29

An electric heater has a metal frame.

The heating element is connected to the live and neutral wires of an a.c. supply. The metal frame is connected to the earth wire.

Which row gives the correct connections for the fuse and the switch?

	fuse	switch
A	in the earth	in the live
B	in the earth	in the neutral
C	in the live ✓	in the live ✓
D	in the live	in the neutral

both fuse and switch are usually on live wire
- fuse to cut off current if too much current flows.
- Switch to switch on current in the live wire
- Neutral wire only completes the circuit for current to flow.

56. June/2023/Paper_0625/21/No.25

A wire has a uniform circular cross-sectional area.

$R = \frac{\rho l}{A}$ but ρ = constant $\therefore R \propto \frac{l}{A}$

Which statement is correct?

A The resistance of the wire is directly proportional to its cross-sectional area and inversely proportional to its diameter.

$\Rightarrow R \propto l$

B The resistance of the wire is directly proportional to its cross-sectional area and inversely proportional to its length.

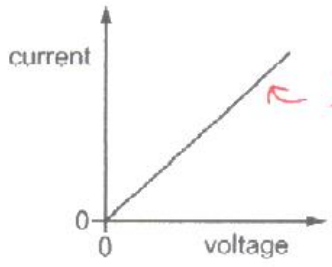
$R \propto \frac{1}{A}$

C ✓ The resistance of the wire is directly proportional to its length and inversely proportional to its cross-sectional area.

D The resistance of the wire is directly proportional to its length and inversely proportional to its diameter.

57. June/2023/Paper_0625/21/No.26

The diagram shows the current–voltage graph for a metal wire.



← Straight line implies resistance remains constant

$R = \frac{V}{I}$.

What can be deduced from the graph?

A As voltage increases, the temperature of the wire increases.

B As voltage increases, the temperature of the wire decreases.

C As voltage increases, the resistance of the wire increases.

D ✓ As voltage increases, the resistance of the wire remains constant.

58. June/2023/Paper_0625/21/No.27

A battery is connected to a circuit. It is switched on for 1.0 minute. During that time, there is a current of 0.40 A in the circuit and the battery supplies a total of 48 J of energy.

Which row gives the charge that passes and the electromotive force (e.m.f.) of the battery?

	charge that passes in 1.0 minute / C	e.m.f. of the battery / V
A	0.40	2.0
B	0.40	120
C ✓	24	2.0
D	24	120

$E = V \times I \times t$; t in seconds.

$V = \frac{E}{I \times t}$

$= \frac{48}{0.4 \times 1 \times 60}$

$= 2.0\,V$

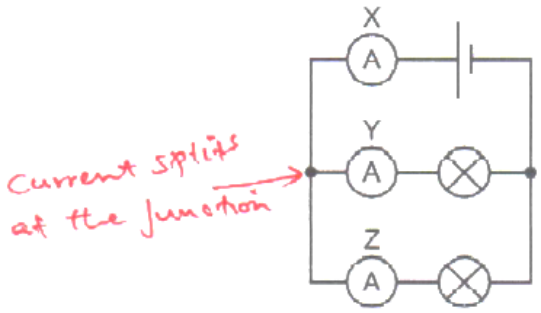
$Q = I \times t$

$= 0.4 \times (1 \times 60)$

$= 24\,C$

59. June/2023/Paper_0625/21/No.28

The circuit diagram shows two identical lamps connected in parallel to a cell. Three ammeters, X, Y and Z, are also connected in the circuit, as shown.



$I_X = I_Y + I_Z$

Which statement about the current in X is correct?

A It is equal to the current in Y and to the current in Z.

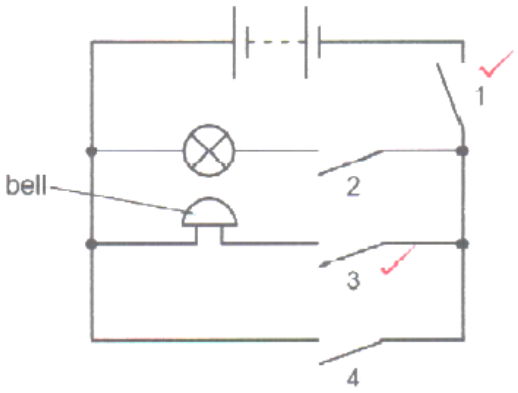
B It is less than either the current in Y or the current in Z.

C ✓ It is equal to the sum of the current in Y and the current in Z.

D It is equal to the difference between the current in Y and the current in Z.

60. June/2023/Paper_0625/21/No.29

A student connects the circuit shown.



Which switches must be closed for the bell to ring without lighting the lamp?

A 1 and 2 only (B) 1 and 3 only C 1, 3 and 4 D 2, 3 and 4

61. June/2023/Paper_0625/22/No.25

Which statement about electric current in a conductor is correct?

A In a d.c. circuit, the electric current gradually decreases along the conductor.

B In a d.c. circuit, the free electrons flow back and forth.

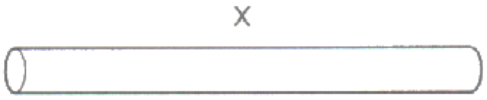
C In an a.c. circuit, the electric current remains exactly the same all the time.

(D) In an a.c. circuit, the flow of charge changes direction continually.

a.c flows forward and backward continually.

62. June/2023/Paper_0625/22/No.26

A piece of metal wire X with a uniform diameter has resistance R.



A second piece of wire Y is made of the same metal and has a uniform diameter.

Y has double the cross-sectional area of X and half the length of X.

What is the resistance of Y?

(A) $\frac{R}{4}$ B $\frac{R}{2}$ C R D $4R$

$R = \frac{\rho l}{A}$ $R_x = \frac{\rho l}{A}$

$R_Y = \frac{\rho \times \frac{1}{2} l}{2A}$ $\rho = \frac{R \times A}{l}$

$\frac{R_Y \times 2A}{\frac{1}{2}l} = \frac{R_x \times A}{l}$ $R_y = \frac{R \times \frac{1}{2}}{2} = \frac{R}{4}$

63. June/2023/Paper_0625/22/No.27

An electric fire is connected to a 240 V supply and transfers energy at a rate of 1.0 kW.

How much charge passes through the fire in 1.0 h?

$P = V \times I$ | $I = \frac{P}{V}$ | $I = \frac{1000\,W}{240\,V} = 4.17\,A$

$Q = I \times t$ | $= 4.17 \times 3600$ | $= 15000\,C$ | $\simeq 1.5 \times 10^4\,C$

1.0 h = 3600 s

A 42 C

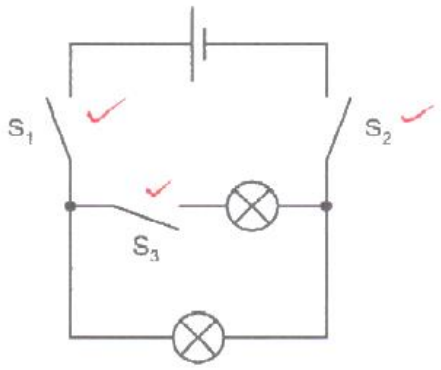
B 250 C

C 1.5×10^4 C

D 2.4×10^5 C

64. June/2023/Paper_0625/22/No.28

Two lamps are connected in parallel.



Which switches must be closed so that both lamps light?

A S_1 and S_2 only

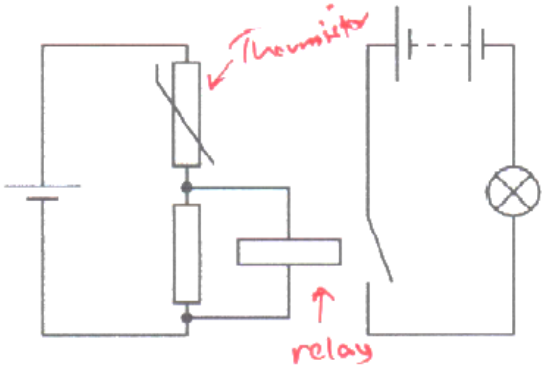
B S_1 and S_3 only

C S_2 and S_3 only

D S_1, S_2 and S_3

65. June/2023/Paper_0625/22/No.29

The diagram shows a circuit that switches on a lamp when there is a change in the environment.



Which change in the environment causes the lamp to be switched on?

A a decrease in light intensity

B a decrease in temperature

C an increase in light intensity

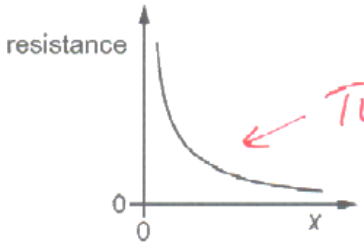
D ✓ an increase in temperature

- Thermistor is a temp dependant resistor
- At high temp its resistance decreases.
- This makes more current to flow hence making electromagnet in relay stronger, thus switch on the lamp circuit

66. June/2023/Paper_0625/23/No.25

A student does an experiment to investigate the resistance of a metal wire.

The graph shows the results from the experiment.



This is inverse relationship.

What is plotted on the *x*-axis?

A ✓ diameter of the wire

B length of the wire

C temperature of the wire

D current in the wire

$R = \frac{\rho \times l}{A}$

Since ρ is same for a given metal

$\therefore R \propto \frac{l}{A}$; Area $= \pi \left(\frac{d}{2}\right)^2$

$\Rightarrow R \propto \frac{1}{A}$; $\therefore R \propto \frac{1}{\pi \left(\frac{d^2}{2}\right)^2}$

67. June/2023/Paper_0625/23/No.26

The cost of electrical energy is \$0.25 for each unit of 1 kWh. A 2200 W heater is switched on for 48 minutes.

What is the cost of this use?

A \$0.44 B \$0.55 C \$26 D \$440

$t = \frac{48}{60} = 0.8\,h$

$E = P \times t = 2200\,W \times 0.8\,h = 2.2\,kW \times 0.8\,h = 1.76\,kWh$

$cost = 1.76 \times 0.25 = 0.44 = \$0.44$

68. June/2023/Paper_0625/23/No.27

The table describes four different resistance wires. They are all made from the same metal.

Which wire has the smallest resistance?

	length of wire / m	diameter of wire / mm
A	2.0	1.0
B	2.0	1.5
C	3.0	1.0
D	3.0	1.5

$R = \frac{\rho \times l}{A}$, but ρ = constant

$\therefore R \propto \frac{l}{A}$, $A = \pi\left(\frac{d}{2}\right)^2$

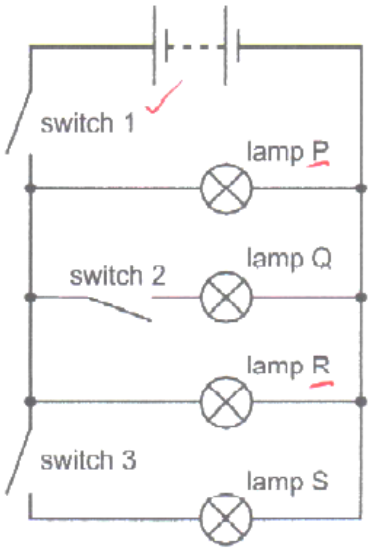
$\Rightarrow R \propto l$

$R \propto \frac{1}{\pi\left(\frac{d}{2}\right)^2}$

Shortest wire and thickest has smallest resistance

69. June/2023/Paper_0625/23/No.28

The circuit shown contains three switches and four lamps P, Q, R and S.



Which switches must be closed to light only lamps P and R?

A switch 1 only

B switch 1 and switch 2

C switch 1 and switch 3

D switch 2 and switch 3

70. June/2023/Paper_0625/31/No.9

Fig. 9.1 shows a series circuit. Two of the components in the circuit are labelled.

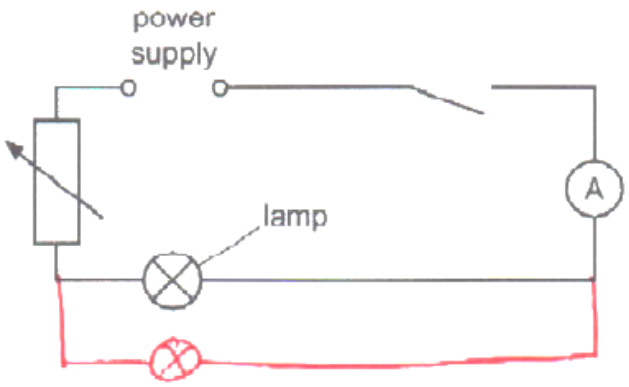


Fig. 9.1

(a) State the name of **two** other components in the circuit.

1 Ammeter

2 Variable resistor

3. Switch [2]

(b) The current in the lamp is 0.40A. The potential difference (p.d.) across the lamp is 6.0V.

Calculate the power dissipated in the lamp.

$P = V \times I$

$= 6.0V \times 0.40A$

$= 2.4\ W$

power = 2.4 W [3]

(c) Draw on Fig. 9.1 to show a lamp connected in parallel with the lamp in the circuit. Use the correct symbol. [1]

[Total: 6]

71. June/2023/Paper_0625/32/No.8

A student uses the circuit in Fig. 8.1 to measure the resistance of the heater in the circuit.

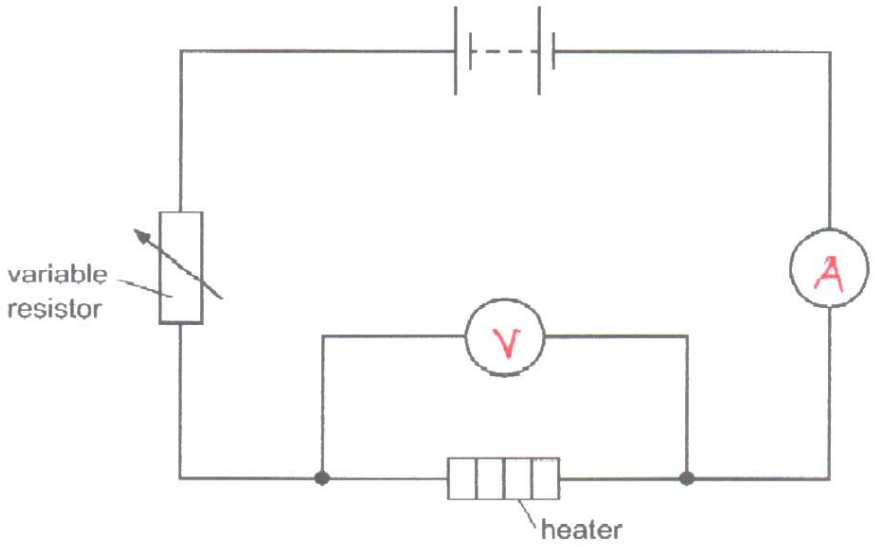


Fig. 8.1

(a) The symbols for the meters in Fig. 8.1 are incomplete.

Complete the symbols for the two meters by writing in the circles in Fig. 8.1. [2]

(b) The current in the heater is 1.4A and the potential difference (p.d.) across the heater is 8.0V.

Calculate the resistance of the heater.

$R = \frac{V}{I}$

$= \frac{8.0\,V}{1.4\,A}$

$= 5.7\ \Omega$

resistance = 5.7 Ω [3]

(c) The heater is switched on for 30s. The current in the heater is 1.4A and the p.d. across it is 8.0V.

Calculate the electrical energy transferred by the heater during the 30s.

$E = V \times I \times t$

$= 8.0 \times 1.4 \times 30$

$= 336\ J$

$\simeq 340\ J$ (2 s.f.)

energy transferred = 340 J [3]

[Total: 8]

72. June/2023/Paper_0625/32/No.9(a)

A student has a desktop computer that connects to the 240V a.c. mains electrical supply. Fig. 9.1 shows the desktop computer.

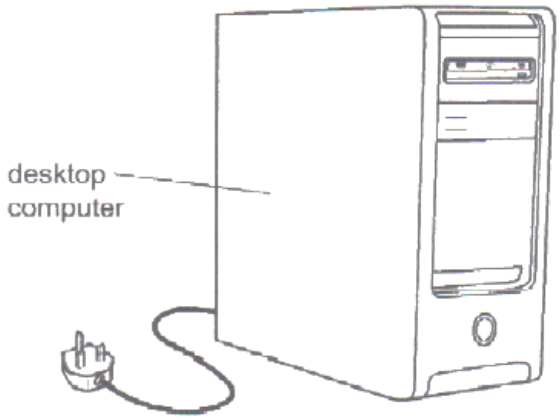


Fig. 9.1

(a) The desktop computer has an on-off switch in one of the wires that connect it to the mains supply.

State and explain which wire includes the switch.

- Switch is on the live wire
- So when switch is off, no current will get to the computer, so it is disconnected from the mains voltage. [3]

73. June/2023/Paper_0625/41/No.7

Fig. 7.1 shows a circuit that contains a battery, a switch, a voltmeter and three 40Ω resistors, R_1, R_2 and R_3.

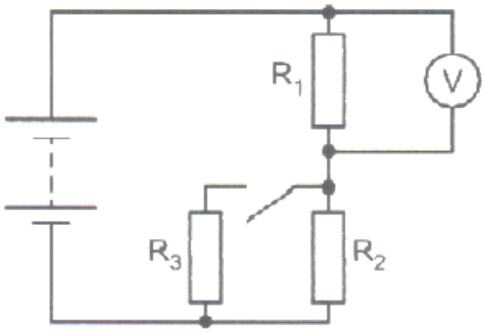


Fig. 7.1

The switch is open and resistors R_1 and R_2 form a potential divider.

(a) Describe what is meant by a potential divider.

A circuit with two resistors in series which split cells voltage in proportion to the two resistors.

..... [2]

(b) The reading on the voltmeter is 7.5V.

(i) Calculate the electromotive force (e.m.f.) of the battery.

$V_{out} = \frac{V_{in} \times R_1}{R_1 + R_2}$; $7.5 = \frac{V_{in} * 40}{40+40}$; $V_{in} = \frac{7.5 \times 80}{40}$; $= 15V$

e.m.f. = 15V ..... [1]

(ii) The switch is closed.

Calculate the resistance of the complete circuit.

$R_p = \frac{40 \times 40}{40+40}$

$= \frac{1600}{80}$

$= 20\,\Omega$

$R_T = 20 + 40$

$= 60\,\Omega$

resistance = 60 Ω [3]

(c) Calculate the reading on the voltmeter when the switch is closed.

$V_{out} = \frac{15 \times 40}{20+40}$

$= \frac{600}{60}$

$= 10\,V$

reading = 10 V [2]

[Total: 8]

74. June/2023/Paper_0625/33/No.8

(a) Fig. 8.1 shows the electrical symbols for some circuit components.

Draw a line from each electrical symbol to the name of the circuit component it represents.

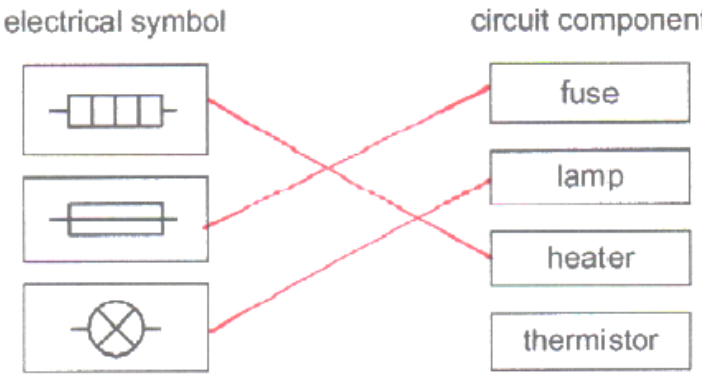


Fig. 8.1

[3]

(b) Fig. 8.2 shows a circuit including a battery, a fixed resistor R and an ammeter.

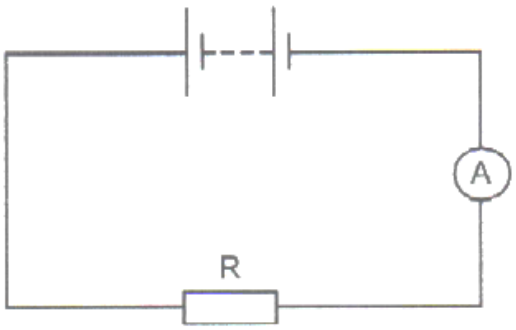


Fig. 8.2

The reading on the ammeter is 0.38A.
The potential difference across the fixed resistor R is 12V.

(i) Calculate the resistance of the fixed resistor R.

$R = \frac{V}{I}$

$= \frac{12\,V}{0.38\,A}$

$= 31.5\,\Omega$

$R = 32\,\Omega$ (to 2 s.f).

resistance = 32 Ω [3]

(ii) Calculate the electrical power transferred in the fixed resistor R. Include the unit.

$P = V \times I$

$= 12V \times 0.38\ A$

$= 4.56\ W$

$\simeq 46\ W$

power transferred = 46 unit Watts [4]

[Total: 10]

75. June/2023/Paper_0625/42/No.8(c)

(c) Fig. 8.2 shows a circuit.

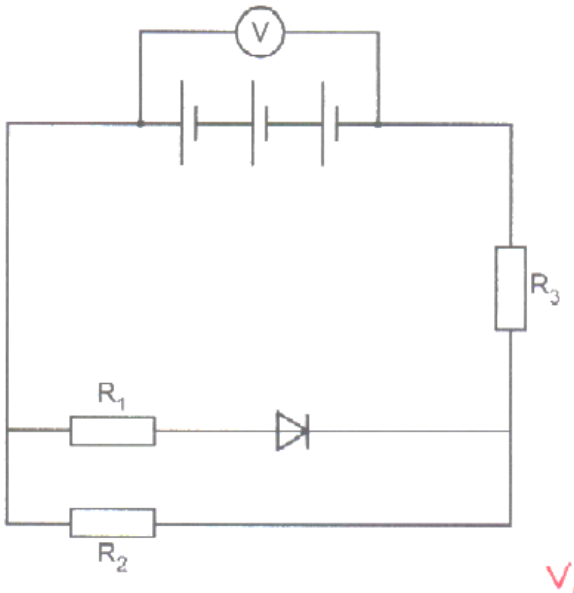


Fig. 8.2

Let $R_1 = R_2 = R_3 = 2\Omega$

$\therefore R_p = \frac{2\times2}{2+2} = \frac{4}{4} = 1\Omega$

$V_{R_2} = \frac{6.0\times1}{1+2} = \frac{6}{3} = 2V$

$V_{R_3} = \frac{6\times2}{2+1} = \frac{12}{3} = 4V$

$\therefore$ 2V : 4V = 1 : 2

The three cells are identical and have zero resistance.
The resistors R_1, R_2 and R_3 are identical.
The reading on the voltmeter is 6.0 V.
When the diode is conducting, it has zero resistance and zero potential difference (p.d.) across it.

(i) Determine the e.m.f. of one cell.

$\frac{6.0\,V}{3} = 2.0V$

e.m.f. = 2.0V [1]

(ii) Determine the ratio of the p.d. across R_2 to the p.d. across R_3.

$R_2 : R_3 = 1 : 2$ [1]

(iii) All the cells are reversed.

1. State and explain the change in current in R_1.

- No current will flow since diode is reverse biased, hence blocks current [1]

2. Determine the new value of the ratio of the p.d. across R_2 to the p.d. across R_3.

$R_2 : R_3 = 1 : 1$ [1]

Since no current flows through R_1, Then p.d of battery will be shared equally btw R_2 and R_3 since they are identical. $V_{R_2} = 3.0V$ $V_{R_3} = 3.0V$

$\therefore 3 : 3 = 1 : 1$

[Total: 8]

76. June/2023/Paper_0625/43/No.6

An electric heater uses a resistance wire of resistance 26 Ω. The power dissipated in the resistance wire is 2500 W.

(a) Calculate the current in the resistance wire.

$P = I^2R$

$I = \sqrt{\frac{P}{R}}$

$= \sqrt{\frac{2500}{26}}$

$= 9.8\ A$

current = 9.8 A [3]

(b) The resistance wire of the heater has a length of 1.2 m and a cross-sectional area of $7.9 \times 10^{-7}\ m^2$.

A new heater is designed using wire of the same material with length 1.8 m and cross-sectional area $5.8 \times 10^{-7}\ m^2$.

Calculate the resistance of this wire.

$R = \frac{\rho l}{A}$

$\rho = \frac{R \times A}{l}$

$= \frac{26 \times 7.9 \times 10^{-7}}{1.2}$

$= 1.7116 \times 10^{-5}\ \Omega m$

$R_2 = \frac{1.7116 \times 10^{-5} \times 1.8}{5.8 \times 10^{-7}}$

$= 53\ \Omega$

resistance = 53 Ω [3]

(c) The 2500 W heater is used in a country where electricity costs 0.30 dollars per kilowatt-hour.

Calculate the cost of using the heater continuously for two days.

Two days = 2 × 24
= 48 hours

P = 2500 W = 2.5 kW

t = 48 h

E = P × t
= 2.5 kW × 48 h
= 120 kWh

Cost = 120 kWh × 0.30
= $36

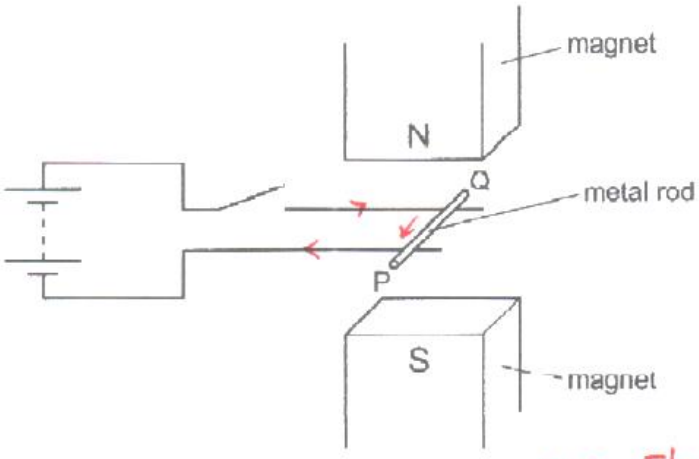
cost = 36 dollars [2]

[Total: 8]

Electromagnetism – 2023 IGCSE 0625 Phyiscs

1. Nov/2023/Paper_ 0625/11/No.32

A metal rod PQ rests on two horizontal metal wires that are attached to a battery. The rod lies between the poles of a magnet.



When the switch is closed, the rod moves to the right.

What could be changed so that the rod moves to the left?

use Fleming's left hand rule to find direction of Force, F.

A Open the switch.

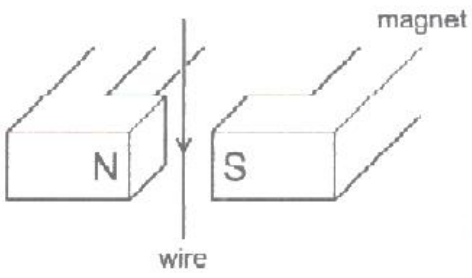
B Reverse the battery terminals and exchange the poles of the magnet.

C Reverse the battery terminals but without exchanging the poles of the magnet. ✓

D Turn the metal rod around (P and Q exchanged).

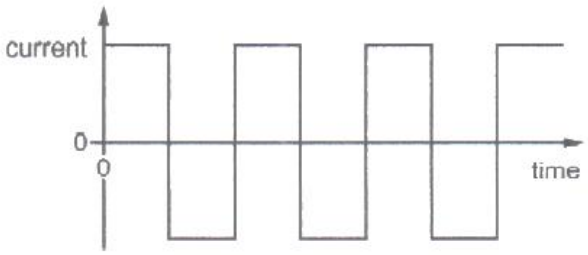
2. Nov/2023/Paper_ 0625/12/No.32

The diagram shows a wire in the magnetic field between two poles of a magnet.



using Flemings Left hand rule, the force acting on the wire will change direction when current is reversed.

The current in the wire repeatedly changes between a constant value in one direction and a constant value in the opposite direction, as shown in the graph.



What is the effect on the wire?

(A) ✓ The force on the wire alternates between one direction and the opposite direction.

B The force on the wire is constant in size and direction.

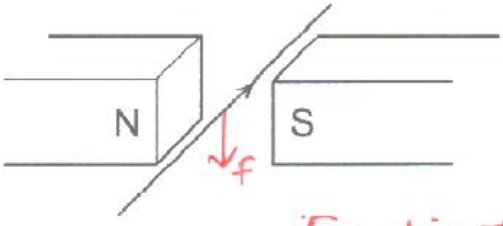
C There is no force acting on the wire at any time.

D There is only a force on the wire when the current reverses.

3. Nov/2023/Paper_ 0625/13/No.32

A current passes along a wire placed between the poles of a permanent magnet.

The wire experiences a force due to the magnetic field.



For direction of F to be upward
1. reverse current
2. reverse magnetic poles.
But effect only one not both at a time.

What will change the direction of this force?

A increasing the current

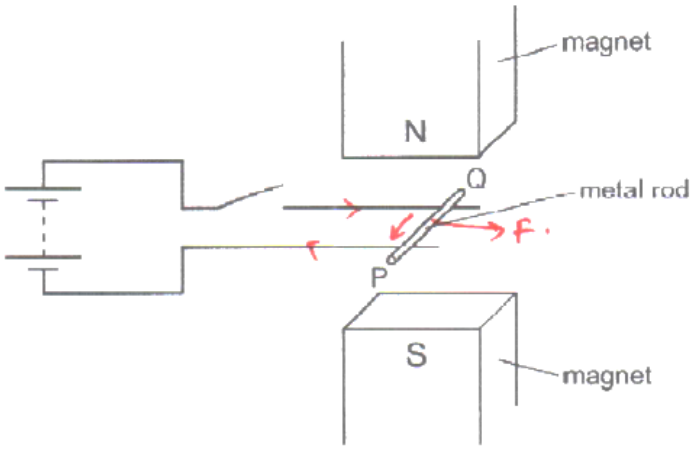
(B) ✓ reversing the current

C increasing the strength of the magnetic field

D using an electromagnet with the same polarity as the permanent magnet

4. Nov/2023/Paper_ 0625/21/No.32

A metal rod PQ rests on two horizontal metal wires that are attached to a battery. The rod lies between the poles of a magnet.



When the switch is closed, the rod moves to the right.

What could be changed so that the rod moves to the left?

A Open the switch.

B Reverse the battery terminals and exchange the poles of the magnet.

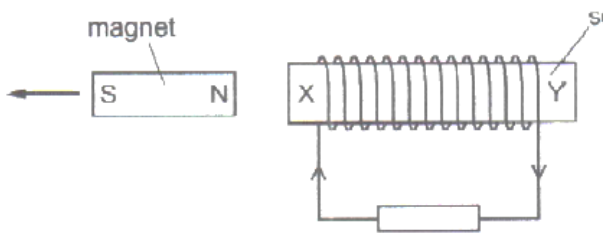
C Reverse the battery terminals but without exchanging the poles of the magnet.

D Turn the metal rod around (P and Q exchanged).

Reversing the terminals will reverse the direction of current through the rod (from P to Q) and cause the rod to move left.

5. Nov/2023/Paper_ 0625/22/No.31

A piece of soft iron XY has a coil of wire wound round it.



direction of induced current will still in clockwise direction

The N pole of a bar magnet is pulled away from end X which causes an induced current in the coil.

The magnet is now turned round so that the N pole is on the left. It is taken to the other end of the soft iron and the N pole is pushed towards end Y. A new current is induced in the coil.

Which statement is correct?

A The new induced current is in the opposite direction and causes the soft iron to attract the N pole.

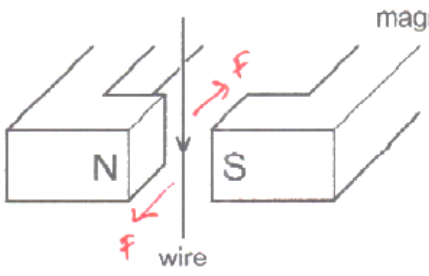
B The new induced current is in the opposite direction and causes the soft iron to repel the N pole.

C The new induced current is in the same direction and causes the soft iron to attract the N pole.

D The new induced current is in the same direction and causes the soft iron to repel the N pole.

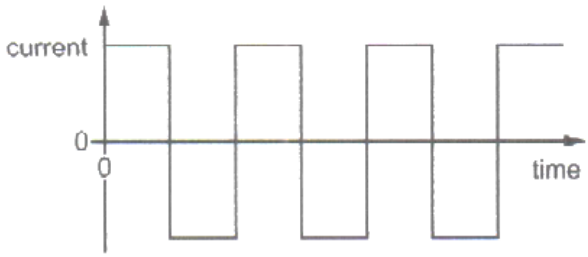
6. Nov/2023/Paper_ 0625/22/No.32

The diagram shows a wire in the magnetic field between two poles of a magnet.



Use Flemings left hand rule, the wire is push outside when current flows down, and pushed inside the magnet when current is flowing upwards.

The current in the wire repeatedly changes between a constant value in one direction and a constant value in the opposite direction, as shown in the graph.



What is the effect on the wire?

(A) ✓ The force on the wire alternates between one direction and the opposite direction.

B The force on the wire is constant in size and direction.

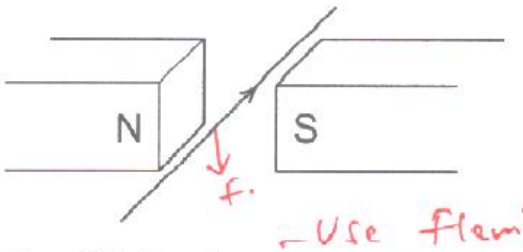
C There is no force acting on the wire at any time.

D There is only a force on the wire when the current reverses.

7. Nov/2023/Paper_ 0625/23/No.32

A current passes along a wire placed between the poles of a permanent magnet.

The wire experiences a force due to the magnetic field.



- Use flemings left hand rule to see f is down.
- changing direction of current, makes force to act upwards.

What will change the direction of this force?

A ✓ increasing the current

(B) reversing the current

C increasing the strength of the magnetic field

D using an electromagnet with the same polarity as the permanent magnet

8. Nov/2023/Paper_ 0625/32/No.10

(a) Different materials have differing magnetic properties.

(i) State the name of a material that is suitable for a **temporary** magnet.

Soft Iron ..... [1]

(ii) State the name of a material that is suitable for a **permanent** magnet.

Steel ..... [1]

(iii) State how a magnet can show that a material is non-magnetic.

By not getting attracted to the magnet. ..... [1]

(b) A teacher uses the arrangement in Fig. 10.1 to demonstrate an electric bell. When the switch is closed, the hammer repeatedly hits the metal gong.

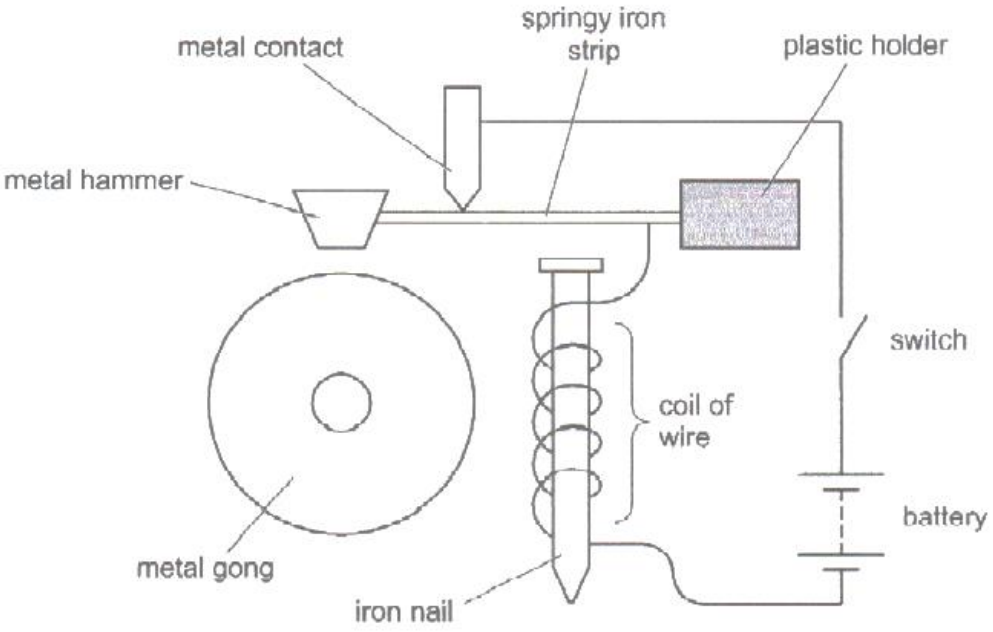


Fig. 10.1

Using the information in Fig. 10.1, explain why the hammer repeatedly hits the metal gong when the switch is closed.

- Current flow when Circuit is complete.
- This makes Iron nail (coil) become electromagnet and attract the Springy Iron strip for hammer to strike the Gong.
- This breaks the circuit at the metal contact [4]
- This attraction stops and the Springy strip Spring back to make contact again and complete circuit.

[Total: 7]

9. Nov/2023/Paper_ 0625/33/No.9

(a) Describe what is meant by alternating current (a.c.).

Current that changes direction repeatedly. [1]

(b) A teacher demonstrates how a loudspeaker works by using the equipment shown in Fig. 9.1.

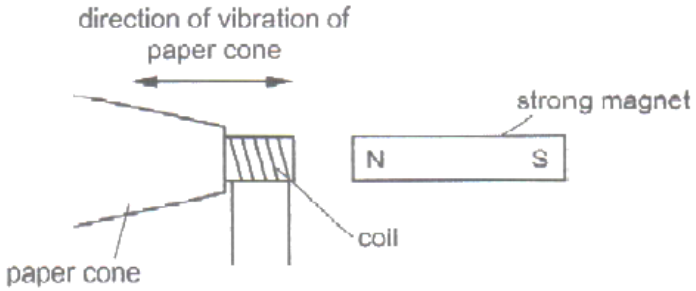


Fig. 9.1

There is an alternating current in the coil. The paper cone and coil vibrate as shown in Fig. 9.1.

(i) Explain why the paper cone vibrates. Use your ideas about magnetism.

- The coil becomes electromagnet when current flow.
- The electromagnets gets attracted by permanent magnet and also gets repelled. [3]

(ii) When the paper cone vibrates, the teacher hears a sound. audible sound 20Hz – 20000Hz

Suggest a value for the frequency of the alternating current. Include the unit.

frequency = 10,000

unit Hz

[2]

[Total: 6]

10. Nov/2023/Paper_ 0625/43/No.8(a)

(a) Fig. 8.1 shows the single turn coil of a simple direct current (d.c.) motor.

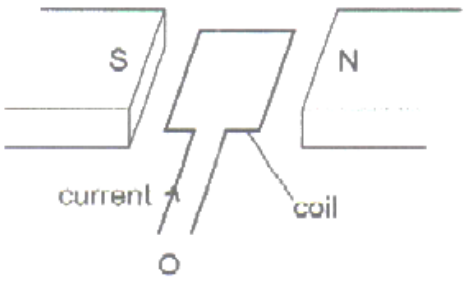


Fig. 8.1

(i) Explain the direction of the turning effect as seen by an observer at O.

- Coil turns clockwise
- Force near South pole act upwards and force on coil near N-pole act down. [2]

(ii) The coil is replaced by an otherwise identical new coil with three turns and the same current in the coil.

State how the turning effect compares with the turning effect in **(i)**.

there is greater turning effect [1]

(iii) A third coil is identical to the coil in **(i)** except that its resistance is three times greater. The potential difference (p.d.) across the coil is the same as the p.d. in **(i)**.

