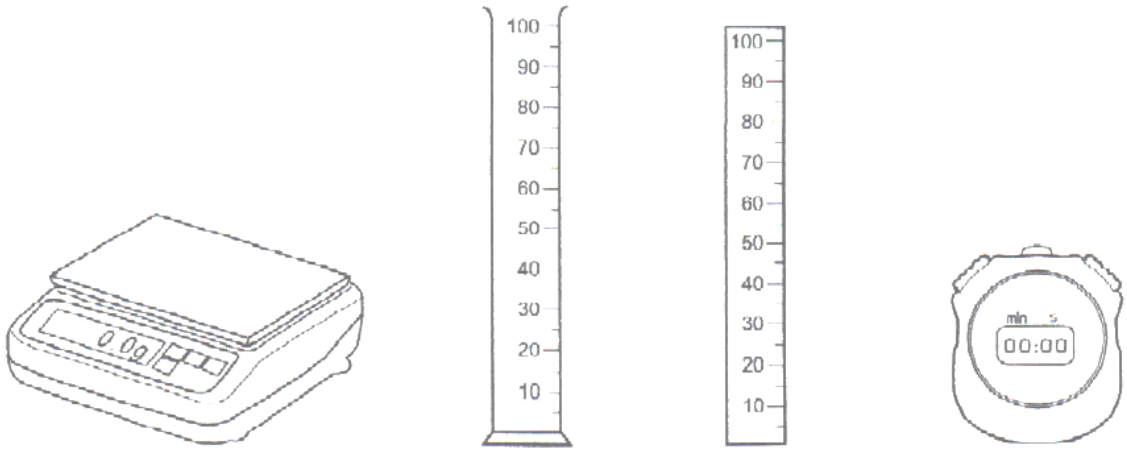
Density – 2022 November IGCSE 0625

1. Nov/2022/Paper_22,23/No.4

The diagram shows four pieces of laboratory apparatus.



balance | measuring cylinder | ruler | stop-watch

Which pieces of apparatus are used to find the density of a liquid?

A balance and stop-watch

B balance and measuring cylinder ✓

C measuring cylinder and ruler

D stop-watch and ruler

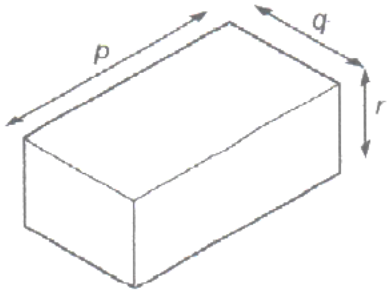
$\rho = \frac{m}{V}$

mass – use balance

volume – use measuring cylinder

2. Nov/2022/Paper_21/No.4

The diagram shows the dimensions of a solid rectangular block of metal of mass *m*.



Which expression is used to calculate the density of the metal?

A $\frac{m}{(p \times q)}$

B $\frac{m}{(p \times q \times r)}$ ✓

C $m \times p \times q$

D $m \times p \times q \times r$

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

$V = p \times q \times r$

$\therefore \rho = \frac{m}{p \times q \times r}$

3. Nov/2022/Paper_33/No.2

A builder buys some tiles to repair a floor. He checks that the new tiles are the same size as the tiles on the floor.

The dimensions of the tiles on the floor are 25 cm × 20 cm × 0.30 cm.

The new tiles are shown in Fig. 2.1.

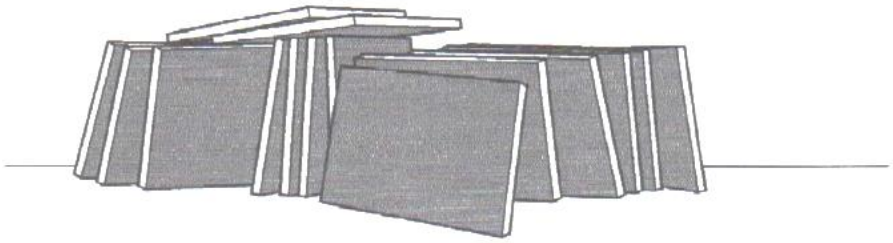


Fig. 2.1

(a) (i) State the name of a suitable instrument for measuring the length and width of each tile.

ruler ..... [1]

(ii) Describe how to determine the average thickness of **one** new tile.

- Place 10 tiles on top of each other.
- Measure total thickness of the 10 tiles
- Divide total thickness by 10 . ..... [3]

(b) The dimensions of a tile are 25 cm × 20 cm × 0.30 cm.

The mass of the tile is 410 g.

(i) Calculate the volume of the tile.

vol = l × w × h
= 25 × 20 × 0.30
= 150 cm³

volume = 150 ..... cm³ [1]

(ii) Calculate the density of the tile. Include the unit in your answer.

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

$= \frac{410\,g}{150\,cm^3}$

$= 2.7\,g/cm^3$

density = 2.7 ..... unit g/cm³ ..... [4]

(iii) Calculate the weight of the tile.

$W = m \times g$

$m = \frac{410\,g}{1000} = 0.41\,kg$

$= 0.41 \times 10$

$= 4.1\,N$

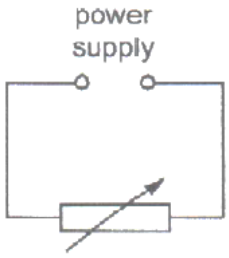
weight = 4.1 ..... N [3]

[Total: 12]

Electricity – 2022 November IGCSE 0625

1. Nov/2022/Paper_21/No.26

The diagram shows a circuit containing a variable resistor connected to a variable power supply.



The table shows the currents for different values of the potential difference (p.d.) and the resistance.

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

p.d. / V	resistance / Ω	current
3.6	12	I_1
1.2	12	I_2
3.6	6	I_3

$I_1 = \frac{3.6}{12} = 0.3\ A$

$I_2 = \frac{1.2}{12} = 0.1\ A$

$I_3 = \frac{3.6}{6} = 0.6\ A$

What is the order of the currents from smallest to largest?

$I_2 < I_1 < I_3$

A $I_1 \rightarrow I_2 \rightarrow I_3$ **B** $I_1 \rightarrow I_3 \rightarrow I_2$ **C** $I_2 \rightarrow I_1 \rightarrow I_3$ ✓ **D** $I_3 \rightarrow I_1 \rightarrow I_2$

2. Nov/2022/Paper_21/No.29

A lamp rated 12 V, 2.0 A is switched on for one minute.

How much energy is transferred by the lamp?

A 6.0 J **B** 24 J **C** 360 J **D** 1440 J ✓

$E = V \times I \times t$

$V = 12V$

$I = 2.0A$

$t = 1min = 60s$

(time in seconds)

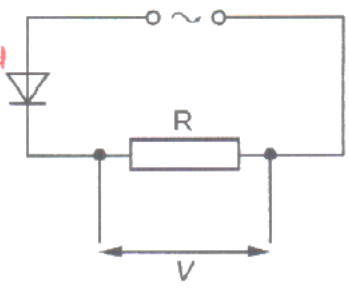
$E = 12 \times 2.0 \times 60$

$= 1440J$

3. Nov/2022/Paper_21/No.30

An alternating current (a.c.) power supply is connected in series with a resistor R and a diode.

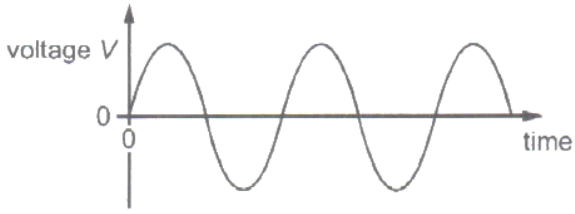
a.c oscillates forward and backward at a frequency of 50 times every second (50Hz)



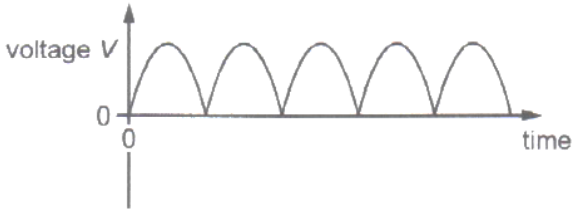
- Diode is direction dependent resistor.
- It allows current only in one direction and block current in reverse direction

Which graph shows how the voltage *V* across the resistor R varies with time?

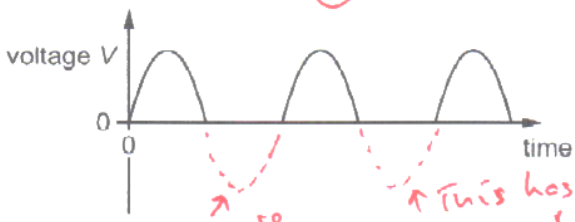
A



B



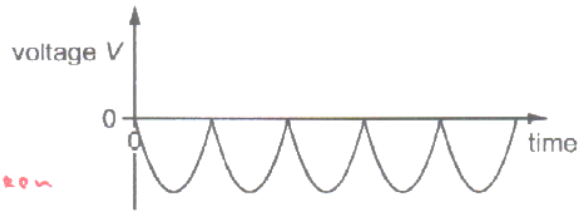
C ✓



reverse current

This has been blocked

D



4. Nov/2022/Paper_21/No.31

A student makes four resistors using different pieces of wire. The wires have different diameters and lengths. All the pieces of wire are made of the same material.

Which piece of wire will make the resistor with the largest resistance?

	diameter / mm	length / cm
A	0.8	10
B	0.8	17
C	2.0	10
D	2.0	17

Resistance depends on
1. Length of wire
2. Temperature
3. material
4. Thickness

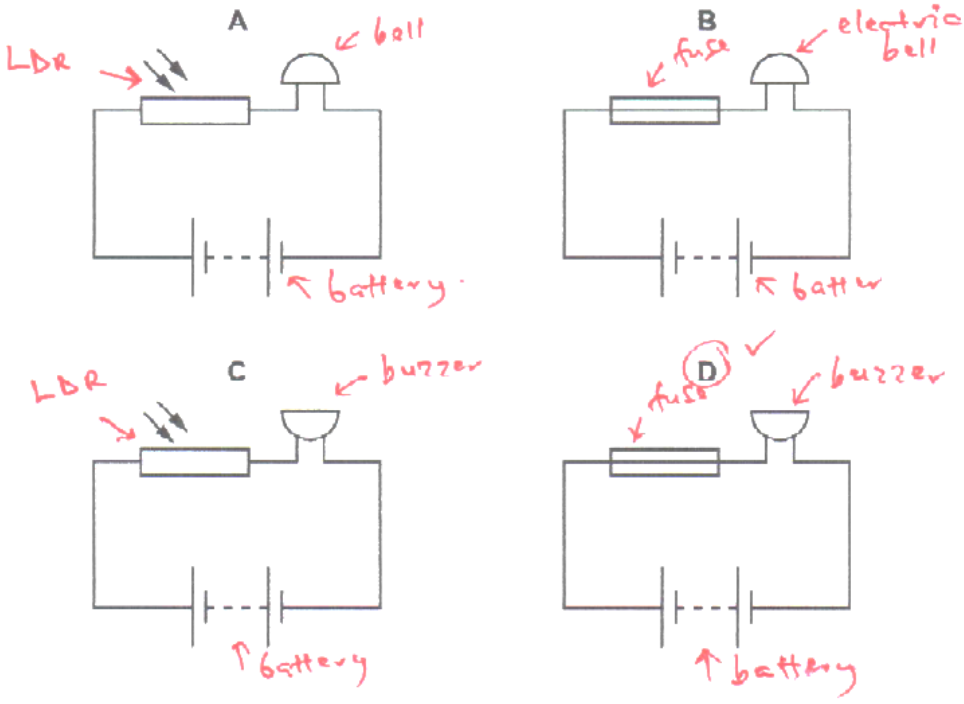
$R = \frac{\rho \times l}{A}$

$\therefore$ $R \propto l$ – longer wire has more resistance

$R \propto \frac{1}{A}$ – Thinner wire has more resistance.

5. Nov/2022/Paper_21/No.32

Which diagram shows a circuit containing a battery, a fuse and a buzzer?

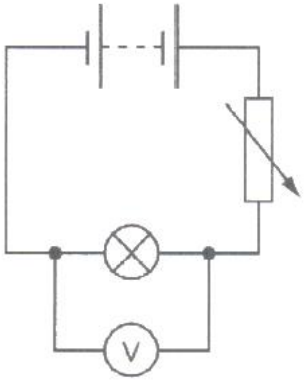


6. Nov/2022/Paper_22/No.26

The diagram shows a circuit used to control the potential difference (p.d.) across a lamp.

The variable resistor is adjusted until the p.d. across the lamp is 6.0 V.

The current in the lamp is 0.5 A.



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

$= \frac{6.0\,V}{0.5\,A}$

$= 12\,\Omega$

What is the resistance of the lamp?

A 0.083 Ω **B** 3.0 Ω **C** 6.5 Ω **D** 12.0 Ω ✓

7. Nov/2022/Paper_22/No.27

A charge Q flows for time t through a resistor of resistance R.

$Q = I \times t$

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

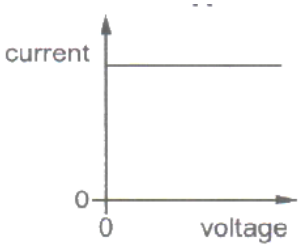
Which equation gives the current I in the resistor?

A $I = Qt$ **B** $I = Rt$ **C** $I = \frac{Q}{t}$ ✓ **D** $I = \frac{R}{t}$

8. Nov/2022/Paper_22/No.29

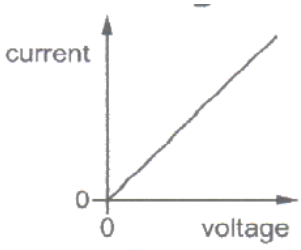
Which diagram shows a graph of current against voltage for a filament lamp?