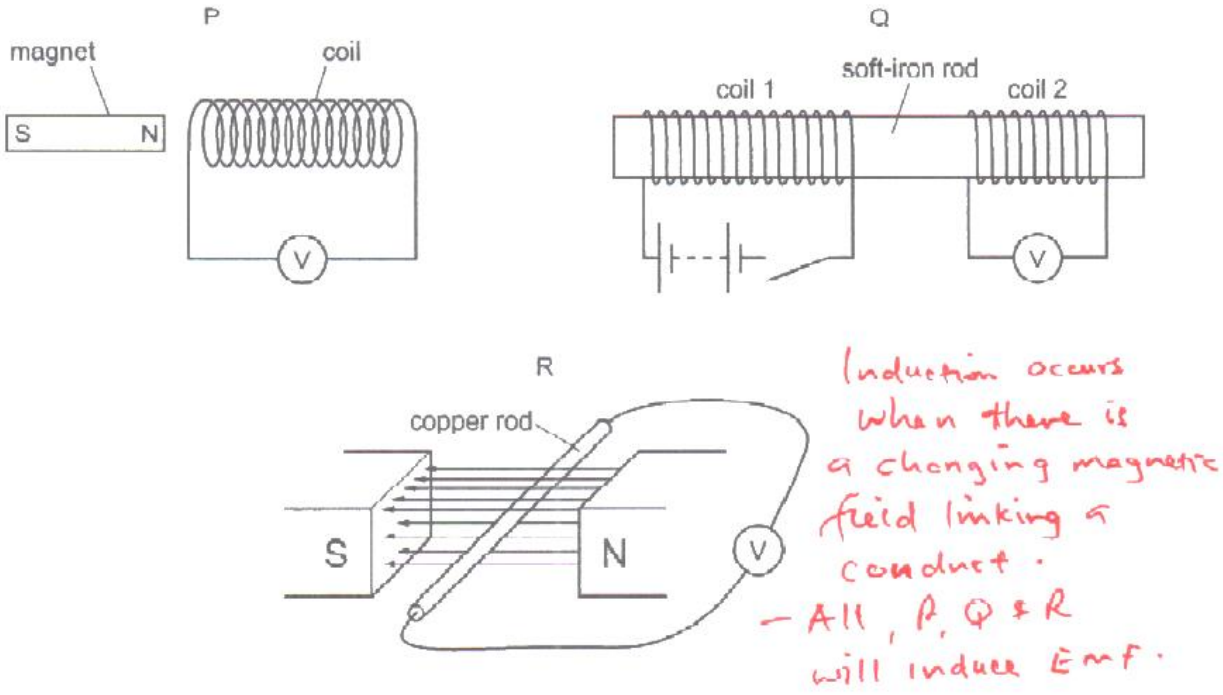
State how the turning effect compares with the turning effect in **(i)**.

Less turning effect since less current flow in the coil due to resistance increase. [1]

Electromagnetic Induction – 2023 IGCSE 0625 Physics

1. Nov/2023/Paper_ 0625/11/No.31

A teacher sets up the equipment for three demonstrations, P, Q and R.



Induction occurs when there is a changing magnetic field linking a conduct.
- All P, Q & R will induce EMF.

In demonstration P, the magnet is moved to the right.

In demonstration Q, the switch is closed.

In demonstration R, the copper rod is moved vertically upwards.

Which demonstrations can be used to demonstrate electromagnetic induction?

A P and Q only **B** P and R only **C** Q and R only **D** P, Q and R ✓

2. Nov/2023/Paper_ 0625/11/No.33

A transformer in a computer is used to transform the mains voltage of 240 V to 12 V.

The number of turns on the secondary coil is 2000.

$N_p = \frac{V_p}{V_s} \times N_s$

$= \frac{240}{12} \times 2000$

$= 40{,}000$ turns

Which statement about the transformer is correct?

A It is a step-down transformer and has 100 turns on its primary coil.

B It is a step-down transformer and has 40 000 turns on its primary coil. ✓

C It is a step-up transformer and has 100 turns on its primary coil.

D It is a step-up transformer and has 40 000 turns on its primary coil.

3. Nov/2023/Paper_ 0625/12/No.33

A transformer has N_p turns on its primary coil and N_s turns on its secondary coil. The voltage across the primary coil is V_p and the voltage across the secondary coil is V_s.

What is the relationship between these four quantities?

A $V_p \times V_s = N_p \times N_s$

B ✓ $\frac{V_p}{V_s} = \frac{N_p}{N_s}$

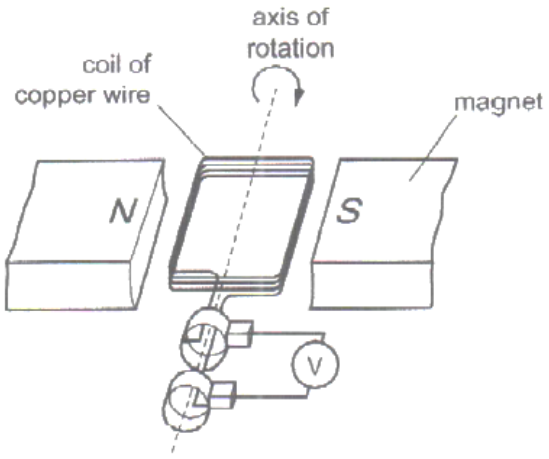
C $\frac{V_p}{V_s} = \frac{N_s}{N_p}$

D $\frac{V_p}{V_s} = N_p \times N_s$

$\frac{V_p}{V_s} = \frac{N_p}{N_s}$.

4. Nov/2023/Paper_ 0625/13/No.31

A generator uses the principle of electromagnetic induction.



Which change would increase the induced electromotive force (e.m.f.) in the coil?

A ✓ increasing the number of turns in the coil ← Also

B placing the magnets further apart

C using a coil made from steel wire

D reversing one of the magnets

1. turning coil faster
2. Using stronger magnets
3. Increasing cross section of coil.

5. Nov/2023/Paper_ 0625/13/No.33

What is a transformer used for?

A changing a direct current into an alternating current

B ✓ changing the magnitude of an alternating voltage

C reducing the frequency of an alternating current

D switching off the current in a circuit when there is a fault

Transformer either steps up or down voltage of a.c.
Magnitude – size

6. Nov/2023/Paper_ 0625/21/No.31

A current in a solenoid produces a uniform magnetic field inside the solenoid. The magnetic field direction is due east.

Which changes will produce a stronger magnetic field with a direction due west?

A Use a smaller current and turn the solenoid through 180°.

B Use a smaller current and reverse the current.

C Use a larger current and turn the solenoid through 90°.

D Use a larger current and reverse the current.

use larger current.

change direction of current (reverse)

7. Nov/2023/Paper_ 0625/21/No.33

A transformer in a computer is used to transform the mains voltage of 240 V to 12 V.

The number of turns on the secondary coil is 2000.

Which statement about the transformer is correct?

A It is a step-down transformer and has 100 turns on its primary coil.

B It is a step-down transformer and has 40 000 turns on its primary coil.

C It is a step-up transformer and has 100 turns on its primary coil.

D It is a step-up transformer and has 40 000 turns on its primary coil.

Step-down.

$\frac{N_p}{N_s} = \frac{V_p}{V_s}$

$N_p = \frac{240 \times 2000}{12}$

$= 40,000$ turns in primary coil.

8. Nov/2023/Paper_ 0625/22/No.33

A transformer has N_p turns on its primary coil and N_s turns on its secondary coil. The voltage across the primary coil is V_p and the voltage across the secondary coil is V_s.

What is the relationship between these four quantities?

A $V_p \times V_s = N_p \times N_s$

B $\frac{V_p}{V_s} = \frac{N_p}{N_s}$

C $\frac{V_p}{V_s} = \frac{N_s}{N_p}$

D $\frac{V_p}{V_s} = N_p \times N_s$

$\frac{V_s}{V_p} = \frac{N_s}{N_p}$

9. Nov/2023/Paper_ 0625/23/No.33

What is a transformer used for?

A changing a direct current into an alternating current

B changing the magnitude of an alternating voltage

C reducing the frequency of an alternating current

D switching off the current in a circuit when there is a fault

Transformer step-up or down voltage of an alternating power supply.

10. Nov/2023/Paper_ 0625/33/No.8

(a) Fig. 8.1 shows an arrangement for transmitting electricity generated by a power station.

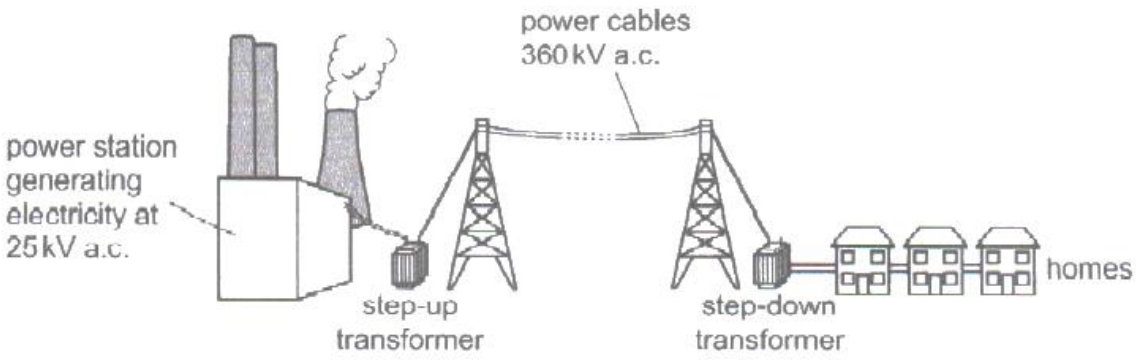


Fig. 8.1 (not to scale)

The step-up transformer has 500 turns on the primary coil.

Calculate the number of turns on the secondary coil of the step-up transformer. Use the information given in Fig. 8.1.

$N_S = \frac{V_S \times N_P}{V_P}$ $N_S = \frac{360 \times 10^3 \times 500}{25 \times 10^3} = 7200$

number of secondary turns = 7200 [3]

(b) State **two** benefits of using high voltages for transmitting electricity.

1 Smaller current in cables so less power loss.

2 thinner, cheaper cables can be use, meaning less cost [2]

3. The pylons can be placed further apart because the cables are lighter. [Total: 5]

11. Nov/2023/Paper_ 0625/43/No.8(b)

(b) Fig. 8.2 is a voltage–time graph showing the output of a simple alternating current (a.c.) generator at times t_0, t_1, t_2 and t_3.

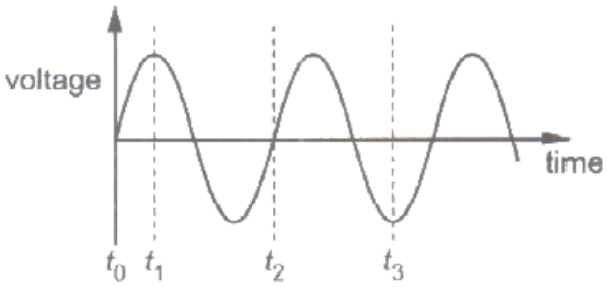


Fig. 8.2

Fig. 8.3 is an end view of the plane of the coil of the generator at time t_0. The coil is rotating clockwise.

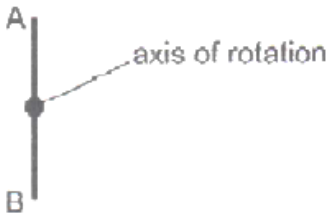


Fig. 8.3

(i) Draw an end view of the position of the plane of the coil at time t_1. Include the labels A and B.

At t_1 coil has gone 90° rotation

[1]

(ii) Draw an end view of the position of the plane of the coil at time t_2. Include the labels A and B.

Coil has gone through 360° at t_2.

[1]

(iii) Draw an end view of the position of the plane of the coil at time t_3. Include the labels A and B.

[1]

12. June/2023/Paper_0625/11/No.31

A simple electric generator induces an electromotive force (e.m.f.).

Which modification would increase the induced e.m.f.?

A Increase the number of turns in the coil of the generator.

B Increase the distance between the magnetic poles.

C Reduce the strength of the magnetic field around the coil.

D Reverse the direction of the magnetic field.

To increase induced emf
1. Increase speed of rotating coil or magnetic
2. Increase number of turns on coil
3 - Use a strong magnet

13. June/2023/Paper_0625/11/No.33

What is an advantage of transmitting electricity at a high voltage?

A It is faster.

B It is safer.

C Less energy is wasted.

D Less equipment is needed.

- At high voltage, current is much reduced according to the equation $P = V \times I$
- Less current cause less heating on transmission line, so less heat is dissipated.

14. June/2023/Paper_0625/12/No.32

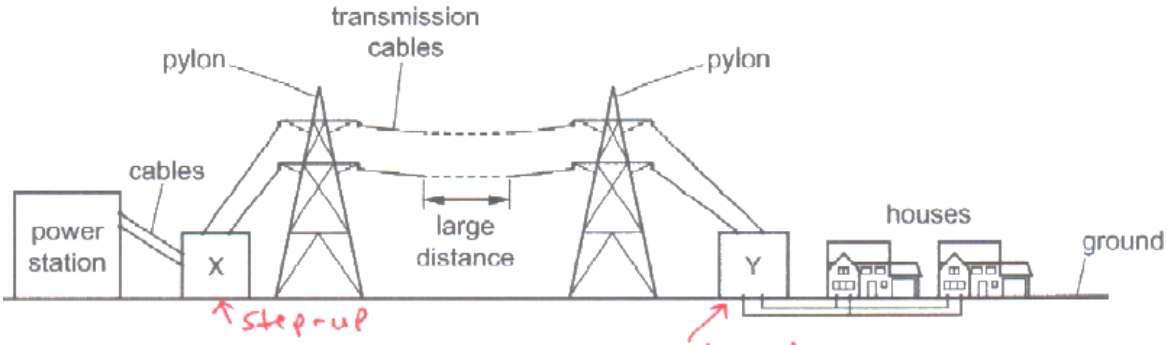
In which device is the magnetic effect of a current **not** used?

A electromagnet ✓
B loudspeaker ✓
C potential divider ✓
D relay ✓

Current through a conductor has two effects
1- heating effect
2- Magnetic effect.
- The magnetic effect of current is used in Electromagnetics, loudspeaker and relay.

15. June/2023/Paper_0625/12/No.33

The diagram represents the transmission of electricity from a power station to homes that are many kilometres away. Two transformers are labelled X and Y.



What type of transformers are X and Y?

	X	Y
A	step-down transformer	step-down transformer
B	step-down transformer	step-up transformer
C ✓	step-up transformer	step-down transformer
D	step-up transformer	step-up transformer

- Step-up transformer is usually near power stations
- Step-down is located near consumers.

16. June/2023/Paper_0625/13/No.30

Which electrical device uses the turning effect produced by a current-carrying coil in a magnetic field?

↑ coil turns in a magnetic field when current flow in a motor.

A a.c. generator
B d.c. motor ✓
C relay
D transformer

} These 2 use magnetic effect of current through a coil.

17. June/2023/Paper_0625/13/No.32

A student makes four different types of transformer. She counts the number of turns on the primary and secondary coils. She labels each transformer as either step-up or step-down.

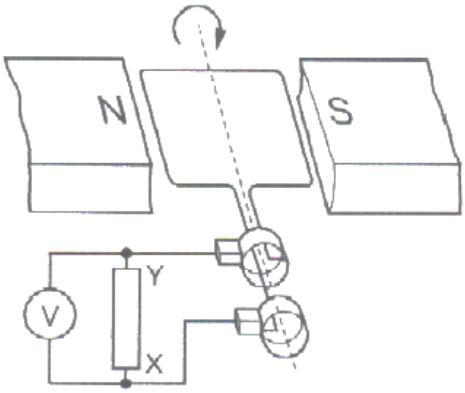
Which row shows the correct labels?

- Step-down has more turns in primary coil than Secondary coil.
- Step-up has $N_p < N_s$.

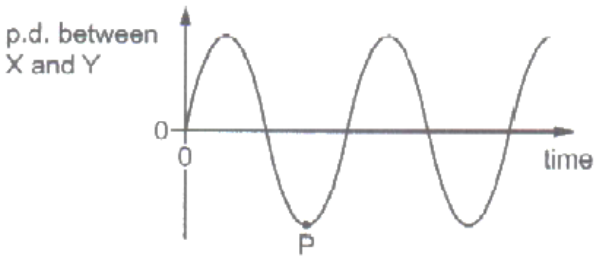
	number of turns on the primary coil	number of turns on the secondary coil	step-up or step-down transformer
A	5	5	step-up
B	10	5	step-up
C	10	20	step-down
D ✓	20	10	step-down

18. June/2023/Paper_0625/21/No.30

The diagram shows an a.c. generator.



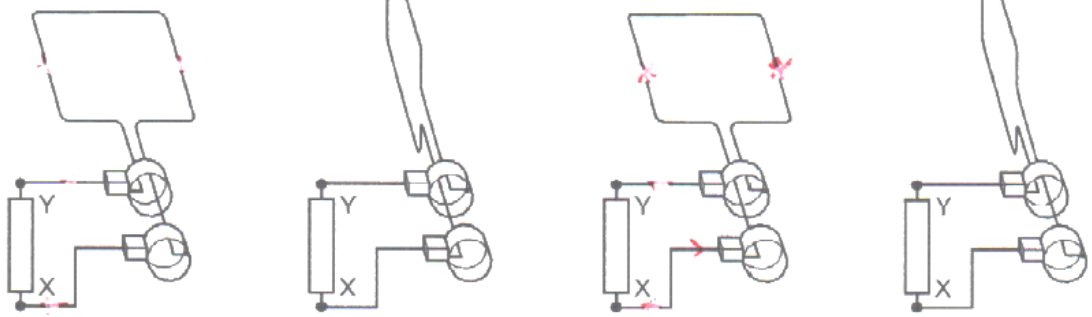
The graph shows the potential difference (p.d.) between points X and Y plotted against time. A positive value of p.d. indicates that X is more positive than Y.



use flemings right hand rule to determine the direction of induced current

Which diagram shows the position of the coil at point P on the graph?

A B C ✓ D



- Max p.d is induced when coil is horizontal.
- At P, the p.d is maximum, but with -ve p.d
- For X to be more +ve than Y, then current direction is from X to Y, not from Y to X as in A

19. June/2023/Paper_0625/22/No.30

A step-down transformer is 100% efficient. It has an input voltage of 240 V a.c. and an output voltage of 60 V a.c.

The current in the primary coil is 0.50 A.

What is the current in the secondary coil?

A 0.13 A B 0.50 A C ✓ 2.0 A D 8.0 A

$P_{in} = P_{out}$

$P = V \times I$

$V_p \times I_p = V_s \times I_s$

$I_s = \frac{V_p \times I_p}{V_s}$

$= \frac{240 \times 0.50}{60}$

$= 2.0\ A$.

20. June/2023/Paper_0625/23/No.31

Which component forms part of a d.c. motor but **not** a simple moving coil a.c. generator?

A the coil

B the brushes

C the magnet

D ✓ the split-ring commutator

d.c motor
- coil
- magnet
- brushes
- split-ring commutator

a.c generator
- coil
- magnets
- brushes
- slip-ring.

21. June/2023/Paper_0625/23/No.32

A transformer has 5500 turns on the primary coil and 500 turns on the secondary coil.

The output of the secondary coil is 110 V a.c. and is connected to a heater. The transformer is 100% efficient.

The heater produces a power of 132 W.

What is the current in the primary coil?

A ✓ 0.11 A B 0.12 A C 11 A D 12 A

$P = V \times I$; $I_s = \frac{P}{V}$; $I_s = \frac{132}{110}$; $I_s = 1.2\,A$

$V_p = \frac{N_p \times V_s}{N_s}$; $= \frac{5500 \times 110}{500}$; $= 1210\,V$

$P_{in} = P_{out}$; $\therefore I_p = \frac{P_{in}}{V_p}$; $= \frac{132\,W}{1210\,V}$; $= 0.109\,A$; $\approx 0.11\,A$

The scattering of alpha-particles from a thin gold foil produces the following observations.

22. June/2023/Paper_0625/31/No.10

(a) Fig. 10.1 shows an arrangement used to demonstrate electromagnetic induction.

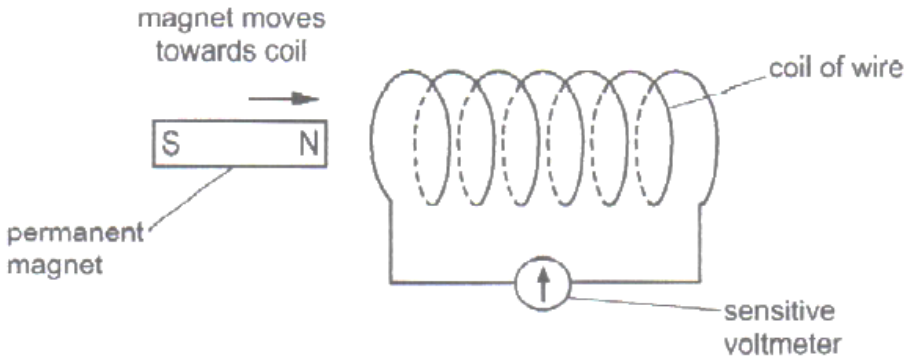


Fig. 10.1

(i) When the magnet moves towards the coil of wire, the pointer on the sensitive voltmeter deflects to the right.

Explain why the pointer deflects.

- Magnetic fields cuts the coil of wire - This induces an emf in coil. [2]

(ii) State **two** changes that increase the deflection on the sensitive voltmeter.

1 move magnet faster towards coil.

2 Increase turns on the coil

[2]

(b) Fig. 10.2 shows the symbol for a transformer. The primary coil is connected to a voltage of 180 V a.c.

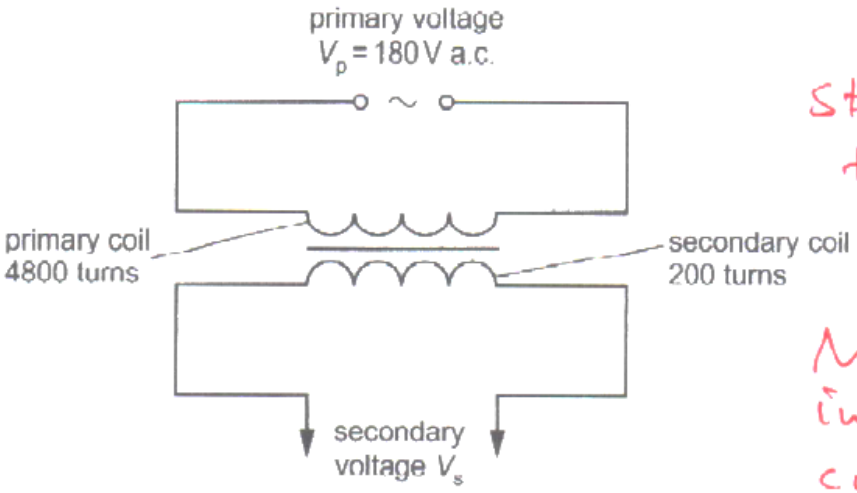


Fig. 10.2

Step-down transformer

More turns in primary coil than in Secondary Coil

$N_p = 4800$

$N_s = 200$

Calculate the secondary voltage V_s for the transformer.

$$V_s = \frac{N_s \times V_p}{N_p}$$

$$= \frac{200 \times 180}{4800}$$

$$= 7.5 \text{ V}$$

V_s = ... 7.5 ..... V [3]

[Total: 7]

23. June/2023/Paper_0625/31/No.7(b)

(b) Visible light is a region of the electromagnetic spectrum.

State **one** region of the electromagnetic spectrum which has waves of longer wavelength than waves of visible light.

IR, microwaves, Radio waves ..... [1]

24. June/2023/Paper_0625/31/No.9(b)

Fig. 9.1 shows a series circuit. Two of the components in the circuit are labelled.

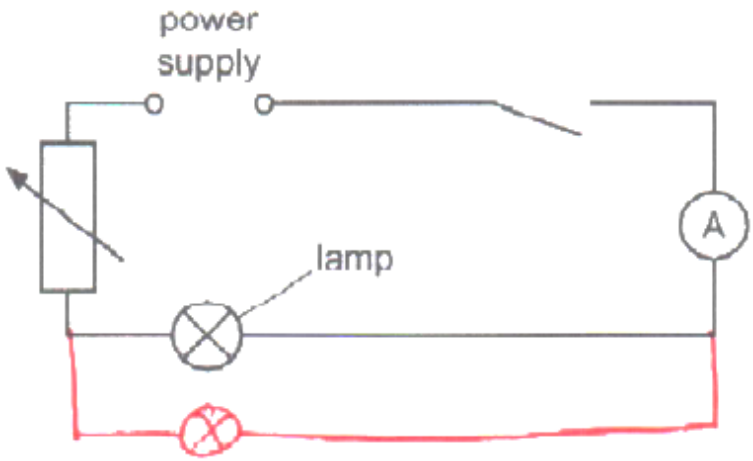


Fig. 9.1

(b) The current in the lamp is 0.40A. The potential difference (p.d.) across the lamp is 6.0V.

Calculate the power dissipated in the lamp.

$P = V \times I$

$= 6.0\,V \times 0.40\,A$

$= 2.4\,W$

power = 2.4 W [3]

25. June/2023/Paper_0625/41/No.8

The electricity supplied to a town is transmitted using a high-voltage cable. A transformer in the town has a soft-iron core.

(a) Explain the principle of operation of a simple iron-cored transformer.

- Alternating current in primary coil generates a changing magnetic field.
- Iron core concentrate and transfers the magnetic field to the secondary coil and emf is induced by the changing fi [4]

(b) The transformer steps the supply voltage down from 220 000 V to 33 000 V.

(i) There are 450 turns on the secondary coil.

Calculate the number of turns on the primary coil.

$N_p = \frac{V_p \times N_s}{V_s}$

$= \frac{220{,}000 \times 450}{33\,000}$

$N_p = 3000$ turns

number of turns = 3000 [2]

(ii) The electrical power transferred to the transformer by the high-voltage cable is 77 MW.

Calculate the current in the primary coil.

$P = V \times I$

$I = \frac{P}{V}$

$= \frac{77 \times 10^6 \text{ W}}{220{,}000}$

$= 350$ A

current = 350 A [3]

[Total: 9]

26. June/2023/Paper_0625/43/No.7

The voltage across the primary coil of a 100% efficient transformer is 220 V and the voltage across the secondary coil is 12 V.

(a) The current in the secondary coil is 2.5A.

Calculate the current in the primary coil.

$V_p \times I_p = V_s \times I_s$

$I_p = \frac{V_s \times I_s}{V_p}$

$= \frac{12 \times 2.5}{220}$

$= 0.136$

$\simeq 0.14\,A$

current = 0.14 A [3]

(b) Calculate the ratio of the number of turns on the primary coil to the number of turns on the secondary coil of the transformer.

$\frac{V_p}{V_s} = \frac{N_p}{N_s}$

$\frac{N_p}{N_s} = \frac{220}{12}$

220 : 12

18 : 1

ratio = 18 : 1 [2]

[Total: 5]

Electromagnetic Spectrum – 2023 IGCSE 0625 Physics

1. Nov/2023/Paper_ 0625/11/No.22

Where do all types of electromagnetic waves travel at the same speed?

A air
B a vacuum
C glass
D water

- In vacuum, no medium, so EM waves do not change speed.
- In other media, EM waves get refracted, so change speed & slow down.

2. Nov/2023/Paper_ 0625/12/No.22

The table shows different types of wave in the electromagnetic spectrum.

radio waves	microwaves	infrared waves	visible light	ultraviolet waves	X-rays	gamma rays

Where do all the waves travel at the same speed?

A in a vacuum
B in diamond
C in glass
D in water

In these media, EM waves undergo refraction which changes their speed.

3. Nov/2023/Paper_ 0625/13/No.22

The diagram shows the electromagnetic spectrum.

γ-rays	E	ultraviolet	F	infrared	microwaves	G

E: X-ray; F: visible; G: radio

Which types of wave are E, F and G?

	E	F	G
A	radio	visible light	X-rays
B	radio	X-rays	ultrasound
C	X-rays	radio	ultrasound
D	X-rays	visible light	radio

4. Nov/2023/Paper_ 0625/21/No.22

A radio transmitter broadcasts at a frequency of 200 kHz.

↑ EM wave – speed = 3.0×10^8 m/s

What is the wavelength of these radio waves?

$c = f \times \lambda$

$\lambda = \frac{c}{f} = \frac{3.0 \times 10^8}{200 \times 10^3} = 1500\,m$

$= 1.5 \times 10^3$

A 6.7×10^{-4} m B 1.5 m C 1.5×10^3 m D 1.5×10^8 m

5. Nov/2023/Paper_ 0625/22/No.22

The frequency of the microwaves used in a microwave oven is 2400 MHz.

↑ EM wave $c = 3.0 \times 10^8$ m/s

What is the wavelength of these microwaves?

A 0.125 m B 8.00 m C 125 m D 7200 m

$c = f \times \lambda$; $\lambda = \frac{c}{f}$; $\lambda = \frac{3.0 \times 10^8}{2400 \times 10^6} = 0.125\,m$

6. Nov/2023/Paper_ 0625/31/No.5

Fig. 5.1 shows the main regions of the electromagnetic spectrum in order of increasing frequency.

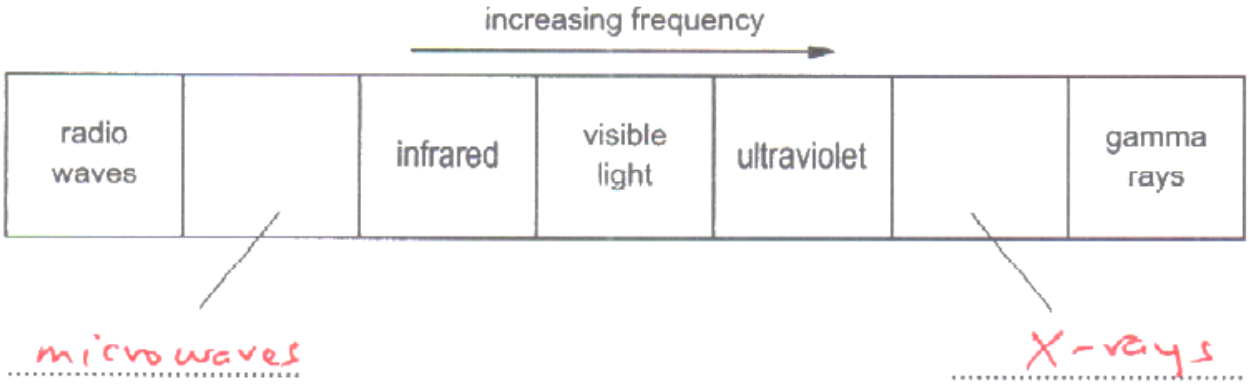


Fig. 5.1

(a) Two of the regions are unlabelled.

Add the correct label to each of the unlabelled regions in Fig. 5.1. [2]

(b) State **one** use of infrared radiation and **one** use of ultraviolet radiation.

infrared radiation - Intruder alarms.
- Remote control for televisions

ultraviolet radiation
- Sterilising water
- detecting fake bank note. [2]

(c) Describe possible harmful effects of excessive exposure to:

infrared radiation
Cause skin burns.

ultraviolet radiation
- Skin cancer.
- cause cataracts [2]
- damage surface skin cells [Total: 6]

7. Nov/2023/Paper_ 0625/33/No.5

(a) Fig. 5.1 shows regions of the electromagnetic spectrum in order of increasing wavelength. **Two** of the regions are unlabelled.

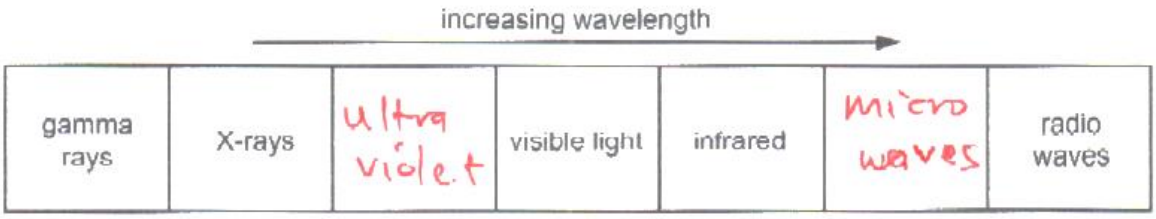


Fig. 5.1

(i) Complete Fig. 5.1 by writing the name of each unlabelled region in the correct box. [2]

(ii) State **two** properties that are the same for all regions of the electromagnetic spectrum.

1 They are all transverse waves
- All have same speed in vacuum 3.0×10^8 m/s

2 - All travel in vacuum
- All transfer energy.

[2]

(b) **(i)** State **one** use for infrared radiation.

remote control for television [1]

(ii) State **one** harmful effect of excessive exposure to infrared radiation.

Skin burns. [1]

[Total: 6]

8. Nov/2023/Paper_ 0625/41/No.4(c)

A radio transmitter is a very tall, thin cylinder. It is prevented from falling over by wires which have one end fixed to the transmitter and the other end fixed in the ground. The ends of the wires in the ground are a long distance from the transmitter.

Fig. 4.1 shows the transmitter and two of the wires.

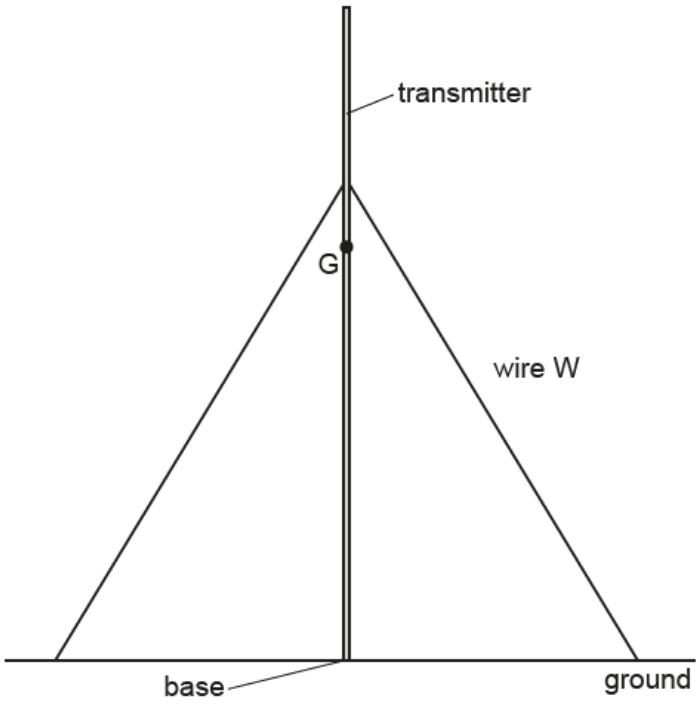


Fig. 4.1

(c) The radio transmitter uses radio waves to transmit radio and television programmes.

State **one** other use of radio waves.

– Radio frequency Identification (RFID)

– Bluetooth [1]

– Wifi

– Astronomy

– Radar (radio detection and ranging).

[Total: 7]

9. Nov/2023/Paper_ 0625/42/No.7

Fig. 7.1 shows some uses of electromagnetic radiation and different regions of the electromagnetic spectrum.

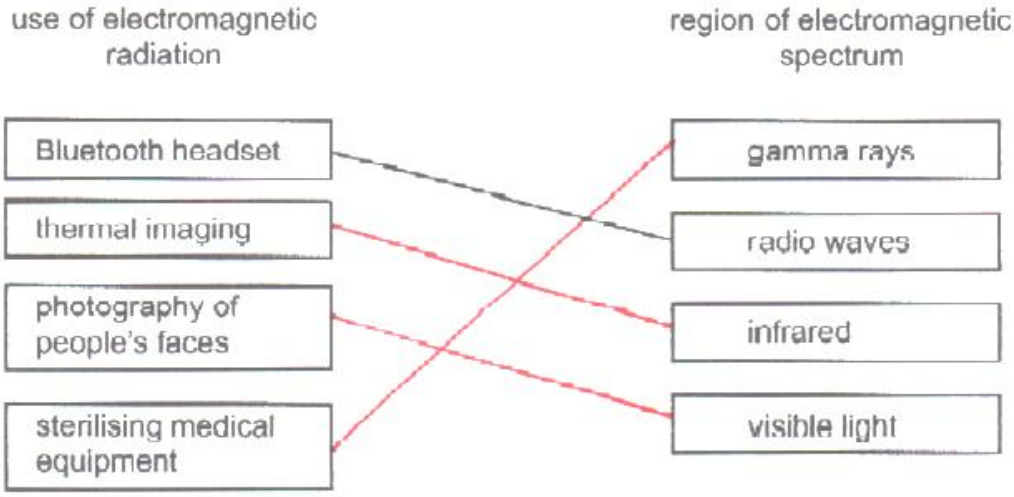


Fig. 7.1

(a) Draw a line from each use to the correct region of the spectrum. Each region of the spectrum is used once. One line has been completed for you. [2]

(b) State the speed of electromagnetic waves in a vacuum.

speed = 3.0×10^8 m/s [1]

(c) A Bluetooth headset can be used to listen to music on a mobile (cell) phone without the need for wires to connect the headset to the phone.

(i) The headset uses frequencies in the range 2.40–2.48 GHz.

Calculate the wavelength of the radio waves when the frequency is in the middle of the frequency range.

$\frac{2.40 + 2.48}{2}$

$= 2.44 \times 10^9$ Hz

$c = f \times \lambda$

$\lambda = \frac{c}{f}$

$\lambda = \frac{3.0 \times 10^8}{2.44 \times 10^9}$

$= 0.12$ m

wavelength = 0.12 m. [3]

(ii) Suggest why a Bluetooth headset only works well over short distances.

- The radio waves lose energy and get weaker passing through walls. [1]

[Total: 7]

10. June/2023/Paper_0625/11/No.21

Which statement is correct?

A A remote controller emits microwave radiation. ✗

B ✓ A remote controller emits infrared radiation.

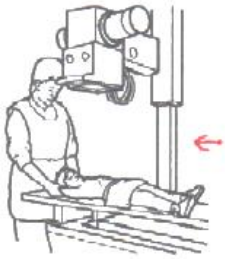
C A remote controller emits ultrasound. ✗

D A remote controller emits ultraviolet radiation. ✗

11. June/2023/Paper_0625/12/No.21

The two devices shown use different types of electromagnetic waves.

medical scanning



← X-ray

remote controller

← Infrared. (IR)

Which types of waves are used in these devices?

— Medical scanning uses X-ray since they are penetrating and will pass through a patient.

— Remote controller uses IR waves.

	medical scanning	remote controller
A	ultraviolet	infrared
B	ultraviolet	microwaves
C ✓	X-rays	infrared
D	X-rays	microwaves

12. June/2023/Paper_0625/13/No.21

Which row matches a region of the electromagnetic spectrum to one of its uses?

	region	use
A	gamma rays	intruder alarms
B	infrared	satellite television
C ✓	microwaves	mobile (cell) phones
D	radio waves	sterilising food

gamma – used to treate cancer

IR – used by remote control and intruder alarms

Radio – used for communication

13. June/2023/Paper_0625/21/No.21

Visible light has wavelengths in the range 4.0×10^{-7} m to 7.0×10^{-7} m.

What is the range of the frequencies of visible light?

A 0.12 Hz to 0.21 Hz

B 120 Hz to 210 Hz

C 4.3×10^{11} Hz to 7.5×10^{11} Hz

D ✓ 4.3×10^{14} Hz to 7.5×10^{14} Hz

$f = \frac{c}{\lambda}$

$= \frac{3.0 \times 10^{8}}{4.0 \times 10^{-7}}$

$= 7.5 \times 10^{14}$ Hz

$f = \frac{3.0 \times 10^{8}}{7.0 \times 10^{-7}}$

$= 4.3 \times 10^{14}$ Hz

14. June/2023/Paper_0625/22/No.21

A radio station broadcasts a signal with a frequency of 89 MHz.

Speed of EM wave = 3.0×10^{8} m/s

89×10^{6} Hz

What is the wavelength of this signal?

A 3.7 µm B ✓ 3.4 m C 3.7 km D 3.4 Mm

$c = f \times \lambda$

$\lambda = \frac{c}{f} = \frac{3.0 \times 10^{8}}{89 \times 10^{6}}$

$= 3.37$ m

$\simeq 3.4$ m.

A boy shouts and hears the echo from a tall building 2.2 s later.

15. June/2023/Paper_0625/23/No.21

A student writes four statements matching a communication system to the region of the electromagnetic spectrum that it uses to transmit signals.

Which statement is correct?

A Wireless internet uses visible wavelengths. ← Use radio waves for Wi-fi

B Mobile phones use X-rays. ← Mobile phones use microwaves

C ✓ Cable television uses infrared wavelengths.

D Bluetooth uses ultraviolet wavelengths. ← blue tooth use radio waves

16. June/2023/Paper_0625/41/No.6

A mobile phone (cell phone) network uses microwaves of frequency 1.9×10^9 Hz to transmit and receive signals.

The speed of microwaves in air is 3.0×10^8 m/s.

(a) Calculate the wavelength of these microwaves in air.

$\lambda = \frac{c}{f}$

$= \frac{3.0 \times 10^8 \text{ m/s}}{1.9 \times 10^9 \text{ s}^{-1}}$

$= 0.15789$

$\lambda \approx 0.16$ m

wavelength = 0.16 m. [2]

(b) State **two** reasons why microwaves are used for mobile phone (cell phone) signals.

1 Microwaves only need short antennas

2 Microwaves are able to penetrate some walls. [2]

(c) All mobile phone (cell phone) networks use digital signals to communicate with the phone.

(i) Describe, with the aid of a diagram, how a digital signal differs from an analogue signal.

- digital signal consists of two values 1 and 0
- Analogue varies over a range of values. [3]

(ii) State **two** advantages of using digital signals rather than analogue signals.

1 Signal can be regenerated to remove noise from signal

2 transmission of data is faster

3. Data can be compressed

4. data can be transmitted over longer distances. [2]

[Total: 9]

17. June/2023/Paper_0625/33/No.6

Table 6.1 shows regions of the electromagnetic (e.m.) spectrum.

Two of the regions are not labelled.

Table 6.1

gamma rays	X-rays	UV	visible light	infrared	microwaves	radio waves

(a) **(i)** Complete Table 6.1 by writing the name of each region that is not labelled. [2]

(ii) State **two** properties that are the same for waves in all regions of the e.m. spectrum.

1 They are all transverse waves

2 Travel at same speed in vacuum of 3.0×10^8 m/s

[2]

(b) X-rays are used in hospitals to check for broken bones.

(i) State **one** other use for X-rays.

Kill Cancer Cell, detect art fraud [1]

(ii) State **one** precaution taken by people who work with X-rays.

- limit exposure time [1]
- Use a screen shield

[Total: 6]

18. June/2023/Paper_0625/43/No.5(a)

(a) Two types of electromagnetic radiation are used in glass optical fibres for high-speed broadband.

(i) State the type of electromagnetic radiation, other than visible light, which is used in glass optical fibres.

Infra-red ..... [1]

(ii) Give **two** reasons why these two types of electromagnetic radiation are used in glass optical fibres for high-speed broadband.

1 Glass is transparent to both visible light and IR .....

2 Both visible light and IR can carry high rates of data. .....

[2]

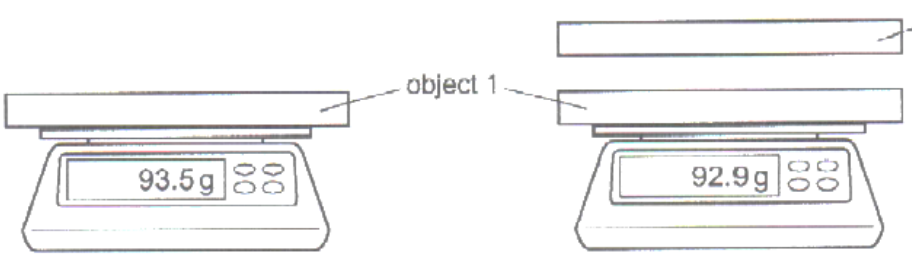
Electrostatics – 2023 IGCSE 0625 Physics

1. Nov/2023/Paper_ 0625/11/No.25

Object 1 is given a negative charge and placed on a balance.

↑ electrons

Object 2, which is also charged, is brought close to object 1 and the reading on the balance changes as shown.



← positive charge so attracts object 1, so balance reading has decreased.

Which action would further decrease the reading on the balance?

A Add the same number of electrons to both objects.

B Remove the same number of electrons from both objects.

C Transfer electrons from object 1 to object 2.

(D) ✓ Transfer electrons from object 2 to object 1.

– Giving more electrons to object 1, means it will be attracted more strongly by object 2, reducing balance reading further.

2. Nov/2023/Paper_ 0625/11/No.28

A plastic rod is rubbed with a cloth. The rod becomes positively charged because of the movement of charged particles.

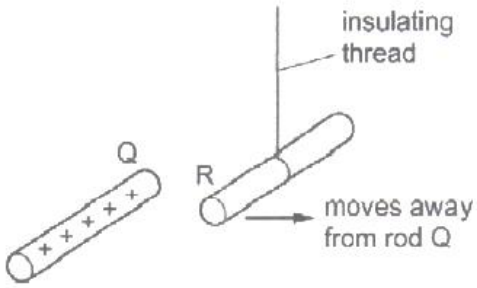
Which row gives the name of these charged particles and the direction in which they move?

	charged particles	direction of movement
A	electrons	from cloth to rod
(B) ✓	electrons	from rod to cloth
C	protons	from cloth to rod
D	protons	from rod to cloth

For rod to be truly charged, electrons flow from rod to cloth.

3. Nov/2023/Paper_ 0625/12/No.28

In the diagram, rod R is suspended from an insulating thread.



When the positively charged rod Q is brought close to rod R, rod R moves away from rod Q.

Which conclusion can be made from this observation?

↑repulsion
- R has similar charges as Q
- so R is truly charged.

A Rod R is charged, but it is not possible to identify the sign of the charge.

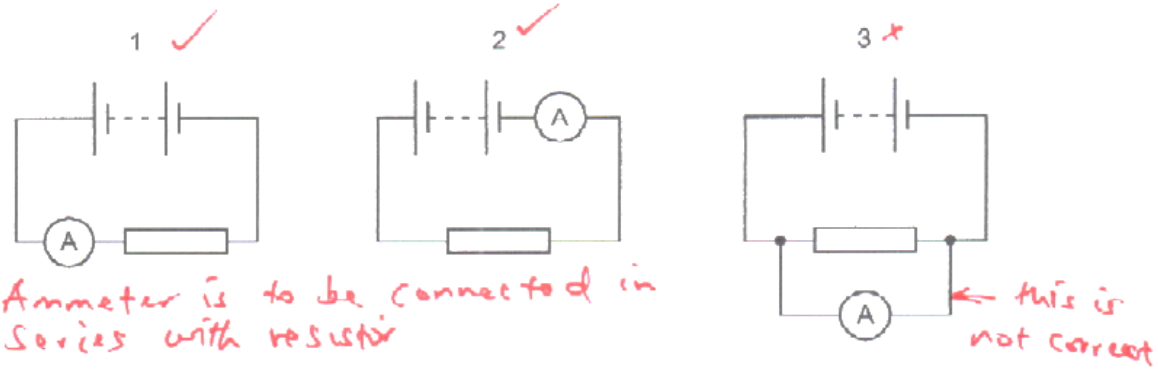
B Rod R must be positively charged. ✓

C Rod R must be negatively charged.

D Rod R is uncharged.

4. Nov/2023/Paper_ 0625/13/No.25

A student uses an ammeter to measure the current in a resistor. He considers three different circuits, as shown.



In which of the circuits does the ammeter measure the current in the resistor?

A 1, 2 and 3 B 1 and 2 only ✓ C 1 only D 3 only

5. Nov/2023/Paper_ 0625/21/No.28

A plastic rod is rubbed with a cloth. The rod becomes positively charged because of the movement of charged particles.

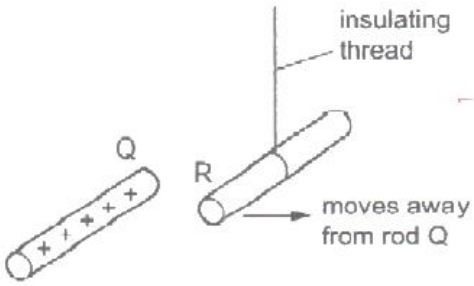
Which row gives the name of these charged particles and the direction in which they move?

	charged particles	direction of movement
A	electrons	from cloth to rod
B ✓	electrons	from rod to cloth
C	protons	from cloth to rod
D	protons	from rod to cloth

- Electrons move from the rod to the cloth.
- The rod has now more protons and so it becomes truly charged.
- The cloth becomes negatively charged.

6. Nov/2023/Paper_ 0625/22/No.28

In the diagram, rod R is suspended from an insulating thread.



- Like charges repel
- Unlike charges attract.

When the positively charged rod Q is brought close to rod R, rod R moves away from rod Q.

↑ repelling.

Which conclusion can be made from this observation?

A Rod R is charged, but it is not possible to identify the sign of the charge.

B ✓ Rod R must be positively charged.

- So charge on R must be +ve.

C Rod R must be negatively charged.

D Rod R is uncharged.

7. Nov/2023/Paper_ 0625/23/No.28

A teacher wishes to show the production of electrostatic charges.

She holds a rod and rubs it with a cotton cloth. A copper rod, a glass rod, a plastic rod and a steel rod are available.

Which two rods would both be suitable to use?

In metals charge will flow.

- So electrostatic charges will only form on insulators, in this case glass rod and plastic rod.

A a copper rod and a glass rod

B ✓ a glass rod and a plastic rod

C a plastic rod and a copper rod

D a plastic rod and a steel rod

8. Nov/2023/Paper_ 0625/41/No.7

(a) A plastic rod is uncharged.

When the rod is rubbed with a woollen cloth, the rod becomes negatively charged.

Explain, in terms of particles, why the rod becomes negatively charged.

- Electron (-vely charged) move from the cloth to the rod. The gain of the electrons by the rod gives it negative charge [2]

(b) Fig. 7.1 shows a negatively charged metal sphere S.

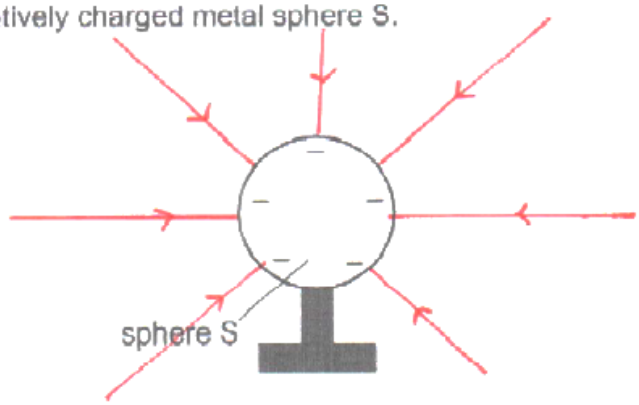


Fig. 7.1

There is an electric field surrounding S.

(i) State what is meant by an electric field.

- A region in space where an electric charge (+ve or -ve) experiences a force. [1]

(ii) On Fig. 7.1, draw the pattern of the electric field surrounding sphere S and indicate its direction. [2]

(c) Fig. 7.2 shows a small negative charge Z placed near to sphere S.

Like charges repels.

Fig. 7.2

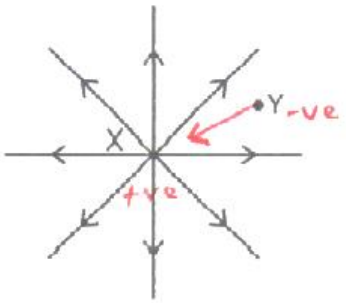
Charge Z experiences a force due to the electric field surrounding S.

On Fig. 7.2, draw an arrow to show the direction of this force on Z. [1]

[Total: 6]

9. Nov/2023/Paper_ 0625/43/No.7

(a) Fig. 7.1 shows the electric field pattern around point X.



+ve & -ve charges attract. So Y will move towards X.

Fig. 7.1

(i) On Fig. 7.1, draw an arrow to indicate the direction of the force on a negative point charge placed at point Y. [2]

(ii) State what is at point X to produce the field pattern shown in Fig. 7.1.

Positive point charge, since direction of field is away from point X [2]

(b) A piece of plastic is charged positively by friction.

State what charge transfers occur during this process.

- Electrons are removed from the plastic by friction. So it remains with a net positive charge. [2]

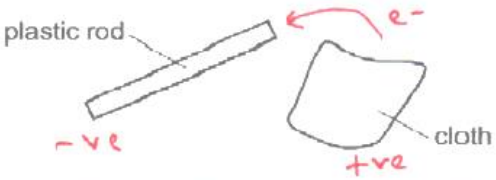
(c) Explain how the structure of an electrical conductor differs from the structure of an electrical insulator.

Conductors have mobile delocalised electrons but insulators do not have. [2]

[Total: 8]

10. June/2023/Paper_0625/11,21/No.24

A plastic rod is rubbed with a cloth.

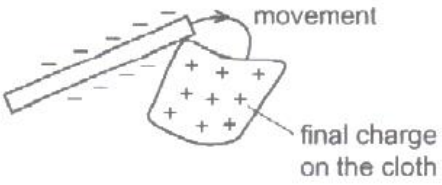


The rod and the cloth both become charged as electrons move between them.

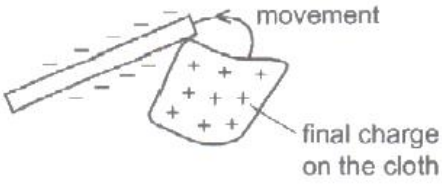
The rod becomes negatively charged.

Which diagram shows how the rod becomes negatively charged and shows the final charge on the cloth?

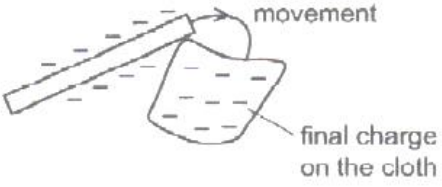
A



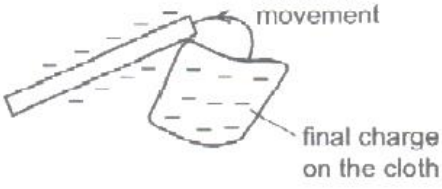
B ✓



C



D



11. June/2023/Paper_0625/12/No.24

A plastic rod is rubbed with a dry cloth. The rod becomes positively charged.

Why has the rod become positively charged?

A It has gained electrons.

B It has gained neutrons.

C ✓ It has lost electrons.

D It has lost neutrons.

The rod loses electrons and is left with more protons hence gains +ve charge.

- Protons (+ve)
- Electrons (-ve).

12. June/2023/Paper_0625/13/No.24

A plastic rod and a dry cloth are uncharged.

The rod is now rubbed with the cloth and they both become charged. The rod becomes negatively charged because some charged particles move from the cloth to the rod.

What is the charge on the cloth and which particles moved in the charging process?

	charge on cloth	particles that moved
A	negative	electrons
B	negative	neutrons
C ✓	positive	electrons
D	positive	neutrons

- only electron can move
proton cannot move.

Rod — -vely

Cloth — +vely

13. June/2023/Paper_0625/22/No.24

A plastic rod is rubbed with a dry cloth. The rod becomes positively charged.

Why has the rod become positively charged?

A It has gained electrons.

B It has gained neutrons.

C ✓ It has lost electrons.

D It has lost neutrons.

- Electrons moved from the rod to cloth.
- So rod loses electron
- cloth gains electrons from the rod.

14. June/2023/Paper_0625/23/No.24

A plastic rod and a dry cloth are uncharged.

The rod is now rubbed with the cloth and they both become charged. The rod becomes negatively charged because some charged particles move from the cloth to the rod.

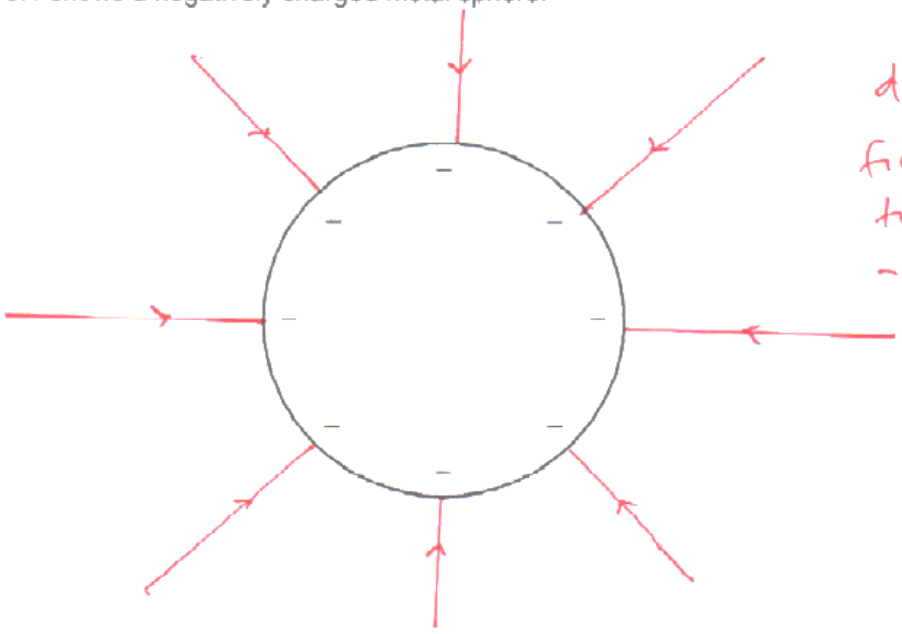
What is the charge on the cloth and which particles moved in the charging process?

	charge on cloth	particles that moved
A	negative	electrons
B	negative	neutrons
C ✓	positive	electrons
D	positive	neutrons

- Rod gain electrons from cloth to become -ve.
- Cloth become +vely charged

15. June/2023/Paper_0625/42/No.8(b)

(b) Fig. 8.1 shows a negatively charged metal sphere.



direction of field is towards a -ve charge.

Fig. 8.1

On Fig. 8.1, draw **four** lines to show the electric field and its direction. [2]

Direction of around a +vely charged body is away.

Energy Resources – 2023 IGCSE 0625 Physics

1. Nov/2023/Paper_ 0625/11/No.9

Which energy resource is non-renewable?

A geothermal
B natural gas
C solar
D wind

Geothermal, solar, wind } All are renewables, will not get depleted.

2. Nov/2023/Paper_ 0625/12/No.9

In a small power station, biofuel is used to generate electricity.

Which energy store is reduced by this process?

A chemical
B kinetic
C nuclear
D thermal

biofuel – contains chemical energy
– As chemical energy is converted to electrical energy it reduces.

3. Nov/2023/Paper_ 0625/13/No.9

Electrical power is generated from different resources. Some of these resources are listed.

- chemical energy stored in biofuels
- chemical energy stored in fossil fuels ← Non-renewable.
- energy stored in tides
- geothermal resources
- hydroelectric resources
- light from the Sun
- nuclear fuel ← non-renewable

How many of the resources listed are classified as renewable? ← does not run out, will always be present and available

A 3 B 4 C 5 D 6

4. Nov/2023/Paper_ 0625/31/No.6(a, c)

Fig. 6.1 shows four wind turbines.

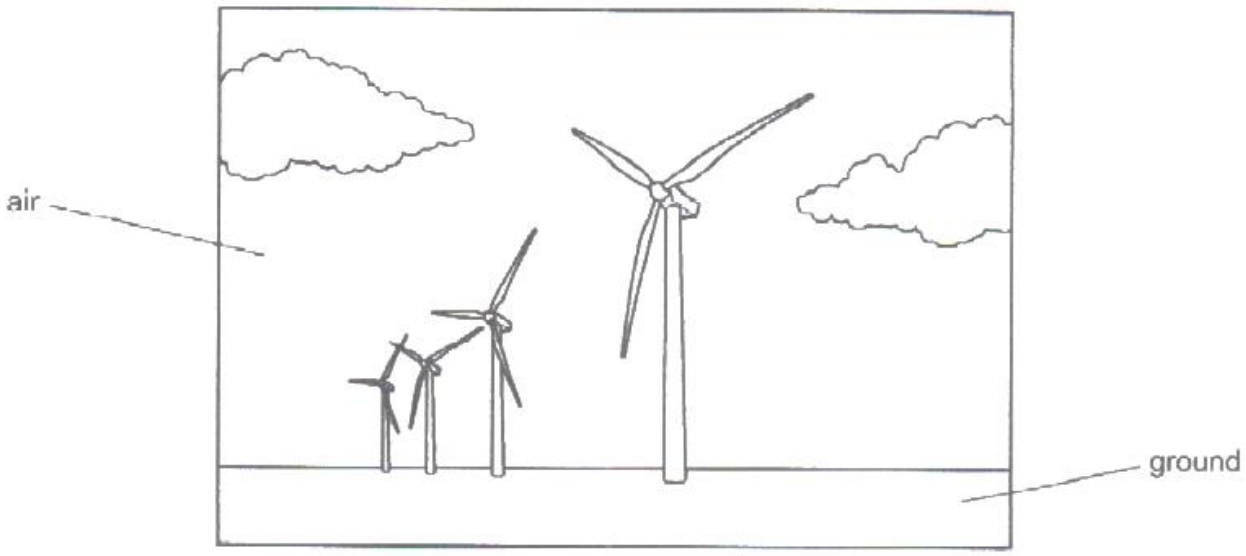


Fig. 6.1

(a) Describe how a wind turbine generates electrical power.

- K.E of wind turns the turbines
- The turbines rotates the generator which produce electricity. [3]

(c) For transmission, the output voltage is increased to 132 kV.

State **two** advantages of transmitting electrical power at high voltage.

1 Thinner cables can be used so reducing cost gains

2 Lower current, so reduces power losses during transmission [2]

5. Nov/2023/Paper_ 0625/41/No.5

Many methods of generating electrical power involve the use of water.

(a) Describe **one** method of generating electrical power from energy stored in water.

- In a dam the water has stored gpe
- When release down through tunnels, the gpe store is transferred to K.E sto
- The moving water turns the turbine which turns the generator. [3]

(b) For the method you chose in **(a)**, state **one** advantage and **one** disadvantage of generating electricity this way.

advantage the store is a renewable energy resource.

disadvantage During drought, the water level in the dam go down and generation of electricity is affected. [2]

(c) State **two** methods of generating electrical power for which the main source of energy is **not** the Sun.

1 Geothermal energy

2 Tidal energy [2]

3. Nuclear energy

[Total: 7]

6. June/2023/Paper_0625/23/No.11

Research is being carried out to produce electrical energy from the fusion of hydrogen nuclei.

Which row shows two of the problems in designing a fusion reactor?

	temperature needed	why obtaining a high density of hydrogen nuclei is difficult
A	very low	the nuclei are negatively charged and repel each other
B	very low	the nuclei are positively charged and repel each other
C	very high ✓	the nuclei are negatively charged and repel each other
D ✓	very high ✓	the nuclei are positively charged and repel each other ✓

H - nuclei contains a proton and neutron
- Protons have a +ve charge
- Like charges repel.

$^{2}_{1}H + {}^{2}_{1}H \longrightarrow {}^{3}_{2}He + {}^{1}_{0}n$.

- This is equation for nuclear fusion of H-atoms

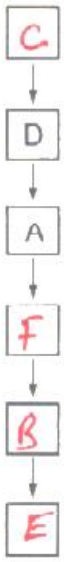
7. June/2023/Paper_0625/31/No.3

Electricity is distributed from wind turbines to homes and industry.

(a) Statements A–F describe the main stages in the transfer of energy from the Sun to electrical energy in a wind turbine generator.
The statements A–F are **not** in the correct order.

A Air moves from regions of high pressure to regions of low pressure.
B The turbine blades turn a generator.
C Energy from the Sun heats the atmosphere unevenly.
D Uneven heating of the atmosphere produces regions of different atmospheric pressure.
E The generator produces electrical energy.
F Moving air turns the turbine blades.

Complete the flow chart to describe how a wind turbine uses energy from the Sun to generate electrical energy. Insert the missing letters in the empty boxes.



[3]

(b) State **two** disadvantages, apart from cost, of using wind turbines to produce electrical energy for homes and industry.

1 large area of land is needed for wind farm

2 Energy output is small.

[2]

3. Depends on availability of wind

4. Causes noise pollution.

5. Harms birds.

[Total: 5]

8. June/2023/Paper_0625/33/No.2

Fig. 2.1 shows an engineer working with wind turbines.

Fig. 2.1

(a) Complete the sentences describing how electrical power is generated by energy in the wind.

(i) The source of the wind energy is ..the Sun.. . [1]

(ii) When the blades turn, electrical power is generated in the ..generator.. . [1]

(b) Describe **two** advantages, apart from cost, of generating electrical power by using wind turbines compared with using a coal-fired power station.

1 No polluting gases are emitted so it is a clean source of energy

2 It is renewable, wind will never stop flowing.

[2]

[Total: 4]

9. June/2023/Paper_0625/43/No.2(b, c)

(b) State **two** energy resources for which the Sun is **not** the main source.

1 Geothermal

2 nuclear

3 - Tidal.

[2]

(c) State and explain whether each of the following methods of electrical power generation is renewable.

(i) power generation in a nuclear power station

statement Non-renewable

explanation Nuclear fuel is used up and it not possible to replace it

[2]

(ii) power generation from waves in the sea

statement Renewable

explanation Waves in the sea will always be there, they are never used up.

[2]

Forces – 2023 IGCSE 0625 Physics

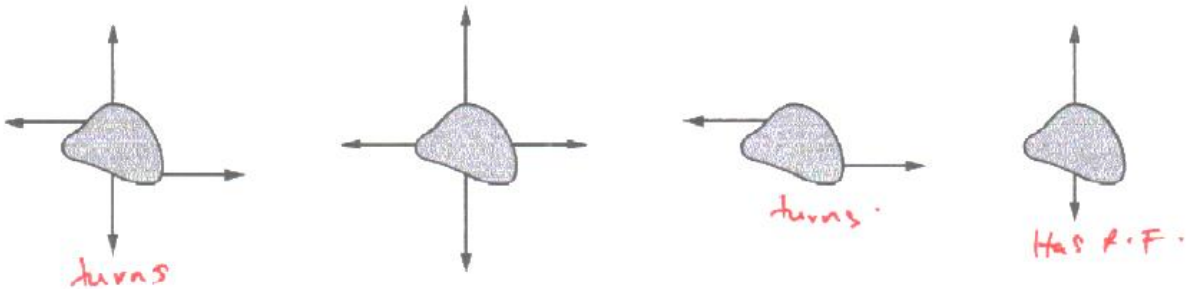
1. Nov/2023/Paper_ 0625/11,21/No.6

Forces are applied to four identical objects.

The length of each arrow indicates the magnitude of the force.

Which object is in equilibrium? Object has no Resultant force nor turning moment.

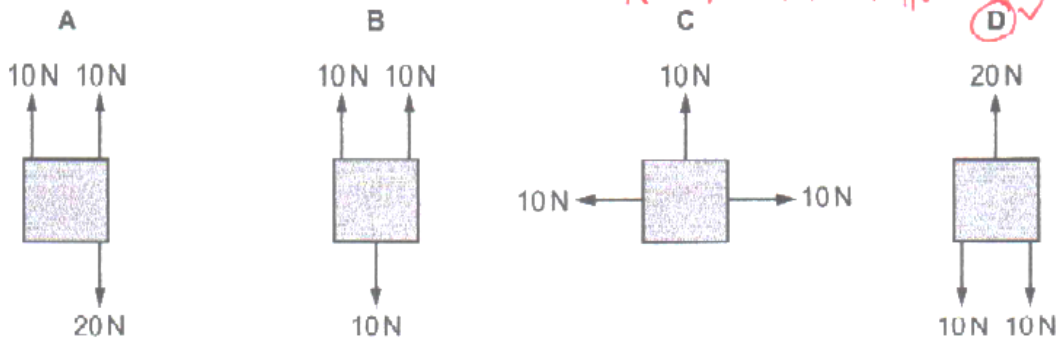
A B C D



2. Nov/2023/Paper_ 0625/12,22/No.6

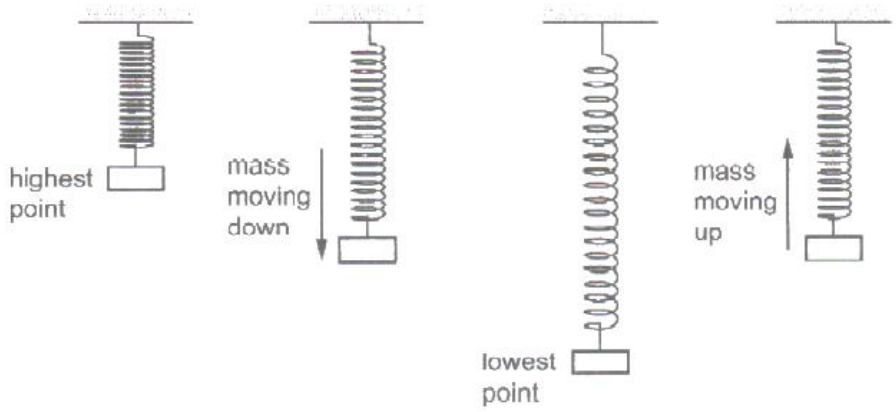
The diagrams show four identical objects. Each object is acted on by only the forces shown.

Which diagram shows an object in equilibrium? - No turning moment - No Resultant force. D



3. Nov/2023/Paper_ 0625/13/No.8

A mass bounces up and down on a steel spring. The diagram shows the mass and the spring at different points during the motion.



At which point is the least energy in the gravitational potential store of the mass and at which point is the most energy in the elastic store of the spring?

	least energy in gravitational potential store of the mass	most energy in the elastic store of the spring
A	mass moving down	mass moving up
B	mass moving down	lowest point
C	lowest point	mass moving up
D ✓	lowest point ✓	lowest point ✓

- At lowest point, the spring is closer to ground so Δh is smaller
$gpe = mg\Delta h$.
- Most elastic store is when spring is stretched most

4. Nov/2023/Paper_ 0625/22/No.5

A satellite orbits the Earth at constant speed in a circular orbit.

Which statement is correct?

A The resultant force on the satellite is zero.

B ✓ The resultant force on the satellite is towards the Earth.

C The resultant force on the satellite is away from the Earth.

D The resultant force on the satellite is in the direction of its motion.

object in circular orbit has a resultant force acting toward the centre of rotation.

5. Nov/2023/Paper_ 0625/23/No.5

An object moves in a circle at constant speed.

Which statement about the force needed on the object is correct?

A A force away from the centre of the circle keeps the object moving in the circle.

B A force in the direction of motion of the object keeps it moving in the circle.

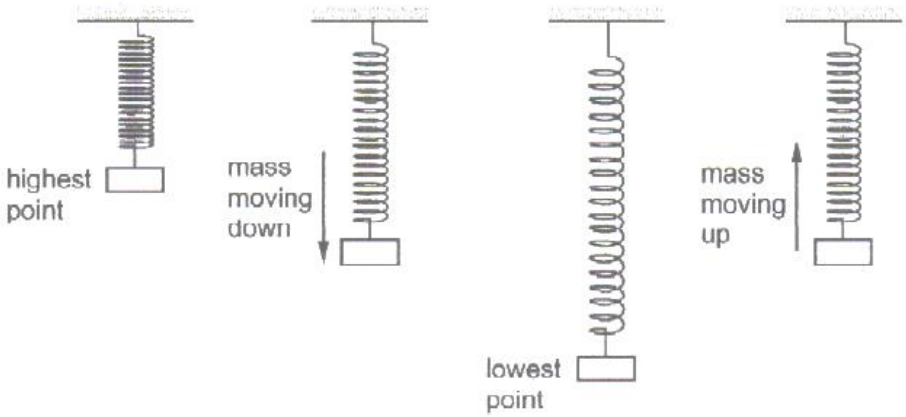
C A force towards the centre of the circle keeps the object moving in the circle. ✓

D No force is needed to keep the object moving at constant speed in the circle.

All object in circular motion have a resultant force directed at the centre of rotation to keep object changing direction each second.

6. Nov/2023/Paper_ 0625/23/No.8

A mass bounces up and down on a steel spring. The diagram shows the mass and the spring at different points during the motion.



At which point is the least energy in the gravitational potential store of the mass and at which point is the most energy in the elastic store of the spring?

	least energy in gravitational potential store of the mass	most energy in the elastic store of the spring
A	mass moving down	mass moving up
B	mass moving down	lowest point
C	lowest point	mass moving up
D ✓	lowest point	lowest point

gpe = mgh.
- Least gpe is at lowest point

e.p.e = $\frac{1}{2}fx$

- Most e.p.e is when spring is stretched most, so is at the lowest point.

7. Nov/2023/Paper_ 0625/31/No.2(b)

The mass of a solid metal cylinder is 400 g and its volume is 52 cm^3.

(b) The cylinder is falling at constant speed through the air. Fig. 2.1 shows the vertical forces acting on the cylinder.

upward force = downward force

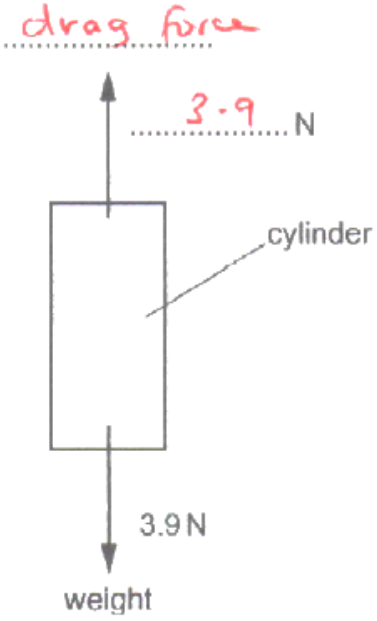


Fig. 2.1 (not to scale)

On Fig. 2.1, write the name and the size of the upward force on the cylinder. [2]

8. Nov/2023/Paper_ 0625/32/No.3b(ii)

(ii) The graph of load against extension for a spring is shown in Fig. 3.3.

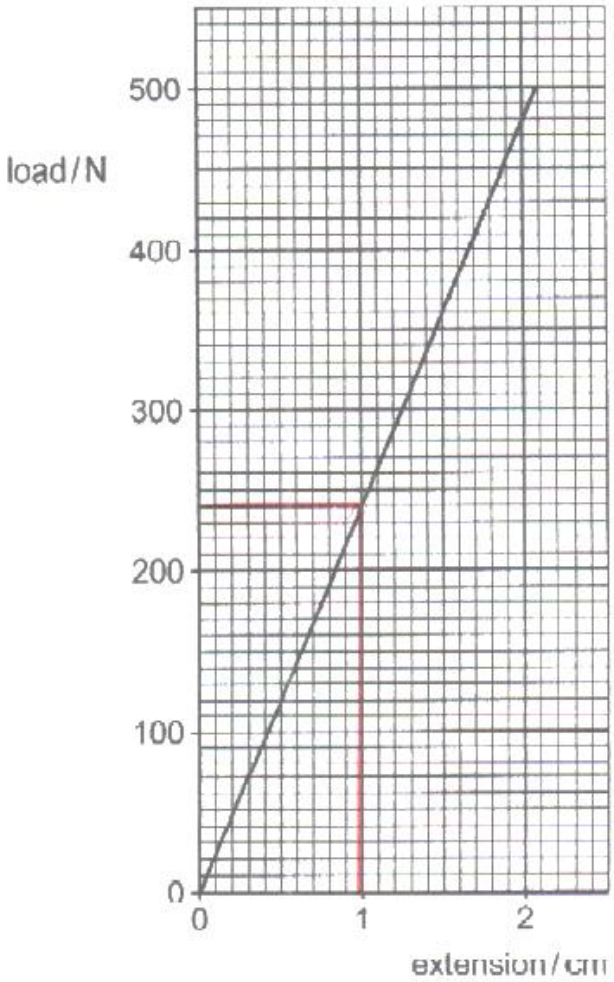


Fig. 3.3

The unstretched length of the spring is 16 cm.

Determine the length of the spring when the load on the spring is 240 N.

16 + 1 = 17 cm

length of spring = ... 17. ..... cm [2]

9. Nov/2023/Paper_ 0625/42/No.3(b)

(b) Fig. 3.2 shows the directions of two forces acting on a different balloon as it moves.

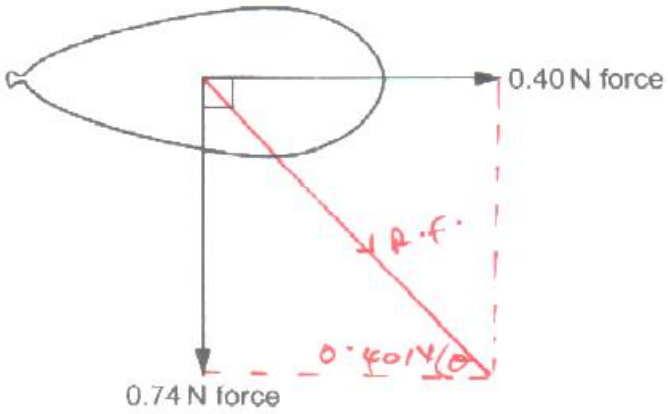


Fig. 3.2 (not to scale)

Determine the magnitude and direction of the resultant force on the balloon.

Use Pythagoras theorem

$R.F = \sqrt{0.74^2 + 0.40^2}$

$= 0.84\ N.$

Direction:

$$\tan\theta = \frac{0.74}{0.40}$$

$$\theta = \tan^{-1}(1.85)$$

$$= 61.6^\circ$$

$$\simeq 62^\circ$$

magnitude ..... 0.84 N .....

direction relative to horizontal force ..... 62° .....

[4]

10. Nov/2023/Paper_ 0625/43/No.2

(a) Fig. 2.1 is a graph that shows how the extension of a spring varies with the load suspended from it.

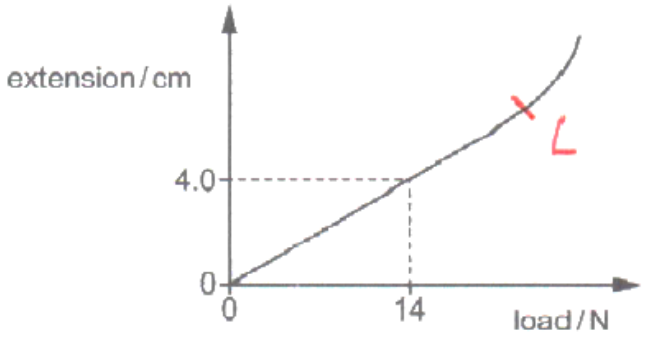


Fig. 2.1

(i) Determine the spring constant of this spring.

$F = k\,\Delta x$

$k = \frac{F}{\Delta x}$

$= \frac{14}{4.0}$

$= 3.5\ N/cm$

spring constant = ... 3.5 N/cm ..... [3]

(ii) On Fig. 2.1, mark the limit of proportionality and label this point L. [1]

(b) Fig. 2.2 shows a car travelling at constant speed around corner A on a road.