A



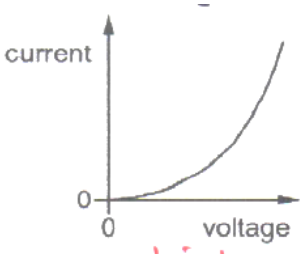
None

B



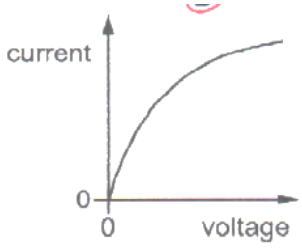
ohmic resistor

C



diode

D

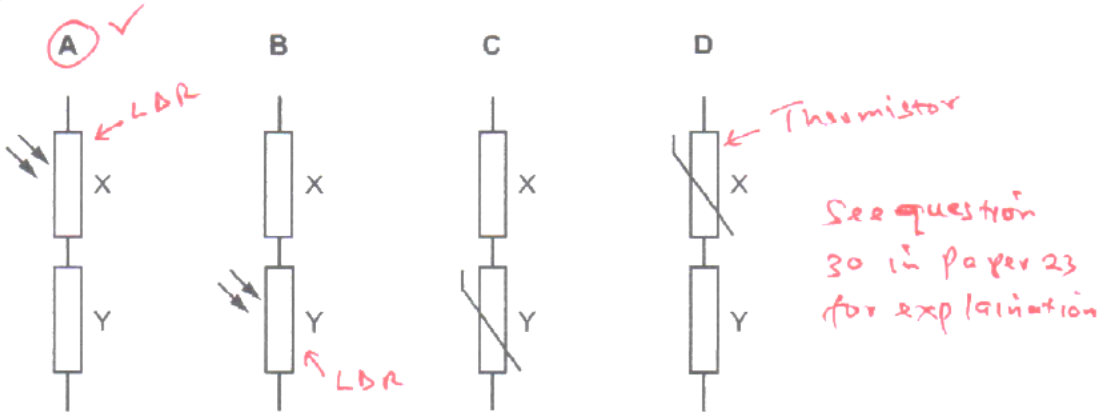


filament lamp

9. Nov/2022/Paper_22/No.30

Each potential divider is placed in a circuit with a power supply.

Which potential divider makes the potential difference (p.d.) across component Y increase when the light intensity increases?



See question 30 in Paper 23 for explanation

10. Nov/2022/Paper_22/No.31

1 Diagram 1 is a circuit diagram showing an a.c. power supply connected to four diodes and a resistor.

Diagram 2 shows the output voltage from the power supply.

diagram 1

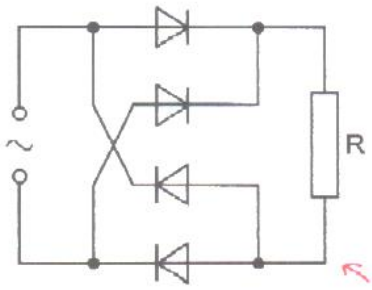
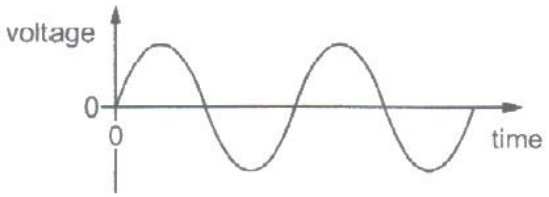


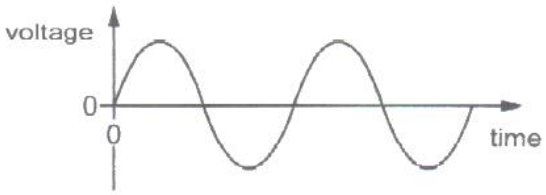
diagram 2



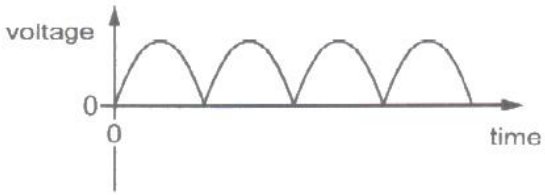
This is a rectification circuit, it converts a.c to d.c

Which graph correctly shows the voltage–time curve across resistor R?

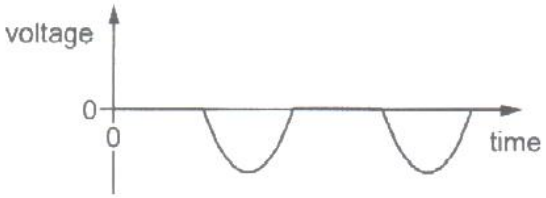
A



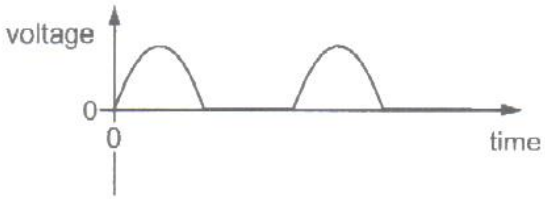
B



C



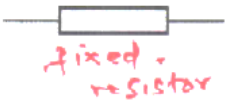
D



11. Nov/2022/Paper_22/No.32

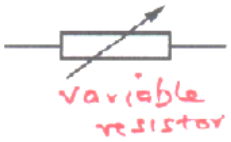
Which diagram shows the circuit symbol for a fuse?

A



fixed resistor

B



variable resistor

C

heater

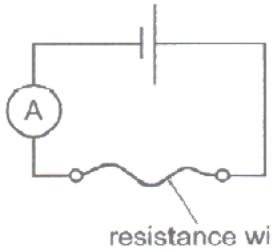
D ✓

fuse

12. Nov/2022/Paper_23/No.26

A student is investigating a resistance wire.

She measures the current in a 50 cm length of resistance wire.



The student repeats the experiment using a 100 cm length of the same resistance wire.

What is the effect of this change on the current in the circuit and on the resistance of the wire?

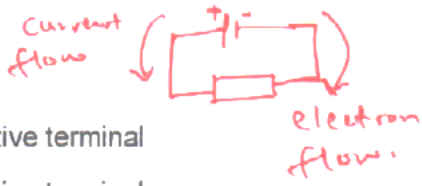
	effect on current	effect on resistance
A	decreases ✓	decreases
B ✓	decreases ✓	increases ✓
C	increases	decreases
D	increases	increases ✓

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

- $R \propto l$ – longer wire has more resistance
- The higher the resistance the less the current.

13. Nov/2022/Paper_23/No.27

A resistor is connected to a cell so that there is a current from the positive terminal of the cell to the negative terminal.



What causes the current in the resistor?

A electrons moving from the negative terminal of the cell to the positive terminal

B electrons moving from the positive terminal of the cell to the negative terminal

C protons moving from the negative terminal of the cell to the positive terminal

D protons moving from the positive terminal of the cell to the negative terminal

14. Nov/2022/Paper_23/No.29

Which combination of the current in a resistor and the time for which it is present results in a charge of 240 C passing through the resistor?

$Q = I \times t$

A a current of 2.0 A for 120 s → $Q = 2 \times 120 = 240\,C$ ✓

B a current of 4.0 A for 960 s → $Q = 4 \times 960 = 3840\,C$

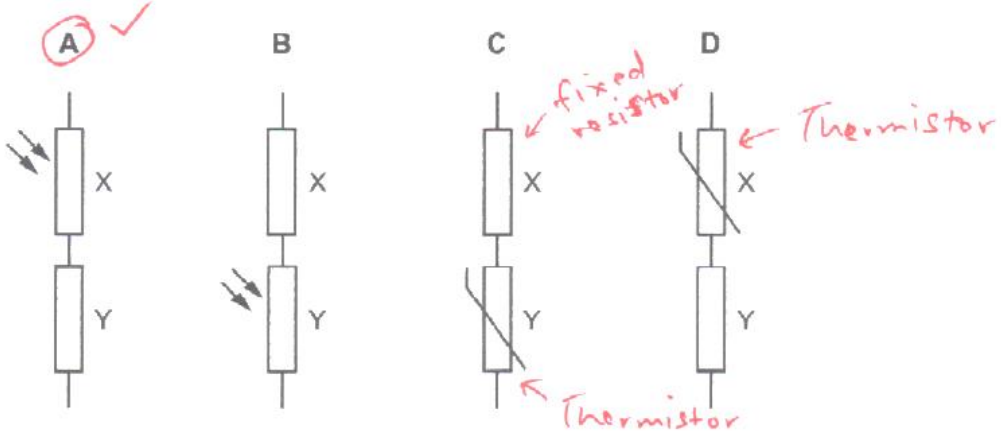
C a current of 6.0 A for 40 minutes → $Q = 6 \times 40 \times 60 = 14400\,C$

D a current of 8.0 A for 30 minutes → $Q = 8 \times 30 \times 60 = 14,400\,C$

15. Nov/2022/Paper_23/No.30

Each potential divider is placed in a circuit with a power supply.

Which potential divider makes the potential difference (p.d.) across component Y increase when the light intensity increases?



LDR - is light dependent resistor

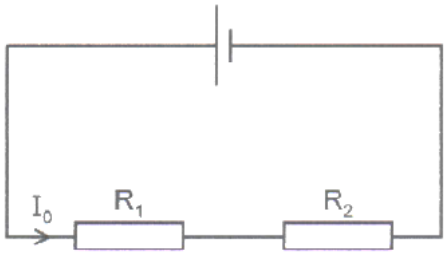
- At higher light intensity resistance is less
- So p-d at Y will increase, since

p-d at X + p-d at Y = constant.

- Fixed resistors are not affected by change in light intensity
- Also thermistors, not affected by light, but by temperature.

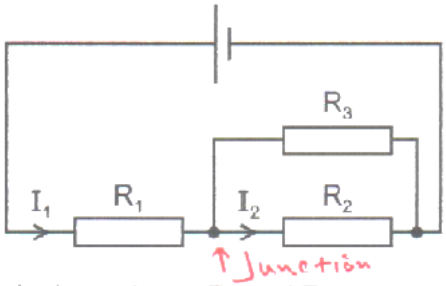
16. Nov/2022/Paper_23/No.31

Two resistors, R_1 and R_2, are connected in series in a circuit, as shown.



The current in the resistors is I_0.

Another resistor, R_3, is then connected in parallel with R_2, as shown.



How do the currents I_1 and I_2 in the resistors R_1 and R_2 compare to current I_0?

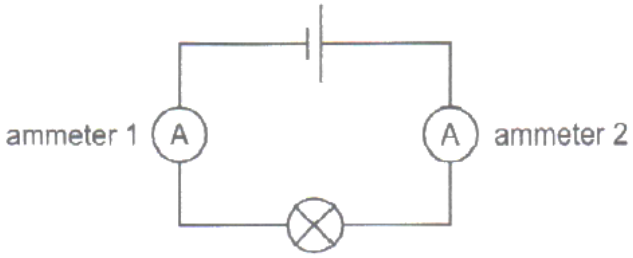
	current in R_1	current in R_2
A	$I_1 = I_0$	$I_2 < I_0$
B	$I_1 = I_0$	$I_2 = I_0$
C	$I_1 > I_0$	$I_2 = I_0$
D ✓	$I_1 > I_0$	$I_2 < I_0$

- When R_3 is connected parallel to R_2, the total circuit resistance decreases.
- So $I_1 > I_0$

- At the junction current splits, so $I_2 < I_0$.

17. Nov/2022/Paper_23/No.32

The diagram shows a circuit containing a cell, a lamp and two ammeters.



The current reading on ammeter 2 is 0.20 A.

What is the name for this type of circuit and what is the reading on ammeter 1?

	type of circuit	reading on ammeter 1
A	series ✓	0.20 A ✓
B	series ✓	greater than 0.20 A
C	parallel	0.20 A
D	parallel	greater than 0.20 A

- In a series circuit, current is same at all points.
- So ammeter 2 will read 0.20 A just like ammeter 1.

18. Nov/2022/Paper_31/No.8

Fig. 8.1 shows an electric circuit set up by a student.

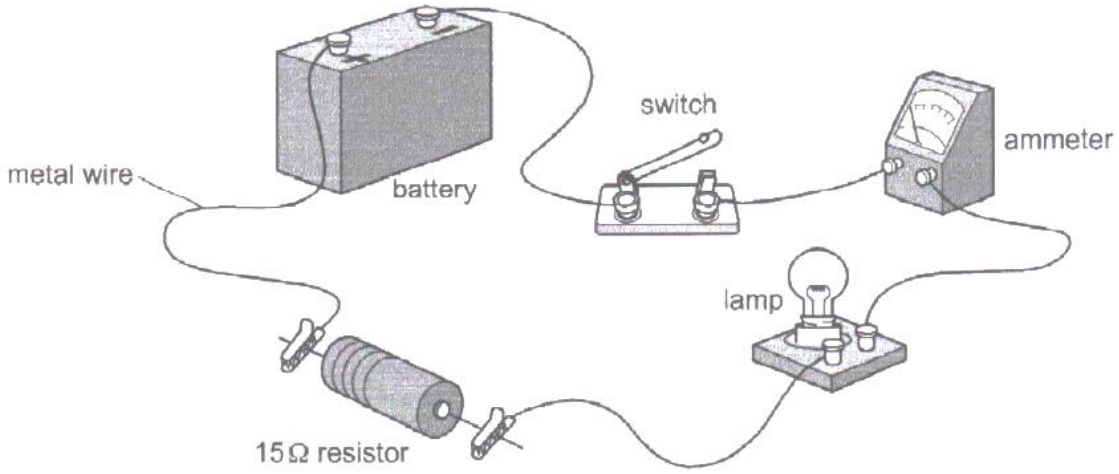
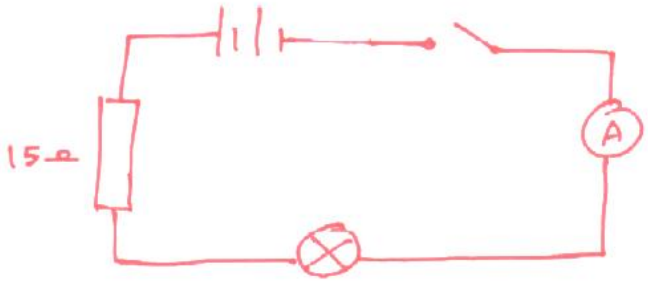


Fig. 8.1

(a) Using standard symbols, draw a circuit diagram for the student's circuit.



[4]

(b) When the switch is closed there is a current in the circuit.

State the name of the particles flowing in the metal wire.

electrons ..... [1]

(c) The current in the 15Ω resistor in Fig. 8.1 is 0.40A when the switch is closed.

Calculate the potential difference (p.d.) across the 15Ω resistor.

$V = I \times R$

$= 0.40 \times 15$

$= 6.0\ V$

p.d. across resistor = 6.0 ..... V [3]

[Total: 8]

19. Nov/2022/Paper_32/No.8

A student uses the circuit in Fig. 8.1 to find the resistance of a piece of iron wire.

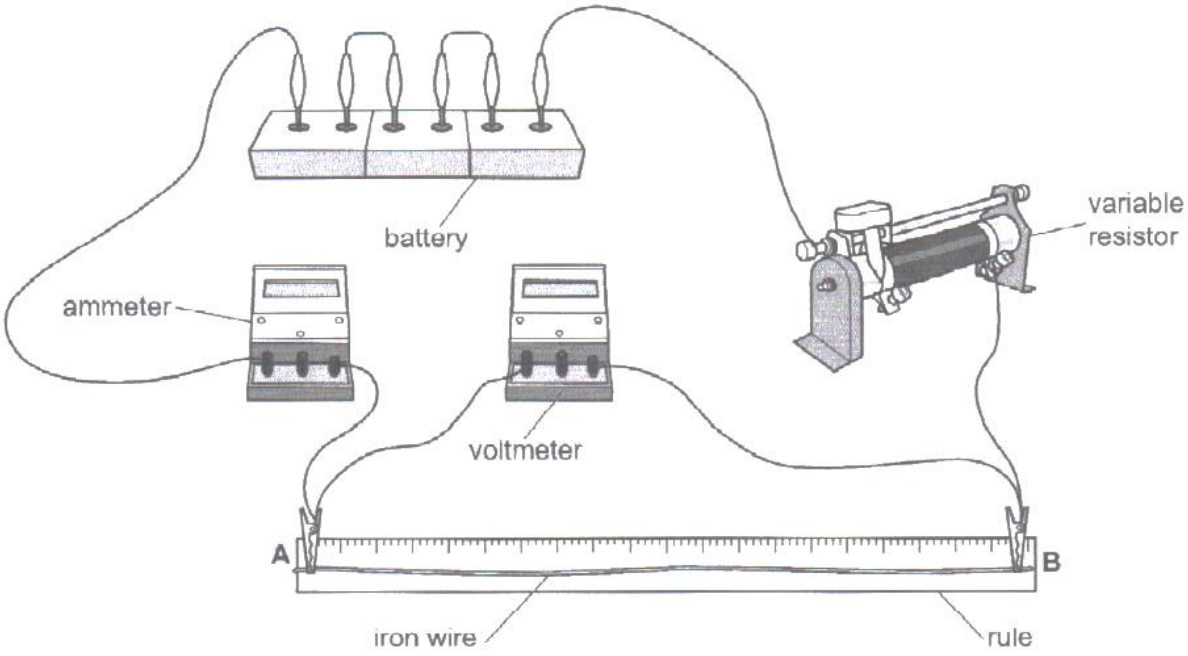
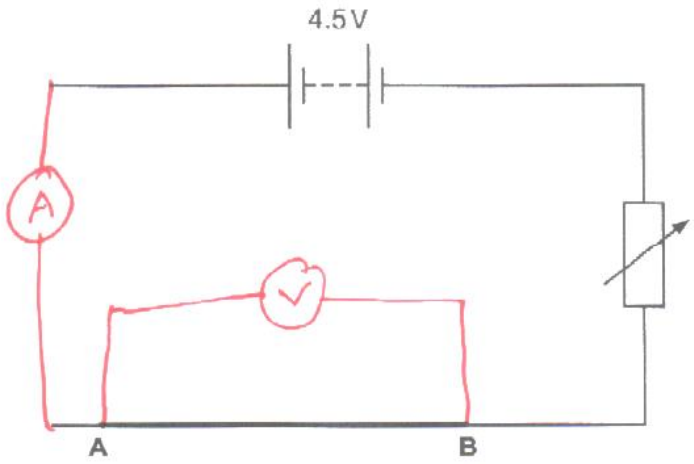


Fig. 8.1

(a) Complete Fig. 8.2 to show the circuit diagram for the arrangement shown in Fig. 8.1.

The piece of iron wire is shown as the thicker line between the points A and B.



[3]

Fig. 8.2

(b) The reading on the voltmeter is 1.56 V.

The reading on the ammeter is 0.112 A.

Calculate the resistance of the iron wire. Include the unit in your answer.

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

$= \frac{1.56\ V}{0.112\ A}$

$= 13.9\ \Omega$

$\simeq 14\ \Omega$ (2 s.f.)

resistance = ... 14 ..... unit ..... Ω ..... [4]

[Total: 7]

20. Nov/2022/Paper_32/No.9(d_ e)

(d) Using the information in Fig. 9.1, calculate the reading on the voltmeter.

$V_p = 10V$

$N_p = 200$

$N_s = 800$

$V_s = ?$

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

$V_s = \frac{800 \times 10}{200}$

$= 40V$

reading on voltmeter = ... 40 ..... V [3]

(e) The 10 V a.c. power supply is replaced by a 10 V d.c. battery.

State the reading on the voltmeter.

transformers do not work with direct current (dc).

reading on voltmeter = ... 0 ..... V [1]

[Total: 7]

21. Nov/2022/Paper_33/No.9

(a) Fig. 9.1 shows a hazardous scenario of using electricity in a kitchen.

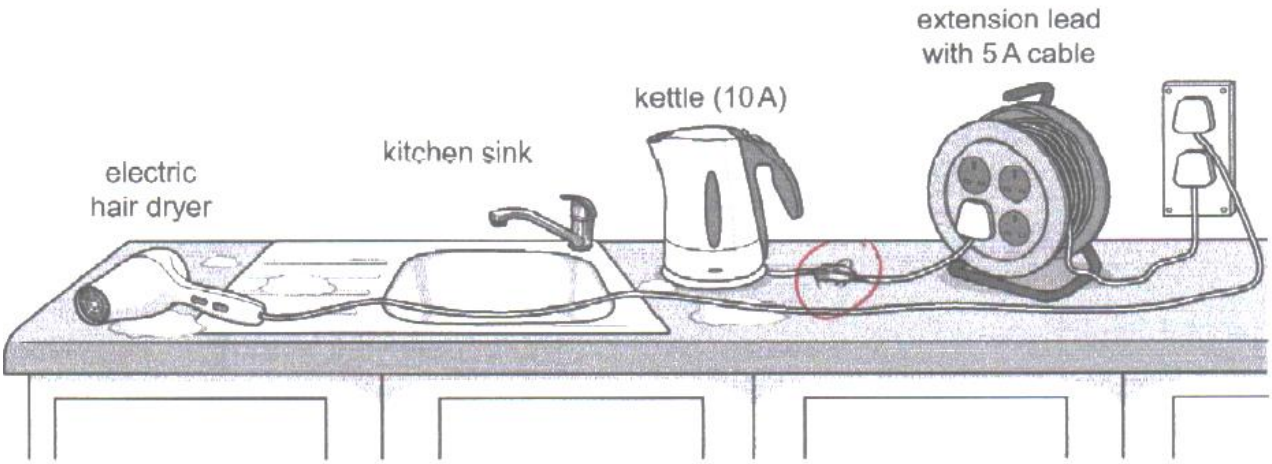


Fig. 9.1

(i) Identify **three** electrical hazards in Fig. 9.1.

1. damage insulation of the wire
2. Wet conditions
3. 5A cable connected to 10A Kettle.

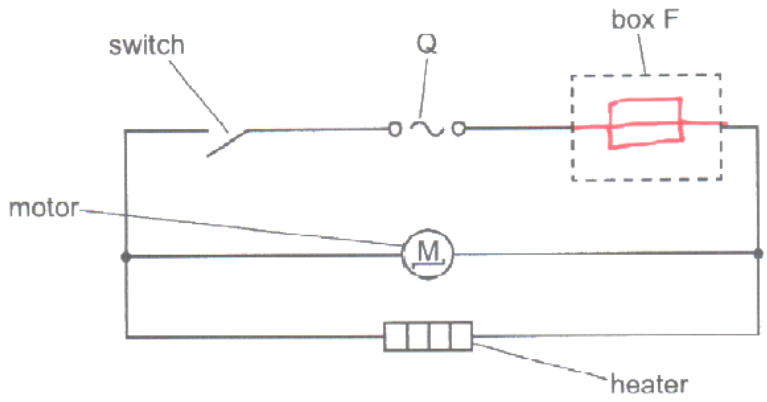
[3]

(ii) Give **two** possible consequences of the electrical hazards in Fig. 9.1.

1. Overheating - this can cause fire outbreak.
2. Electric shock - can be fatal when touched..

[2]

(b) Fig. 9.2 shows the circuit for a hair dryer.



a-c – alternating current.

Fig. 9.2

(i) State the name of the component labelled Q in Fig. 9.2. a-c power supply [1]

(ii) On Fig. 9.2, in the dashed box F, draw the circuit symbol for a fuse. [1]

(iii) State the purpose of a fuse.

to protect circuit from excessive current [1]

(iv) State an advantage of using a circuit breaker instead of a fuse.

can be reset quickly [1]

(c) A different hair dryer has a fuse and two heat settings.

When the hair dryer is used on the low heat setting, the current in the hair dryer is 5.2A.
When the hair dryer is used on the high heat setting, the current in the hair dryer is 8.9A.

Circle **one** correct fuse rating for this hair dryer.

5A **10A** **13A** **15A** **30A** [1]

[Total: 10]

The fuse rating should be slightly bigger than the highest current in the circuit of the device, but not too large

eg 15A and 30A are way too large from 8.9A

22. Nov/2022/Paper_41/No.8

The unit of the two electrical quantities electromotive force (e.m.f.) and potential difference (p.d.) is the volt (V).

(a) State **one** other similarity between e.m.f. and p.d.

Both are energy per unit charge

$V = \frac{I}{Q}$ [1]

(b) State **one** difference between e.m.f. and p.d.

p.d is voltage across an electrical component, emf is voltage of the power source in a circuit [1]

(c) A battery consists of four cells, each of e.m.f. 1.2V, in series.

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

emf = 1·2 × 4
= 4·8 V

e.m.f. = 4·8 V [1]

(ii) The battery is connected in a circuit with four 12 Ω resistors. Fig. 8.1 is the circuit diagram.

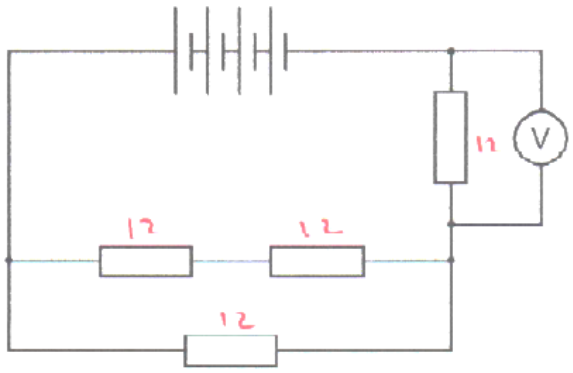


Fig. 8.1

Calculate the total resistance of this arrangement of resistors.

Series: R = 12+12 = 24 Ω

Parallel R = $\frac{24 \times 12}{24+12}$ = 8 Ω

Total Series R = 12 + 8 = 20 Ω

resistance = 20 Ω [3]

(iii) Calculate the reading on the voltmeter in Fig. 8.1.

Current in circuit

$I = \frac{4 \cdot 8\ V}{20\ \Omega}$

= 0·24 A

V = I × R
= 0·24 × 12
= 2·88 V

reading = 2·9 V [2]

[Total: 8]

23. Nov/2022/Paper_42/No.8

Fig. 8.1 shows an electrical circuit.

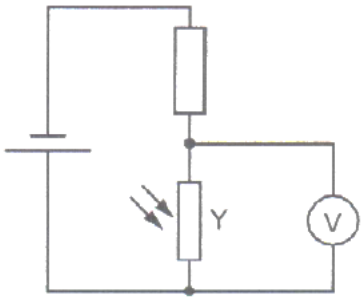


Fig. 8.1

(a) The light intensity at the circuit increases from dark to bright.

State any effect on the resistance of component Y.

Resistance of Y decreases.

State and explain any effect on the reading of the voltmeter.

- Voltmeter reading will decrease.
- Resistance is proportional to voltage across component Y.

[3]

(b) The circuit shown in Fig. 8.2 is switched on for 2.0 min.

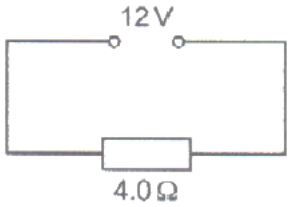


Fig. 8.2

The current in the 4.0Ω resistor is 3.0A and the magnitude of the charge on an electron is 1.6×10^{-19}C.

(i) Calculate the number of electrons that pass through the resistor each second.

$Q = I \times t$

$= 3 \times 2 \times 60$

$= 360\,C$

No of $e^- s = \frac{360\,C}{1.6 \times 10^{-19} C} = \frac{2.25 \times 10^{21}}{120} = 1.875 \times 10^{19}$

number = 1.9×10^{19} e's [3]

(ii) Calculate the power dissipated by the resistor.

$P = I \times V$

$= 3\,A \times 12\,V$

$= 36\,W$

power = 36 W [2]

[Total: 8]

24. Nov/2022/Paper_43/No.8(b)

(b) Fig. 8.2 shows an electric circuit.

negative charge.

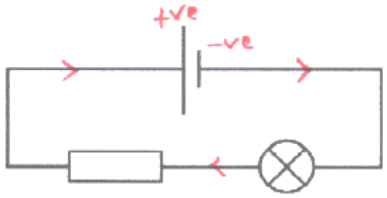


Fig. 8.2

On Fig. 8.2, draw an arrow to show the direction of flow of electrons and explain how you determined the direction.

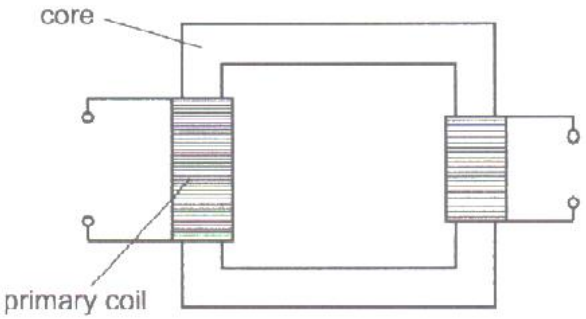
explanation ..... Current flow from +ve to -ve terminal [1]
opposite to the direction of flow
of electrons.

[Total: 5]

Electromagnetic Induction – 2022 November IGCSE 0625

1. Nov/2022/Paper_21/No.34

The diagram represents a transformer.



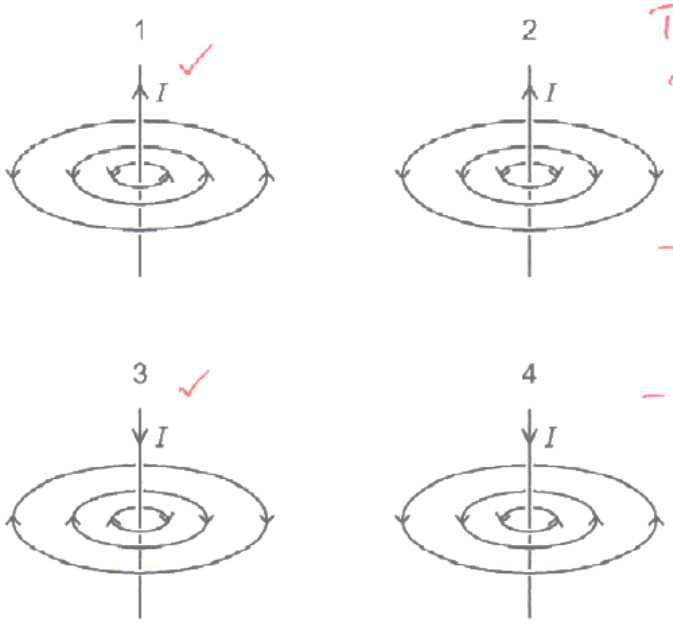
Which row shows materials suitable for making the core and the primary coil?

	core	primary coil
A	iron ✓	copper ✓
B	iron ✓	plastic ✗
C	steel ✗	copper ✓
D	steel ✗	plastic ✗

core – soft iron
primary coil – copper wire

2. Nov/2022/Paper_21/No.35

The diagrams show the magnetic field lines around a wire carrying a current, I.