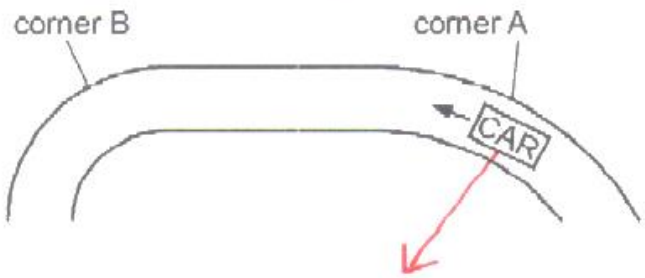


Fig. 2.2

(i) On Fig. 2.2, mark with an arrow the direction of the resultant force acting on the car as it travels around corner A. [2]

(ii) Corner B has a smaller radius than corner A. The car travels at the same speed around corner B as around corner A.

State how the resultant force changes due to the car travelling around a corner of smaller radius.

force increases to keep car in the circular path. [1]

[Total: 7]

11. June/2023/Paper_0625/11/No.7

Four objects are moving.

Which object has a zero resultant force acting on it?

R·f is net force on an object

A the object moving at a decreasing speed ← Has R·f in opposite direction to motion

B the object moving at an increasing speed ← R·f is in the same direction with motion

C the object moving at a constant speed in a circle ← In circle, R·f is towards centre

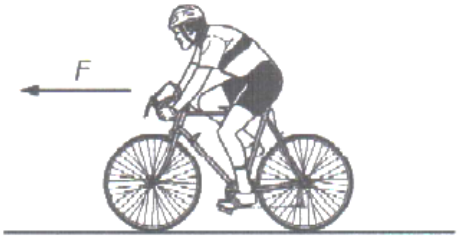
(D) ✓ the object moving at a constant speed in a straight line ← Since forward force = backward force

∴ R·F = 0

12. June/2023/Paper_0625/13,23/No.6

A cyclist is travelling in a straight line along a horizontal road at a constant speed.

A constant driving force *F* acts on the cyclist in the forward direction shown.



Which statement about the magnitude of the frictional forces acting on the cyclist is correct?

(A) ✓ The magnitude is equal to *F*.

B The magnitude is smaller than *F*, but greater than zero.

C The magnitude is greater than *F*.

D The magnitude is zero.

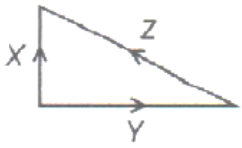
At constant speed both the forward and backward forces are equal.

∴ R·F = 0

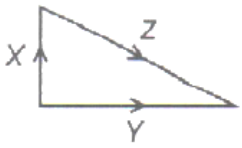
13. June/2023/Paper_0625/21/No.1

Which vector diagram correctly shows the force *Z* as the resultant of forces *X* and *Y*?

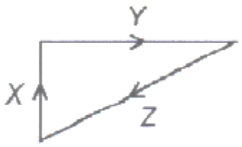
A



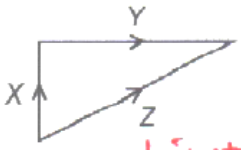
B



C



D ✓



same direction as the two forces.

14. June/2023/Paper_0625/21/No.2

An object falls towards the surface of the Earth.

The object is falling at its terminal velocity. ↑ constant speed

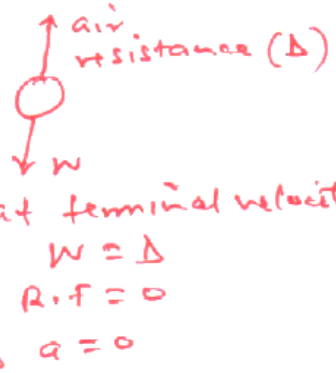
Which statement is correct?

A There is air resistance and the acceleration of the object is negative.

B ✓ There is air resistance and the acceleration of the object is zero.

C There is no air resistance and the acceleration of the object is negative.

D There is no air resistance and the acceleration of the object is zero.



15. June/2023/Paper_0625/21/No.4

On the Earth, a spring stretches by 5.0 cm when a mass of 3.0 kg is suspended from one end.

$W = m \times g$ $W = 3 \times 9.8 = 29.4\,N$

The gravitational field strength on the Moon is $\frac{1}{6}$ of that on the Earth.

Which mass, on the Moon, would stretch the spring by the same extension?

A 0.50 kg B 3.0 kg C 5.0 kg D ✓ 18 kg

$f = kx$

$k = \frac{f}{x} = \frac{29.4}{5} = 5.88\,N/cm$

$f = mg$ but $g = \frac{1}{6} \times 9.8$ on Moon

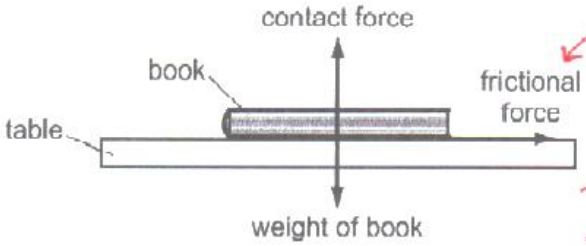
$m \times \frac{1}{6} \times 9.8 = 5.88\,N/cm \times 5\,cm$

$m = \frac{5.88 \times 5 \times 6}{9.8} = 18\,kg$

16. June/2023/Paper_0625/21/No.7

A train is travelling horizontally in a straight line. A book is on a table in the train.

The diagram shows all the forces acting on the book.



friction opposes motion

- So train is accelerating to the right.
- This is because tends to move to the left hence friction is opposing this motion

How is the train moving?

A accelerating to the left of the diagram

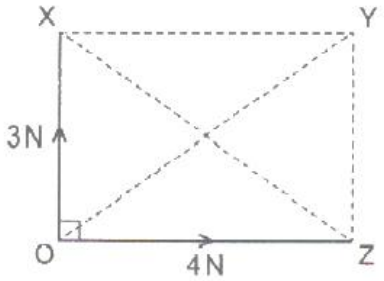
B accelerating to the right of the diagram ✓

C moving at uniform speed to the left of the diagram

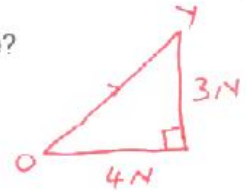
D moving at uniform speed to the right of the diagram

17. June/2023/Paper_0625/22/No.1

Forces of 3 N and 4 N act at right angles, as shown.



What is the resultant force?



$R.F = \sqrt{4^2 + 3^2}$

$= \sqrt{25}$

$= 5N$

A 1 N along XZ

B 5 N along XZ

C 5 N along OY ✓

D 7 N along OY

18. June/2023/Paper_0625/22/No.2

A light ball is held at rest at the top of a tall cliff. It is released and falls through the air, eventually reaching its terminal velocity.

Which row describes the behaviour of the ball as it descends?

	the initial acceleration of the ball	the final acceleration of the ball
A	0	0
B	0	g
(C) ✓	g	0
D	g	g

$g = 9.8\ m/s^2$

- Initially acceleration of ball is $9.8\ m/s^2$
- As it fall, air resistance increase.
- This reduces the resultant force and hence acceleration since

$$a = \frac{R \cdot F}{m}$$

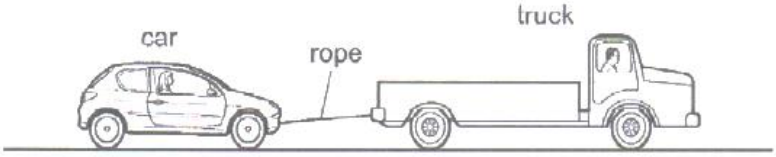
- At terminal velocity (constant velocity) weight = air resistance

$\therefore R \cdot F = 0$

$\Rightarrow$ acc = 0.

19. June/2023/Paper_0625/22/No.7

A truck is towing a car along a straight horizontal road at a constant speed.



The rope breaks.

Which row gives the direction of the initial acceleration of the truck after the rope breaks and the reason for the acceleration?

	direction of acceleration of the truck	reason
A	left	the driving force is greater than the resistive forces on the truck
B	left	the driving force is smaller than the resistive forces on the truck
(C) ✓	right ✓	the driving force is greater than ✓ the resistive forces on the truck
D	right ✓	the driving force is smaller than the resistive forces on the truck

- The driving force is greater than friction
- So truck has resultant force acting on it.

$\Rightarrow$ It now will accelerate to the right since R.F is to the right.

20. June/2023/Paper_0625/23/No.7

A spring has an unstretched length of 3.0 cm. When a force of 60 N is applied to the spring, its length increases to 5.0 cm. The limit of proportionality is not exceeded.

What is the spring constant of the spring?

A 7.5 N/cm B 12 N/cm C 20 N/cm D ✓ 30 N/cm

Extension = 5.0 − 3.0
= 2.0 cm

$F = k\Delta x$

$k = \frac{F}{\Delta x}$

$k = \frac{60\ N}{2.0\ cm}$

$= 30\ N/cm$

21. June/2023/Paper_0625/32/No.2(c)

(c) Fig. 2.2 shows the horizontal forces on a cyclist.

Fig. 2.2

(i) Calculate the size of the resultant force on the cyclist.

R.F = 220 − 160
= 60 N

resultant force = 60 N [1]

(ii) State the effect, if any, of the resultant force on the motion of the cyclist.

Cyclist is accelevating forward [1]

22. June/2023/Paper_0625/41/No.1

Fig. 1.1 shows a straight section of a river where the water is flowing from right to left at a speed of 0.54 m/s.

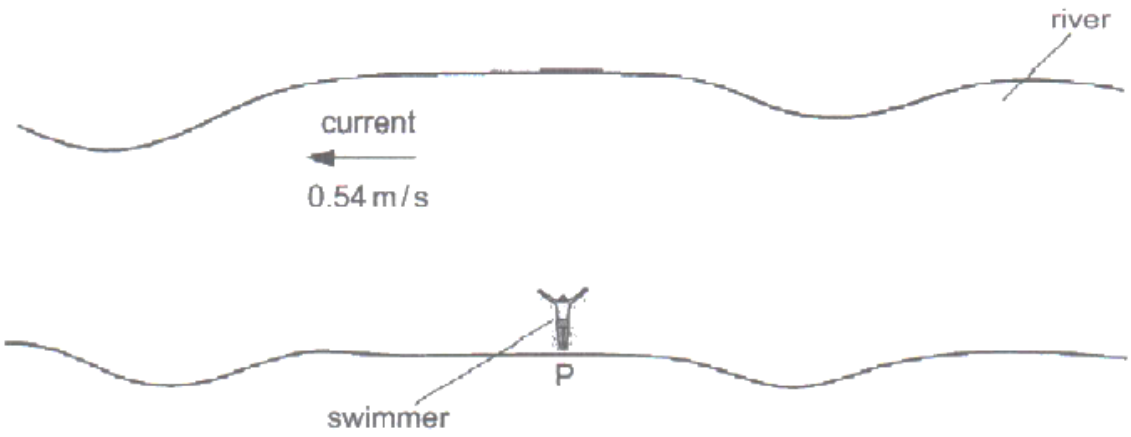
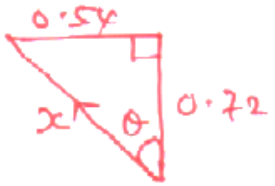


Fig. 1.1 (not to scale)

A swimmer starts at point P and swims at a constant speed of 0.72 m/s relative to the water and at right angles to the current.

(a) (i) Determine, relative to the river bank, both the magnitude and direction of the swimmer's velocity.



$x = \sqrt{0.54^2 + 0.72^2}$

$= \sqrt{0.81}$

$= 0.9\ m/s$

$\tan\theta = \frac{0.72}{0.54}$

$\theta = \tan^{-1}\left(\frac{0.72}{0.54}\right)$

$= 53^\circ$

magnitude of velocity = 0.90 m/s

direction of velocity 53°

[4]

(ii) After 1.5 minutes, the swimmer reaches point Q.

↑ Change to seconds by (1.5 × 60) seconds.

Calculate the distance between P and Q.

$d = s \times t$

$= 0.90 \times (1.5 \times 60)\ s$

$= 81\ m$

distance = 81 m [3]

(b) When the swimmer is crossing the river, his actions produce a constant forward force on his body.

Explain why he moves at a constant speed.

- There is friction of water on the swimmer backwards
- So the net resultant force on the swimmer is zero, so his speed remains constant. [2]

[Total: 9]

23. June/2023/Paper_0625/42/No.1

(a) Fig. 1.1 shows a helicopter which is stationary at a height of 1500 m above the ground.

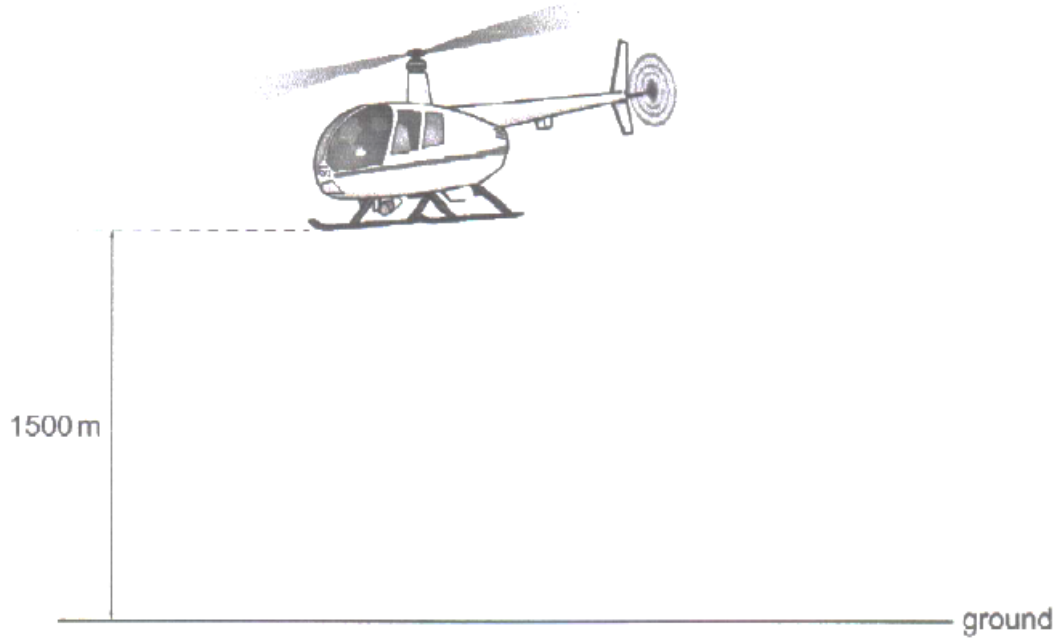


Fig. 1.1 (not to scale)

(i) State the **two** conditions necessary for the helicopter to remain in equilibrium.

condition 1 ..... Resultant force is zero

.....

condition 2 ..... No resultant Moment

.....

[2]

(ii) The mass of the helicopter is 3200 kg.

Calculate the change in the gravitational potential energy of the helicopter as it rises from the ground to 1500 m.

$\Delta gpe = mg\Delta h$

$= 3200 \times 9.8 \times 1500$

$= 47,040,000\ J$

$= 4.7 \times 10^7\ J$

change in gravitational potential energy = ... $4.7 \times 10^7\ J$ ..... [2]

(b) Fig. 1.2 shows a vertical speed–time graph for a parachutist who jumps from a stationary hot-air balloon.

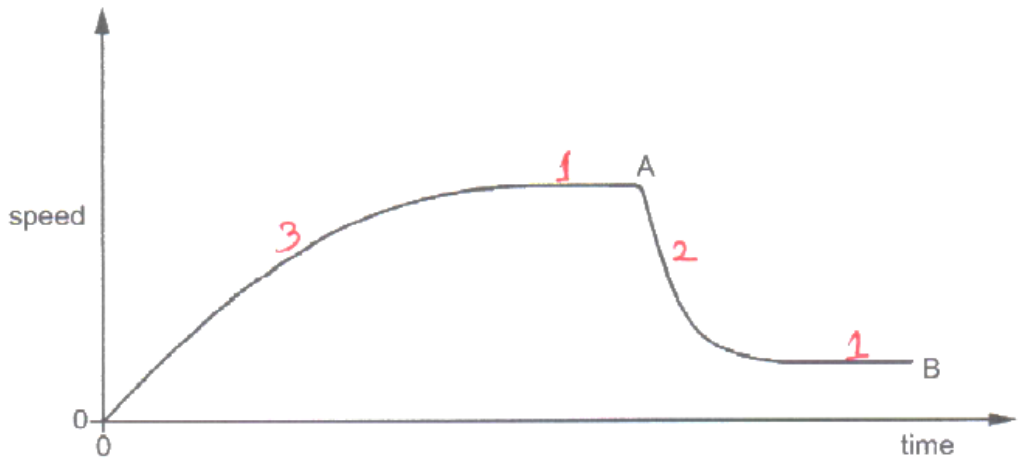


Fig. 1.2

The parachutist jumps from the balloon at time = 0 and reaches the ground at B. The point A indicates when the parachute opens.

(i) On Fig. 1.2, label a point on the graph where the acceleration is:
- zero with '1'
- negative with '2'
- decreasing with '3'. [3]

(ii) Explain, in terms of forces, the changes in motion which occur from when the parachutist leaves the hot-air balloon until point A.

- Initially he accelerates down due to gravitational force acting on him
- Air resistance increase as speed increase.
- The net resultant downward force decreases, so acceleration decreases
- When his weight (downwards) equals air resistance (upward) the speed remains constant as they descent down. [4]

[Total: 11]

24. June/2023/Paper_0625/43/No.1(b)

Fig. 1.1 shows a balloon filled with helium gas.

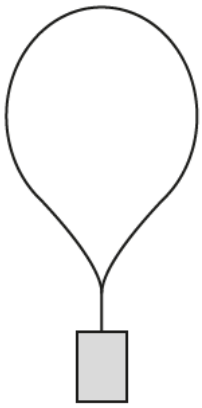


Fig. 1.1

The mass of the balloon is 120 kg.

(b) The resultant force on the balloon is 54 N.

Show that the acceleration of the balloon is 0.45 m/s^2.

$R - F = m \times a$

$a = \frac{R - F}{m}$

$= \frac{54\,N}{120\,kg}$

$= 0.45\,m/s^2$ [2]

Magnetism – 2023 IGCSE 0625 Physics

1. Nov/2023/Paper_ 0625/11/No.24

Which metal could be used for a permanent magnet and which metal could be used for the core of an electromagnet?

	permanent magnet	core of electromagnet
A	iron	copper
B	iron	steel
C	steel	copper
D ✓	steel	iron

Steel – hard magnetic materials forms permanent magnets.

Iron – Soft magnetic material lose magnetism easily when magnetised.

2. Nov/2023/Paper_ 0625/12/No.24

A hard magnetic material can be used to make a permanent magnet.

A soft magnetic material can be used to make a temporary magnet.

Which row shows whether iron and steel are hard or soft magnetic materials?

	iron	steel
A	hard	hard
B ✓	hard	soft
C ✓	soft ✓	hard ✓
D	soft ✓	soft

Iron – Soft magnetic material

Steel – hard magnetic material.

3. Nov/2023/Paper_ 0625/13/No.24

Which metal can be attracted by a magnet?

↑ magnetic material.

A zinc

B lead

C ✓ iron ✓

D copper

- Zinc, lead & copper are non-magnetic so cannot be attracted by magnet

4. Nov/2023/Paper_ 0625/21/No.24

Which metal could be used for a permanent magnet and which metal could be used for the core of an electromagnet?

	permanent magnet	core of electromagnet
A	iron	copper
B	iron	steel
C	steel	copper
D ✓	steel ✓	iron ✓

Steel - hard magnetic material will retain magnetism for a long time

Iron - Soft magnetic material, will lose magnetism quickly

- copper is not magnetic material.
- So steel will be used for permanent magnet
- Iron used in electromagnets core.

5. Nov/2023/Paper_ 0625/22/No.24

A hard magnetic material can be used to make a permanent magnet.

A soft magnetic material can be used to make a temporary magnet.

Which row shows whether iron and steel are hard or soft magnetic materials?

	iron	steel
A	hard	hard
B	hard	soft
C ✓	soft	hard
D	soft	soft

Temporary magnet - Iron

Permanent magnet - Steel.

6. Nov/2023/Paper_ 0625/23/No.24

Which metal can be attracted by a magnet?

A zinc

B lead

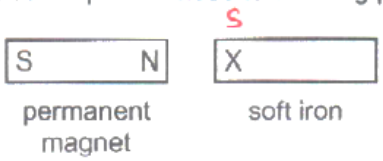
C ✓ iron ← Magnetic material

D copper

Zinc, lead, copper } All are non-magnetic, cannot be attracted by magnet.

7. June/2023/Paper_0625/11/No.23

An unmagnetised piece of soft iron is placed close to a strong permanent magnet, as shown.



What is the induced polarity of end X of the soft iron and in which direction does the magnetic force act on the soft iron?

	polarity of end X	direction of force on the soft iron
A	N	to the left
B	N	to the right
C	S ✓	to the left ✓
D	S ✓	to the right

- The N-pole of the magnet induces a S-poth on Soft Iron at X.
- N and S pole attract, So force of magnet will pull Soft Iron towards itself, that is to the left.

8. June/2023/Paper_0625/12/No.23

The magnetic field of a bar magnet can be represented by magnetic field lines.

Which diagram shows two magnetic field lines correctly?

Field lines travel from N-pole to S-pole.

9. June/2023/Paper_0625/13/No.23

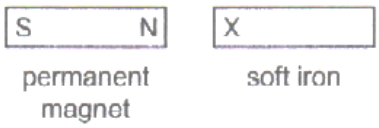
Which row gives the metal used to make the core of an electromagnet and one property of the electromagnet?

	metal	property
A	iron	permanent magnet
B ✓	iron	temporary magnet
C	steel	permanent magnet
D	steel	temporary magnet

↑ Soft Iron core is used since can easily be magnetised and demagnetised.
- So it makes temporary magnet.

10. June/2023/Paper_0625/21/No.23

An unmagnetised piece of soft iron is placed close to a strong permanent magnet, as shown.



What is the induced polarity of end X of the soft iron and in which direction does the magnetic force act on the soft iron?

	polarity of end X	direction of force on the soft iron
A	N	to the left
B	N	to the right
C ✓	S	to the left
D	S	to the right

N-pole induces a S-pole at X on the soft iron.
- Unlike pole attract, so the N-pole on magnet will pull S-pole on soft iron to the left direction

11. June/2023/Paper_0625/22/No.23

The magnetic field of a bar magnet can be represented by magnetic field lines.

Which diagram shows two magnetic field lines correctly?

Field lines travel from N-pole to S-pole.

12. June/2023/Paper_0625/23/No.23

Which row gives the metal used to make the core of an electromagnet and one property of the electromagnet?

	metal	property
A	iron	permanent magnet
B ✓	iron	temporary magnet
C	steel	permanent magnet
D	steel	temporary magnet

↑ Soft iron is easily magnetised and easily demagnetised.
– So it makes a temporary magnet and is useful for electromagnets core.
– Electromagnets are magnetic when current is flowing and when current is, they lose their magnetism.

13. June/2023/Paper_0625/31/No.8

Fig. 8.1 shows the magnetic field pattern around two permanent magnets. The magnets are repelling each other.

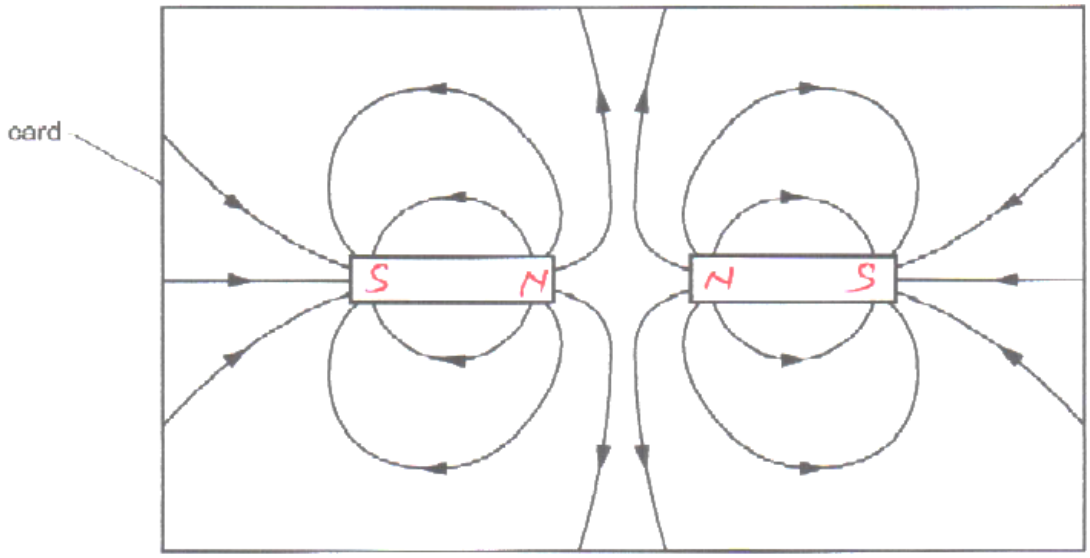


Fig. 8.1

(a) On Fig. 8.1, label both the poles on **each** magnet. [1]

(b) Describe how to plot the shape and direction of the magnetic field pattern shown in Fig. 8.1.

- Make use of a plotting compass.
- Place the compass near one end of magnet
- Mark a point at end of compass arrow
- Move compass the marked point and repeat the marking and join up the points to draw a line [4]

[Total: 5]

- Plot more than one line.

14. June/2023/Paper_0625/32/No.7(a)

A student uses a permanent magnet to lift some unmagnetised nails. Some of the nails are made of iron and some are made of steel. Fig. 7.1 shows the magnet lifting the nails.

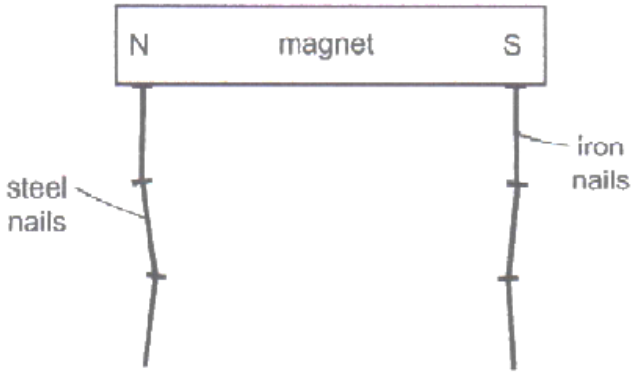


Fig. 7.1

(a) (i) Each nail lifts the nail below it by induced magnetism.

Describe what is meant by induced magnetism.

– A magnetic material becomes magnetised by touching a magnet and get a pole opposite to that of the magnet. [2]

(ii) The student leaves the nails attached to the magnet for several hours, then removes the magnet.

State a difference between a magnetic property of the iron nails and of the steel nails.

– Steel nails become permanently magnetised. [1]

15. June/2023/Paper_0625/42/No.8(a)

(a) (i) State what is meant by a magnetic field.

A region in space where a magnetic pole experiences a force. [1]

(ii) Define the direction of a magnetic field.

– Field is usually in the direction of the force on the N-pole. [1]

Mass and Weight – 2023 IGCSE 0625 Physics

1. Nov/2023/Paper_ 0625/11/No.3

An object weighs 19 N on a planet where the acceleration of free fall is 3.8 m/s^2.

What is the mass of the object?

A 0.20 kg B 1.9 kg C 5.0 kg D 72 kg

$W = m \times g$

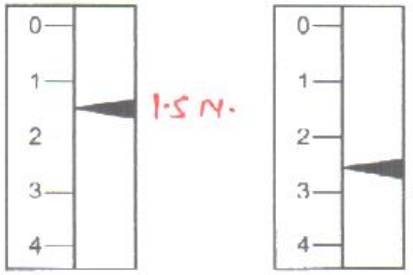
$m = \frac{W}{g}$

$= \frac{19}{3.8}$

$= 5.0\ kg$

2. Nov/2023/Paper_ 0625/11/No.4

An object is suspended from a spring balance on the Earth. The same object is suspended from the same spring balance on another planet.



Mass of object is same on Earth and the other planet.

Weight is more in the other planet

Which statement explains the difference between the two readings?

A Both the mass and the weight of the object are greater on the other planet.

B The mass of the object is greater on the other planet than on the Earth, but the weight is unchanged.

C The spring stretches more easily when on the other planet.

D The weight of the object is greater on the other planet than on the Earth, but the mass is unchanged.

3. Nov/2023/Paper_ 0625/12/No.4

A person steps onto a bathroom scale.

The bathroom scale records both mass and weight.

Which row shows the readings on the bathroom scale?

	mass	weight
A	60 N	590 kg
B ✓	60 kg	590 N
C	590 kg	60 N
D	590 N	60 kg

Unit	Quantity
kg	mass
N	weight

Mass of a man is approximately 60 kg.

$W = m \times g$

$= 60 \times 9.81$

$= 588.6\ N$

$\approx 590\ N$

4. Nov/2023/Paper_ 0625/13/No.3

A vehicle sent to explore the surface of Mars has a mass of 200 kg.

The acceleration of free fall on Mars is 3.7 m/s^2.

What is the weight of the vehicle on Mars?

A 20 N B 54 N C ✓ 740 N D 2000 N

$W = m \times g$

$= 200 \times 3.7$

$= 740\ N$

5. Nov/2023/Paper_ 0625/13/No.4

A student writes about mass and weight.

Which statement is correct?

A A ship which is floating has mass but no weight.

B Mass is a scientific word that means the same as weight.

C Mass is measured in newtons.

D ✓ The mass of an astronaut is the same on the Moon as on the Earth.

Mass remains same from place to place, but weight changes.

6. Nov/2023/Paper_ 0625/21/No.4

The table shows the mass and volume of three different liquids, X, Y and Z. $\rho = \frac{m}{V}$

liquid	mass / g	volume / cm^3
X	120	200
Y	80	67
Z	100	120

$\rho = 120 \div 200 = 0.6$

$\rho = 80 \div 67 = 1.2$

$\rho = 100 \div 120 = 0.8$

The liquids are placed in the same container. The liquids do not mix.

Which liquid is at the top of the container and which liquid is at the bottom?

	liquid at top	liquid at bottom
(A) ✓	X	Y
B	X	Z
C	Y	X
D	Y	Z

- Top liquid has the least density, which is X.
- Y is at the bottom, it is the most dense of the 3 liquids.

7. Nov/2023/Paper_ 0625/33/No.3(a)

The mass of a glass bottle is 0.18 kg.

(a) Calculate the weight of the bottle.

$W = m \times g$

$= 0.18 \times 9.81$

$= 1.76\ N$ (1)

$\approx 1.8\ N$ (1)

weight = 1.8 N [2]

8. June/2023/Paper_0625/11/No.4

A space rocket travels to the Moon.

The acceleration of free fall is greater on the Earth than it is on the Moon.

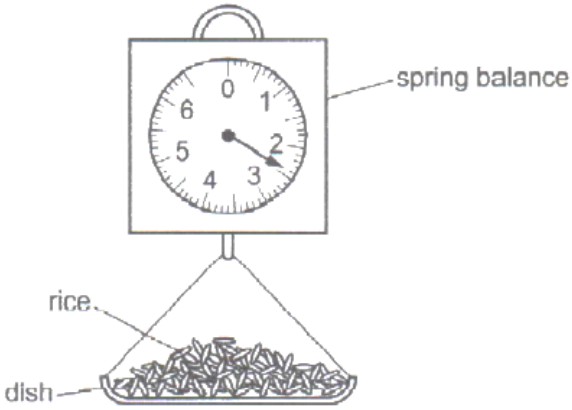
How do the mass and weight of the space rocket on the Moon compare with their values on the Earth?

	mass on the Moon	weight on the Moon
A	less than on the Earth	same as on the Earth
B	less than on the Earth	more than on the Earth
C	same as on the Earth	less than on the Earth
D	same as on the Earth	more than on the Earth

- Mass which is quantity of substance remains same on Earth & Moon
- Weight = m x g will less on the Moon since g on moon is less

9. June/2023/Paper_0625/11/No.5

A shopkeeper pours rice into a dish that hangs from a spring balance. He records the reading.



A customer buys some pasta. The shopkeeper notices that the reading on the spring balance, with just pasta in the dish, is the same as it was with just rice in the dish.

Which quantity **must** be the same for the rice and for the pasta?

A density

B temperature

C volume

D weight

$W = m \times g$

Since $g = 9.8\ m/s^2$ constant

and Mass of pasta = Mass of rice

∴ Weight of both is same.

10. June/2023/Paper_0625/12/No.4

Which two quantities must be known to determine the density of a material?

A mass and area

B mass and volume ✓

C weight and area

D weight and volume

$\rho = \frac{m}{V}$

density = $\frac{\text{mass}}{\text{volume}}$

- So mass of object and its volume are required to calculate objects density.

11. June/2023/Paper_0625/13/No.4

Two rectangular blocks consist of different materials.

Four different methods are suggested to compare the two masses.

1 Compare the accelerations with which they fall freely. ×

2 Compare the values of their lengths × breadths × heights. ×

3 Hang each in turn from the same spring. Compare the extensions. ✓

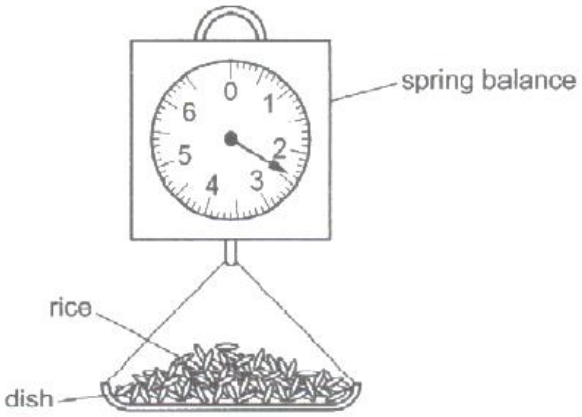
4 Place one in the right-hand pan of a beam balance and the other in the left-hand pan. ✓

Which methods give a comparison of the two masses?

A 1, 2 and 3 B 1 and 2 only C 3 and 4 only ✓ D 4 only

12. June/2023/Paper_0625/21/No.5

A shopkeeper pours rice into a dish that hangs from a spring balance. He records the reading.



A customer buys some pasta. The shopkeeper notices that the reading on the spring balance, with just pasta in the dish, is the same as it was with just rice in the dish.

Which quantity **must** be the same for the rice and for the pasta?

A density

B temperature

C volume

D weight

Both pasta and rice have the same quantity (mass)
But $W = m \times g$
=> Their weight also is same

13. June/2023/Paper_0625/22/No.4

Which statement about mass or weight is **not** correct?

A Masses can be compared using a balance. ✓

B Mass is a force. ← mass is not a force, it is amount of matter in a substance.

C Weights can be compared using a balance. ✓

D Weight is a force. ✓

$W = m \times g$

14. June/2023/Paper_0625/22/No.5

A sphere P, made of steel, has a weight of 10 N on Earth.

Another sphere Q, also made of steel, has a weight of 10 N on Mars.

The gravitational field strength on Earth is greater than the gravitational field strength on Mars.

Which statement is correct?

A The mass of sphere P is the same as the mass of sphere Q.

B The mass of sphere P is less than the mass of sphere Q.

C On Mars, the weight of sphere P is the same as the weight of sphere Q.

D On Earth, the weight of sphere Q is less than 10 N.

mass of P $\rightarrow m = \frac{W}{g}$

$= \frac{10N}{9.8}$

$= 1.02\ kg$

$g_E > g_{mars}$

Let $g_{mars} = 8$

$\therefore m_Q = \frac{10N}{8}$

$= 1.25\ kg$

=> mass of Q is greater than mass P.

15. June/2023/Paper_0625/23/No.2

Which statement about a falling object accelerating close to the Earth's surface is correct?

A The weight of the object is increasing and the force of air resistance on the object is decreasing. ← weight remains same does not change

B The weight of the object and the force of air resistance on the object are of equal magnitude, but act in opposite directions. ← only during terminal velocity.

C ✓ The weight of the object is constant, but the force of air resistance on the object is increasing.

D The weight of the object is less than the force of air resistance. ✗

16. June/2023/Paper_0625/23/No.4

Two rectangular blocks consist of different materials.

Four different methods are suggested to compare the two masses.

1 Compare the accelerations with which they fall freely. ← acc will same for all 4

2 Compare the values of their lengths × breadths × heights. ← This only gives volume

3 Hang each in turn from the same spring. Compare the extensions. ✓ $W = m \times g$

4 Place one in the right-hand pan of a beam balance and the other in the left-hand pan. ✓ Mass is measured using balance

Since g is same for all 4 blocks than $W \propto m$. The greater the extension the greater the mass.

Which methods give a comparison of the two masses?

A 1, 2 and 3 B 1 and 2 only C ✓ 3 and 4 only D 4 only

17. June/2023/Paper_0625/23/No.5

An object in a space probe above the Earth weighs 3.5 N. The gravitational field strength at the height of the space probe is 7.0 N/kg.

The gravitational field strength on the Earth's surface is 9.8 N/kg.

What are the mass and the weight of the object on the Earth's surface?

	mass/kg	weight/N
A	0.50 ✓	3.5
B ✓	0.50 ✓	4.9 ✓
C	2.0	3.5
D	2.0	20

find mass

$m = \frac{W}{g}$

$= \frac{3.5\ N}{7.0\ \frac{N}{kg}}$

$= 0.5\ kg$

On Earths Surface

$g = 9.8\ N/kg$

$\therefore W = 0.5\ kg \times 9.8\ \frac{N}{kg}$

$= 4.9\ N$

18. June/2023/Paper_0625/43/No.1(a)

Fig. 1.1 shows a balloon filled with helium gas.

Fig. 1.1

The mass of the balloon is 120 kg.

(a) Calculate the weight of the balloon. Show your working.

$W = m \times g$

$= 120\,kg \times 9.8\,\frac{N}{kg}$

$= 1176$

$\approx 1200\,N$

weight = 1200 N [1]

Momentum – 2023 IGCSE 0625 Physics

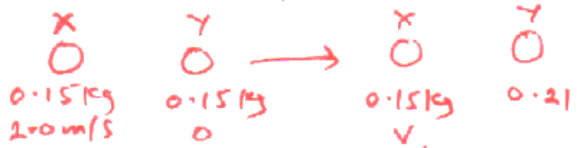
1. Nov/2023/Paper_ 0625/21/No.7

A sphere X collides head on with a second identical sphere Y which is stationary.

The mass of each sphere is 0.15 kg.

Impulse = $F \times t = mv - mu$; for Y $mu = 0$, $mv = 0.21$ Ns.

Sphere X is travelling at a velocity of 2.0 m/s before the collision and produces an impulse of 0.21 Ns on sphere Y.



What is the velocity of sphere X after collision?

A 0.60 m/s in the opposite direction to Y

B ✓ 0.60 m/s in the same direction as Y

C 1.4 m/s in the opposite direction to Y

D 1.4 m/s in the same direction as Y

$(0.15 \times 4) + (0.15 \times 0) = (0.15 \times V) + 0.21$

$3 + 0 = 0.15V + 0.21$

$0.15V = 3 - 0.21$

$v = \frac{0.09}{0.15} = 0.6\ ms^{-1}$

2. Nov/2023/Paper_ 0625/22/No.7

A resultant force F accelerates a car of mass m along a straight horizontal road from rest to a speed v in time t, giving it momentum p.

Which pair of relationships for this situation is correct?

A $pt = mv$ and $F = pt$

B $p = mv$ and $F = pt$

C ✓ $p = mv$ and $Ft = p$

D $p = mvt$ and $Ft = v$

$F = m \times a$

$a = \frac{v - u}{t}$ but $u = 0$.

$a = \frac{v}{t}$

$p = m \times v = mv$

$F = \frac{m \times v}{t}$

$Fxt = mv$

$Ft = p$.