To identify direction of field use right-hand grip rule.
- Thumb point in direction of current
- Fingers will be in field direction

Which diagrams are correct?

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

3. Nov/2022/Paper_22/No.35

Transformers are used in the transmission of electrical power to houses.

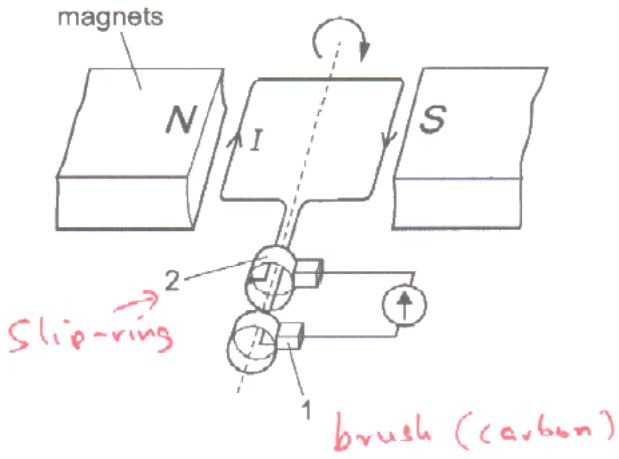
Which type of transformer is used at the power station prior to connection to the power lines and which type is used prior to delivery to the houses?

	power station	before houses
A	step-down	step-down ✓
B	step-down	step-up
C ✓	step-up ✓	step-down ✓
D	step-up ✓	step-up

- In power station, it step-up voltage so there is less current for transmission to minimise power loss.
- Before house, it step-down voltage so to increase current needed to run devices at home.

4. Nov/2022/Paper_22/No.36

The diagram shows an a.c. generator rotating in a clockwise direction.



Slip-ring

brush (carbon)

What are the names of parts 1 and 2?

	1	2
A ✓	brush	slip-ring
B	brush	split-ring commutator
C	slip-ring	brush
D	slip-ring	split-ring commutator

← These are found in d.c motors

5. Nov/2022/Paper_23/No.35

Which metal is used for the core of a transformer?

A aluminium
B copper
C soft iron
D steel

both are non-magnetic material, so not used in core

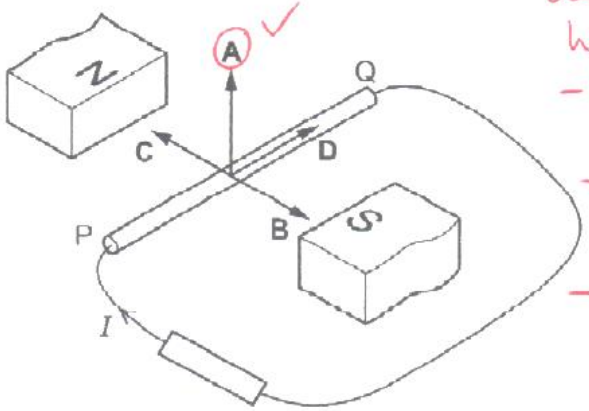
It is easy to magnetise and demagnetise

gets magnetised permanently, so not suitable for core.

6. Nov/2022/Paper_23/No.36

The diagram shows a conducting metal rod PQ in the magnetic field between the N pole and the S pole. The rod is connected to a resistor in a circuit.

In which direction should rod PQ be moved to induce the current I in the direction of the arrow in the circuit?



Use Fleming's right hand
- 1st finger – Field N → S
- 2nd finger – current direction
- Thumb – direction of motion

7. Nov/2022/Paper_31/No.9

Fig. 9.1 shows a transformer used on a building site.

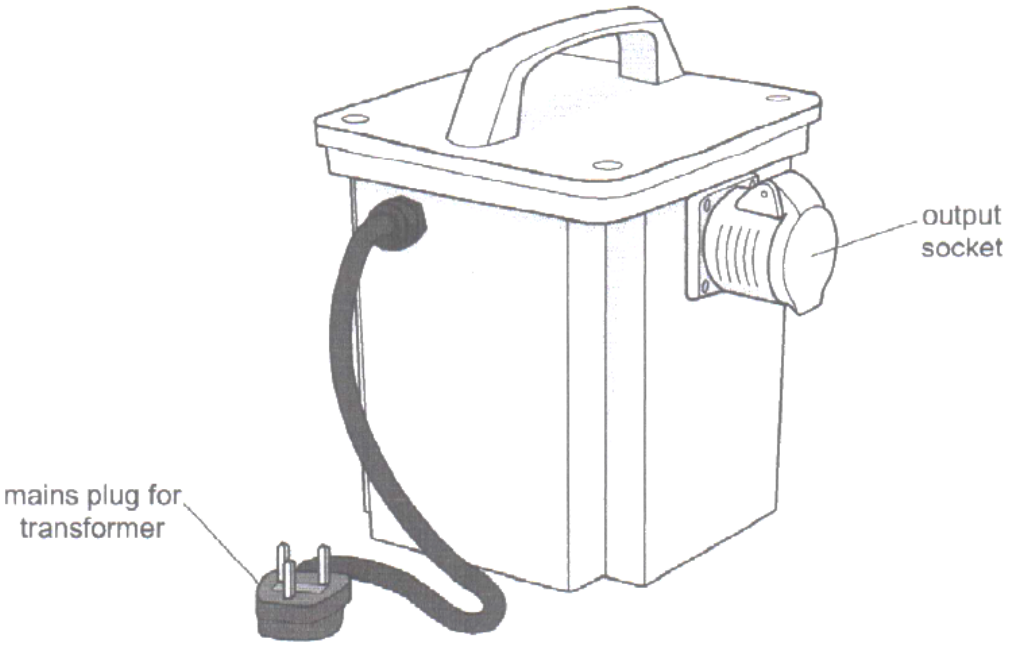


Fig. 9.1

(a) The mains plug for the transformer contains a fuse.

(i) Give a reason why the plug includes a fuse.

fuse protects transformer from overheating [1]

(ii) Explain how a fuse works.

– Large current in fuse will make the fuse wire to melt and break the circuit. [2]

(b) The mains input (primary) potential difference (p.d.) to the transformer is 230 V a.c.

The number of turns on the input (primary) coil is 314. The number of turns on the output (secondary) coil is 150.

Calculate the output (secondary) p.d. from the transformer.

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

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

$V_p = 230\,V$

$N_p = 314$

$N_s = 150$

$V_s = ?$

$V_s = \frac{150 \times 230}{314}$

$= 110\,V$

output p.d. = 110 V [3]

(c) Fig. 9.2 shows an outline of the transformer.

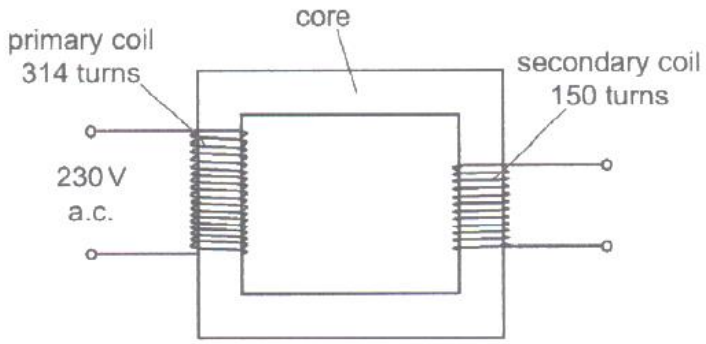


Fig. 9.2

(i) State a suitable material for the core of the transformer.

Soft iron. ..... [1]

(ii) State a suitable material for the primary and secondary coils of the transformer.

Copper wire ..... [1]

(iii) Explain how Fig. 9.2 shows a step-down transformer.

there are fewer turns in secondary coil. ..... [1]

[Total: 9]

8. Nov/2022/Paper_32/No.9(a_ c)

Fig. 9.1 shows a transformer. An a.c. voltmeter is connected to the output of the secondary coil.

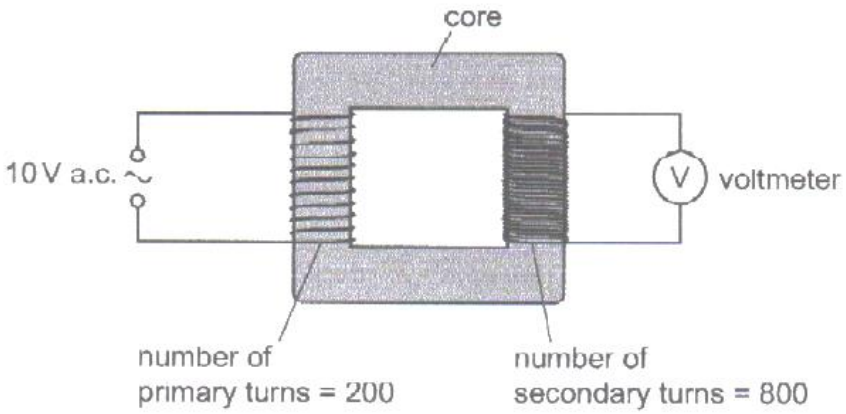


Fig. 9.1

(a) State the meaning of a.c.

alternating current ..... [1]

(b) State the name of the type of transformer shown.

Step-up ..... [1]

(c) State a suitable material for the core of the transformer in Fig. 9.1.

Soft iron ..... [1]

9. Nov/2022/Paper_32/No.10

(a) Fig. 10.1 shows the equipment used by a teacher in a laboratory demonstration.

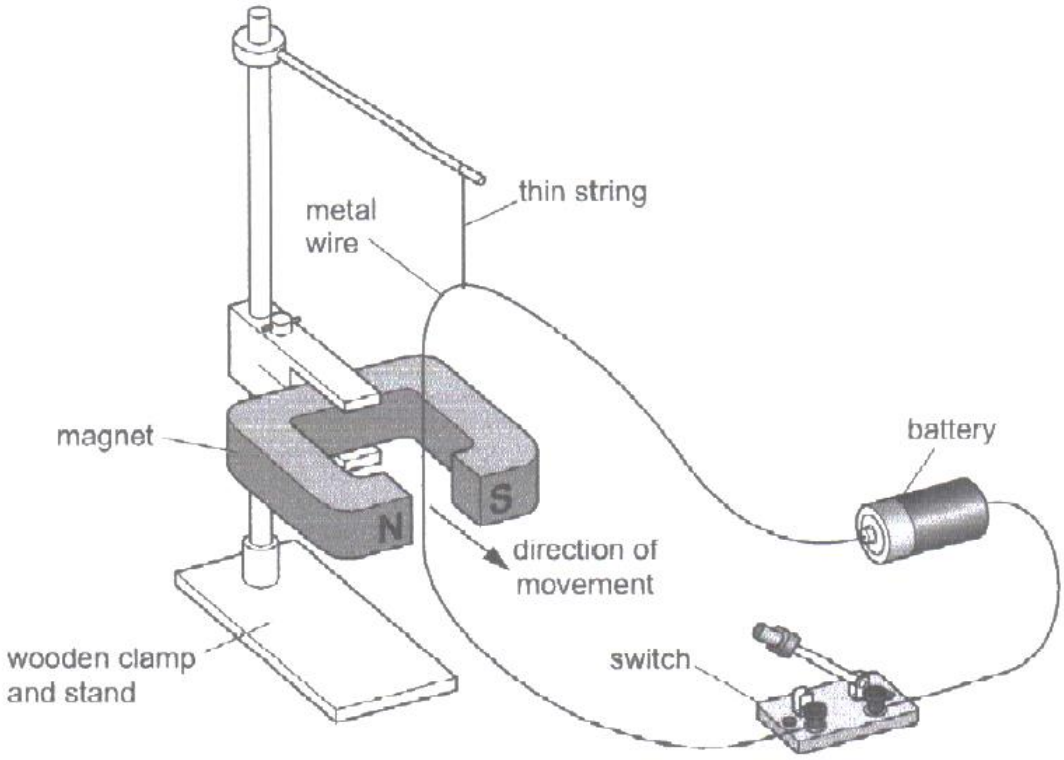


Fig. 10.1

The teacher closes the switch and there is a current in the metal wire.
A force acts on the wire. The wire moves in the direction shown in Fig. 10.1.

(i) State **two** changes that increase the force on the wire.

1. Increase current (or number of cells) [1]
2. Use a Stronger magnet [1]

(ii) State **one** change that reverses the direction of the force on the wire.

Reverse the battery or the magnet. [1]

(b) Fig. 10.2 shows the poles of the magnet.

Draw the shape and show the direction of the magnetic field in the gap between the poles of the magnet.

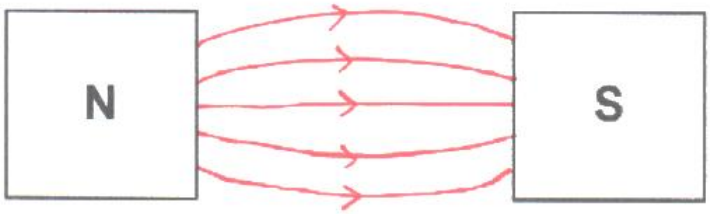


Fig. 10.2

[2]

[Total: 5]

10. Nov/2022/Paper_41/No.7

The electric starter motor in a car is switched on and off using a relay.

The relay consists of a plastic case and two flexible springy strips, X and Y, which are made of soft iron. These iron strips act as the switch when a circuit is connected between the terminals W and Z.

Fig. 7.1 shows X, Y and the plastic case.

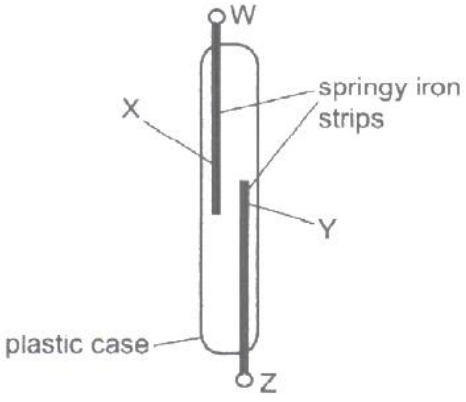


Fig. 7.1

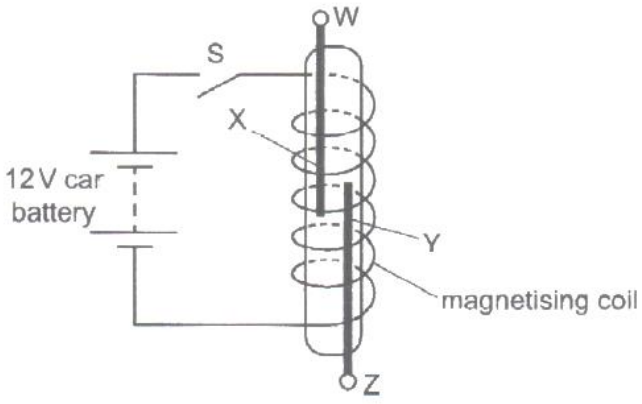


Fig. 7.2

Fig. 7.2 shows the equipment from Fig. 7.1 inside a magnetising coil. The magnetising coil is in series with the 12 V car battery and switch S, which is open.