3. Nov/2023/Paper_ 0625/23/No.7

A car of mass 1200 kg is travelling along a straight horizontal road.

Which impulse is needed to accelerate the car from 5.0 m/s to 10 m/s?

A ✓ 6000 Ns B 12000 Ns C 15000 Ns D 18000 Ns

Impulse $= mv - mu$

$= m(v - u)$

$= 1200(10 - 5)$

$= 1200 \times 5$

$= 6000$ Ns

4. Nov/2023/Paper_ 0625/42/No.3(a)

(a) A balloon of mass 15g is glued to a straw. The straw is threaded onto a horizontal string, as shown in Fig. 3.1. ↑ 0.015 kg
The balloon is filled with air and then the air is released.

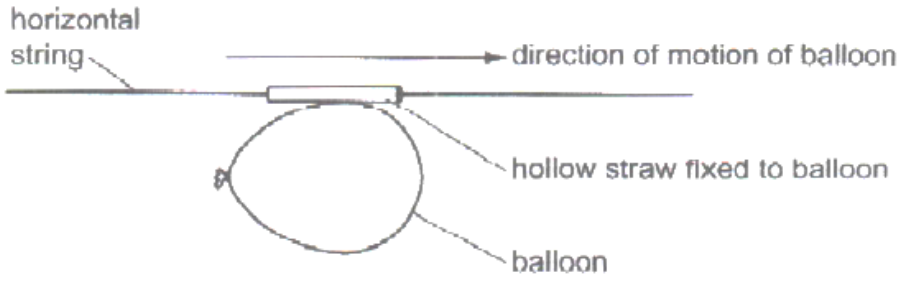


Fig. 3.1

As the air leaves the balloon, the balloon experiences a force.
The balloon accelerates from rest until it reaches a constant speed. It then travels 0.67 m in 0.18 s at this constant speed.

(i) Explain in words what is meant by the term impulse.

Is force multiplied by time for which the force acts. [1]

(ii) Calculate the resultant impulse on the balloon while it is accelerating.

Impulse = Ft

$Ft = mv - mu$

$= 0.015\left(\frac{0.67}{0.18} - 0\right)$.

$= 0.0558$ Ns

≈ 0.056 Ns

impulse = 0.056 Ns [3]

(iii) Explain how momentum is conserved as the balloon accelerates.

- Released air is in opposition direction to balloon motion.
- Momentum of balloon and straw is equal in size (magnitude) to the momentum of air. [2]

5. Nov/2023/Paper_ 0625/43/No.3

Fig. 3.1 shows a boy throwing a ball at an object in a fairground.

Fig. 3.1

The ball has a mass of 190 g and travels horizontally with a constant speed of 6.9 m/s.

(a) Calculate the momentum of the ball.

0.19 kg

$p = m \times v$

$= 0.19 \times 6.9$

$= 1.311$ kg m/s

$\simeq 1.3$ kg m/s

momentum = 1.3 [2]

(b) After hitting the object, the ball bounces back along the same straight path with a speed of 1.5 m/s. The object has a mass of 1.8 kg.

↑ velocity in opposite direction is -ve. (velocity is a vector).

Calculate the speed of the object after it is hit by the ball.

p before = p after collision

$1.3 + 0 = (0.19 \times -1.5) + (1.8 \times v)$

$1.3 = -0.285 + 1.8v$

$v = \frac{1.3 + 0.285}{1.8}$

$= 0.88$ m/s

speed = 0.88 m/s [3]

(c) The kinetic energy of the ball is 4.5 J before the collision and 0.2 J after the collision.

Calculate the change in total kinetic energy of the ball and object during the collision.

K.E before − K.E after

$K.E = \frac{1}{2}mv^2$

$4.5 - \left(0.2 + \frac{1}{2} \times 1.8 \times 0.88^2\right)$

$4.5 - (0.2 + 0.696)$

$4.5 - 0.896 = 3.6\ J.$

change in total kinetic energy = 3.6 J. [3]

[Total: 8]

6. June/2023/Paper_0625/21/No.9

An object of mass 1.2 kg is moving with a velocity of 2.0 m/s when it is acted on by a force of 4.0 N. The velocity of the object increases to 5.0 m/s in the same direction.

For which period of time does the force act on the object?

A 0.90 s ✓ B 1.1 s C 1.5 s D 3.6 s

$F = m \times a$

$a = \frac{F}{m}$

$= \frac{4}{1.2}$

$a = 3.3\ m/s^2$

$a = \frac{v-u}{t}$

$t = \frac{v-u}{a}$

$u = 2.0\ m/s$

$v = 5.0\ m/s$

$t = \frac{5.0 - 2.0}{3.3}$

$= 0.90\ s$

7. June/2023/Paper_0625/22/No.9

A resultant force of 2.0 N acts on an object of mass 3.0 kg for 6.0 s.

What is the change in velocity of the object?

A 0.25 m/s B 1.0 m/s C ✓ 4.0 m/s D 36 m/s

$a = \frac{R.F}{m} = \frac{2.0}{3.0}$

$= 0.67\ m/s^2$

$\frac{v-u}{t} = a$

$v - u = a \times t$

$= 0.67 \times 6$

$= 4.02\ m/s$

$\approx 4.0\ m/s$

v − u is change in velocity

8. June/2023/Paper_0625/23/No.9

A ball of mass 0.25 kg hits a wall at a speed of 16 m/s. It then rebounds back along its original path at a speed of 12 m/s.

What is the impulse experienced by the ball during its impact with the wall?

A 1.0 Ns B 3.0 Ns C 4.0 Ns (D) 7.0 Ns ✓

Impulse = F x t

F x t = mv − mu

u = 16 m/s

v = −12 m/s

impulse = m (v − u)

= 0.25 (−12 − 16)

= −7.0 N s

9. June/2023/Paper_0625/42/No.2

A student catches a cricket ball. The speed of the ball immediately before it is caught is 18 m/s. The mass of the cricket ball is 160 g. → 0.16 kg

(a) Calculate the kinetic energy stored in the cricket ball immediately before it is caught.

$K.E = \frac{1}{2} mv^2$

$= \frac{1}{2} \times 0.16 \times 18^2$

$= 25.92$ J

≈ 26 J

kinetic energy = 26 J ..... [3]

(b) It takes 0.12 s to catch the ball and bring it to rest.

Calculate the average force exerted on the ball.

$F = \frac{mv - mu}{t}$

$= \frac{m(v-u)}{t}$

$= \frac{0.16 \times (0 - 18)}{0.12}$

$= 24$ N

average force = 24 N ..... [2]

(c) As the student catches the ball, she moves her hands backwards.

Explain the effect of this action on the student's hands.

- This increases the time of impact
- so smaller force will act on the students hand, thus it does not hurt as much. [1]

[Total: 6]

$$F = \frac{mv - mu}{t}, \quad F \propto \frac{1}{t}$$

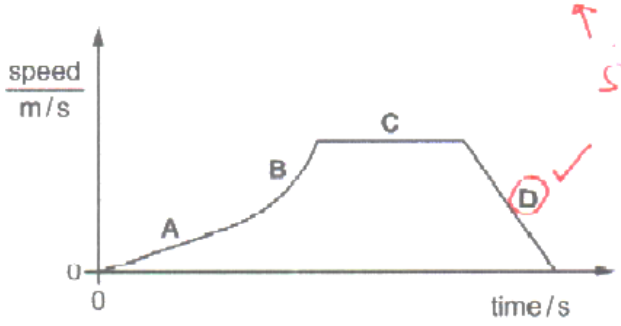
when t is large, the F will be smaller, since F is inversely proportional to time.

Motion – 2023 IGCSE 0625 Physics

1. Nov/2023/Paper_ 0625/11,21/No.2

The graph shows the speed of a car travelling through a town.

Which section of the graph represents a period when the car is decelerating?



Slowing down.

2. Nov/2023/Paper_ 0625/12/No.2

A student measures the average speed of a cyclist in a race.

Which quantities must she measure?

A the total time taken to complete the race and the time taken for the cyclist to reach her highest speed

B the total time taken to complete the race and the total distance travelled by the cyclist at her highest speed

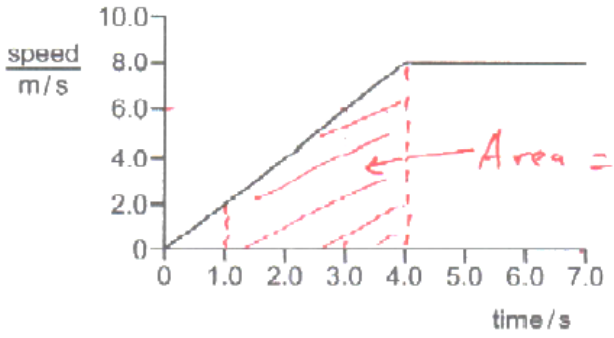
C the total time taken to complete the race and the total distance travelled by the cyclist

D the time taken to reach her highest speed and the total distance travelled by the cyclist

Av. Speed = total distance travelled / total time taken.

3. Nov/2023/Paper_ 0625/12/No.3

The graph shows the motion of a sprinter.



Area = distance travelled

$= \left(\frac{1}{2} \times 3(2 + 8)\right)$

$= \frac{1}{2} \times 3 \times 10$

$= 15\,m$

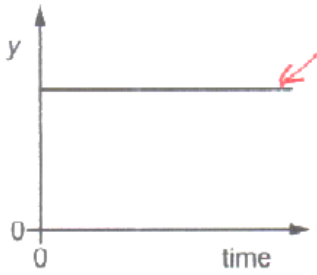
She accelerates steadily from rest to 8.0 m/s in 4.0 s.

How far does she travel in the last three seconds of her acceleration?

A 9.0 m B 15 m C 16 m D 24 m

4. Nov/2023/Paper_ 0625/13/No.2

A train is on a straight track. The graph shows how a quantity *y* varies with time.



Either train is stationary or moving at constant speed.

Which statements can be true?

1 The train is stationary and *y* represents the distance from the last station. ✓

2 The train is moving and *y* represents the distance from the last station. ✓

3 The train is stationary and *y* represents the speed of the train. ×

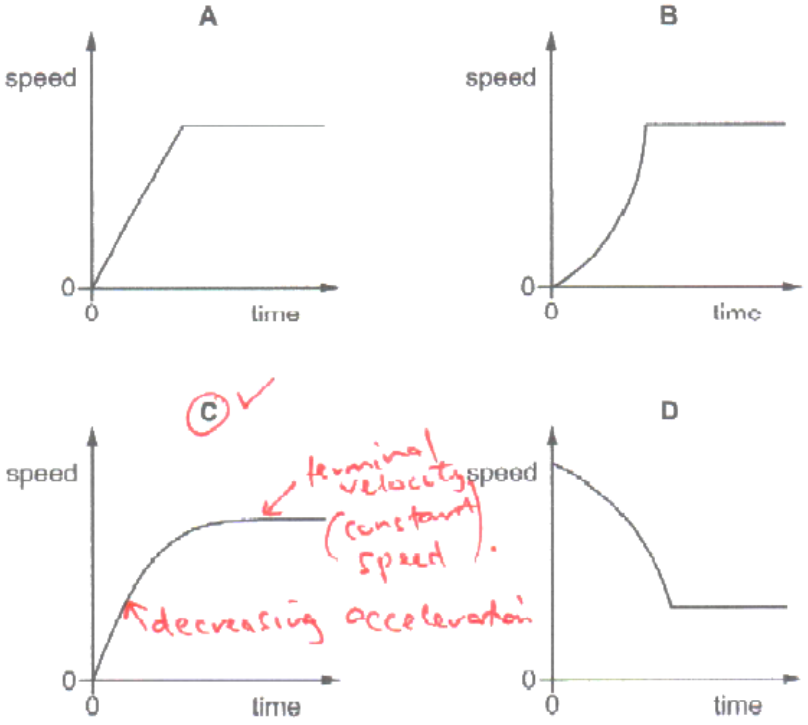
4 The train is moving and *y* represents the speed of the train. ✓

A 1 and 2 B 1 and 4 C 2 and 3 D 3 and 4

5. Nov/2023/Paper_ 0625/21/No.3

An object reaches terminal velocity after being dropped and falling through air.

Which graph shows how its speed varies with time?



6. Nov/2023/Paper_ 0625/22/No.2

A student measures the average speed of a cyclist in a race.

Which quantities must she measure?

av. speed = total distance / total time

A the total time taken to complete the race and the time taken for the cyclist to reach her highest speed

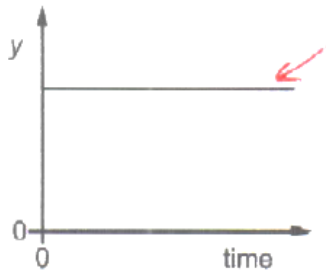
B the total time taken to complete the race and the total distance travelled by the cyclist at her highest speed

C the total time taken to complete the race and the total distance travelled by the cyclist

D the time taken to reach her highest speed and the total distance travelled by the cyclist

7. Nov/2023/Paper_ 0625/23/No.2

A train is on a straight track. The graph shows how a quantity *y* varies with time.



- Either the train is stationary or moving at constant speed.
- So y = distance or y = speed.

Which statements can be true?

1 The train is stationary and *y* represents the distance from the last station. ✓

2 The train is moving and *y* represents the distance from the last station.

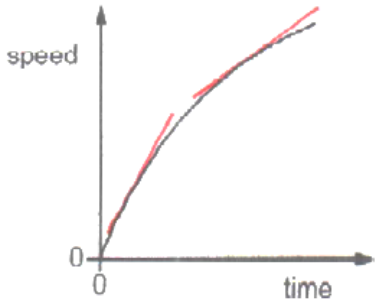
3 The train is stationary and *y* represents the speed of the train.

4 The train is moving and *y* represents the speed of the train. ✓

A 1 and 2 **B** 1 and 4 ✓ C 2 and 3 D 3 and 4

8. Nov/2023/Paper_ 0625/23/No.3

The diagram shows a speed–time graph for a moving object.



- In speed-time graph, the gradient represent acceleration
- The gradient of the curve is reducing, eg from 4m/s² to 3 m/s² but still accelerating.

Which description of the object's motion is correct?

A decreasing acceleration ✓

B decreasing speed

C constant acceleration

D constant speed

9. Nov/2023/Paper_ 0625/31/No.1

Fig. 1.1 shows a distance–time graph for a cyclist.

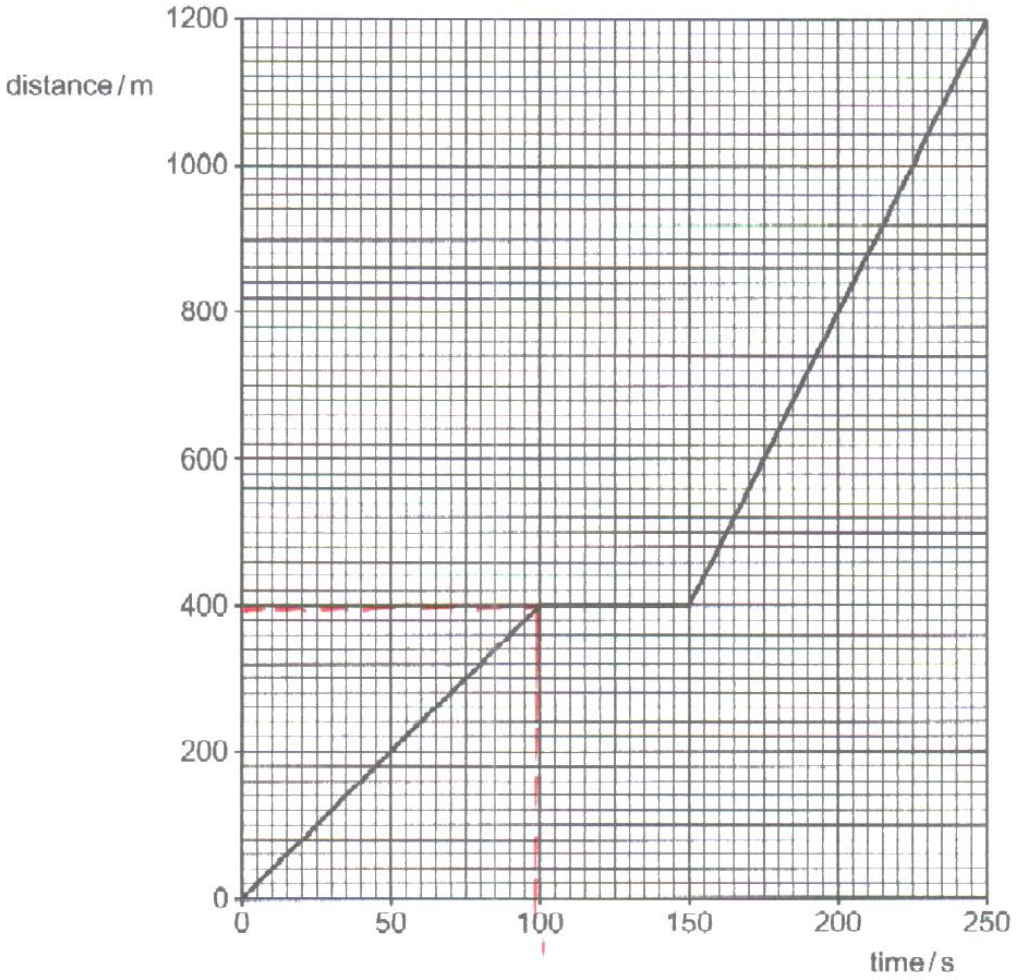


Fig. 1.1

(a) (i) Determine the distance travelled by the cyclist between time = 0 and time = 100 s.

distance travelled = 400 m [1]

(ii) Calculate the speed of the cyclist between time = 0 and time = 100 s.

Speed = gradient

gradient = $\frac{\Delta y}{\Delta x}$

$= \frac{400-0}{100-0}$

$= 4\ m/s$

speed = 4.0 m/s [3]

(iii) Describe the motion of the cyclist between time = 100 s and time = 250 s.

- Was stationary between 100 s and 150 s.
- Then speed was constant btw 150 s and 250 s [2]

(b) Fig. 1.2 shows the cyclist riding along a long straight road.

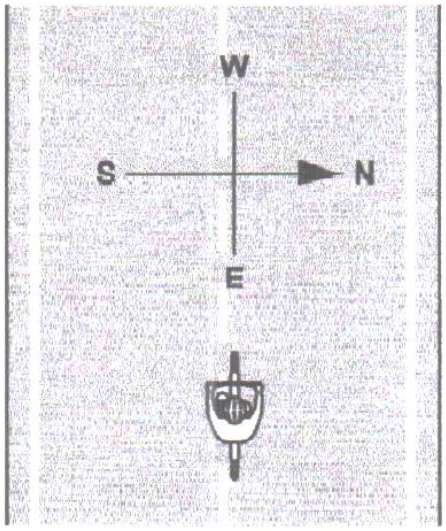


Fig. 1.2

The speed of the cyclist is 15 m/s. Determine the velocity of the cyclist.

Velocity is speed in a specified direction
– So speed is 15 m/s East–west direction

velocity = 15 ..... m/s

direction ..... due west .....

[1]

[Total: 7]

10. Nov/2023/Paper_ 0625/32/No.1

Fig. 1.1 shows the speed–time graph for a cyclist beginning a race. The motion of the cyclist changes at points A, B and C.

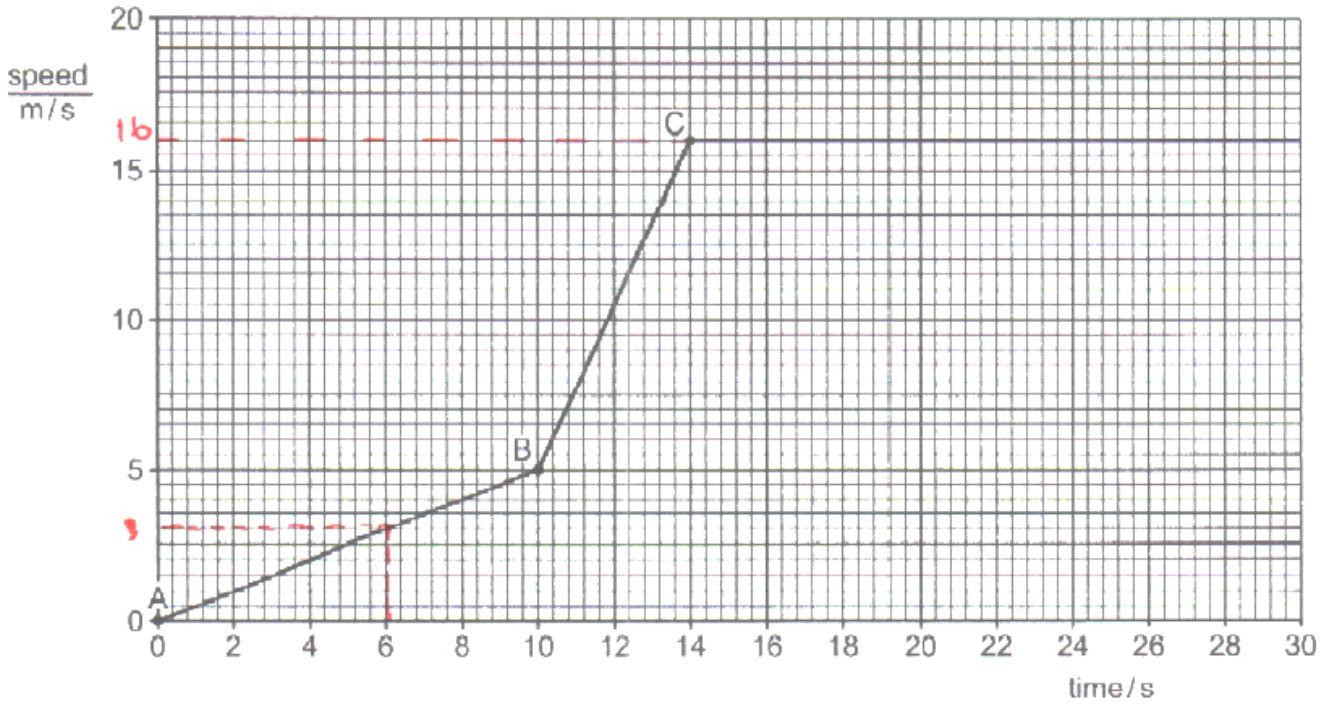


Fig. 1.1

(a) Using information from Fig. 1.1, determine:

(i) the speed of the cyclist at time = 6.0 s

speed = 3.0 m/s [2]

(ii) the maximum speed of the cyclist.

maximum speed = 16 m/s [1]

(b) **(i)** Describe the motion of the cyclist between point A and point B.

Speed is increasing at constant rate. [1]

(ii) Describe how the motion of the cyclist between points B and C differs from the motion between points A and B.

Give a reason for your answer.

difference greater acceleration

reason steeper gradient between BC.

[2]

(c) Determine the distance travelled by the cyclist between point A and point B.

distance = Area under graph,

$= \frac{1}{2} \times 10 \times 5$

$= 25\,m$

distance = ... 25 ..... m [3]

[Total: 9]

11. Nov/2023/Paper_ 0625/33/No.1

Fig. 1.1 shows the speed–time graph for a bus journey.

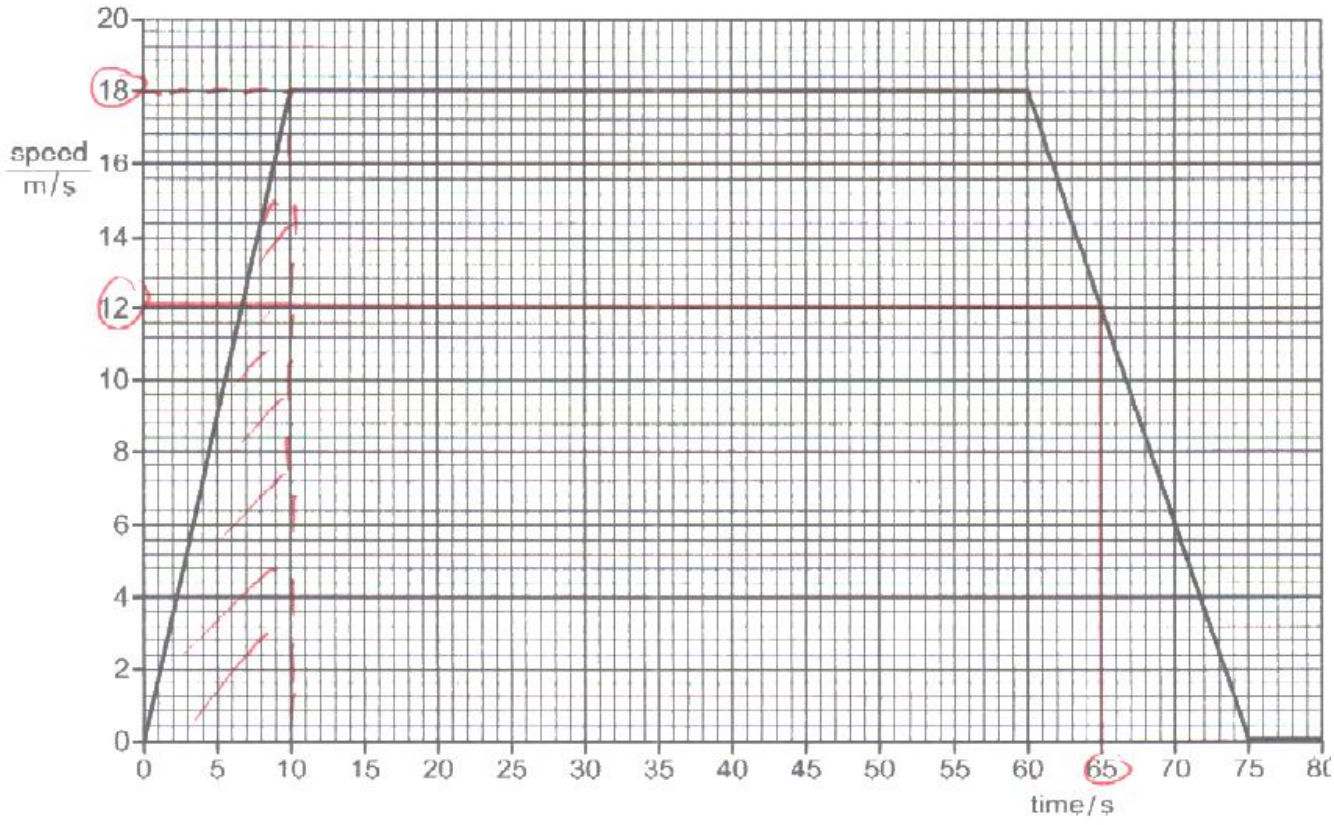


Fig. 1.1

(a) Using the information in Fig. 1.1, determine:

(i) the maximum speed of the bus during the journey

maximum speed = 18 m/s [1]

(ii) the speed of the bus at time = 65 s. On Fig. 1.1, show how you obtained this information.

speed = 12 m/s [2]

(b) Describe how the speed of the bus changes between time = 60 s and time = 80 s.

– Slows down until it stops at 75 s

[2]

(c) Determine the distance travelled by the bus between time = 0 and time = 10 s.

d = area under graph

$= \frac{1}{2} \times 10 \times 18$

$= 90\ m$

distance travelled = 90 m [3]

(d) Fig. 1.2 shows the speed–time graph for another bus journey.

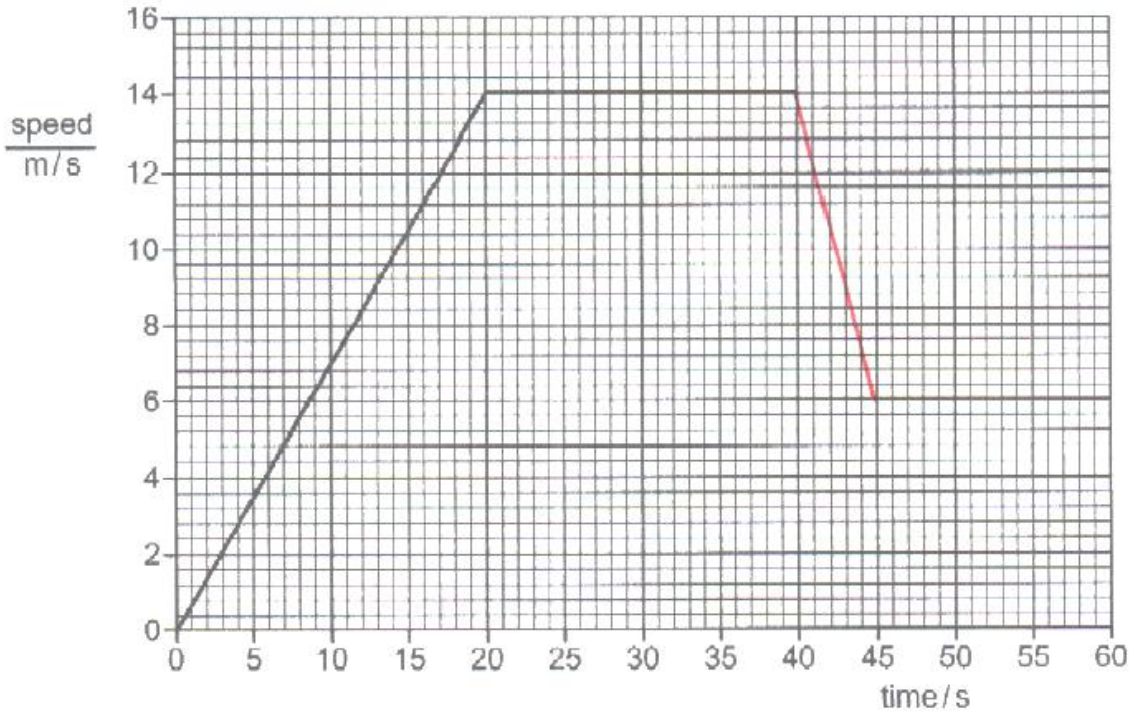


Fig. 1.2

The driver sees a hazard ahead and applies the brakes at time = 40 s.

The bus reduces its speed from 14.0 m/s to 6.0 m/s in a time of 5.0 s.

On Fig. 1.2, draw the speed–time graph for the bus as it reduces its speed. [2]

[Total: 10]

12. Nov/2023/Paper_ 0625/41/No.1

A girl holds a rubber ball out of a window of a tall building. The mass of the ball is 0.20 kg. The ball is at rest 10 m above a concrete path.

(a) Calculate the gravitational potential energy of the ball relative to the concrete path.

$\Delta E_p = mg\Delta h$

$= 0.20 \times 9.81 \times 10$

$= 19.62$ J

$\therefore \Delta E_p = 20$ J

gravitational potential energy = 20 J. [2]

(b) The girl releases the ball and it falls towards the path. The ball strikes the path and bounces vertically upwards.

Fig. 1.1 shows the ball falling towards the path.

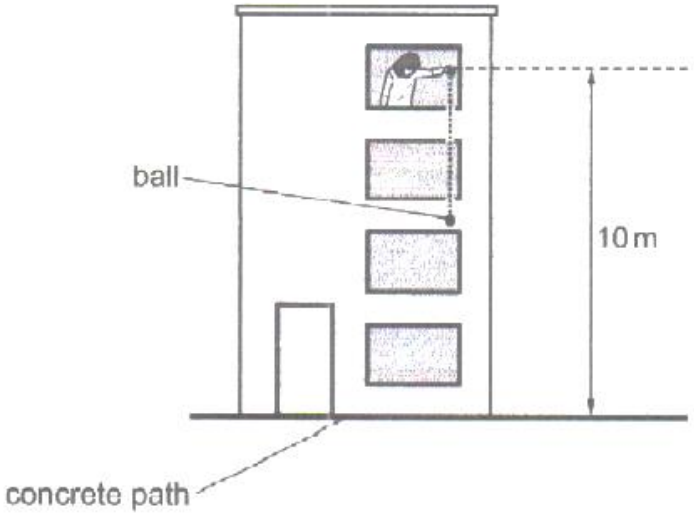


Fig. 1.1

The speed of the ball immediately **before** it strikes the path is 14 m/s.

The speed of the ball immediately **after** it strikes the path is 12 m/s.

(i) Calculate the kinetic energy of the ball immediately **after** it strikes the concrete path.

$K.E = \frac{1}{2}mv^2$

$= \frac{1}{2} \times 0.2 \times 12^2$

$= 14.4$ J

$\simeq 14$ J (2 s.f.)

kinetic energy = 14 J [2]

(ii) Show that the change in momentum of the ball when it bounces off the path is 5.2 kg m/s.

$\Delta p = mv - mu$

$= 0.20(-12 - 14)$

$= -5.2$ kg m/s upwards.

[3]

(iii) The ball is in contact with the path for 0.25 s.

Calculate the average resultant force on the ball when it is in contact with the path.

$f = \frac{\Delta p}{t}$

$= \frac{5.2}{0.25}$

$= 20.8$

$\simeq 21$ N

force = 21 N [2]

[Total: 9]

13. Nov/2023/Paper_ 0625/42/No.1

A car accelerates uniformly in a straight line from rest at time $t = 0$. At $t = 3.2$ s, the speed of the car is 13.0 m/s.

(a) **(i)** Calculate the acceleration of the car.

$a = \frac{v-u}{t}$

but $v = 0$

$\therefore a = \frac{13.0 \text{ m/s}}{3.2 \text{ s}}$

$= 4.0625$

$\therefore a = 4.1 \text{ m/s}^2$

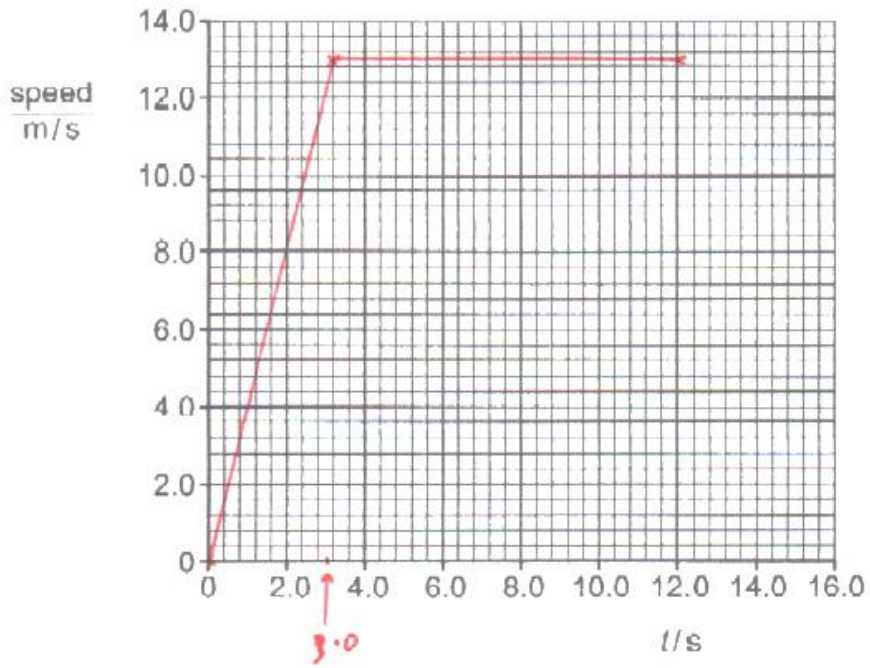
acceleration = 4.1 [2]

(ii) Explain in words what is meant by the term acceleration.

Acceleration is the increase of velocity per unit time. [1]

(b) The car travels at 13.0 m/s from $t = 3.2$ s to $t = 12.0$ s.

(i) Plot the speed–time graph for the car from $t = 0$ to $t = 12.0$ s.



[2]

(ii) Determine the distance travelled by the car between $t = 0$ and $t = 3.2$ s.

distance = area under graph

$= \frac{1}{2} \times 3.2 \times 13$

$= 20.8$ m

$\simeq 21$ m

distance = 21 m. [2]

(c) The car decelerates from 13.0 m/s to 0 m/s at a constant deceleration. The mass of the car is 1350 kg. The car travels 13 m in 2.0 s as it decelerates.

Show that the work done by the car as it decelerates is approximately 1.1×10^5 J.

$W \cdot d = F \times d$

$F = m \times a$

$= 1350 \times 6.5 = 8775$ N

$a = \frac{0 - 13}{2}$

$= -6.5$ m/s^2

$W \cdot d = 8775 \times 13$

$= 114,075$ J

$\simeq 1.1 \times 10^5$ J

[4]

(d) On another day, the car in (c) travels a longer distance while it decelerates from 13.0 m/s to 0 m/s. The deceleration is constant.

Suggest and explain what causes the stopping distance to increase.

suggestion ..... It has worn out tyres .....

.....

explanation ..... There is less friction between tyre and road surface .....

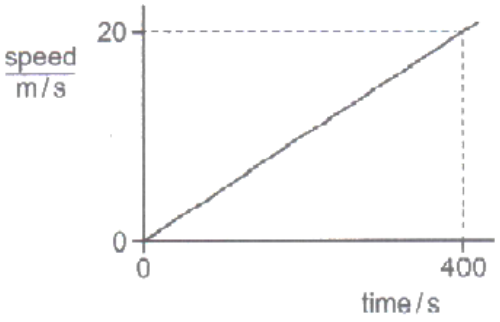
.....

[2]

[Total: 13]

14. June/2023/Paper_0625/11/No.2

The graph represents the motion of a vehicle.



In S-t graph, the distance travelled = area under the graph

$A = \frac{1}{2} \times b \times h$

$= \frac{1}{2} \times 400 \times 20$

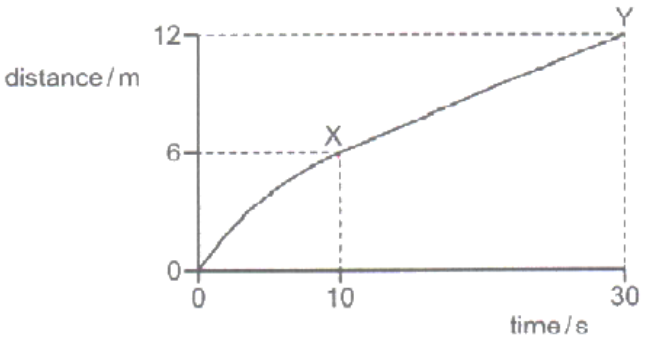
$= 4000\,m$

What is the distance travelled by the vehicle in 400 s?

A 20 m B 400 m C 4000 m D 8000 m

15. June/2023/Paper_0625/11/No.3

The diagram shows a distance–time graph for an object moving in a straight line.



What is the average speed between X and Y?

A 0.20 m/s B 0.30 m/s C 0.40 m/s D 0.60 m/s

av. speed = $\frac{\text{total distance}}{\text{total time}}$

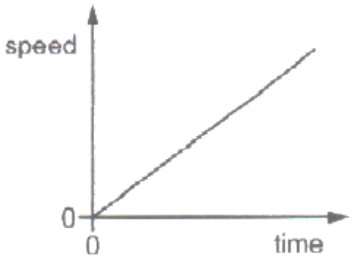
$= \frac{12-6}{30-10}$

$= \frac{6}{20}$

$= 0.3\,m/s$

16. June/2023/Paper_0625/12/No.2

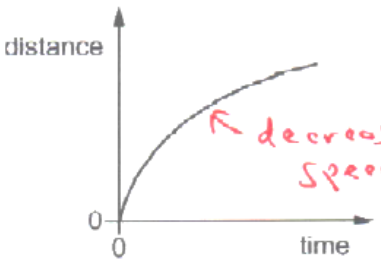
The speed–time graph represents a short journey.



← Speed is increasing with time - so distance increases with time also.

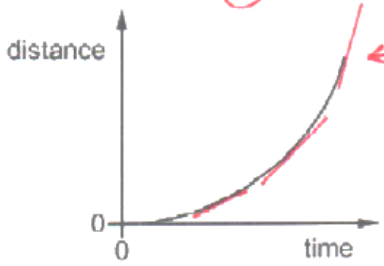
Which distance–time graph represents the same journey?

A



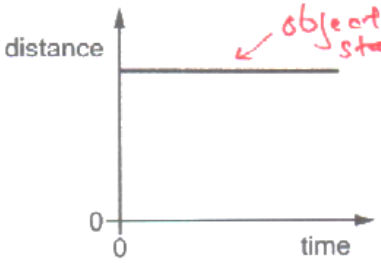
↖ decreasing speed

B ✓



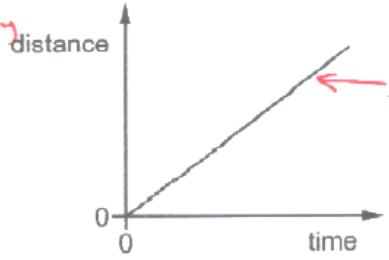
← Increasing gradient means increasing speed.

C



← object is stationary

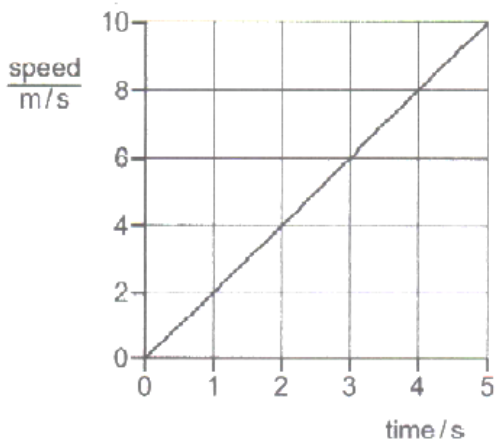
D



← Speed is constant since gradient is same.

17. June/2023/Paper_0625/12/No.3

The graph represents the motion of a car.



distance travelled = Area under the graph.

$A = \frac{1}{2} \times b \times h$

$= \frac{1}{2} \times 5 \times 10$

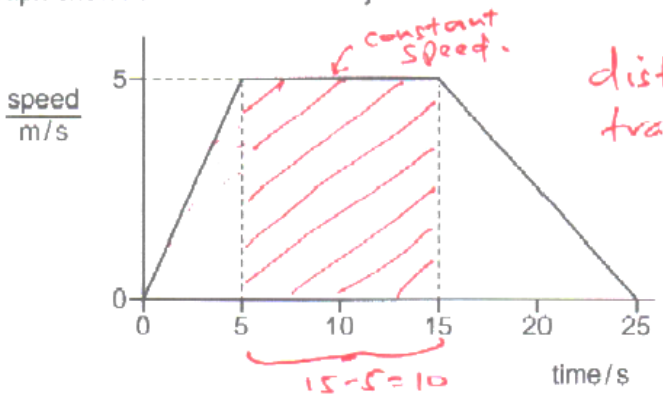
$= 25\ m$

How far has the car moved between 0 and 5 s?

A 2 m B 10 m C 25 m D 50 m

18. June/2023/Paper_0625/13,23/No.2

The speed–time graph shows the motion of an object.



distance travelled = Area under graph

$A = l \times w$

$= 10 \times 5$

$= 50\ m$

How far does the object travel at constant speed?

A 25 m B 50 m C 75 m D 125 m

19. June/2023/Paper_0625/13/No.3

A rock falls off a cliff onto a beach. The effect of air resistance on the rock is negligible.

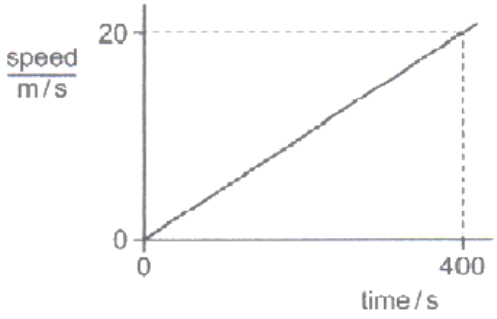
Which row describes the acceleration and speed of the rock as it falls?

	acceleration	speed
A	constant ✓	constant
(B)	constant ✓	increasing ✓
C	increasing	constant
D	increasing	increasing

- Acceleration is $9.8\ m/s^2$ which is constant, since there is no air resistance to oppose motion
- Since rock is accelerating, its speed increases.

20. June/2023/Paper_0625/21/No.3

The graph represents the motion of a vehicle.



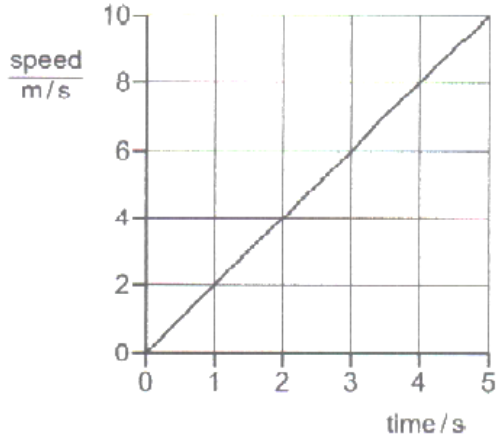
In s-t graph,
distance travelled = Area under graph
Area = $\frac{1}{2} \times b \times h$.
$= \frac{1}{2} \times 400 \times 20$
$= 4000\ m$

What is the distance travelled by the vehicle in 400 s?

A 20 m B 400 m (C) ✓ 4000 m D 8000 m

21. June/2023/Paper_0625/22/No.3

The graph represents the motion of a car.



distance travelled = Area under graph

Area = $\frac{1}{2} \times b \times h$
$= \frac{1}{2} \times 5 \times 10\ \frac{m}{s}$
$= 25\ m$

How far has the car moved between 0 and 5 s?

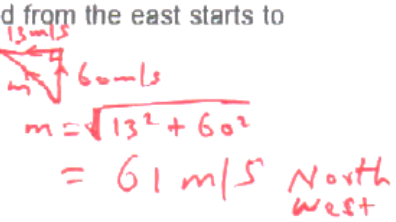
A 2 m B 10 m (C) ✓ 25 m D 50 m

22. June/2023/Paper_0625/23/No.3

An aircraft is moving at 60 m/s in a northerly direction when a cross-wind from the east starts to blow. The speed of the wind is 13 m/s.

What is the magnitude of the aircraft's velocity when the wind is blowing?

A 47 m/s B 59 m/s C 61 m/s D 73 m/s



23. June/2023/Paper_0625/31/No.1

A cyclist is travelling along a straight road. Fig. 1.1 shows the speed–time graph for the cyclist. The graph is divided into four sections labelled P, Q, R and S.

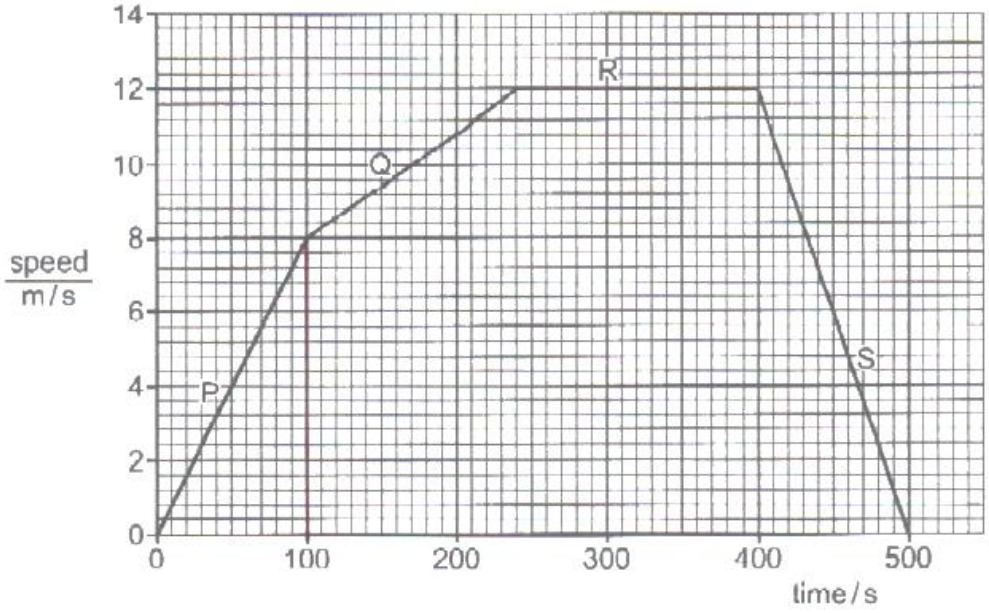


Fig. 1.1

(a) Calculate the distance travelled by the cyclist in section P from time = 0 to time = 100 s.

distance travelled = Area under graph

$A = \frac{1}{2} \times 100 \times 8$

$= 400\,m$

distance travelled = 400 m [3]

(b) Describe the motion of the cyclist in each of sections Q, R and S shown in Fig. 1.1.

Q Cyclist is accelerations

R cyclist is at constant speed

S cyclist is decelerating

[3]

(c) The cyclist is moving north along the road.

Determine the velocity of the cyclist at time = 300 s. Include the unit.

velocity of cyclist = 12 m/s North. [2]

Velocity is a vector, so it has a size and direction

[Total: 8]

24. June/2023/Paper_0625/32/No.2(a, b)

Fig. 2.1 shows the speed–time graph for a cyclist.

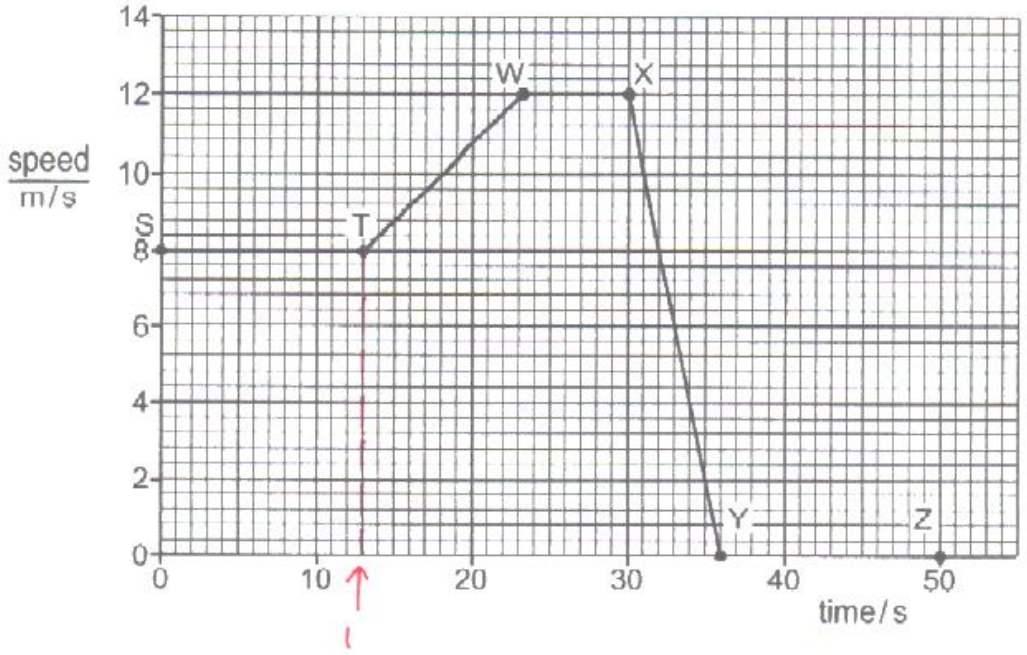


Fig. 2.1

(a) In Fig. 2.1, the sections ST, TW, WX, XY and YZ indicate stages of the cyclist's journey.

State **one** section which shows the cyclist **moving** with:

(i) constant speed

ST or WX ..... [1]

(ii) constant deceleration

XY ..... [1]

(iii) constant non-zero acceleration.

TW or XY ..... [1]

(b) Calculate the distance travelled by the cyclist in section ST.

distance travelled = Area under graph

Area = l x w

= 13 x 8

= 104 m

distance travelled = 104 ..... m [3]

≈ 100 m (2 s.f.).

25. June/2023/Paper_0625/33/No.1

Fig. 1.1 shows the distance–time graph for an engineer's journey.
She drives from her home directly to her office and parks the car.
She then drives from her office to her friend's house and parks the car.

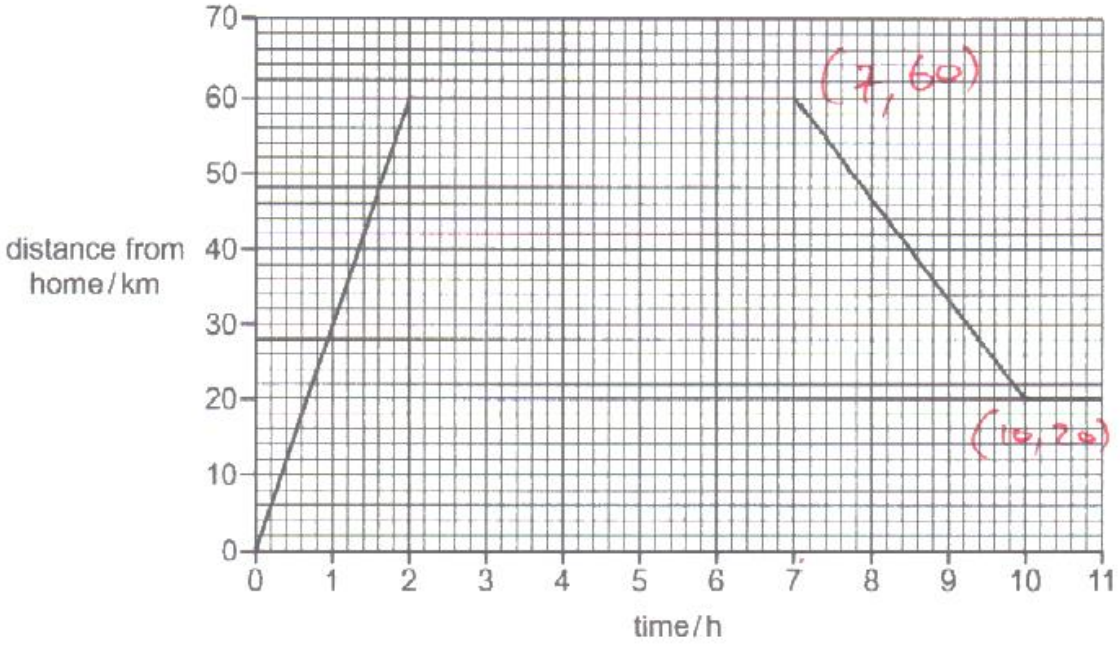


Fig. 1.1

(a) Determine the distance between:

(i) the engineer's home and her office ..... 60 km ..... km [1]

(ii) the engineer's office and her friend's house. ..... 60 - 20 = 40 km ..... km [1]

(b) Determine the time taken to travel between:

(i) the engineer's home and her office ..... 2 h ..... h [1]

(ii) the engineer's office and her friend's house. ..... 10 - 7 = 3 h ..... h [1]

(c) Calculate the speed of the car between time = 7 h and time = 10 h.

Gradient = Speed

$G = \frac{\Delta y}{\Delta x}$

$= \frac{60-20}{10-7}$

$= \frac{40}{3}$

$= 13 \text{ km/s}$

speed = ... 13 ..... km/h [3]

[Total: 7]

26. June/2023/Paper_0625/41/No.2

Fig. 2.1 shows a motorcyclist accelerating along a straight horizontal section of track.

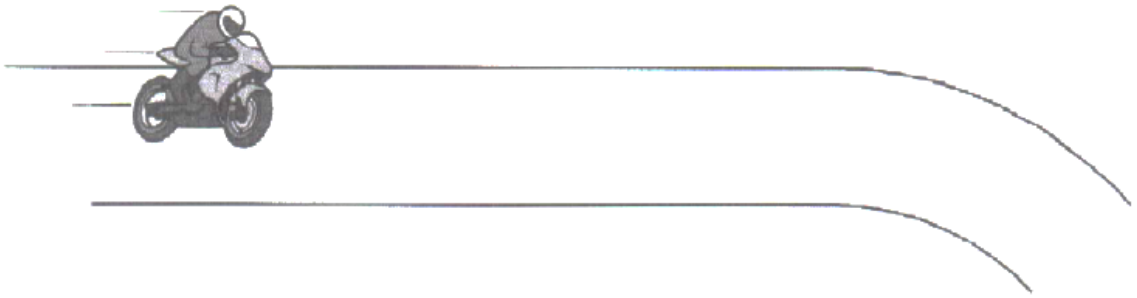


Fig. 2.1

The motorcyclist and motorcycle have a combined mass of 240 kg.

(a) On the straight horizontal section of the track, the motorcyclist accelerates from rest at $7.2\,m/s^2$.

(i) The motorcyclist reaches the end of the straight section of track in 5.3 s.

Calculate the speed of the motorcyclist at the end of the straight section.

$V = u + at$

$= 0 + (7.2 \times 5.3)$

$= 38\ m/s$

speed = 38 m/s [2]

(ii) Calculate the resultant force on the motorcyclist and motorcycle on the straight section of track.

$R \cdot f = m \times g$

$= 240\ kg \times 7.2\ m/s^2$

$= 1728\ N$

$\approx 1700\ N$

resultant force = 1700 N [2]

27. June/2023/Paper_0625/43/No.1(c, d)

(c) The balloon accelerates upwards from rest at 0.45 m/s^2 for 8.0 s.

Calculate the velocity of the balloon after 8.0 s.

$u = 0$
$a = 0.45\ m/s^2$
$v = ?$
$t = 8.0\ s$
$v = u + at$

$v = 0 + (0.45 \times 8.0)$
$= 3.6\ m/s$

velocity = 3.6 m/s [2]

(d) Calculate the distance travelled by the balloon in the first 8.0 s.

$av.\ speed = \frac{3.6}{2}$
$= 1.8\ m/s$

$av.\ speed = \frac{distance}{time}$

$distance = av.\ speed \times time$
$= 1.8 \times 8$
$= 14.4\ m$
$\approx 14\ m$

distance = 14 m. [2]

Particle of model matter – 2023 IGCSE

1. Nov/2023/Paper_ 0625/11/No.12

Why can a gas be compressed easily into a smaller volume?

A The particles are far apart. ← so they can be pushed closer together.

B The particles do not attract each other.

C The particles move randomly.

D The volume of each particle can be reduced.

2. Nov/2023/Paper_ 0625/12/No.12

Brownian motion is the random motion of particles.

In which states of matter is Brownian motion observed?

A gases, liquids and solids

B gases and liquids only

C gases and solids only

D liquids and solids only

Random motion occurs in both liquid and gaseous state where molecule move from one point to another.
- Solid state, particle do not move only vibrate.

3. Nov/2023/Paper_ 0625/12/No.15

Which diagram shows the processes happening during changes of state?

A

gas —boiling→ liquid —solidification→ solid

B

gas —condensation→ liquid —melting→ solid

C

solid —melting→ liquid —boiling→ gas

solidifying or freezing. ← Condensing

D

solid —solidification→ liquid —boiling→ gas

4. Nov/2023/Paper_ 0625/13/No.12

A sealed bottle of constant volume contains air.

The air in the bottle is heated by the Sun.

What is the effect on the average speed of the air particles in the bottle and the average distance between them?

$K.E = \frac{1}{2}mv^2$

Temp $\propto$ K.E, so at higher temp, speed of particles increase

But distance between particles stays same.

	average speed of air particles	average distance between air particles
A	decreases	decreases
B	decreases	stays the same
C	increases	increases
D ✓	increases	stays the same

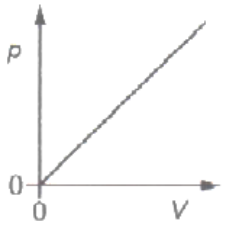
5. Nov/2023/Paper_ 0625/13/No.13

Which graph shows the relationship between the pressure p of a fixed mass of gas and its volume V at a constant temperature?

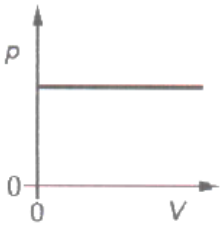
$p \propto \frac{1}{V}$

C ✓

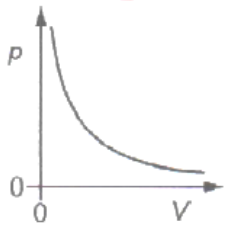
A



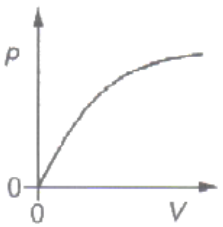
B



C



D



As pressure increase volume decreases.

6. Nov/2023/Paper_ 0625/21/No.12

Why can a gas be compressed easily into a smaller volume?

A ✓ The particles are far apart. ← gas particles can be made to move closer together because there is space between them.

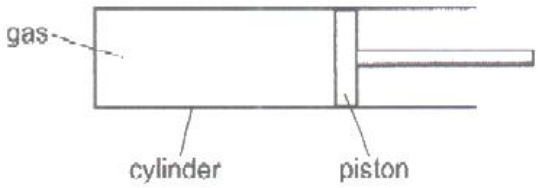
B The particles do not attract each other.

C The particles move randomly.

D The volume of each particle can be reduced.

7. Nov/2023/Paper_ 0625/21/No.13

A gas is contained in a cylinder by a movable piston.



The gas is heated so that it expands at **constant pressure**.

How is the force of each collision of a gas particle with the piston affected and how does the frequency of collisions between the gas particles and the piston change?

	force	frequency
A ✓	increases	decreases
B	increases	increases
C	stays the same	decreases
D	stays the same	increases

- At higher temp, the particles gain K.E and move faster.
- So they hit the piston at higher speed and so force increase.
- Since the volume has increased, the frequency of collision decreases.

8. Nov/2023/Paper_ 0625/22/No.12

Brownian motion is the random motion of particles.

In which states of matter is Brownian motion observed?

A gases, liquids and solids

B ✓ gases and liquids only

C gases and solids only

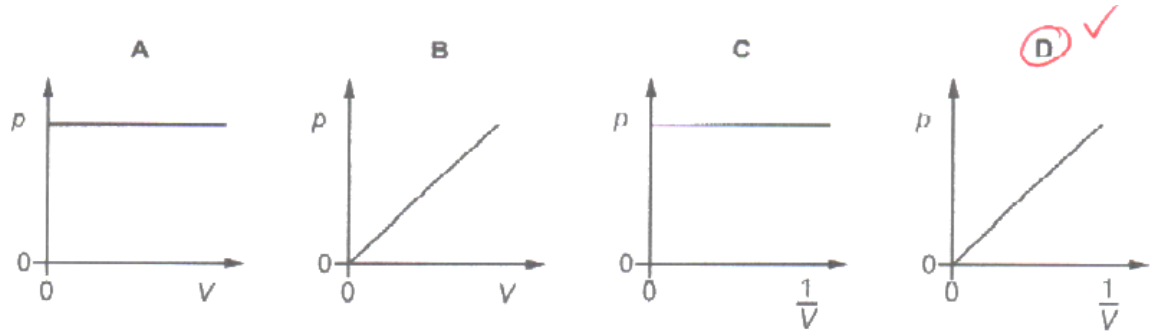
D liquids and solids only

↑ in liquid and gas since particles are free to move in all directions

9. Nov/2023/Paper_ 0625/22/No.13

The volume of a fixed mass of gas is varied. The temperature remains constant.

Which graph shows how the pressure p of the gas varies with volume V?



$p \propto \frac{1}{V}$

$p = \frac{k}{V}$

$p = k \times \frac{1}{V}$

$y = mx + c$ (equation of straight line)

- If you plot p against $\frac{1}{V}$ the graph will straight line passing through the origin.

10. Nov/2023/Paper_ 0625/23/No.12

A sealed bottle of constant volume contains air.

The air in the bottle is heated by the Sun.

What is the effect on the average speed of the air particles in the bottle and the average distance between them?

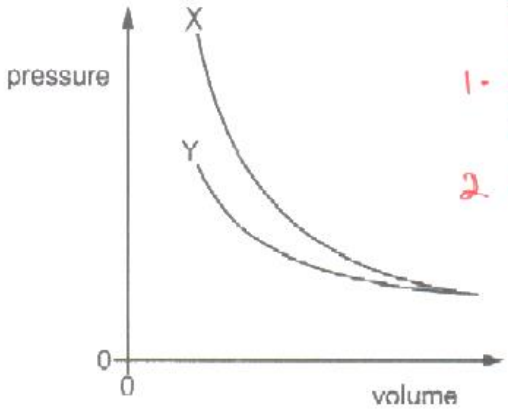
	average speed of air particles	average distance between air particles
A	decreases	decreases
B	decreases	stays the same
C	increases	increases
D	increases	stays the same

- At higher temp, air particles have high K.E
- Increase of K.E will increase speed of particles $K.E = \frac{1}{2}mv^2$.
- Since there is no change of state, the distance between air particles remains same.

11. Nov/2023/Paper_ 0625/23/No.13

In an experiment to investigate the relationship between the volume of a sample of air and its pressure, the volume of the sample is decreased and its pressure is measured continuously.

Curve X on the graph shows the results that would be expected for a fixed mass of air at constant temperature. Curve Y shows the results that are obtained in this particular experiment.



Two reasons
1. Either the temp is decreasing.
2. or the amount of gas is reducing due to leakage.

Which row shows two possible reasons why curve Y is different from curve X?

	1	2
A	the temperature of the air **increases** as the volume is decreased	air leaks **into** the container as the volume is decreased
B	the temperature of the air **increases** as the volume is decreased	air leaks **out of** the container as the volume is decreased
C	the temperature of the air **decreases** as the volume is decreased	air leaks **into** the container as the volume is decreased
D ✓	the temperature of the air **decreases** as the volume is decreased	air leaks **out of** the container as the volume is decreased

12. Nov/2023/Paper_ 0625/31/No.3(a, b)

Fig. 3.1 represents the arrangement and separation of particles in a liquid. Each circle represents a particle.

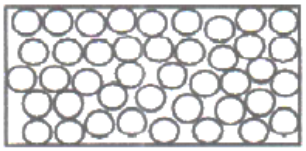


Fig. 3.1

(a) In the box in Fig. 3.2, draw at least **four** circles to show the arrangement and separation of particles in a **gas**.

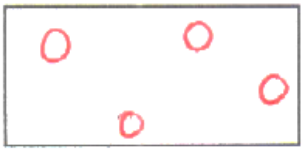


Fig. 3.2

[2]

(b) Describe the arrangement, separation and motion of particles in a **solid**.

- Arrangement - regular (uniform) at fixed positions
- Seperation - closely packed
- Motion - Vibrating at fixed positions. [3]

13. Nov/2023/Paper_ 0625/41/No.3(a)

Liquids are difficult to compress whereas gases can be compressed easily.

(a) Explain, in terms of particles, why it is difficult to compress liquids.

- In liquid, particles are close to each other.
- This increases the force of repulsion and is not possible to push the particles any more closer. [2]

14. Nov/2023/Paper_ 0625/42/No.4(a)

Fig. 4.1 shows a bottle part-filled with water. The air inside the bottle is at the same pressure as the air outside the bottle. The bottle and its contents are at room temperature.

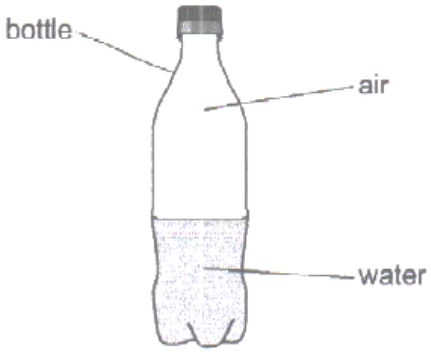


Fig. 4.1

(a) The temperature of the bottle and its contents are increased.

(i) Explain, in terms of particles, how the air pressure inside the bottle changes as the temperature increases.

- At high temp, K.E of particles increase
- The air particles has more frequent collision with sides of the bottle.
- There is greater force per unit area giving more pressure. [3]

(ii) The lid is removed from the bottle.

State and explain how the air pressure inside the bottle changes.

statement Pressure will decrease.

explanation Some air particles escapes from inside to bottle to outside air. [2]

15. June/2023/Paper_0625/11/No.14

Gases, liquids and solids are made up of small particles.

Which row gives the relative separation of the particles?

	gas	liquid	solid
A	far apart	far apart	far apart
B	far apart	far apart	close together
C	far apart	close together	close together
D	close together	close together	far apart

- Particle is both solid and liquids are close together.
- Particles in gases are far apart.

16. June/2023/Paper_0625/11/No.15

Which statements about evaporation of water are correct?

1 Evaporation causes the remaining liquid to cool.

2 During evaporation, the more energetic particles escape from the surface of the liquid.

3 Evaporation only happens at 100 °C. × boiling occurs at 100°C: Evaporation occur at any temperature

A 1, 2 and 3 B 1 and 2 only C 1 and 3 only D 2 and 3 only

17. June/2023/Paper_0625/12/No.14

Four students describe the phrase 'absolute zero' during a lesson on the particle model.

Which student is correct?

↑ is lowest temp possible

A This is the lowest possible temperature.

There is no temp below 0 K.

B Particles in a solid start vibrating.

C Particles do not have any weight.

D Particles have the least gravitational potential energy.

There is is no -1 K or -274 °C. (It does not exist).

18. June/2023/Paper_0625/12/No.15

At the surface of a liquid, the more energetic molecules can escape from the liquid into the atmosphere.

Which name is given to this process?

A boiling ← liquid changing to gas

B condensation ← gas changing to liquid

C evaporation ← liquid changing to gas

D melting ← solid changing to liquid

19. June/2023/Paper_0625/13/No.14

What is the lowest possible temperature (absolute zero) and what happens to the energy of particles at this temperature?

Absolute zero = −273 °C

Particles have no K.E, since they do not vibrate.

	lowest possible temperature / °C	particle energy
A	−273	particles have least kinetic energy
B	−273	particles have zero gravitational potential energy
C	0	particles have least kinetic energy
D	0	particles have zero gravitational potential energy

20. June/2023/Paper_0625/13/No.15

Which statement about the particles of a substance after condensation is correct?

↑ gas change to liquid particle get closer and move randomly at slower speed.

A They are close to each other and slide over each other.

B They are close to each other and vibrate about fixed points.

C They are far apart from each other and vibrate about fixed points.

D They are far apart from each other and move freely within the container.

21. June/2023/Paper_0625/21/No.14

A student uses a microscope to observe pollen moving on the surface of water.

Which statement describes the reason for this movement?

Brownian motion, the larger particles are moved when smaller invisible particle collides with larger particles.

A Water molecules are moved by microscopic pollen particles.

B Water molecules are moved by pollen molecules.

C Microscopic pollen particles are moved by water molecules.

D Pollen molecules are moved by water molecules.

22. June/2023/Paper_0625/21/No.15

Which statements about evaporation of water are correct?

1 Evaporation causes the remaining liquid to cool. ✓

2 During evaporation, the more energetic particles escape from the surface of the liquid. ✓

3 Evaporation only happens at 100 °C. ✗ only Boiling of water occurs at 100°C

A 1, 2 and 3 (B) ✓ 1 and 2 only C 1 and 3 only D 2 and 3 only

23. June/2023/Paper_0625/21/No.14

A student uses a microscope to observe pollen moving on the surface of water.

Which statement describes the reason for this movement?

A Water molecules are moved by microscopic pollen particles.

B Water molecules are moved by pollen molecules.

(C) ✓ Microscopic pollen particles are moved by water molecules.

D Pollen molecules are moved by water molecules.

Brownian motion; the larger particles are moved when smaller invisible particle collides with larger particles.

24. June/2023/Paper_0625/21/No.15

Which statements about evaporation of water are correct?

1 Evaporation causes the remaining liquid to cool. ✓

2 During evaporation, the more energetic particles escape from the surface of the liquid. ✓

3 Evaporation only happens at 100 °C. ✗ only Boiling of water occurs at 100°C

A 1, 2 and 3 (B) ✓ 1 and 2 only C 1 and 3 only D 2 and 3 only

25. June/2023/Paper_0625/22/No.14

Four students describe the phrase 'absolute zero' during a lesson on the particle model.

↑ -273 °C

Which student is correct?

(A) ✓ This is the lowest possible temperature.

B Particles in a solid start vibrating. ← at -273 °C particles do not vibrate

C Particles do not have any weight.

D Particles have the least gravitational potential energy.

26. June/2023/Paper_0625/22/No.15

Four students are asked to state and explain the relative magnitudes of the thermal expansion of solids and gases.

Expansion: gas > liquid > solid.

Which student is correct?

A Gases expand more than solids because the molecules in a gas are in random motion.

B Gases expand more than solids because the attractive forces between molecules are much weaker in gases.

C Solids expand more than gases because the molecules are closer together in solids.

D Solids expand more than gases because the molecules in a solid are in a regular pattern.

27. June/2023/Paper_0625/23/No.14

What is the lowest possible temperature (absolute zero) and what happens to the energy of particles at this temperature?

	lowest possible temperature / °C	particle energy
A	−273	particles have least kinetic energy
B	−273	particles have zero gravitational potential energy
C	0	particles have least kinetic energy
D	0	particles have zero gravitational potential energy

Absolute zero = −273 °C or 0 K.

- Particle at 0 K has no K.E, so no motion

28. June/2023/Paper_0625/23/No.15

Which statement about the particles of a substance after condensation is correct?

↑ gas turns to liquid

A They are close to each other and slide over each other.

B They are close to each other and vibrate about fixed points.

C They are far apart from each other and vibrate about fixed points.

D They are far apart from each other and move freely within the container.

- both liquid and solid have particles that very close.
- In liquid particles move randomly and slide over each other.

29. June/2023/Paper_0625/31/No.5

Fig. 5.1 represents some particles of a gas in a metal box. The arrows represent the directions of movement of the particles.

Fig. 5.1 (not to scale)

(a) Describe how the particles in Fig. 5.1 exert a pressure on the walls of the box.

- Particles in random motion collides with the walls of the metal box. This produces a force on area - Pressure = Force ÷ Area. [3]

(b) The number of gas particles in the box increases. The temperature of the gas does **not** change.

State and explain the effect, if any, on the pressure exerted by the gas particles on the walls of the box.

- Pressure will increase
- There are more collision with the walls of the box [2]

[Total: 5]

30. June/2023/Paper_0625/32/No.4(a, b)

A student has a block of solid metal at room temperature.

(a) **(i)** Describe the arrangement, separation and motion of the particles in the solid metal.

- Arrangement – particles are fixed in positi
with regular arrangement
- Seperation – Close packed.
- Motion – Vibrate about fixed positio [3]

(ii) The student cools the block of metal in a freezer.

State the effect, if any, of cooling on the kinetic energy of the particles in the block of metal.

K.E decreases, particles vibrate less [1]

(b) **(i)** State the name of the temperature at which particles have the least kinetic energy.

absolute zero [1]

(ii) State the value of temperature at which particles have the least kinetic energy. Include the unit.

−273°c or 0K [1]

31. June/2023/Paper_0625/33/No.4(a, b)

A tight-fitting lid keeps air inside a metal can.

An airtight rubber bung holds a liquid-in-glass thermometer that is inserted through a hole in the lid, as shown in Fig. 4.1.

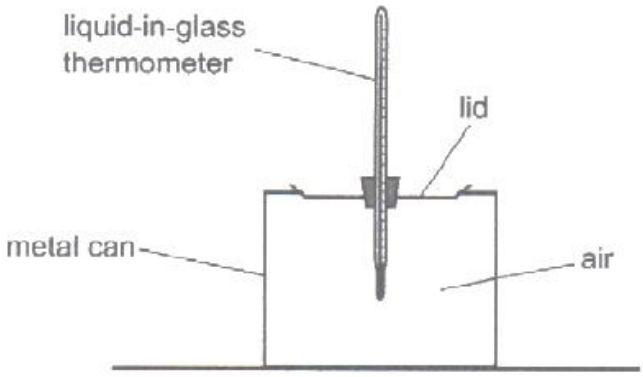


Fig. 4.1

(a) **(i)** State what happens to the liquid in the thermometer when the air temperature rises.

liquid expands ..... [1]

(ii) The temperature of the air in the can is 18 °C.

Calculate the temperature of the air in kelvin.

Kelvin = °C + 273

= 18°C + 273

= 291 K

temperature = 291 K [2]

(b) The can is placed in a refrigerator. The temperature of the air inside the can decreases.

State and explain what happens to the pressure exerted by the air in the can. Use your ideas about gas particles.

- Pressure inside the can decreases
- Gas particles lose K.E and slow down
- There is now less frequent collisions of particles with walls of the can. [3]

32. June/2023/Paper_0625/41/No.3

A rubber balloon is inflated with helium and sealed so that no helium escapes.

The balloon is positioned immediately below the ceiling in a room.

Heaters are switched on and the temperature of the air in the room increases.

(a) When the heaters are first switched on, the temperature of the air immediately below the ceiling increases more quickly than the temperature of the air in the rest of the room.

Explain why this happens.

- Warm air is less dense so it rises to the ceiling displacing cooler more denser air [2]

(b) The temperature of the helium in the balloon increases and as the rubber stretches, the volume occupied by the helium increases.

(i) State what happens to the motion of the helium particles as the temperature increases.

- Particles gain more K.E and their speed increases. [1]

(ii) As the rubber stretches and the volume of the helium increases, the pressure of the helium remains constant.

Explain, in terms of the particles of helium, how the pressure of the helium remains constant.

- Particles collide with rubber harder stretching it
- At larger volume, particle collide less frequently
- The effect of larger volume volume cancel effect of temp increase hence pressure remains constant. [3]

[Total: 6]

33. June/2023/Paper_0625/42/No.4

(a) The temperature of a fixed mass of gas at constant volume is decreased.

State and explain, in terms of particles, how the pressure of the gas changes.

- Pressure of gas will decrease.
- Particles now have smaller K.E so there will be lower rate collision of the particles
- Smaller force results to less pressure [3]

(b) **(i)** State the value of absolute zero in °C.

value of absolute zero = -273 °C [1]

(ii) Explain what is meant by the term absolute zero. Refer to particles in your answer.

- It is the lowest possible temperature where particles have least amount of K.E. [2]

(c) Cylinder 1 contains 350 cm^3 of gas at a pressure of 9.0×10^4 Pa. The gas is transferred to cylinder 2 and the pressure increases to 1.6×10^5 Pa. The temperature remains constant.

Calculate the volume of cylinder 2.

$V_1 = 350\ cm^3$

$P_1 = 9.0 \times 10^4\ Pa$

$V_2 = ?$

$P_2 = 1.6 \times 10^5\ Pa$

$V_1 \times P_1 = V_2 \times P_2$

$V_2 = \frac{P_1 \times V_1}{P_2}$

$V_2 = \frac{9.0 \times 10^4 \times 350\ cm^3}{1.6 \times 10^5}$

$= 196.875\ cm^3$

$\approx 200\ cm^3$ (to 2 s.f).

volume = 200 cm^3 [3]

[Total: 9]

Physical Quantities – 2023 IGCSE 0625 Physics

1. Nov/2023/Paper_ 0625/11/No.1

In order to determine the period of a pendulum, a student times one complete swing of the pendulum using an analogue stop-watch with a second hand.

Which change of method produces the greatest improvement in accuracy?

A asking a friend with a shorter reaction time to take the measurement

B measuring the time for 100 swings of the pendulum and dividing it by 100

C measuring the time for a half swing of the pendulum and doubling it

D using a digital timer

for accuracy, do many oscillation and divide their time by the number of oscillations

2. Nov/2023/Paper_ 0625/12/No.1

A student investigates the oscillation of a mass suspended from a spring.