(a) Switch S is now closed.

Explain what happens to the springy iron strips X and Y.

– Both X and Y become magnetised.

– The ends of strips X and Y have opposite magnetic poles so they will attract.

– When they touch, they complete the circuit WZ. [3]

(b) The power of the starter motor is 1.8 kW and it is also operated by the car battery.

(i) Calculate the current in the starter motor when it is used.

$P = V \times I$ $P = 1.8 \times 10^3$ W

$V = 12$ V

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

$= \frac{1.8 \times 10^3}{12}$

$= 150$ A

current = 150 A [2]

(ii) The starter motor circuit is connected between terminals W and Z.

Explain why copper wires with a large cross-sectional area are used for this circuit.

- Thick copper wire have smaller resistance
- So less thermal energy is produced when a current of 150A flow through it. [2]

(c) Fig. 7.3 shows the relay and the symbols for the car battery and the starter motor.

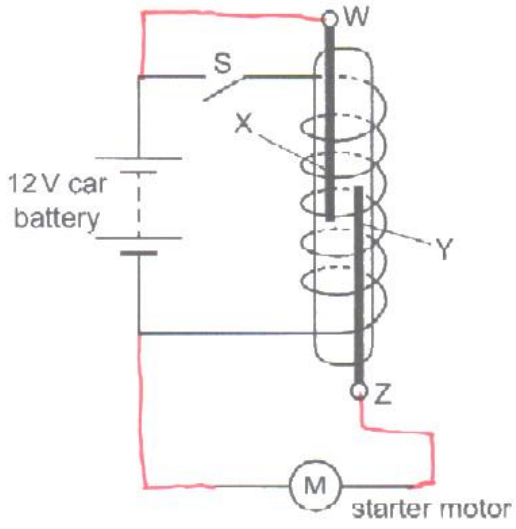


Fig. 7.3

The springy iron strips X and Y act as the switch for the starter motor circuit.

Complete the circuit diagram for the motor circuit. [2]

[Total: 9]

Both the starter motor and the relay are connected to the same battery.

11. Nov/2022/Paper_43/No.9

Fig. 9.1 shows a circuit with an alternating current (a.c.) supply, a resistor and a diode.

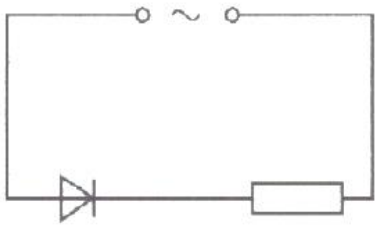


Fig. 9.1

The frequency of the power supply is 50 Hz.

(a) Calculate the time period (time for one complete cycle) of the a.c. supply.

$T = \frac{1}{f}$ Period = $\frac{1}{\text{frequency}}$

$= \frac{1}{50}$

$= 0.02$ s

time = 0.02 [2]

(b) The peak potential difference (p.d.) across the resistor is 340 V.

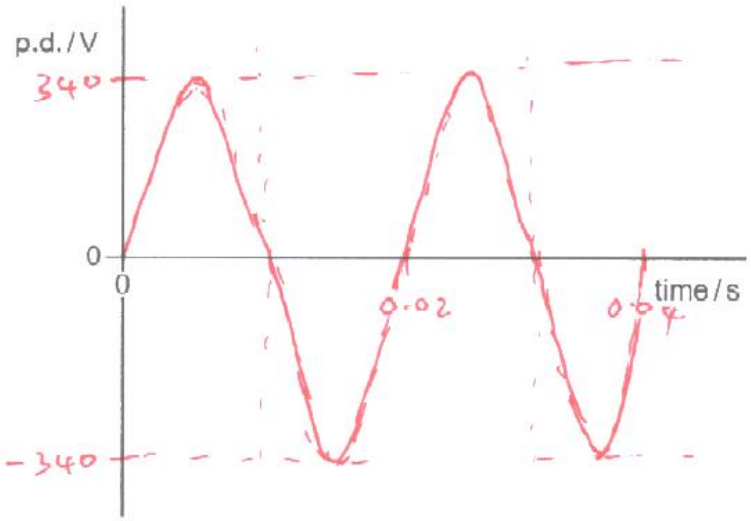


Fig. 9.2

On Fig. 9.2:

(I) sketch a graph to show how the p.d. across the resistor varies with time for two cycles [2]

(II) label the p.d. axis with the value of p.d. at the peak [1]

(iii) label the time axis with two values of time. [2]

[Total: 7]

Electromagnetic Spectrum – 2022 November IGCSE 0625

1. Nov/2022/Paper_21/No.23

What is the speed of microwaves in air?

A $3 \times 10^8 \mu m/s$

B $3 \times 10^8 cm/s$

C $3 \times 10^8 m/s$ ✓

D $3 \times 10^8 km/s$

- Microwave is electromagnetic wave
- All EM waves have a speed of $3.0 \times 10^8 m/s$ in both air and vacuum.

2. Nov/2022/Paper_32/No.5(d_ e)

(d) The chart in Fig. 5.2 shows the regions of the electromagnetic spectrum.

Two of the regions are not labelled.

gamma	X-rays	UV	visible light	infrared	microwaves	radio waves

Fig. 5.2 UV – ultraviolet

(i) Complete the labelling in Fig. 5.2. [2]

(ii) Compare the speed of radio waves and visible light. Complete the sentence.

In a vacuum, radio waves travel ...the same speed as... visible light. [1]

(e) The different regions of the electromagnetic spectrum have different uses.

State the region of the electromagnetic spectrum that is used for:

(i) the remote control for a television ...infrared... [1]

(ii) the signal for satellite television broadcasting ...microwaves.... [1]

3. Nov/2022/Paper_33/No.8

Fig. 8.1 shows the security and waiting areas at an airport.

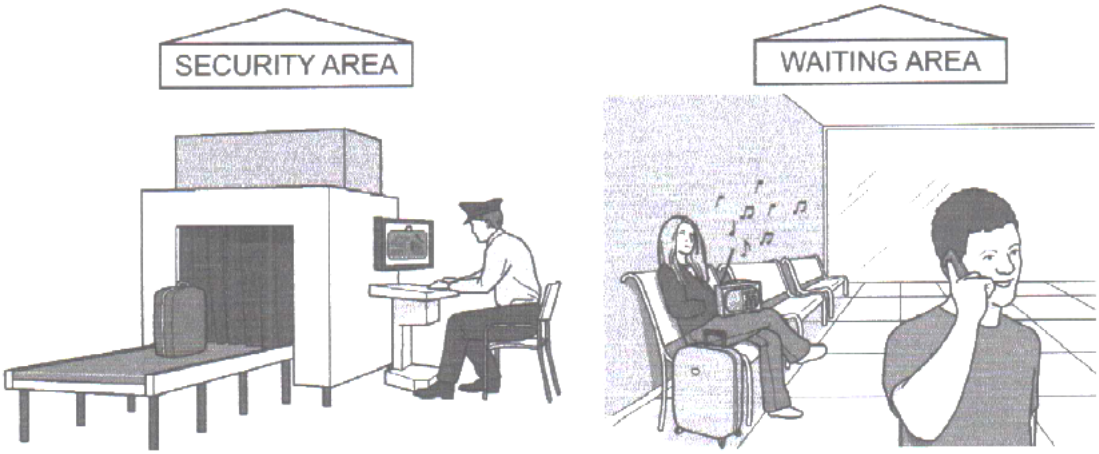


Fig. 8.1

(a) Fig. 8.1 shows several situations in which regions of the electromagnetic (EM) spectrum are being used.

Table 8.1 gives **three** of these situations.

State the name of the region of the EM spectrum which is being used in each situation.

Table 8.1

	situation	region of EM spectrum
1	girl listening to radio	radio waves
2	boy using mobile phone	microwaves
3	security guard checking bags	X-rays

[3]

(b) All waves can be reflected, refracted and diffracted.

State **two** other properties of waves in the electromagnetic spectrum.

property 1 ..... They are transverse .....

property 2 ..... Have a speed of 3.0×10^8 m/s .....

[2]

(c) State **two** safety precautions for working with sources that emit γ (gamma)-radiation.

1. ..... limit time of exposure .....

2. ..... Use a lead shield .....

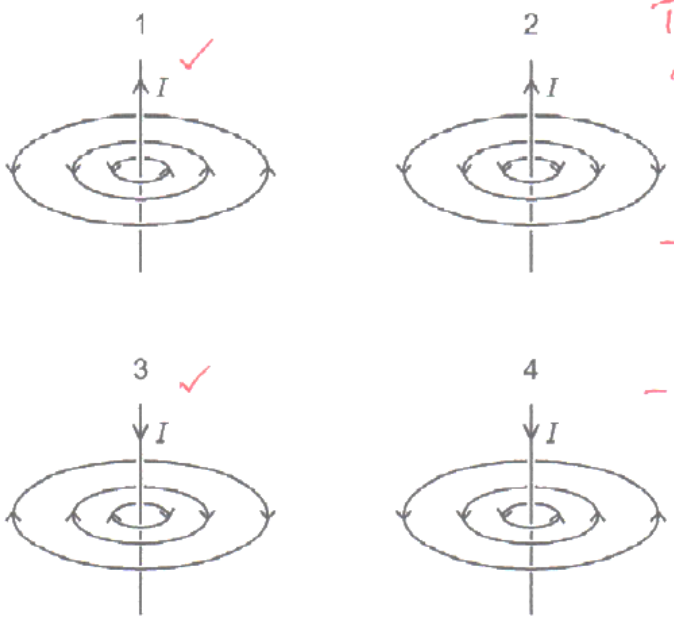
[2]

[Total: 7]

Electromagnetism – 2022 November IGCSE

1. Nov/2022/Paper_21/No.35

The diagrams show the magnetic field lines around a wire carrying a current, I.



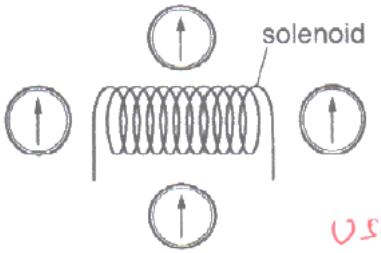
To identify direction of field use right-hand grip rule.
- Thumb point in direction of current
- Fingers will be in field direction

Which diagrams are correct?

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

2. Nov/2022/Paper_,23/No.34

Four small compasses are placed around a solenoid.

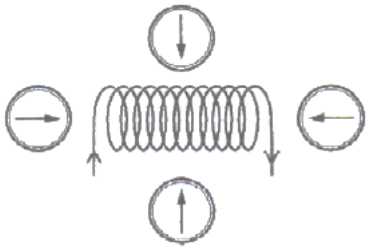


A current is now switched on in the solenoid.

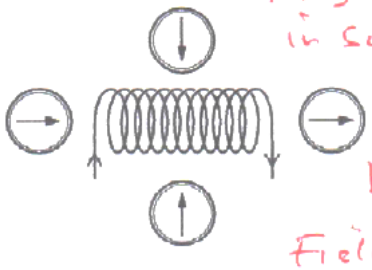
Which diagram shows possible new directions of the compass needles?

Use right-hand grip rule to identify the N-pole and S-pole of Solenoid when current is flowing
- Magnetic field in solenoid is similar to that in bar magnet.
Field is from N to S-pole.

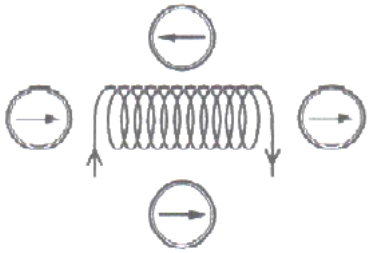
A



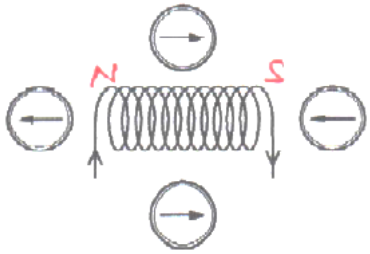
B



C



D ✓



3. Nov/2022/Paper_32/No.7

Fig. 7.1 shows an arrangement that can produce a magnet.

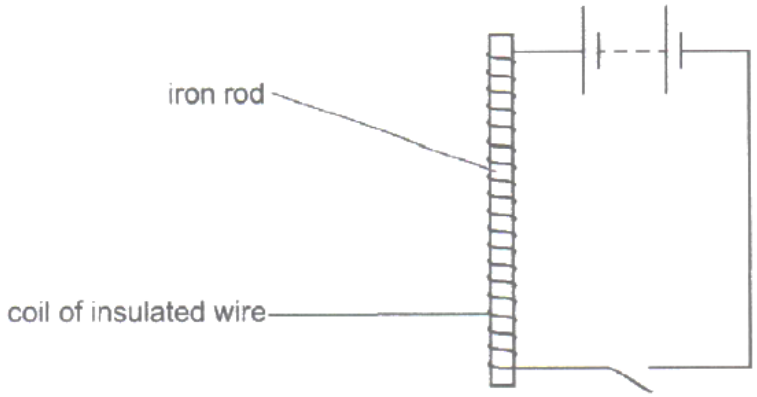


Fig. 7.1

(a) (i) State the name given to the type of magnet in Fig. 7.1.

Electromagnet ..... [1]

(ii) Suggest an advantage of this type of magnet in comparison with other types of magnet.

- It can be switched on and off
- Its strength can be varied ..... [1]

(iii) State **two** ways of increasing the strength of the magnet in Fig. 7.1.

1. Increase current ..... [1]
2. increase the number of turns ..... [1]

(iv) Suggest **one** use for this type of magnet.

used in loudspeakers ..... [1]

(b) (i) Compare the effect of using a steel rod instead of an iron rod in the arrangement in Fig. 7.1.
The steel rod is the same size as the iron rod.

Steel will get permanently magnetised .....

..... [1]

(ii) Compare the effect of using a copper rod instead of an iron rod in the arrangement in Fig. 7.1.
The copper rod is the same size as the iron rod.

- Copper is not magnetic material, so the strength of electromagnet will reduce. ..... [1]

[Total: 7]

Energy Resources – 2022 November IGCSE 0625

1. Nov/2022/Paper_42/No.3

(a) Tidal power derives most of its energy from the Moon and part of its energy from the Sun.

(i) State **one** other source of power which derives its energy from the Sun.

- fossil fuel, solar cell, hydro, wind ..... [1]

(ii) State **one** source of power which does **not** derive its energy from the Sun.

geothermal, nuclear ..... [1]

(b) Fig. 3.1 shows a small water turbine driven by a tidal flow of water to generate electrical power.

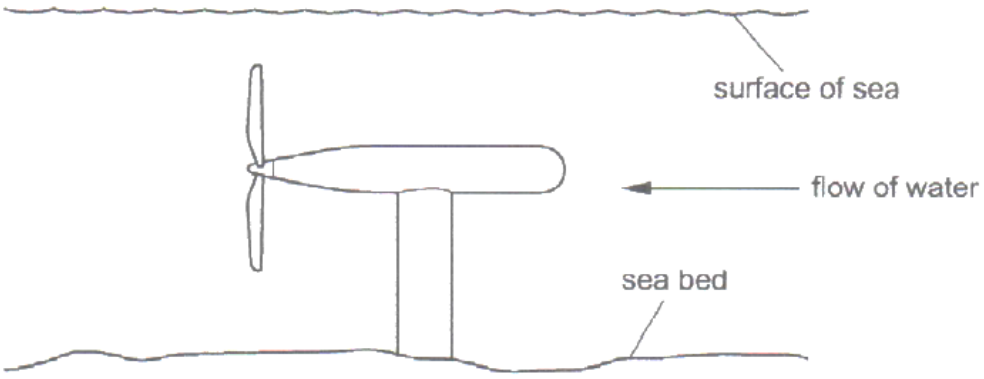


Fig. 3.1

(i) Explain whether this method of generation of electrical power is renewable.

- Yes it is renewable.
- Tides will always be there since the Moon remains in place. ..... [2]

(ii) The mass of water passing through the turbine each second is 6.0×10^3 kg. The speed of the water is 2.0 m/s. 40% of the kinetic energy of the water is converted to electrical energy.

Calculate the electrical power generated.

$t = 1s$

$E_k = \frac{1}{2}mv^2$

$= \frac{1}{2} \times 6.0 \times 10^3 \times (2)^2$

$= 12000\ J$

E_k to $E \cdot E$

$= 12000 \times \frac{40}{100}$

$= 4800\ J$

Power = $\frac{\text{Energy}}{\text{time}}$

$= \frac{4800\ J}{1\ s}$

$= 4800\ W$

power = 4800 W [4]

[Total: 8]

2. Nov/2022/Paper_43/No.3

Fig. 3.1 shows the cross-section of a barrage built across a tidal bay. The barrage is part of a tidal power station.

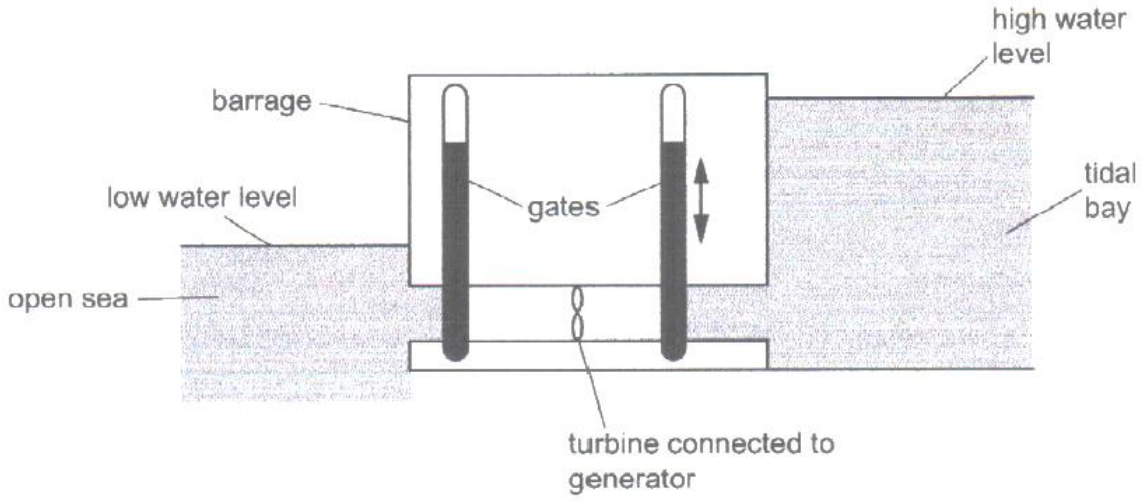


Fig. 3.1

The gates are raised to be open when the tide comes in. The gates are lowered to close when it is high tide. Fig. 3.1 shows the water levels in the open sea and the tidal bay when it is low tide. The gates are raised and water flows through the turbine.

(a) Complete the sentences to describe the energy transfers which take place when the gates are opened.

Use words from the list.

tidal bay **kinetic** **gates** **gravitational potential**
open sea **turbines** **water**

gravitational potential energy of the water in the tidal bay is transferred to kinetic energy in the rotating turbines. This energy is used in the generator to produce electrical power. [3]

(b) State **one** advantage and **one** disadvantage of tidal power as an energy resource.

advantage Its renewable

disadvantage Not available all day.

[2]

(c) State the **main** source of energy for tidal energy.

Moon - gravitation attraction of the sea water by the moon. [1]

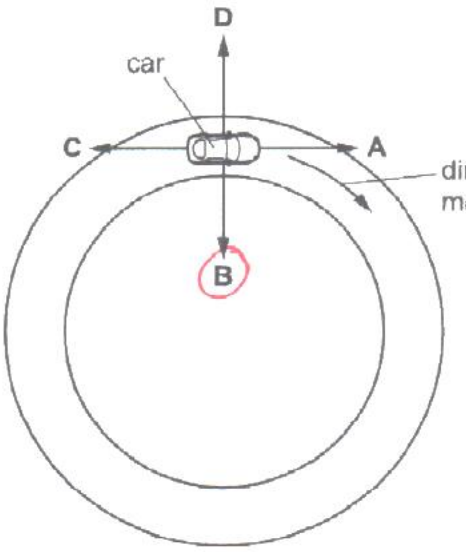
[Total: 6]

Forces – 2022 November IGCSE 0625

1. Nov/2022/Paper_21/No.6

A car is travelling around a circular track at a constant speed, as shown.

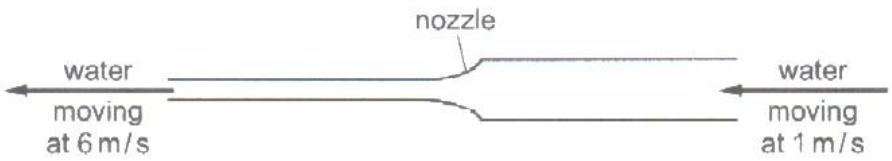
In which direction is the resultant force on the car?



Resultant force is always directed to the centre of a circular motion.

2. Nov/2022/Paper_21/No.7

The diagram shows part of a hose used by a firefighter.



NOT TO SCALE

15 kg of water flows through the hose each second.

Which force is applied to the hose by the water?

A 15 N B 75 N ✓ C 90 N D 105 N

$m = 15\ kg$
$v = 6\ m/s$
$u = 1\ m/s$
$t = 1\ s$

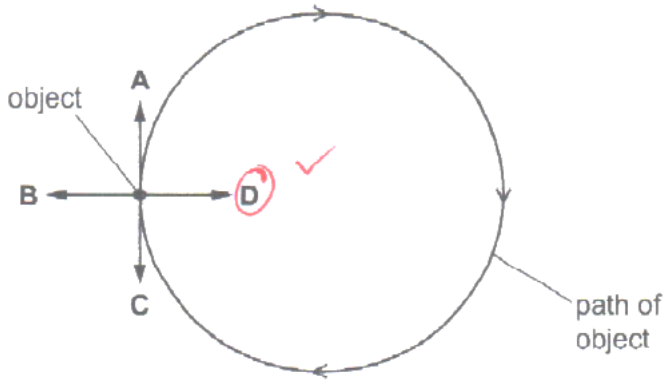
$$f = \frac{mv - mu}{t}$$
$$= \frac{(15 \times 6) - (15 \times 1)}{1}$$
$$= \frac{90 - 15}{1}$$
$$= 75\ N$$

3. Nov/2022/Paper_22,23/No.6

The diagram shows an object moving at a constant speed in a circular path in the direction shown.

A force acts on the object to keep it in the circular path.

In which labelled direction does this force act, when the object is in the position shown?



Resultant force always directed at the centre of circular motion

4. Nov/2022/Paper_32/No.1(b)

(b) The weight of the skydiver is 750 N.

The weight of the skydiver acts downwards, as shown in Fig. 1.4.

While the skydiver is falling, another force acts upwards.

The upward force varies as the skydiver falls.

Fig. 1.4 (not to scale)

(i) On Fig. 1.4, write the name of the upward force on the dotted line above the upward force. [1]

(ii) Suggest a value for the upward force on the skydiver at time = 10 s.

air resistance is less than weight

600 ..... N [1]

(iii) Determine the value of the upward force on the skydiver at time = 30 s.

Has reached terminal velocity, so weight = air resistance.

750 ..... N [1]

5. Nov/2022/Paper_41/No.2

A force is a vector quantity.

(a) (i) State **two** features of a vector quantity.

1. Has direction

2. Has magnitude

[2]

(ii) State the names of **two** other quantities that are vectors.

1. Velocity

2. Acceleration, momentum, displacement etc.

[2]

(b) A student suspends a spring from a clamp stand and measures the length l_0 of the spring.

Fig. 2.1 shows the apparatus.

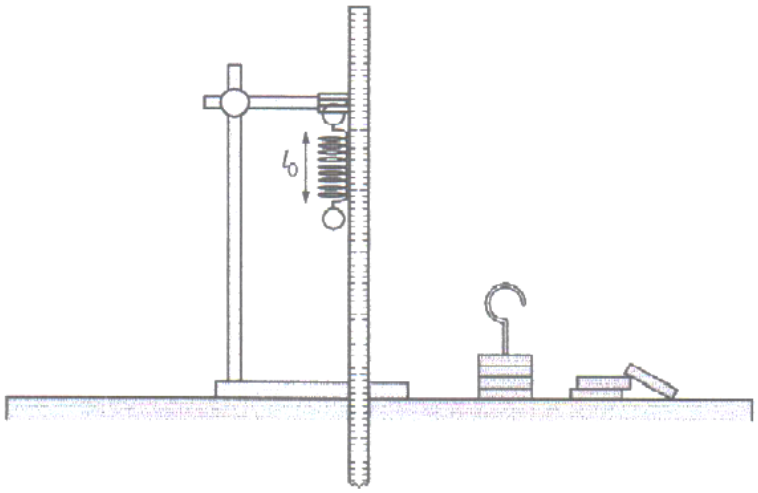


Fig. 2.1 (not to scale)

The student then suspends loads of different weights from the spring and measures the length of the spring for each load. He then plots a graph of the length of the spring against weight.

Fig. 2.2 is the graph that the student plots.

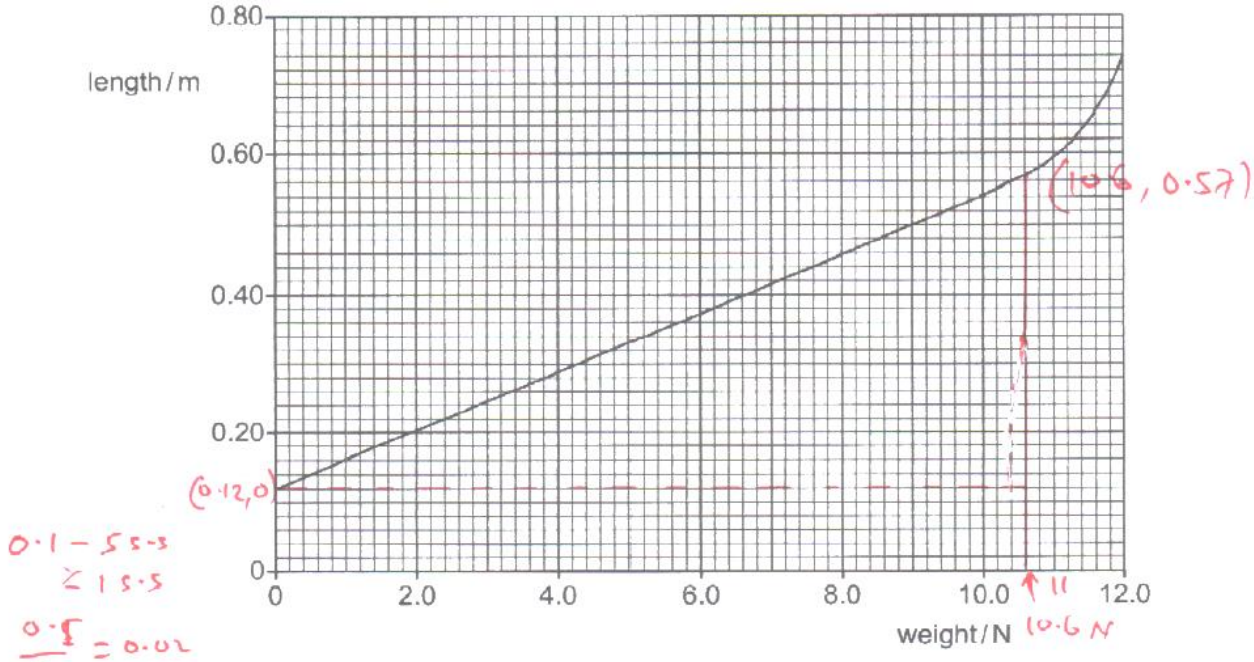


Fig. 2.2

(i) Using Fig. 2.2, determine the initial length l_0 of the spring.

l_0 = ... 0.12 m ..... [1]

(ii) State what is meant by the limit of proportionality and, using Fig. 2.2, determine the weight of the load that causes this spring just to reach the limit of proportionality.

limit of proportionality ..... is the point on the graph up to which extension of spring is directly proportional to the load. .....

weight = ... 10.6 N .....

[2]

(iii) Using Fig. 2.2, determine the spring constant of this spring.

$F = kx$

$k = \frac{F}{x} = \frac{1}{\text{gradient}}$

F is on X-axis
x is on Y-axis

$= \frac{10.6 - 0}{0.57 - 0.12}$

$= \frac{10.6}{0.45}$

$= 23.5$

≈ 24 N/m

spring constant = ... 24 N/m ..... [3]

[Total: 10]

6. Nov/2022/Paper_43/No.1(b)

(b) (i) Calculate the average acceleration of the aeroplane between $t = 0$ and $t = 35$ s.

$\frac{72-0}{35-0} = \frac{72}{35} = 2.1 \text{ m/s}^2$

acceleration = ... 2.1 m/s² ..... [1]

(ii) The combined mass of the aeroplane, its passengers and its fuel on take-off is 1.1×10^5 kg.