The student pulls the mass down from its rest position P and then releases it so that it oscillates vertically.

The student then follows the instructions listed to find the period of the oscillating mass.

1 Count 10 complete oscillations. (2)

2 Divide the time on the stop-watch by 10. (4)

3 Start the stop-watch as the mass passes upwards through point P. (1)

4 Stop the stop-watch. (3)

What is the correct order of these instructions?

A 1 → 3 → 4 → 2

B 3 → 1 → 4 → 2

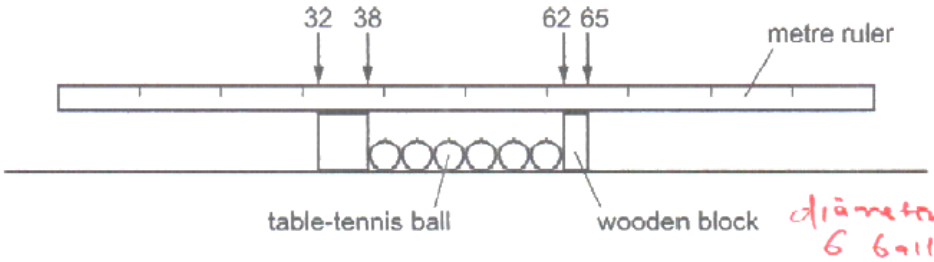
C 3 → 4 → 1 → 2

D 4 → 3 → 2 → 1

Time 10 oscillations and then divide by 10 to get time period for one oscillation.

3. Nov/2023/Paper_ 0625/13/No.1

A student uses a metre ruler to measure the length of six identical table-tennis balls placed between two wooden blocks.



diameter for the 6 balls = 62 − 38 = 24

What is the diameter of one ball?

diameter for one = 24/6 = 4 cm

A 4 cm ✓ B 5 cm C 6 cm D 8 cm

4. Nov/2023/Paper_ 0625/21/No.1

Which is a vector quantity?

A density
B mass
C pressure
D weight ✓

scalars

Vector has size and direction
- acceleration
- velocity
- displacement
- momentum
- force

5. Nov/2023/Paper_ 0625/22/No.1

Which quantity is a scalar quantity?

A acceleration
B force
C time ✓
D velocity

↑ have only size, no direction

Vectors
- acceleration
- velocity
- displacement
- force
- momentum

Scalars
- Area
- mass
- volume
- density
- pressure
- work
- energy
- speed
- distance

6. Nov/2023/Paper_ 0625/23/No.1

How many of the quantities shown are scalars?

mass ✓ momentum (vector) density ✓ energy ✓

A 1 B 2 C 3 ✓ D 4

7. June/2023/Paper_0625/11/No.1

Which unit is a unit of weight?

A kilogram ← mass

B kilojoule ← Energy

C kilometre ← length

D ✓ kilonewton ← weight / force.

Kilo is a prefix with a value of $1000 = 10^3$

∴ Kilonewton = 1000N

8. June/2023/Paper_0625/12/No.1

Which single apparatus is used to find the volume of a solid cube and which single apparatus is used to find the volume of a quantity of liquid?

	volume of solid cube	volume of liquid
A	balance	balance
B	balance	measuring cylinder
C	ruler ✓	balance
D ✓	ruler ✓	measuring cylinder ✓

- is a regular shape.
- So use a ruler to measure length, width and height and use equation $V = l \times w \times h$
- Volume of liquid is measured by measuring cylinder.

9. June/2023/Paper_0625/13/No.1

Which piece of apparatus is used to measure the length of a copper rod of length approximately 2 cm?

A digital timer ← Measures time

B measuring cylinder ← measures volume of liquid

C ✓ ruler

D balance ← Measures mass of substance.

10. June/2023/Paper_0625/32/No.1(a)

A student measures the diameter of some identical steel balls. Fig. 1.1 shows the arrangement she uses.

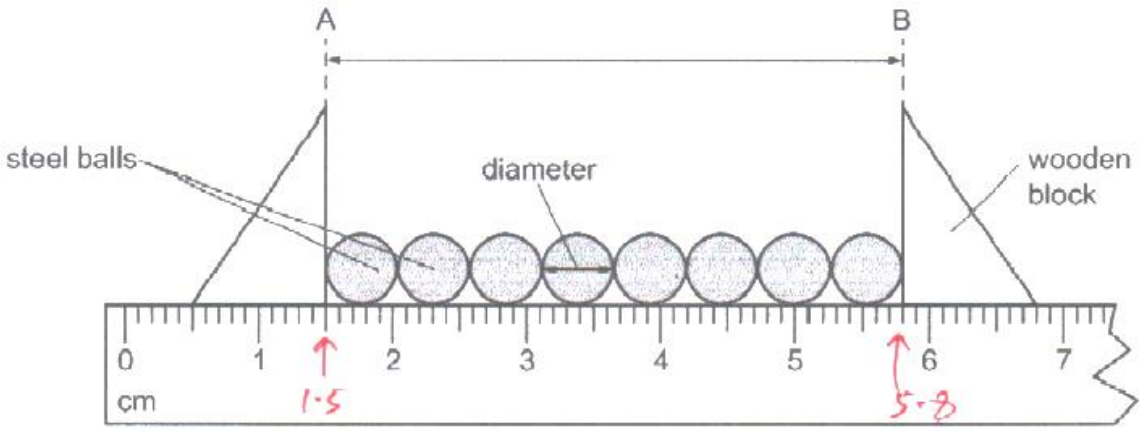


Fig. 1.1 (not to scale)

(a) (i) Using the ruler in Fig. 1.1, determine the distance AB on Fig. 1.1.

$5.8 - 1.5 = 4.3$ cm

distance AB = 4·3 ..... cm [2]

(ii) Use the distance AB to determine the diameter of one steel ball.

$\frac{4.3}{8} = 0.5375$ cm

diamotor of one steel ball = 0·54 ..... cm [2]

Pressure – 2023 IGCSE 0625 Physics

1. Nov/2023/Paper_ 0625/11/No.11

When a diver swims down from the surface of the water to a depth of 10 m, the pressure experienced increases from 100 000 N/m^2 to 200 000 N/m^2.

Which statement explains this increase in pressure?

A The density of the water increases with depth.

B The gravitational field strength increases with depth.

C ✓ The weight of water above the diver increases with depth.

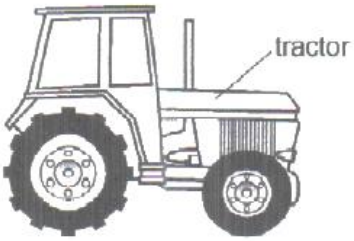
D Water cannot be compressed.

$P = \rho g h$. $P = \frac{F}{A}$

As h (depth) increases weight above swimmer increases.

2. Nov/2023/Paper_ 0625/12/No.11

Tractors have large tyres. These help to prevent the wheels from sinking into soft ground.



Which statement explains this?

A Larger tyres exert a greater force on the ground.

B Larger tyres exert a greater pressure on the ground.

C Larger tyres exert a smaller force on the ground.

D ✓ Larger tyres exert a smaller pressure on the ground.

$P = \frac{F}{A}$

When area A is large, pressure P, will be small for the force F.

3. Nov/2023/Paper_ 0625/13/No.11

Why is it easier to push a sharp nail, rather than a blunt nail, into a piece of wood?

A The sharp nail exerts a larger force on the wood.

B The sharp nail exerts a smaller force on the wood.

C ✓ The sharp nail exerts a larger pressure on the wood.

D The sharp nail exerts a smaller pressure on the wood.

Pressure = $\frac{\text{force}}{\text{Area}}$

- Smaller area produce large pressure.
- Sharp mean Smaller area
- Blunt mean large area.

4. Nov/2023/Paper_ 0625/21/No.11

The water in a swimming pool exerts a pressure at the bottom of the pool.

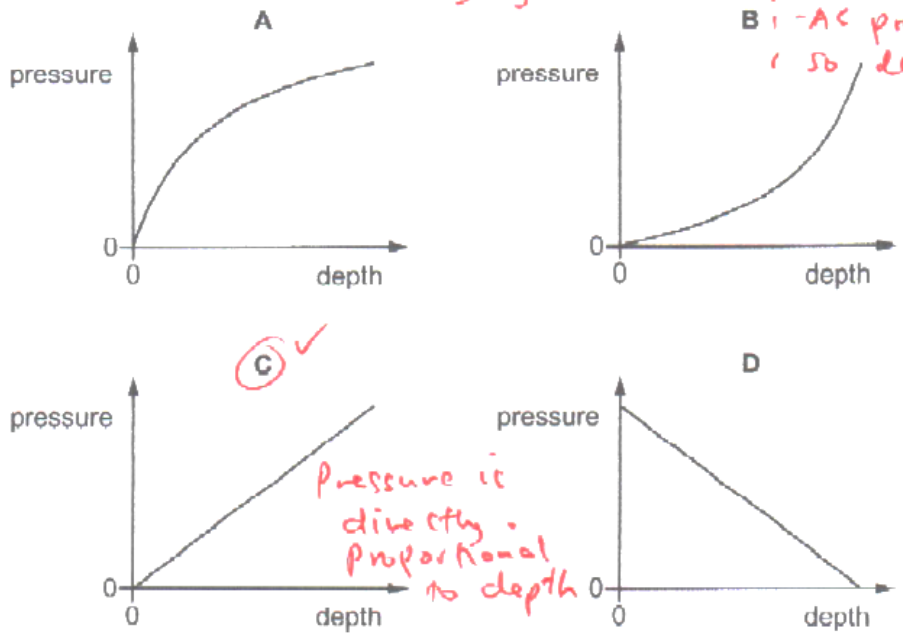
Which graph shows the relationship between the pressure exerted by the water and the depth of water in the pool?

(Assume the density of water is constant.)

$p = \rho g h$. ∴ $p = k \times h$

$\rho \times g$ = constant ⇒ $p \propto h$.

As pressure increases so depth increases.



✓ C

Pressure is directly proportional to depth

5. Nov/2023/Paper_ 0625/22/No.11

An object is a depth h below the surface of a liquid. The pressure due to the liquid at this depth is p. The gravitational field strength is g.

$p = \rho g h$. ⇒ $\rho = \frac{p}{gh}$.

What is the density ρ of the liquid?

A $\rho = pgh$ B $\rho = \frac{pg}{h}$ C $\rho = \frac{ph}{g}$ ✓ D $\rho = \frac{p}{hg}$

6. Nov/2023/Paper_ 0625/23/No.11

An object is immersed in a liquid of density ρ. The pressure at this depth due to the liquid is p. The gravitational field strength is g.

$p = \rho g h$.

∴ $h = \frac{p}{\rho \times g}$.

What is the equation for the depth h of the object beneath the surface?

A $h = p\rho g$ B $h = \frac{\rho g}{p}$ ✓ C $h = \frac{p}{\rho g}$ D $h = \frac{pg}{\rho}$

7. Nov/2023/Paper_ 0625/41/No.3(b)

(b) Fig. 3.1 shows a rectangular block floating in water. The density of the water is 1000 kg/m^3.

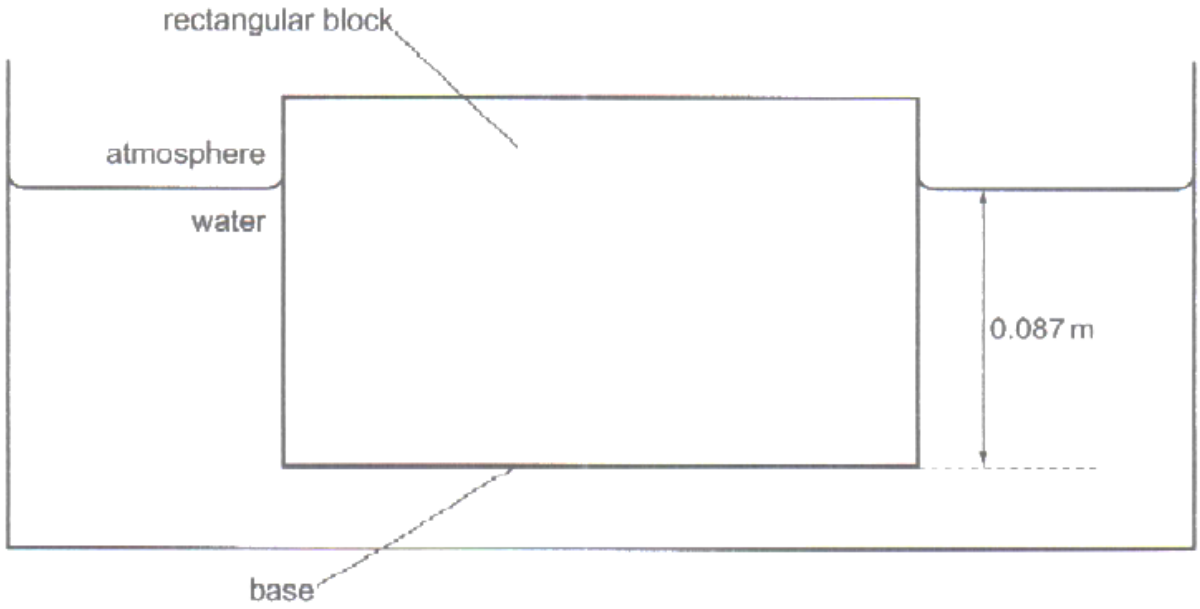


Fig. 3.1

The area of the base of the block is 0.014 m^2. The base of the block is at a depth of 0.087 m below the surface of the water.

(i) Show that the pressure due to the water at the base of the block is approximately 850 Pa.

$P = \rho g h$.

$= 1000 \times 9.81 \times 0.087$

$= 852.6$ Pa.

$\simeq 850$ Pa

[2]

(ii) Calculate the force F on the base of the block caused by the pressure given in **(b)(i)**.

$P = \frac{F}{A}$

$F = P \times A$

$F = 852.6 \times 0.014$

$= 11.9$

$\simeq 12$ N

$F =$ 12 N [2]

(iii) Force F is equal to the weight of the block.

Calculate the mass of the block.

$m = \frac{W}{g}$; $m = \frac{12\text{ N}}{9.81} = 1.2$ kg

mass = 1.2 kg [2]

8. Nov/2023/Paper_ 0625/42/No.4(c)

Fig. 4.1 shows a bottle part-filled with water. The air inside the bottle is at the same pressure as the air outside the bottle. The bottle and its contents are at room temperature.

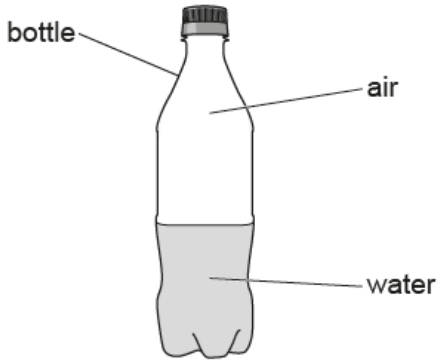


Fig. 4.1

(c) Another plastic bottle is filled to the top with water. The height of the bottle is 40.0 cm. The density of water is $1.0 \times 10^3 \text{ kg/m}^3$.

↑ 0.40 m

Calculate the pressure difference between the top and bottom of the water.

$\Delta p = \rho g \Delta h$.

$= 1.0 \times 10^3 \times 9.81 \times 0.40$

$= 3924 \text{ Pa}$

$\simeq 3900 \text{ Pa}$

pressure difference = 3900 Pa [2]

9. June/2023/Paper_0625/11/No.13

A woman has a weight of 600 N. She stands on a horizontal floor. The area of her feet in contact with the floor is 0.050 m^2.

What is the pressure she exerts on the floor?

A $1.2 \times 10^3 N/m^2$

B $2.4 \times 10^3 N/m^2$

C ✓ $1.2 \times 10^4 N/m^2$

D $2.4 \times 10^4 N/m^2$

$P = \frac{F}{A}$

$= \frac{600N}{0.05m^2}$

$= 12,000 N/m^2$

$= 1.2 \times 10^4 N/m^2$

10. June/2023/Paper_0625/12/No.13

A rectangular marble block has dimensions 1 m by 1 m by 5 m and weighs 125 000 N.

The marble block is stored with the long side resting on the ground, as in diagram 1.

$P = \frac{F}{A}$

$= \frac{125000N}{(5 \times 1)m^2}$

$= 25,000 N/m^2$

diagram 1

diagram 2

$P = \frac{125000N}{(1 \times 1)m^2}$

$= 125000 N/m^2$

What is the change in the pressure on the ground due to the block when the block is stored as in diagram 2 rather than diagram 1?

A a decrease of 25 000 N/m^2

B ✓ an increase of 100 000 N/m^2

C an increase of 125 000 N/m^2

D no change

$\therefore \Delta P = 125000 - 25000$

$= 100,000 N/m^2$

11. June/2023/Paper_0625/13/No.13

A solid cube has sides 0.50 m long and a mass of 120 kg. It stands on the ground on one face.

Which pressure does the cube exert on the ground?

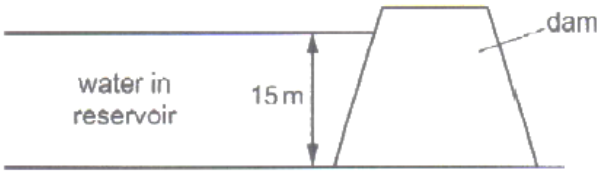
A 480 kg/m^3 B 960 kg/m^3 C ✓ 4700 N/m^2 D 9400 N/m^2

$P = \frac{F}{A}$ $F = m \times g$ $= 120 \times 9.8$ $= 1176N$ | $P = \frac{1176N}{0.25m^2}$ $= 4704 N/m^2$

$A = l \times w$ $= 0.5 \times 0.5$ | $= 4700 N/m^2$

12. June/2023/Paper_0625/21/No.13

A dam holds water in a reservoir. The height of the water in the reservoir is 15 m.



$P = \rho \times g \times h$
$= 1000 \times 9.8 \times 15$
$= 147,000$ Pa
$\approx 150,000$ Pa
(to 2 s.f.)

The density of water is 1000 kg/m^3.

What is the pressure due to the water at the bottom of the dam?

A 6.8 Pa B 1500 Pa C 15000 Pa D ✓ 150000 Pa

13. June/2023/Paper_0625/22/No.13

The density of sea water is 1030 kg/m^3.

The gravitational field strength on the Earth is 9.8 N/kg.

Atmospheric pressure is 101000 Pa.

$P_T = P_w + P_{atm}$; $P_w = \rho g h$; $P_w = P_T - P_{atm}$

$P_w = 513000 - 101000 = 412000$ Pa

At which depth in sea water is the total pressure due to the atmosphere and the water equal to 513000 Pa?

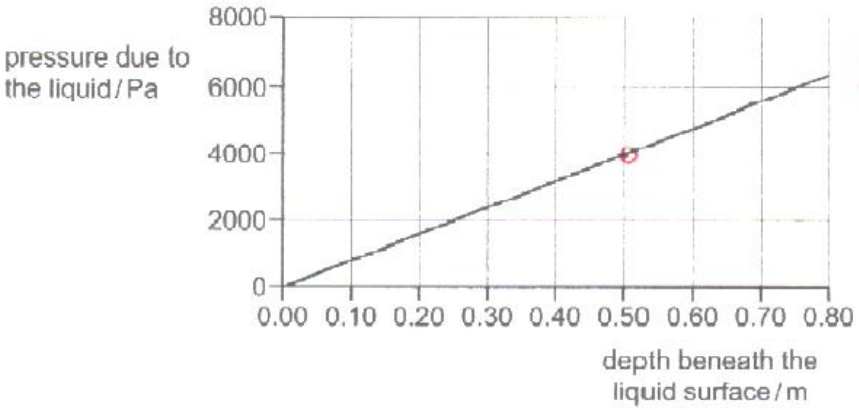
A ✓ 40.8 m B 50.8 m C 400 m D 498 m

$\rho \times g \times h = 412000$ Pa ; $h = \frac{412000}{\rho \times g}$; $h = \frac{412000}{1030 \times 9.8} = 40.8$ m

14. June/2023/Paper_0625/23/No.13

The graph shows how the pressure due to a liquid varies with the depth beneath the liquid surface.

The gravitational field strength g is 9.8 N/kg.



$P = \rho g h$

$\rho = \frac{P}{g \times h}$

$= \frac{4000}{9.8 \times 0.5}$

$= 816$

≈ 820 kg/m^3

What is the density of the liquid?

A 200 kg/m^3 B ✓ 820 kg/m^3 C 2000 kg/m^3 D 8200 kg/m^3

15. June/2023/Paper_0625/31/No.2(a)

Fig. 2.1 shows a concrete beam resting on the ground.

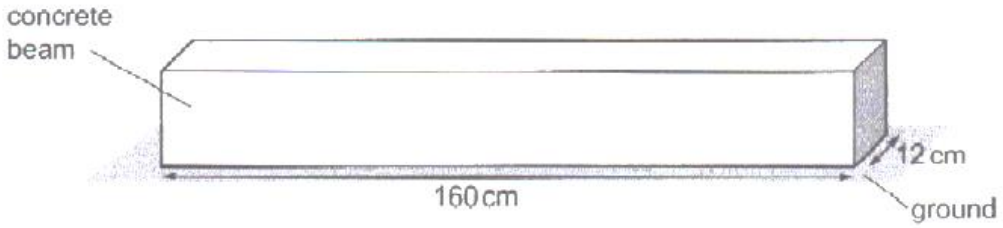


Fig. 2.1 (not to scale)

(a) The weight of the concrete beam is 1540 N.

Calculate the pressure on the ground due to the concrete beam.

$P = \frac{F}{A}$

$= \frac{1540\,N}{(160 \times 12)\,cm^2}$

$= 0.8\,N/cm^2$

pressure = ... 0.8 ..... N/cm^2 [4]

16. June/2023/Paper_0625/32/No.3(c)

A student has a battery-powered torch. Fig. 3.1 shows the torch.

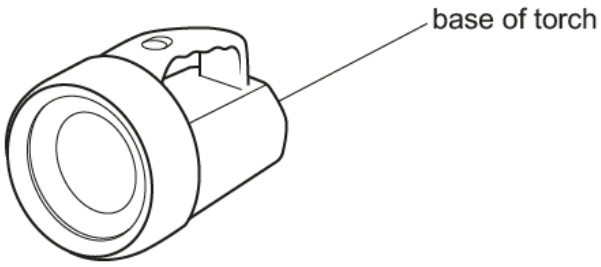


Fig. 3.1

(c) The student places the torch on its base on a shelf. The area of the base of the torch is 44 cm^2. The weight of the torch is 8.5 N.

Calculate the pressure on the shelf due to the torch.

$P = \frac{F}{A}$

$= \frac{8.5\ N}{44\ cm^2}$

$= 0.19\ N/cm^2$ pressure on shelf = 0.19 N/cm^2 [3]

17. June/2023/Paper_0625/33/No.4(c)

A tight-fitting lid keeps air inside a metal can.
An airtight rubber bung holds a liquid-in-glass thermometer that is inserted through a hole in the lid, as shown in Fig. 4.1.

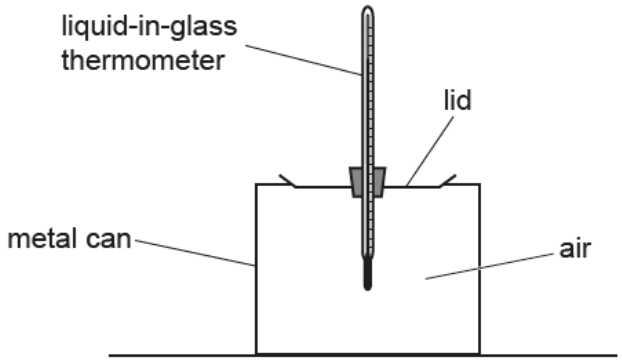


Fig. 4.1

(c) The air in another can exerts a pressure of 102 000 N / m^2 on the lid. The area of the can lid is 0.0082 m^2.

Calculate the force on the lid due to the air in the can.

$F = P \times A$

$= 102000\ N/m^2 \times 0.0082\ m^2$

$= 836.4$

$\simeq 840\ N$

force = ... 840 ..... N [3]

[Total: 9]

18. June/2023/Paper_0625/42/No.3

(a) Fig. 3.1 shows a person moving across an ice-covered pond to reach a ball on the ice.

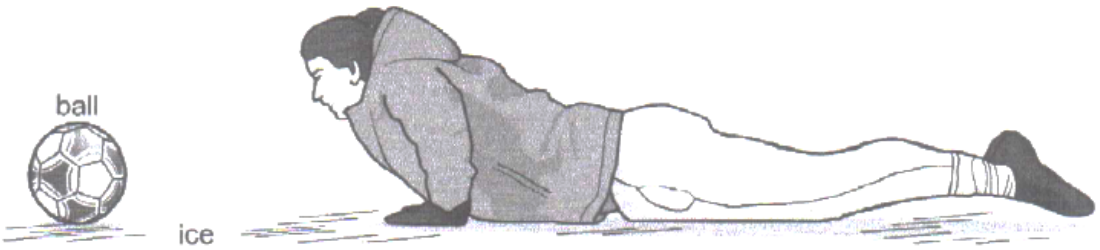


Fig. 3.1

Explain why this way of moving across the ice is safer than walking. Use your understanding of pressure in your answer.

- The weight of the person is spread over a much greater area.
- Since $p = F/A$, the pressure will be lower so ice is less likely to crack [3]

(b) Fig. 3.2 shows a side view of the pond with a layer of ice floating freely on the water.

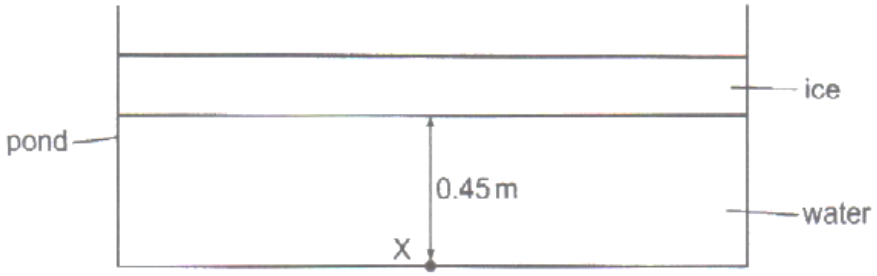


Fig. 3.2

The surface area of the pond is $5.0\,m^2$.
The mass of the ice is 690 kg.
The density of water is $1000\,kg/m^3$.
Point X is 0.45 m below the ice.

Calculate the pressure at point X due to the ice and the water.

$P = \rho g h$

$P_w = 1000 \times 9.8 \times 0.45$

$= 4410\ Pa$

$P_{ice} = \frac{F}{A}$

$= \frac{690 \times 9.8}{5.0}$

$= 1352.4\ Pa$

Total pressure

$= 4410 + 1352.4$

$= 5762.4$

$\simeq 5800\ Pa$

pressure = 5800 Pa [4]

[Total: 7]

19. June/2023/Paper_0625/43/No.2(a)

(a) (i) Define pressure.

Pressure is force per unit area

[1]

(ii) Describe how pressure in a liquid varies with its depth and with its density.

variation with depth

Pressure increases as depth increasing

variation with density

Pressure increases as density of liquid increases

[2]

(b) State **two** energy resources for which the Sun is **not** the main source.

1 Geothermal

2 nuclear

3 - Tidal.

[2]

Sound – 2023 IGCSE 0625 Physics

1. Nov/2023/Paper_ 0625/11/No.23

Dogs can hear sounds in the range from 100 Hz to 45 kHz.

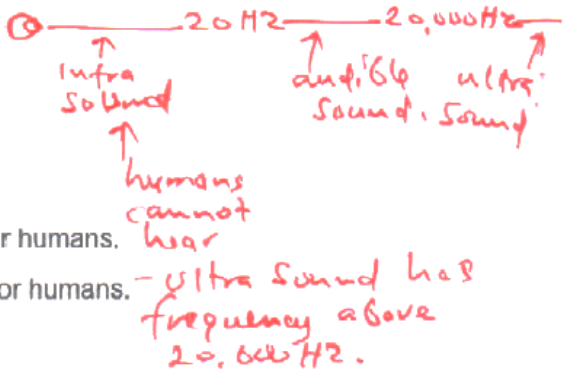
Which statement is correct?

A Any sound a dog can hear can also be heard by a human.

B Any sound a human can hear can also be heard by a dog.

C Dogs can hear some low frequency sounds that are silent for humans.

(D) ✓ Dogs can hear some high frequency sounds that are silent for humans.



2. Nov/2023/Paper_ 0625/12/No.23

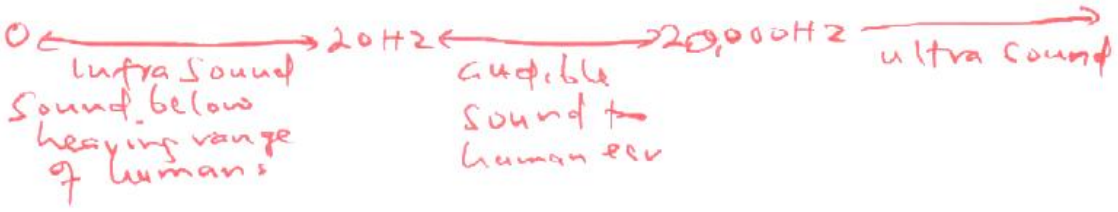
Which statement about a sound that can be heard by a person with normal hearing is correct?

A The sound is a longitudinal wave with a frequency between 2.0 Hz and 20 Hz.

(B) ✓ The sound is a longitudinal wave with a frequency between 20 Hz and 20 000 Hz.

C The sound is a transverse wave with a frequency between 2.0 Hz and 2000 Hz.

D The sound is a transverse wave with a frequency between 2.0 Hz and 20 MHz.



3. Nov/2023/Paper_ 0625/13/No.23

A sound is produced and an echo is heard after the sound reflects off a wall.

← reflected sound.

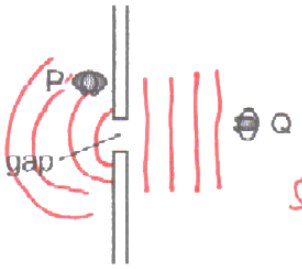
How do the properties of the echo compare to the original sound wave?

	amplitude	frequency	speed
A	lower	lower	lower
(B) ✓	lower	same	same
C	same	lower	lower
D	same	same	same

- Sound loses some energy after travelling through air.
- So amplitude will reduce, but frequency and speed remain same.

4. Nov/2023/Paper_ 0625/21/No.17

Two men, P and Q, stand close to a gap in a wall, as shown. Man P cannot see man Q but man P can hear man Q speaking.



Sound will diffract to P

Which statement explains this?

A Light waves do not diffract at all because they are electromagnetic waves.

B Light waves have a range of frequencies but sound has just one frequency.

C Sound waves are of a higher frequency than light waves.

D Sound waves diffract a lot because their wavelength is a similar size to the width of the gap. ✓

5. Nov/2023/Paper_ 0625/22/No.23

Which row gives typical values for the speed of sound in a solid and in a gas?

	speed of sound in a solid m/s	speed of sound in a gas m/s
A	3	30
B	30	3
C	300	3000
D ✓	3000	300

In solid sound speed is faster than in gas.

6. Nov/2023/Paper_ 0625/23/No.23

Which row gives approximate values for the speed of sound in copper, water and air?

	speed of sound in copper m/s	speed of sound in water m/s	speed of sound in air m/s
A ✓	4500	1500	350
B	350	4500	1500
C	1500	4500	350
D	4500	350	1500

Speed of sound is fastest in solid and slowest in air.

7. Nov/2023/Paper_ 0625/32/No.7

A student can hear trains passing her house.

(a) Describe the motion that a sound wave gives to air particles.

Vibrating backwards and forward. ..... [1]

(b) When the student is at her house, she can hear and see the trains, as shown in Fig. 7.1.

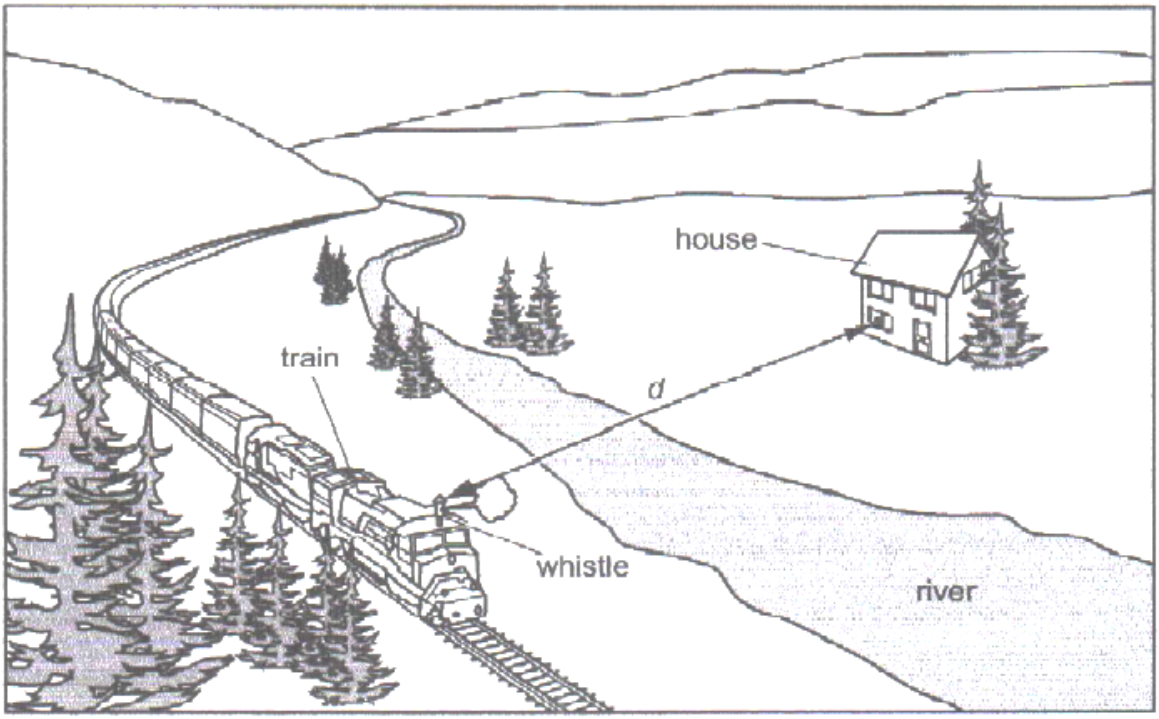


Fig. 7.1 (not to scale)

When a train whistle blows, steam comes out of the whistle.

The student measures the time interval between seeing the steam coming out of the whistle and hearing the whistle.

(i) Suggest a suitable device for measuring this time interval.

Stop watch ..... [1]

(ii) The time interval is 1.6 s between the steam coming out of the whistle and the student hearing the whistle.

The speed of sound in air is 340 m/s.

Calculate the distance *d* from the whistle to the student.

$d = s \times t$
$= 340 \times 1.6$
$= 544$ m

distance *d* = 544 m [3]

(c) State the range of audible frequencies for a healthy human ear. Include the unit.

20 Hz – 20,000 Hz [2]

8. June/2023/Paper_0625/11/No.22

Student X fires a starting pistol which produces smoke and sound. Student Y is standing 100 m away and sees the smoke the instant it is produced. The speed of sound in air is 340 m/s.

What is the time delay between student Y seeing the smoke and hearing the sound?

$t = \frac{d}{s}$
$= \frac{100\ m}{340\ m/s}$
$= 0.29\ s$

A 0.29 s B 0.59 s C 1.7 s D 3.4 s

9. June/2023/Paper_0625/12/No.22

A boy shouts and hears the echo from a tall building 2.2 s later.

The speed of sound in air is 330 m/s.

How far away from the boy is the building?

$t = \frac{2.2}{2}$
$= 1.1\ s$

$d = s \times t$
$= 330\ m/s \times 1.1\ s$
$= 363\ m$.

A 150 m B 300 m C 360 m D 730 m

10. June/2023/Paper_0625/13/No.22

A ship sounds its horn when it is 790 m from a cliff. A passenger on the ship hears the echo 4.8 s later.

What is the speed of the sound?

$s = \frac{d}{t}$
$t = \frac{4.8}{2} = 2.4\ s$
$s = \frac{790\ m}{2.4\ s}$
$= 329\ m/s$
$\approx 330\ m/s$

A 165 m/s B 330 m/s C 340 m/s D 1896 m/s

11. June/2023/Paper_0625/21/No.22

Student X fires a starting pistol which produces smoke and sound. Student Y is standing 100 m away and sees the smoke the instant it is produced. The speed of sound in air is 340 m/s.

What is the time delay between student Y seeing the smoke and hearing the sound?

A ✓ 0.29 s B 0.59 s C 1.7 s D 3.4 s

$t = \frac{d}{s}$

$= \frac{100\,m}{340\,m/s}$

$= 0.29\,s$

time delay is the time it takes the sound to travel the 100m distance to reach student Y, after seeing the smoke.

12. June/2023/Paper_0625/22/No.22

A boy shouts and hears the echo from a tall building 2.2 s later.

The speed of sound in air is 330 m/s.

How far away from the boy is the building?

A 150 m B 300 m C ✓ 360 m D 730 m

$t = \frac{2.2}{2}$

$= 1.1\,s$

$d = s \times t$

$= 330\,\frac{m}{s} \times 1.1\,s$

$= 363\,m$

$\approx 360\,m$ (2 s.f)

$\approx 3.4\,m$.

13. June/2023/Paper_0625/23/No.22

A ship sounds its horn when it is 790 m from a cliff. A passenger on the ship hears the echo 4.8 s later.

What is the speed of the sound?

A 165 m/s B ✓ 330 m/s C 340 m/s D 1896 m/s

$t = \frac{4.8}{2}$

$= 2.4\,s$

$s = \frac{d}{t} = \frac{790\,m}{2.4\,s}$

$= 329\,m/s$

$\approx 330\,m/s$

14. June/2023/Paper_0625/32/No.5

An observer stands at P and looks into a rock quarry. A small explosion takes place at X in the quarry.

Fig. 5.1 shows the situation.

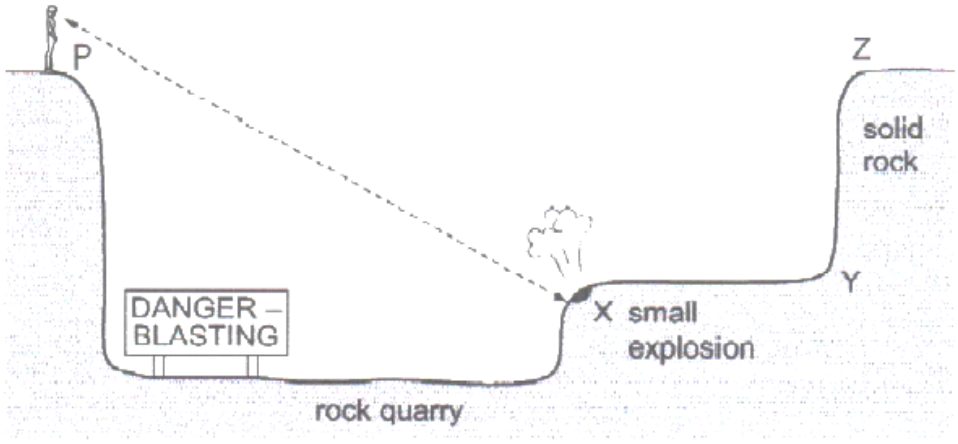


Fig. 5.1 (not to scale)

(a) The observer first hears the sound from the explosion 1.8 s after the explosion occurs. The speed of the sound is 340 m/s.

(i) Calculate the distance XP from the explosion at X to the observer at P.

$d = s \times t$

$= 340 \frac{m}{s} \times 1.8 s$

$= 612 m$

distance XP = 612 m [3]

(ii) The observer then hears a quieter sound from the explosion.

Suggest how the quieter sound waves reach the observer.

- Sound wave reflecting from the solid rock YZ travel to the observer. [2]

(b) Before the explosion, a warning siren produces a sound. The wavelength of the sound is 0.28 m.

The speed of the sound is 340 m/s.

Calculate the frequency of the sound.

$f = \frac{v}{\lambda}$

$= \frac{340 \text{ m/s}}{0.28 \text{ m}}$

$= 1214 \text{ Hz}$

$\simeq 1200 \text{ Hz}$ (2 s.f).

frequency = 1200 Hz [3]

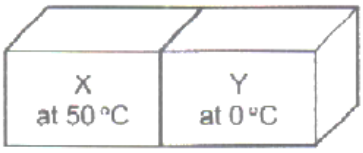
[Total: 8]

Thermal Processes– 2023 IGCSE 0625 Physics

1. Nov/2023/Paper_ 0625/11/No.15

A student has two blocks of metal, X and Y. The temperature of X is 50 °C and the temperature of Y is 0 °C.

The two blocks are placed in contact with each other, as shown.



After some time, both blocks have a temperature of 25 °C.

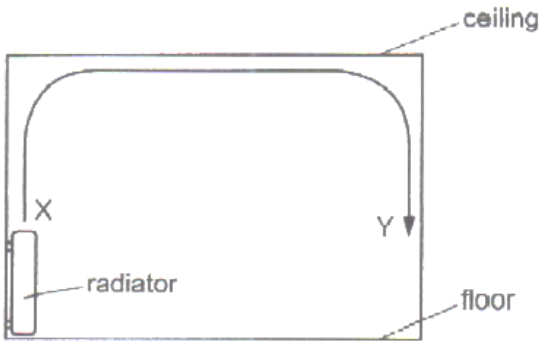
What has happened to the internal energy of each block?

	internal energy of X	internal energy of Y
A	decreased	decreased
B ✓	decreased	increased
C	increased	decreased
D	unchanged	unchanged

- Heat energy flow from higher to lower temperature
- So X lost heat to Y, and Y gain heat from X.
- So internal energy of X decreased while that of Y increased.

2. Nov/2023/Paper_ 0625/11,21/No.16

The diagram shows the view of a room heated by a radiator. The arrowed line from X to Y is the path of the convection current in the air.



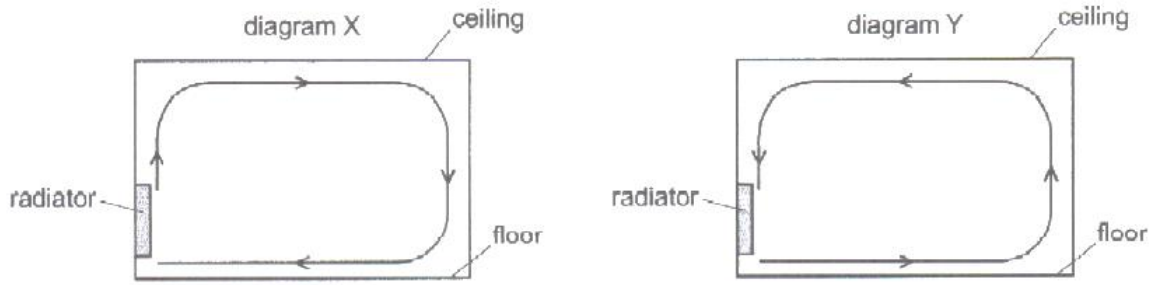
Which row about the air temperature and the air density at X and at Y is correct?

	air temperature	air density
A	higher at X	higher at X
B ✓	higher at X	higher at Y
C	higher at Y	higher at Y
D	higher at Y	higher at X

- Warm air is of less density than cool air

3. Nov/2023/Paper_ 0625/12,22/No.16

A room is heated by a radiator. The diagrams X and Y show two possible circulations of hot air, which heat the room.



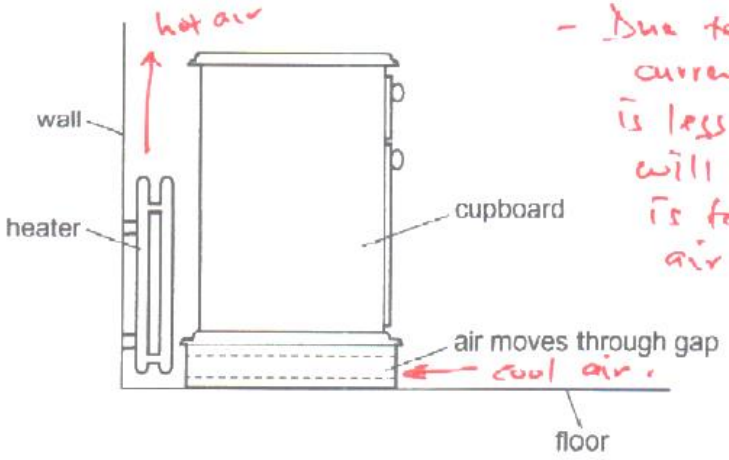
Which diagram and reason explain the heating of the room by convection?

	diagram	reason
A ✓	X ✓	air density decreases when air is heated
B	X ✓	air density increases when air is heated
C	Y	air density decreases when air is heated
D	Y	air density increases when air is heated

hot air is less dense than cold air, so it will rise up and not sink. hot air is raising, so it is correct.

4. Nov/2023/Paper_ 0625/13,23/No.16

A cupboard is placed in front of a heater. Air can move through a gap under the cupboard.



- Due to convection current, hot air is less dense, so it will rise, its place is taken by cool air.

Which row describes the temperature and the direction of movement of the air in the gap?

	air temperature	air direction
A	cool	away from the heater
B ✓	cool	towards the heater
C	warm	away from the heater
D	warm	towards the heater

5. Nov/2023/Paper_ 0625/31/No.3(c)

Fig. 3.1 represents the arrangement and separation of particles in a liquid. Each circle represents a particle.

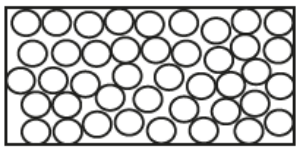


Fig. 3.1

(c) Fig 3.3 shows a fire heating water in a metal pan.

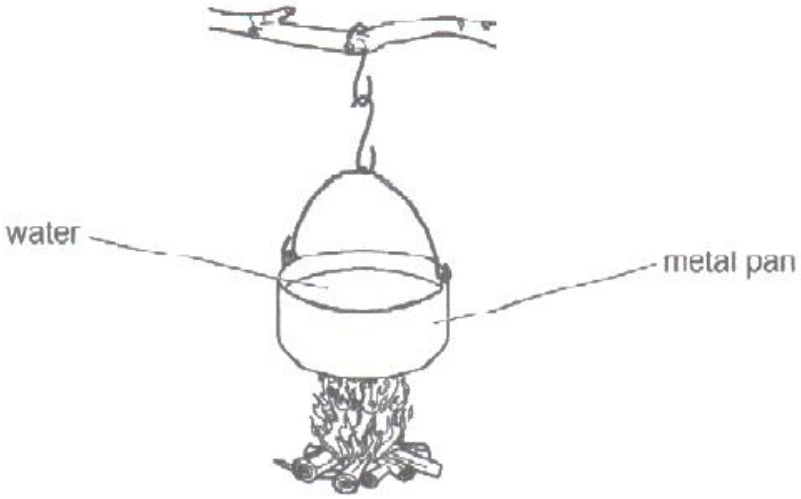


Fig. 3.3

(i) State the name of the process of thermal energy transfer through the metal of the pan.

Conduction ..... [1]

(ii) Describe how thermal energy is transferred through the water by convection.

- Water molecules at bottom of pan gain thermal energy and expanding and becoming less denser.
- So the less denser liquid rises causing the liquid to circulate in pan. ..... [3]

(iii) State the temperature at which the water boils at standard atmospheric pressure.

temperature = 100 °C [1]

6. Nov/2023/Paper_ 0625/32/No.6

(a) Fig. 6.1 shows a cold drink in a thermal jug. The jug reduces thermal energy transfer from the surroundings to the drink.

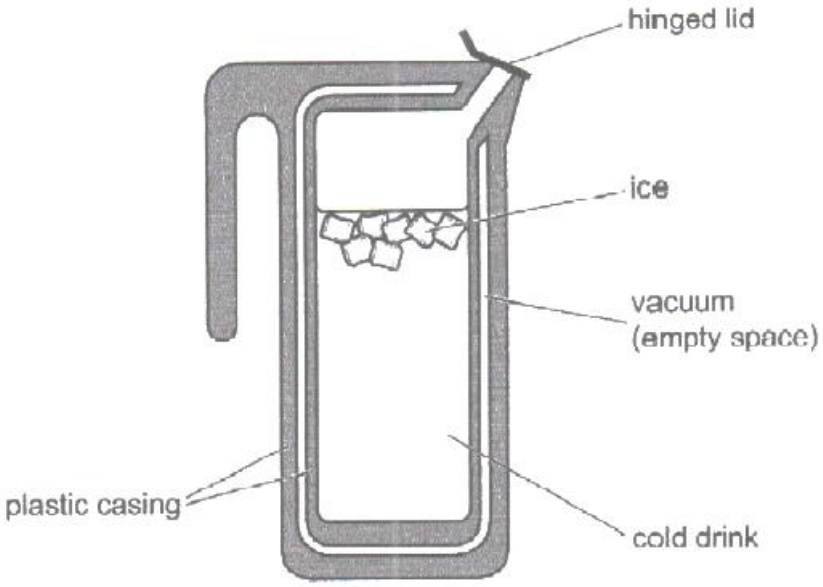


Fig. 6.1

State the names of the **two** processes of thermal energy transfer that are prevented by the vacuum.

Explain how the vacuum prevents these **two** processes of thermal energy transfer.

processes Conduction and Convection

explanation Both need a material (particles) medium to transfer energy. In vacuum there are no particles. [2]

(b) Fig. 6.2 represents a demonstration that shows how water moves when heated. The colour from the crystal shows the flow of the water.

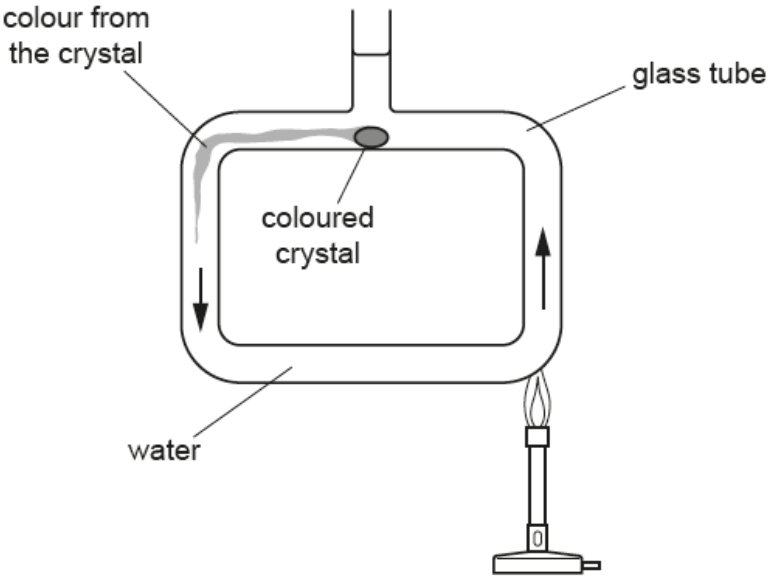


Fig. 6.2

The arrows in Fig. 6.2 show the direction of flow of water in the glass tube when the water is heated.

Explain why the water moves in this way. Use your ideas about density.

- When heated, water gain thermal energy and particle (molecules) move apart (expand).
- Warm water is less dense so it rises up.
- More denser cooler water falls down to take place of warm water that has risen.
- This forms a convectional current.

[4]

[Total: 6]

7. Nov/2023/Paper_ 0625/42/No.4

Fig. 4.1 shows a bottle part-filled with water. The air inside the bottle is at the same pressure as the air outside the bottle. The bottle and its contents are at room temperature.

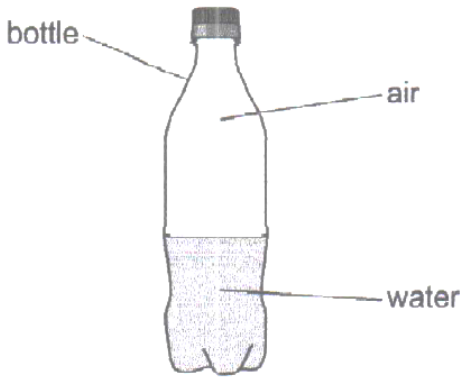


Fig. 4.1

(a) The temperature of the bottle and its contents are increased.

(i) Explain, in terms of particles, how the air pressure inside the bottle changes as the temperature increases.

- At high temp, K.E of particles increases
- The air particles has more frequent collision with sides of the bottle.
- There is greater force per unit area giving more pressure. [3]

(ii) The lid is removed from the bottle.

State and explain how the air pressure inside the bottle changes.

statement ..... Pressure will decrease. .....

explanation ..... Some air particles escapes from inside to bottle to outside air. .....

[2]

(b) The mass of water in the bottle is 0.18 kg. The specific heat capacity of water is 4200 J/(kg °C).

Calculate the thermal energy needed to increase the temperature of the water by 20 °C.

$E = mc\Delta T$.

$= 0.18 \times 4200 \times 20$

$= 15,120$ J

$\simeq 15000$ J

thermal energy = 15000 J [2]

(c) Another plastic bottle is filled to the top with water. The height of the bottle is 40.0 cm. The density of water is 1.0×10^3 kg/m^3.

↑ 0.40 m

Calculate the pressure difference between the top and bottom of the water.

$\Delta p = \rho g \Delta h$.

$= 1.0 \times 10^3 \times 9.81 \times 0.40$

$= 3924$ Pa

$\simeq 3900$ Pa

pressure difference = 3900 Pa [2]

[Total: 9]

8. Nov/2023/Paper_ 0625/42/No.2

Fig. 2.1 shows an electric tumble dryer used to dry wet clothes.

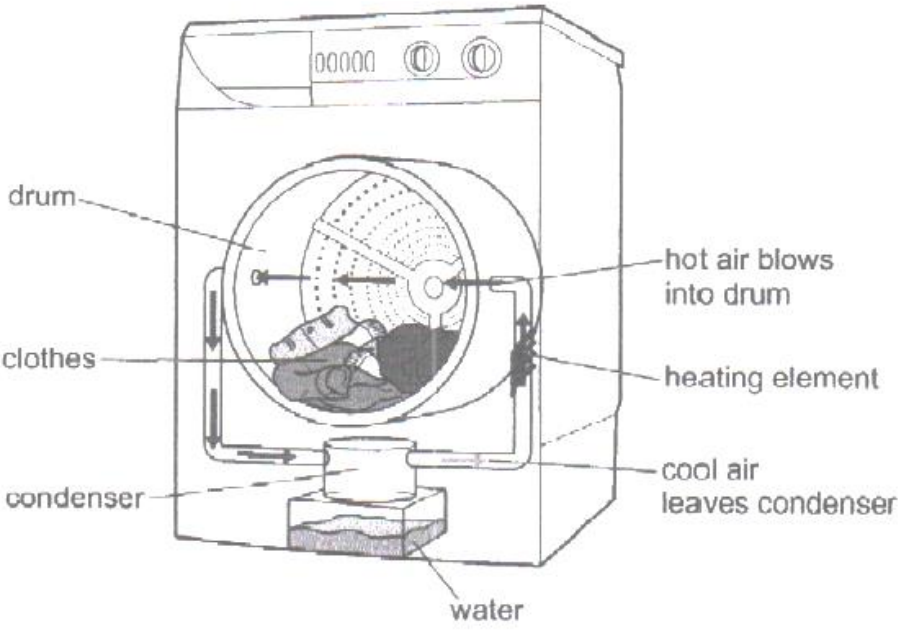


Fig. 2.1

(a) Hot air blows into the drum. The air gains water vapour from the clothes and then leaves the drum. The moist air enters the condenser. Cool air leaves the condenser, passes through the heating element and enters the drum again.

(i) State the process by which the hot air removes water from the wet clothes.

Evaporation [1]

(ii) The air is cooled as it passes through the condenser.

Describe and explain one other way in which the air leaving the condenser is different from the air entering the condenser.

description Has less water content.

explanation Water was removed from the air in the condenser by condensation. [2]

(b) The drum of the tumble dryer rotates, lifting up the wet clothes which then fall down through the hot air.

(i) Name the force that causes the clothes to fall down.

gravity ..... [1]

(ii) When the drum rotates too fast the clothes remain in contact with the wall of the drum.

State the direction of the resultant force on the clothes during the circular motion.

Force is perpendicular to the cloth motion ..... [1]

(c) Suggest why using a clothesline to dry clothes in the open air is better for the environment than using an electric tumble dryer.

- Clothesline use Solar and wind which are renewable resources . ..... [1]

[Total: 6]

9. June/2023/Paper_0625/11/No.16

Which surface is the worst absorber of infrared radiation?

A dull black

B dull white

C shiny black

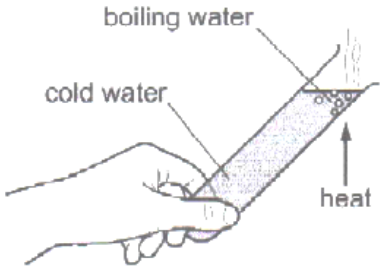
D ✓ shiny white

↑ is the best reflector of IR.
Dull and black surface are good absorbers

10. June/2023/Paper_0625/12/No.16

A teacher puts some cold water in a test-tube.

She holds the bottom of the test-tube while heating the top.



The water at the top boils but she continues to hold the test-tube as the bottom remains cold.

Which conclusion about water is made from this experiment?

A ✓ Water is a bad conductor.

B Water is a bad convector.

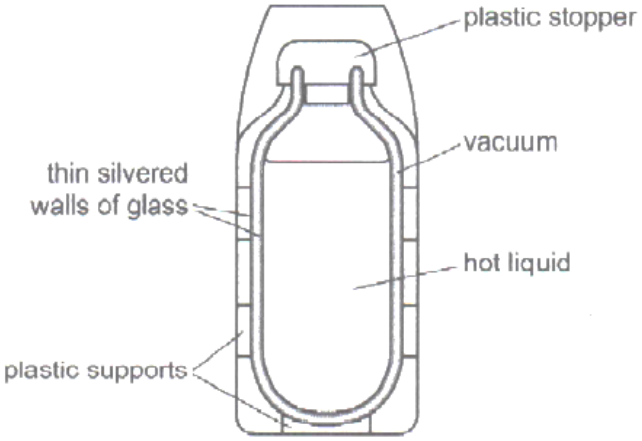
C Water is a good conductor.

D Water is a good convector.

- Heat energy can travel from where heating is applied to where teacher is holding test-tube by conduction.
- Water is a poor conductor, so there is insignificant heat transfer downward.

11. June/2023/Paper_0625/13/No.16

The diagram shows a flask designed to reduce the loss of thermal energy from a hot liquid.



Which methods of thermal energy transfer are the silvered walls designed to reduce?

↑ reflect radiant energy.

A conduction, convection and radiation

B conduction and convection only

C conduction only

D radiation only ✓

12. June/2023/Paper_0625/21/No.16

Some hot water is sealed inside a metal can. The can is in a vacuum in outer space. The hot water slowly cools down.

How does the thermal energy escape into space?

- Thermal energy conducts through the metal can
- Then escapes by radiation from outside the can.

A by conduction then convection

B by conduction then radiation ✓

C by evaporation then convection

D by evaporation then radiation

13. June/2023/Paper_0625/22/No.16

Four cups A, B, C and D contain hot coffee.

Which cup keeps the coffee warm the longest?

	the outside surface of the cup	the top of the cup
A	black	covered with a lid
B	black	no lid
(C) ✓	white	covered with a lid
D	white	no lid

- White is a poor thermal emitter, so it will not lose much heat like black cup.
- When covered, the lid will prevent heat lose through evaporation of the coffee
- Remember evaporation has a cooling effect.

14. June/2023/Paper_0625/23/No.16

Two otherwise identical cars, one black and one white, are at the same initial temperature. The cars are left in bright sunshine and their temperatures increase. During the night, their temperatures decrease.

Which car shows the greater rate of temperature increase and which car shows the greater rate of temperature decrease?

	greater rate of temperature increase	greater rate of temperature decrease
(A) ✓	black	black
B	black	white
C	white	black
D	white	white

- black is a good absorber of radiant heat. So temp of black car increase rapidly
- White car reflect of heat.
- Black is also a good emitter. So its temp decrease rapidly

15. June/2023/Paper_0625/32/No.4(c)

A student has a block of solid metal at room temperature.

(c) The metal block emits thermal radiation from its surface.

State **two** features of a surface that is a good emitter of thermal radiation.

1 black colour

2 dull surface

[2]

16. June/2023/Paper_0625/42/No.5(b)

(b) Fig. 5.2 shows a cross-section of a double-glazed window in the room.

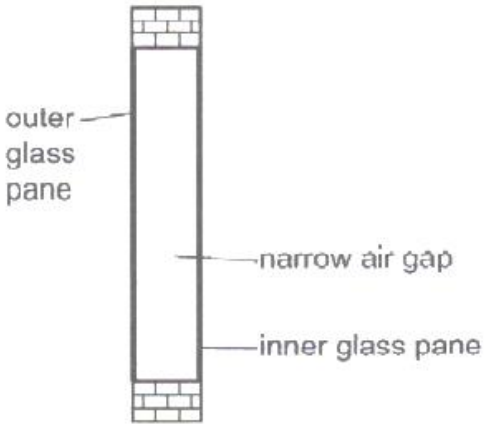


Fig. 5.2

State the main methods of thermal energy transfer from the room to outside which are reduced by this type of window.

Conduction and convection [1]

[Total: 8]

- glass is a poor conductor
- air in the narrow gap is a poor conductor
- Air in the narrow gap is constricted so it will not develop convectional current.

Thermal Properties and temperature – 2023 IGCSE 0625 Physics

1. Nov/2023/Paper_ 0625/11/No.13

The melting point of mercury is –39 °C.

What is the melting point of mercury in kelvin?

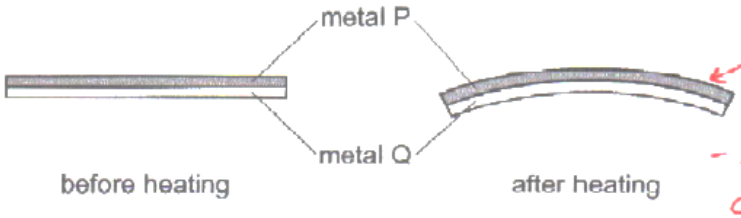
K = 273 + °C
= 273 + (-39) = 234K

A –234 K B 61 K C 234 K D 312 K

2. Nov/2023/Paper_ 0625/11/No.14

A bimetallic strip is used to control the temperature of an electrical appliance. It is made of two different metals fixed together.

The diagram shows the shape of the bimetallic strip before and after heating.



expands more than Q.
- So it bends Q as it expands.

Which statement is correct?

A Metal P contracts more than metal Q on heating.

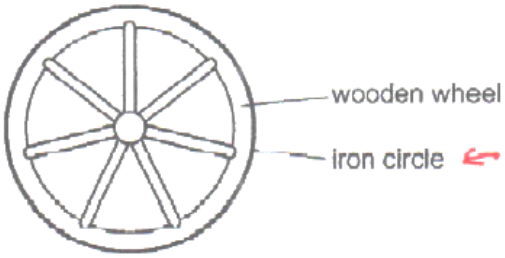
B Metal Q contracts more than metal P on heating.

C Metal P expands more than metal Q on heating.

D Metal Q expands more than metal P on heating.

3. Nov/2023/Paper_ 0625/12/No.14

A wooden wheel can be strengthened by putting a tight circle of iron around it.



← Iron will expand when heated and so increase diameter and circumference to be fit over wood.
— When it cools down it will contract and fit nicely over wood.

Which action would make it easier to fit the circle over the wood?

A cooling the iron circle only

B heating the iron circle

C heating the wooden wheel and cooling the iron circle

D heating the wooden wheel but not heating or cooling the iron circle

4. Nov/2023/Paper_ 0625/13/No.14

What happens when a metal block is heated?

- Metals are good heat conducts.
- They expand when heated, so their dimensions will increase.

(A) ✓ Its width, height and length all increase.

B Its width increases only.

C Its height increases only.

D Its length increases only.

5. Nov/2023/Paper_ 0625/13/No.15

Which statement about the temperature of the solid describes what happens when a solid is melting?

At change of state temp remains constant till all has melted.

A The temperature increases and there is an input of energy.

B The temperature increases and there is no input of energy.

(C) ✓ The temperature remains constant and there is an input of energy.

D The temperature remains constant and there is no input of energy.

6. Nov/2023/Paper_ 0625/21/No.14

On a warm day, a carton of fresh milk is covered with a wet cloth.

↑ water from cloth evaporates. evaporation has a cooling effect.

Why does this help to reduce the temperature of the milk?

(A) ✓ Some water evaporates from the cloth so the remaining water becomes cooler.

B The water has a very high specific heat capacity.

C The water insulates the milk from the warm air around it.

D Water is always colder than the air around it.

7. Nov/2023/Paper_ 0625/21/No.15

A chef heats some water in a pan on a hotplate.

The temperature of the water rises by 10 °C in time t.

She then puts the same volume of oil in an identical pan on the same hotplate.

The specific heat capacity of water is 2.5 times that of oil and water is 1.1 times denser than oil.

What is the time for the temperature of the oil to rise by 10 °C?

A ✓ 0.36t B 0.44t C 2.3t D 2.8t

$E = P \times t$ · (Power × time).

$E = m \times c \times \Delta T$

$m = \rho \times V$.

$\therefore E = P \times t = (\rho \times V) \times c \times \Delta T$

Water

$P \times t = (1.1\rho \times V) \times 2.5c \times 10$

$= 27.5\rho Vc$

oil:

$P \times t_{oil} = (\rho \times V) \times c \times 10$

$= 10\rho Vc$

Volume is equal for both

$V = \frac{P \times t}{27.5\rho c}$

$V = \frac{P \times t_{oil}}{10\rho c}$

$\frac{P \times t_{oil}}{10\rho c} = \frac{P \times t}{27.5\rho c}$

$t_{oil} = \frac{10}{27.5} = 0.36t$

8. Nov/2023/Paper_ 0625/22/No.14

Liquid evaporates from a beaker.

What happens to the temperature of the remaining liquid and how does this temperature change affect the rate of evaporation?

	temperature	rate of evaporation
A ✓	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

- Evaporation has a cooling effect.
- So temp of remaining liquid will decrease due to evaporation
- But rate of evaporation will decrease, because less energetic particles are left behind.

9. Nov/2023/Paper_ 0625/22/No.15

Thermal energy ΔE is supplied to an object of mass m which does not change its state during the heating process. The temperature of the object rises by ΔT.

What is the specific heat capacity of the object?

A ✓ $\frac{\Delta E}{m\Delta T}$ B $\frac{m\Delta T}{\Delta E}$ C $\frac{\Delta E \Delta T}{m}$ D $\frac{\Delta E m}{\Delta T}$

$\Delta E = mc\Delta T$

c.

$c = \frac{\Delta E}{m\Delta T}$.

10. Nov/2023/Paper_ 0625/23/No.14

A student splashes water on to her face. Here are three statements about the effects.

P The water uses energy to evaporate.

Q The water gains energy from the student.

R The face of the student cools.

All 3 are correct.

Which statements are correct?

A P and Q only B P and R only C Q and R only (D) P, Q and R ✓

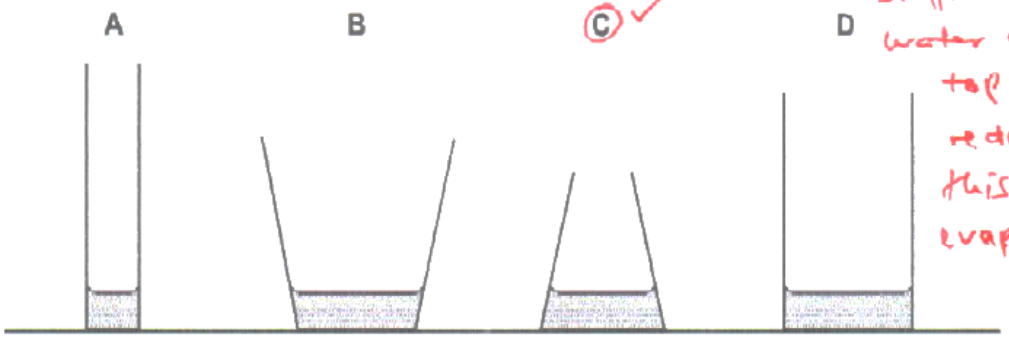
11. Nov/2023/Paper_ 0625/23/No.15

Four containers each contain water.

More water at the same temperature is added to each container.

From which container does water now evaporate more slowly than it did before?

In C, as the volume increases, the surface area of water at the top will reduce, and this affects evaporation.



12. Nov/2023/Paper_ 0625/42/No.2

Fig. 2.1 shows an electric tumble dryer used to dry wet clothes.

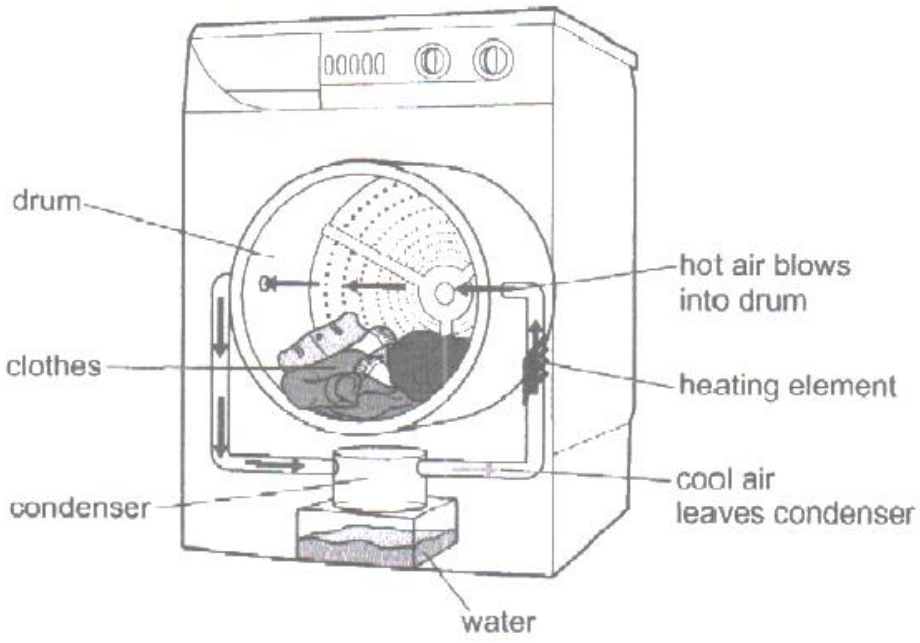


Fig. 2.1

(a) Hot air blows into the drum. The air gains water vapour from the clothes and then leaves the drum. The moist air enters the condenser. Cool air leaves the condenser, passes through the heating element and enters the drum again.

(i) State the process by which the hot air removes water from the wet clothes.

Evaporation [1]

(ii) The air is cooled as it passes through the condenser.

Describe and explain one other way in which the air leaving the condenser is different from the air entering the condenser.

description Has less water content.

explanation Water was removed from the air in the condenser by condensation. [2]

(b) The drum of the tumble dryer rotates, lifting up the wet clothes which then fall down through the hot air.

(i) Name the force that causes the clothes to fall down.

Gravity ..... [1]

(ii) When the drum rotates too fast the clothes remain in contact with the wall of the drum.

State the direction of the resultant force on the clothes during the circular motion.

Force is perpendicular to the cloth motion ..... [1]

(c) Suggest why using a clothesline to dry clothes in the open air is better for the environment than using an electric tumble dryer.

- Clothesline use Solar and wind which are renewable resources . ..... [1]

13. Nov/2023/Paper_ 0625/42/No.4(b)

(b) The mass of water in the bottle is 0.18 kg. The specific heat capacity of water is 4200 J/(kg °C).

Calculate the thermal energy needed to increase the temperature of the water by 20 °C.

$E = mc\Delta T$.

$= 0.18 \times 4200 \times 20$

$= 15,120\ J$

$\simeq 15000\ J$

thermal energy = 15000 J [2]

14. Nov/2023/Paper_ 0625/43/No.4

(a) The lowest possible temperature is zero kelvin (0 K).

(i) State the name of this lowest possible temperature.

Absolute zero ..... [1]

(ii) Nitrogen boils at 77 K.

Calculate the boiling point of nitrogen on the Celsius scale.

$°C = K - 273$

$= 77 - 273$

$= -196°C$

boiling point = -196 °C [2]

(b) The temperature of a fixed mass of gas at constant volume changes from 300 K to 400 K.

State and explain, in terms of particles, the effect on the pressure of the gas.

statement ..... Pressure increases .....

explanation ..... gas particles now move faster and collide more frequently with larger force with walls of container - The larger force per unit area results to pressure increase. [4]

(c) A sample of gas is at a pressure of 120 kPa. The volume of the gas is doubled at constant temperature.

Calculate the new pressure of the gas.

$V_1 = V$

$P_1 = 120 \times 10^3$ Pa

$V_2 = 2V$

$P_2 = ?$

$P_2 = \frac{P_1 V_1}{V_2}$

$= \frac{120 \times 10^3 \times V}{2V}$ $= 60 \times 10^3$

$= 60$ kPa

pressure = 60 kPa [2]

[Total: 9]

15. June/2023/Paper_0625/41/No.4

A student investigates the efficiency of a filament lamp. Fig. 4.1 shows the filament lamp with its glass bulb immersed in water in a beaker.

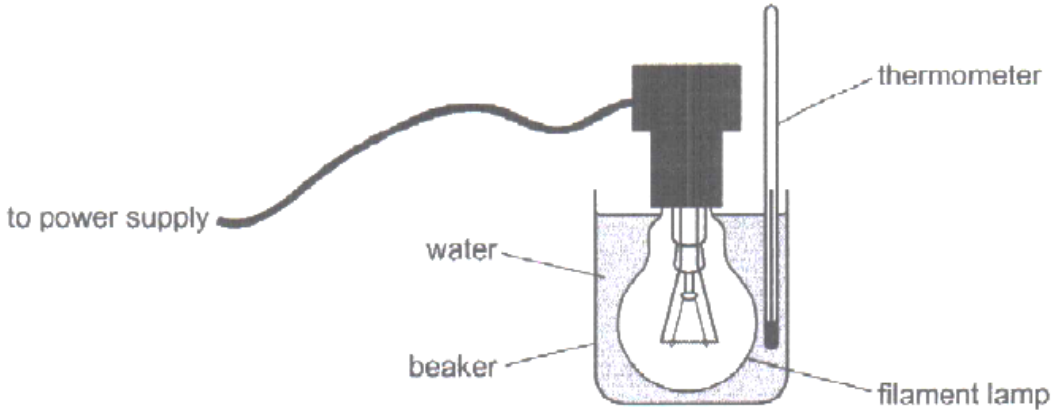


Fig. 4.1

The reading on the thermometer in the water is 19.0 °C.

Only the glass of the lamp is in contact with the water and the electrical connections are completely insulated.

The lamp is switched on.

At the end of the experiment, the temperature of the water is 21.5 °C.

(a) The mass of the water in the beaker is 600 g and the specific heat capacity of water is 4200 J/(kg °C).

↑ 0.6 kg

(i) Show that the increase in the internal energy of the water is 6300 J.

$E = m\ c\ \Delta T$

$= 0.6\ \text{kg} \times 4200\ \frac{\text{J}}{\text{kg °C}} \times (21.5 - 19)\ °\text{C}$

$= 6300\ \text{J}$

[3]

(ii) In the experiment, the lamp is switched on for 500 s. The power supplied to the filament lamp is 13 W. The useful energy from the lamp is transferred as light. The energy that increases the temperature of the water is wasted energy.

Determine the maximum possible efficiency of the filament lamp.

$E = P \times t$
$= 13\,W \times 500\,s$
$= 6500\,J$

Useful energy
$= 6500 - 6300$
$= 200\,J$

$\text{Efficiency} = \frac{200}{6500} \times 100$
$= 3.07$
$\simeq 3.1\%$

maximum possible efficiency = 3.1 % [4]

(b) The efficiency of the lamp is less than the value determined in **(a)(ii)**.

Suggest **one** reason for this.

- Some thermal energy is transferred from the water to air, beaker and bench, and this does not go to raise the temperature of water. [1]

[Total: 8]

- So temp change of water is underestimate due to thermal energy losses.
- So efficiency of the lamp is overestimate.

16. June/2023/Paper_0625/42/No.5(a)

(a) Fig. 5.1 shows an electric heater used to heat a room.

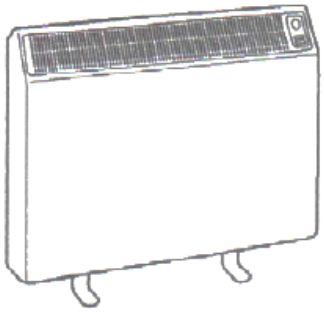


Fig. 5.1

The dimensions of the room are 4.5 m × 6.1 m × 2.4 m.
The density of air is 1.2 kg/m^3.

(i) Show that the mass of air in the room is 79 kg.

$m = \rho \times V$

$= 1.2\ \frac{kg}{m^3} \times (4.5 \times 6.1 \times 2.4)\ m^3$

$= 79.056\ kg$

$=$

[2]

(ii) The power of the heater is 1100 W. The specific heat capacity of air is 1000 J/(kg °C).

Calculate the time taken to increase the temperature of the air in the room from 16.0 °C to 20.0 °C.

$P = \frac{E}{t}$

but $E = mc\Delta T$.

$\therefore P = \frac{mc\Delta T}{t}$

$t = \frac{mc\Delta T}{P}$

$t = \frac{79\ kg \times 1000\ \frac{J}{kg\,°C} \times (20-16)\,°C}{1100\ W}$

$= 287\ s$

$\approx 290\ s$ (to 2 s.f).

time = 290 s [4]

(iii) Suggest **one** reason why the time calculated in **(a)(ii)** is the **minimum** time needed to increase the temperature of the air in the room from 16.0 °C to 20.0 °C.

- Some thermal energy is transferred to furniture and some escape through the windows from the room. [1]

17. June/2023/Paper_0625/43/No.3

(a) (i) State which state of matter, solid, liquid or gas, has the greatest thermal expansion and which has the least.

greatest expansion ..... gas .....

least expansion ..... solid .....

[2]

(ii) Describe, in terms of the motion and arrangement of particles, the structures of solids and gases.

solids ..... Particle arranged in regular patterns close together, and vibrate about fixed positions .....

gases ..... Particle have no arrangement, but move freely randomly and faster in all directions .....

[3]

(b) (i) Define specific heat capacity.

Energy required to raise the temperature of 1 kg of substance by 1 °C. ..... [2]

(ii) A student carries out an experiment to determine the specific heat capacity of a metal. A cylinder of the metal is heated by a 12 W electrical heater.

State the readings that the student takes.

$P = \frac{E}{t}$ $E = P \times t$ $c = \frac{E}{m \times \Delta T} = \frac{P \times t}{m \times \Delta T}$

t – time .....

m – mass .....

ΔT – Initial and final temperatures. ..... [3]

[Total: 10]