Calculate the average resultant force on the aeroplane between $t = 0$ and $t = 35$ s.

$F = m \times a$

$= 1.1 \times 10^5 \times 2.1$

$= 231,000 \text{ N}$

$\approx 230,000 \text{ N}$ (2 s.f)

$\approx 230 \text{ kN}$

force = ... 230 kN . ..... [2]

(iii) The force provided by the engines of the aeroplane is constant.

Give **one** possible explanation for the change in acceleration of the aeroplane between $t = 0$ and $t = 35$ s.

Acceleration is highest at the start but due to air resistance increase, it decreases with time.

[1]

(iv) On Fig. 1.2, sketch a graph to show how the acceleration of the aircraft varies between $t = 0$ and $t = 35$ s.

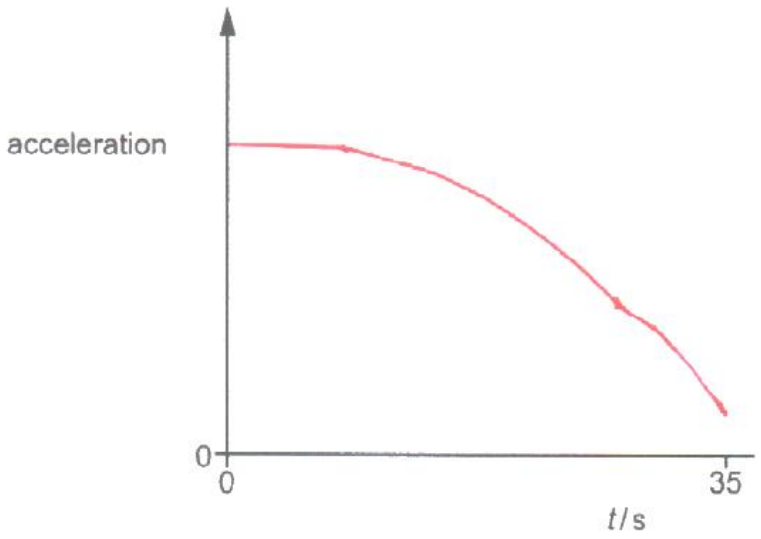


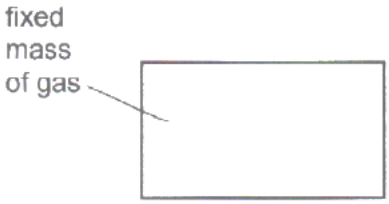
Fig. 1.2

[3]

Kinetic Molecular of Matter – 2022 November IGCSE

1. Nov/2022/Paper_21/No.12

A fixed mass of gas is trapped in a container. The temperature of the gas is increased but the volume of the gas is kept constant.



How does this change affect the average kinetic energy of the molecules and the pressure on the walls of the container?

	average kinetic energy	pressure
A ✓	increases ✓	increases ✓
B	stays the same	increases
C	increases ✓	decreases
D	decreases	increases

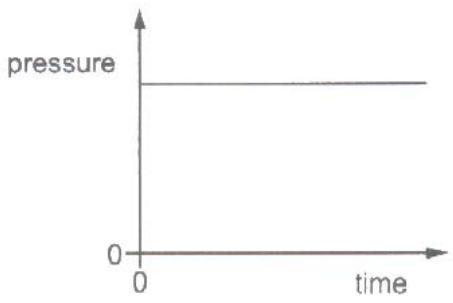
- Increase in temp increases the speed of molecules and their K-E
- There is more frequent collision per unit time hence pressure of gas increases.

2. Nov/2022/Paper_23/No.12

The pressure of a fixed mass of gas in a cylinder is measured. The volume of the gas in the cylinder is slowly decreased. The temperature of the gas does not change.

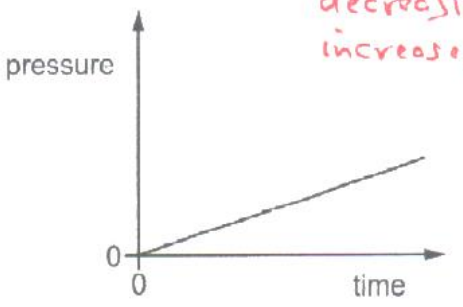
Which graph shows how the pressure of the gas changes during this process? $P \propto \frac{1}{V}$

A

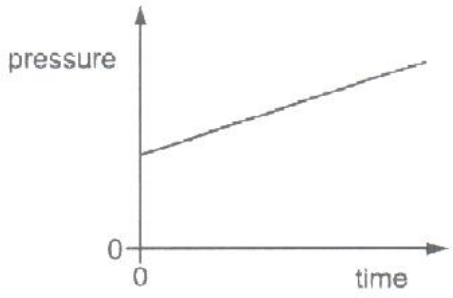


B

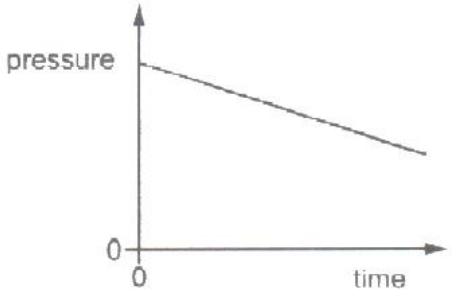
decreasing volume increases pressure



C ✓



D



3. Nov/2022/Paper_21/No.13

Which row correctly describes boiling and evaporation of water?

	boiling	evaporation
A	bubbles seen	occurs at surface only
B	bubbles seen	occurs throughout the water
C	no bubbles	occurs at surface only
D	no bubbles	occurs throughout the water

4. Nov/2022/Paper_22/No.13

Which change in the design of a liquid-in-glass thermometer makes it more sensitive?

A a larger liquid reservoir

B a longer tube

C a smaller liquid reservoir

D a wider tube

Sensitive means quick to detect slight change in temperature
- large bulb
- thin capillary

} make thermometer sensitive

5. Nov/2022/Paper_23/No.13

Which statement about evaporation is correct?

evaporation has a cooling effect

A A body in contact with an evaporating liquid loses thermal energy.

B A decrease in the surface area of an evaporating liquid increases the rate of evaporation.

C A wind over a liquid decreases the rate of evaporation.

D It is necessary to provide an external source of thermal energy to a liquid for it to evaporate.

6. Nov/2022/Paper_31/No.5(b)

(b) Some gas is trapped in a cylinder fitted with a moveable piston. Fig. 5.2 shows the arrangement.

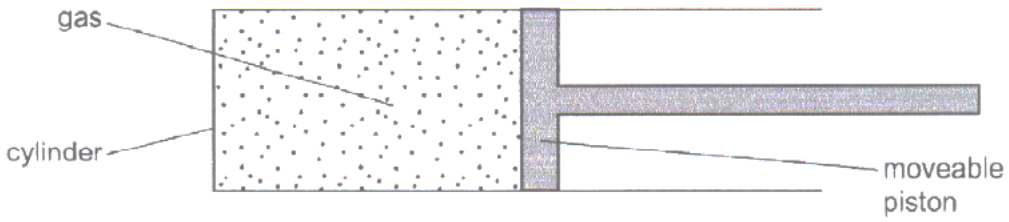


Fig. 5.2

(i) Describe how the gas exerts a pressure on the cylinder.

Use your ideas about molecules.

- Moving air molecules collide with cylinder wall.
- This creates force. Force per unit area cause pressure [2]

(ii) The piston moves and increases the volume occupied by the gas. The temperature of the gas remains constant. Fig. 5.3 shows the new position of the piston.

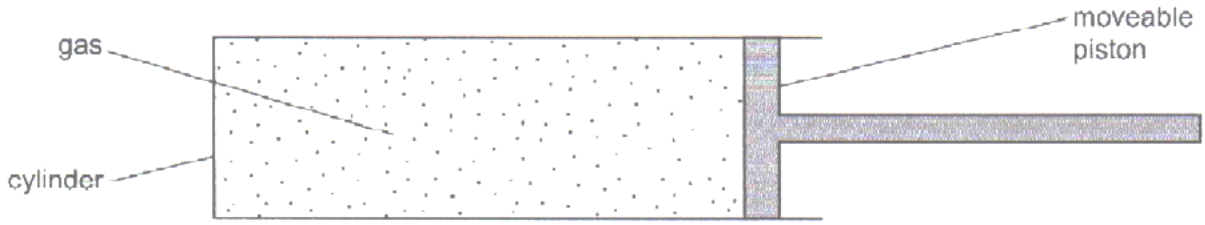


Fig. 5.3

State and explain what happens to the pressure of the gas on the cylinder.

- Pressure decreases because there are fewer collision with cylinder wall when volume is larger [2]

7. Nov/2022/Paper_32/No.4(a)

Fig. 4.1 shows students walking to school. There are puddles of water on the ground.

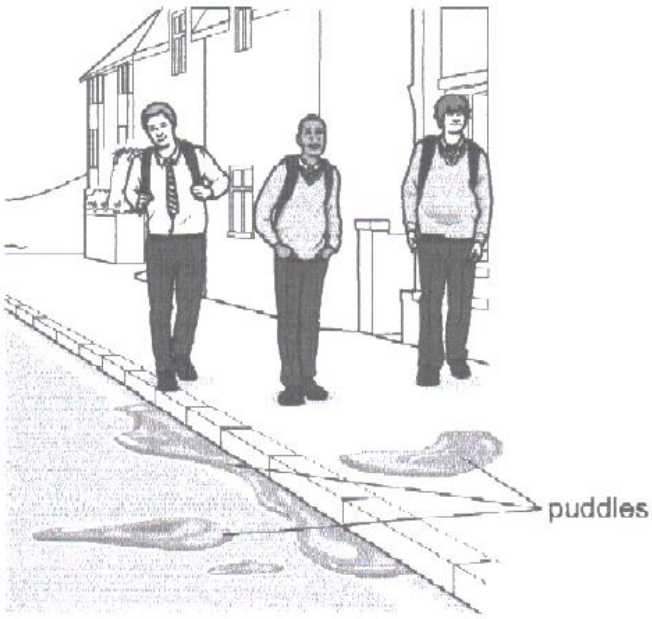


Fig. 4.1

After school, the puddles have disappeared and the ground is dry.

(a) (i) State the name of the process that causes the puddles to disappear.

Evaporation ..... [1]

(ii) Describe the process that causes the puddles to disappear.
Use your ideas about molecules.

More energetic water molecules at the surface escape from liquid into gas by overcoming attractive forces between water molecules. [3]

8. Nov/2022/Paper_33/No.4(c)

(c) Describe the arrangement and movement of the molecules in a solid and in a gas. Write your answer in Table 4.1.

Table 4.1

	solid	gas
arrangement of molecules	regular and close together	Irregular and random and far apart.
movement of molecules	vibrate in fixed positions	move fast in random manner

[4]

9. Nov/2022/Paper_41/No.4(c, d)

(c) When the temperature reaches –18 °C, the pressure of the gas in the cylinder is still equal to that of the atmosphere.

Explain, in terms of the particles of the gas, how the pressure remains equal to its original value.

- As the temperature decreases, particles slow down and so collide with cylinder wall less hard.
- Since the volume also decreases, the particles collide with the wall more frequently.
- These two efforts cancel each other and so pressure remain unchanged. [3]

(d) As the temperature of the metal cylinder decreases, the volume of the metal decreases. The decrease in the volume of the metal is much less than the decrease in the volume of the gas.

Explain, in terms of the particles of the metal, why the decrease in the volume of the metal is less than that of the gas.

- In metal, the particles are already touching compared to those of a gas particle.
- So decrease in distance between particles in the metal is very small, hence volume of the metal decreases very little as temperature decreases. [2]

[Total: 11]

Light – 2022 November IGCSE 0625

1. Nov/2022/Paper_23/No.20

An object is placed 30 cm in front of a plane mirror.

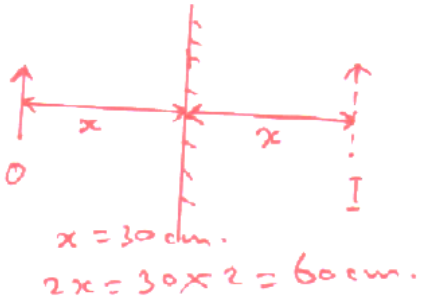
Which statement describes the image of the object?

A The image is the same size and 30 cm from the object.

B The image is the same size and 60 cm from the object. ✓

C The image is smaller and 30 cm from the object.

D The image is smaller and 60 cm from the object.

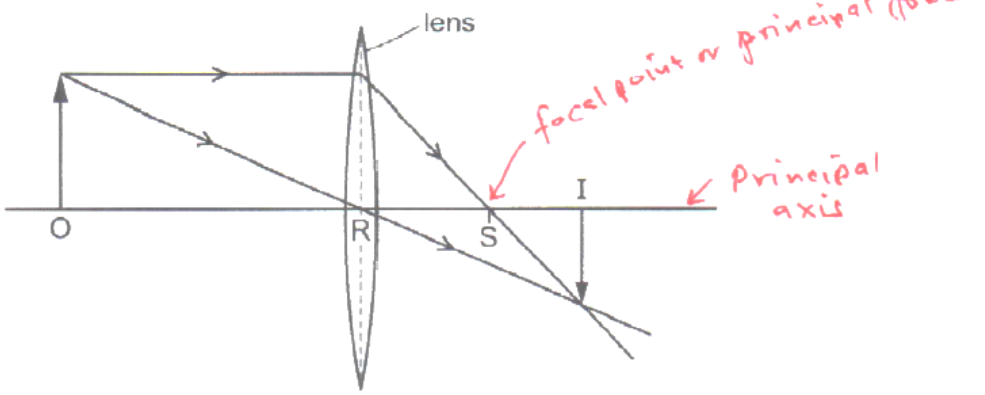


$x = 30$ cm.

$2x = 30 \times 2 = 60$ cm.

2. Nov/2022/Paper_23/No.21

The diagram shows the action of a thin converging lens on two rays of light. The rays are from the top of an object O. An inverted image I is formed.



Which name is given to the distance RS?

A principal axis

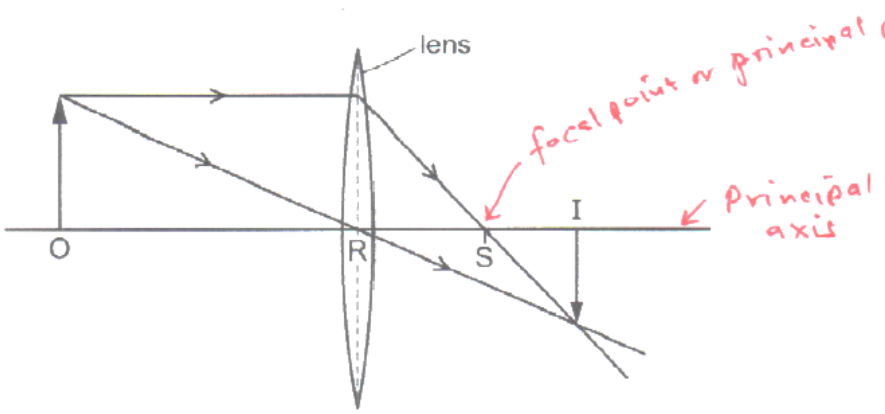
B principal focus – this is at S

C focal length ✓

D real length

3. Nov/2022/Paper_21/No.19

The diagram shows the action of a thin converging lens on two rays of light. The rays are from the top of an object O. An inverted image I is formed.



Which name is given to the distance RS?

A principal axis

B principal focus – this is at S

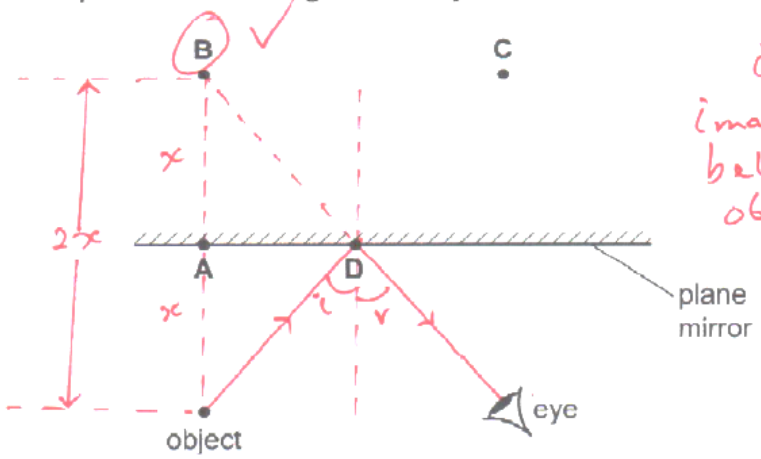
C focal length ✓

D real length

4. Nov/2022/Paper_21/No.20

The diagram shows an object in front of a plane mirror.

At which labelled position is the image of the object formed?



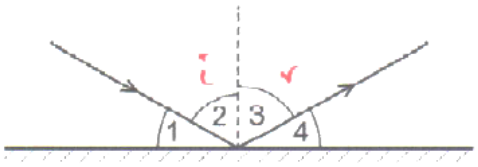
i = r

image is same distance behind mirror as object is infront of mirror.

5. Nov/2022/Paper_21/No.21

A ray of light is shone onto the surface of a mirror.

$2x = 30 \times 2 = 60\,cm.$



i is between normal and incident ray

r is between normal and reflected ray.

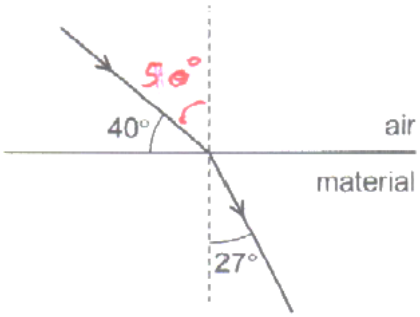
Which two angles represent the angle of incidence and the angle of reflection?

A 1 and 2 **B** 1 and 4 **C** 2 and 3 ✓ **D** 3 and 4

6. Nov/2022/Paper_22/No.19

A ray of light travels from air into a material, as shown.

$90 - 40 = 50°$



What is the refractive index of the material?

A 1.4 **B** 1.5 **C** 1.7 ✓ **D** 1.9

$n = \frac{\sin i}{\sin r}$

$= \frac{\sin 50°}{\sin 27°}$

$= 1.68$

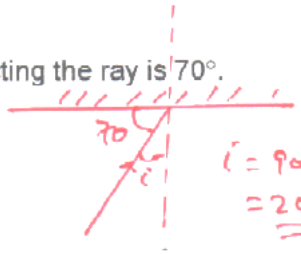
≈ 1.7 (2 s.f)

7. Nov/2022/Paper_22/No.21

The angle between an incident ray and the surface of a plane mirror reflecting the ray is 70°.

What is the angle of incidence?

A 20° ✓ **B** 40° **C** 70° **D** 140°



$i = 90 - 70$

$= 20°$

8. Nov/2022/Paper_22/No.23

An object is reflected in a plane mirror.

Which description of the image is correct?

A diminished and real

B enlarged and virtual

C same size and real

D same size and virtual

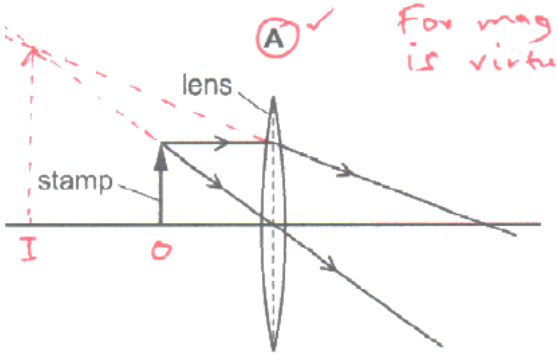
Image in plane mirror
1. Virtual – cannot be formed on screen
2. Same size as object.
3. Same distance behind mirror as object is infront
4. Laterally inverted

9. Nov/2022/Paper_23/No.19

A person uses a magnifying glass to look at a stamp.

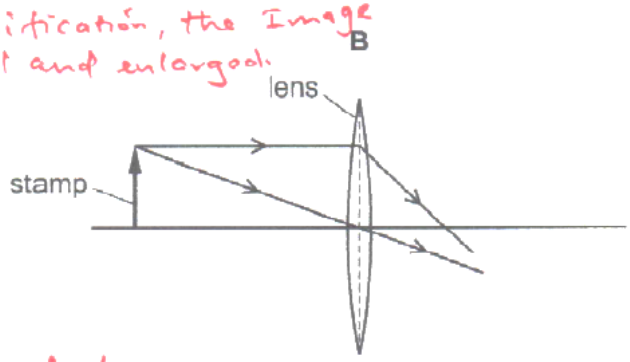
Which ray diagram shows a thin converging lens being used to do this?

A



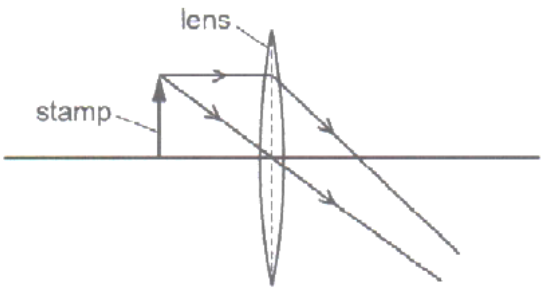
For magnification, the Image is virtual and enlarged.

B

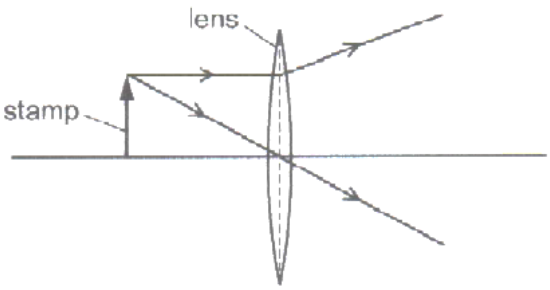


The image and object are in same side of the lens.

C



D



10. Nov/2022/Paper_32/No.6

(a) Fig. 6.1 shows a ray of light striking a plane mirror.

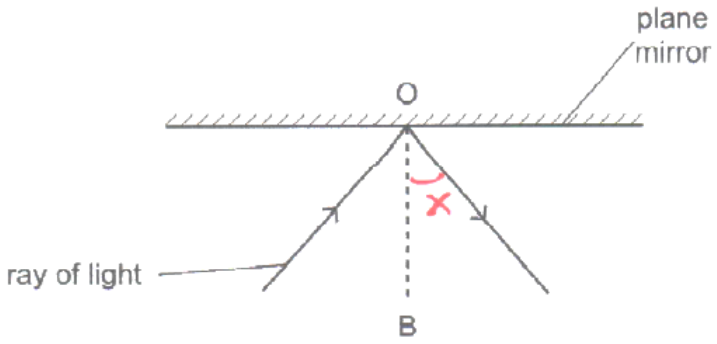


Fig. 6.1

(i) State the name of the dashed line OB in Fig. 6.1.

Normal line ..... [1]

(ii) On Fig. 6.1, indicate the angle of reflection by drawing an X. [1]

(iii) State the law of reflection.

angle of incidence = angle of reflection ..... [1]

(b) A candle is placed in front of a plane mirror. An image of the candle is formed in the mirror.

Circle the words from the list that describe the image of the candle.

enlarged **diminished** **same size** **upside-down** **upright** [2]

(c) Fig. 6.2 shows a ray of red light striking one side of a glass prism.

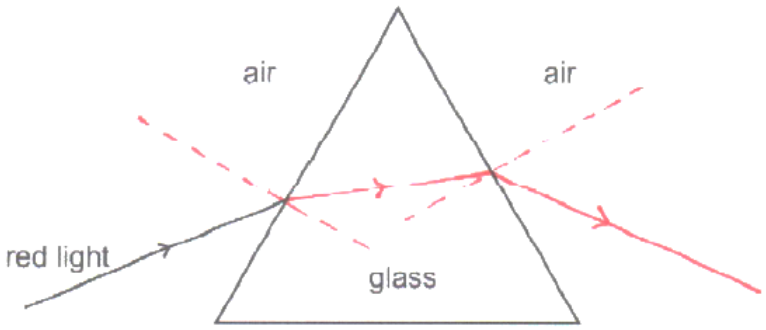


Fig. 6.2

(i) On Fig. 6.2, draw a line to indicate the path of the red light travelling through the glass prism and emerging into the air. [2]

(ii) Explain why the red light follows the path you have drawn in **(c)(i)**.

It undergoes refraction at the interfaces of the glass prism and air. ..... [1]

[Total: 8]

11. Nov/2022/Paper_33/No.5

(a) A student shines a ray of red light towards a large glass prism, as shown in Fig. 5.1.
The angles of the prism are 45°, 90° and 45°.
The critical angle for the glass is 42°.

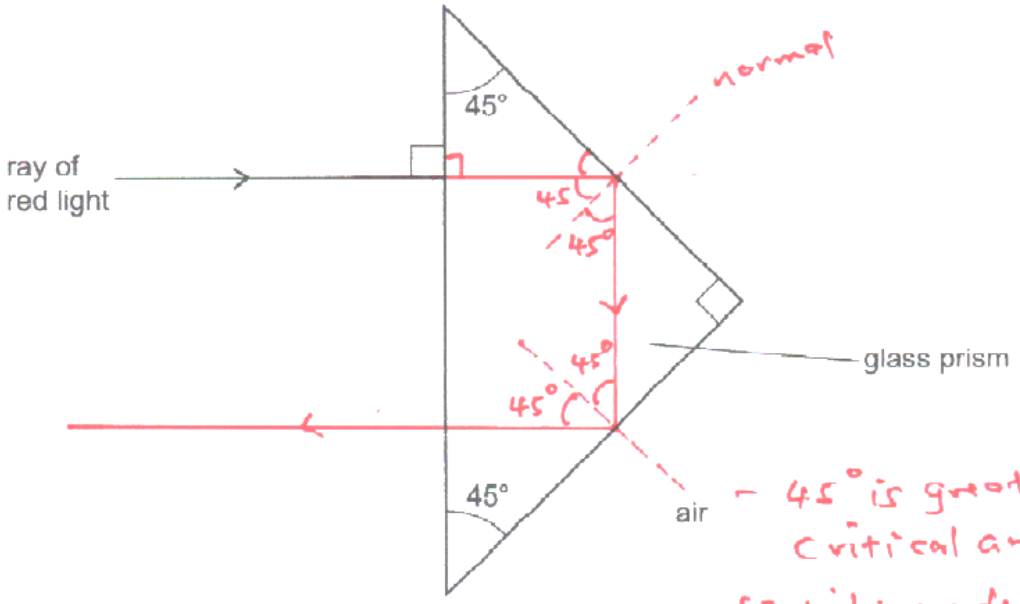


Fig. 5.1

On Fig. 5.1:

(i) continue the path of the ray in the glass prism to a boundary between glass and air [1]

(ii) draw and label the normal at the point your ray hits the boundary between glass and air [1]

(iii) continue your ray until it emerges into the air. [2]

(b) The spectrum of visible light is made up of seven colours.

Fig. 5.2 shows a partially completed spectrum for visible light. ROYGBIV

red	orange	yellow	green	blue	indigo	violet
←						

Fig. 5.2

(i) On Fig. 5.2, write the names of the missing colours. [2]

(ii) State the property of visible light that increases in the direction of the arrow in Fig. 5.2.

Wavelength. [1]

[Total: 7]

12. Nov/2022/Paper_33/No.6

A vertical arrow O is used as an object for a converging lens.

Fig. 6.1 shows a ray of light from the object passing through the lens.

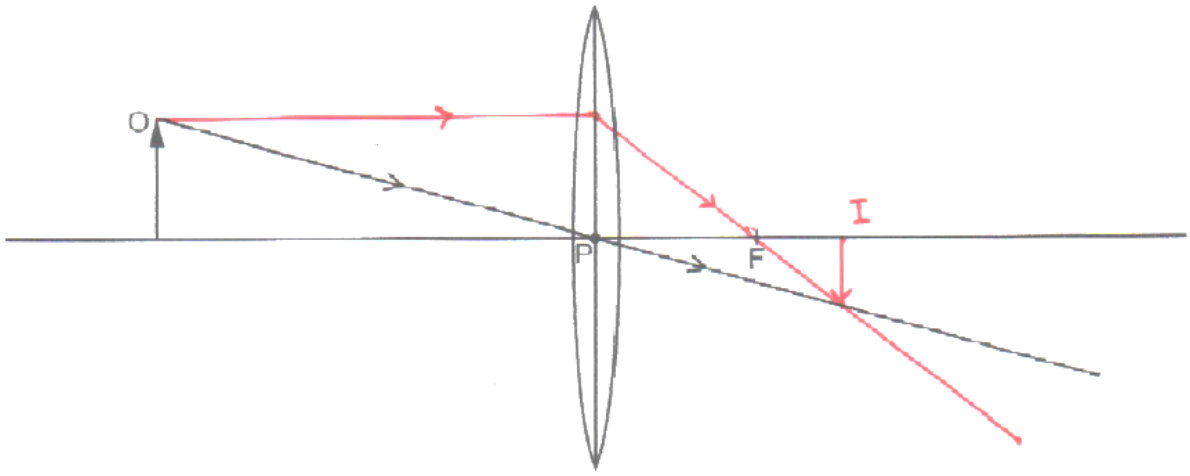


Fig. 6.1

The point labelled F is a principal focus of the lens.

(a) State the name of the distance labelled PF on Fig. 6.1.

focal length ..... [1]

(b) On Fig. 6.1, draw another ray that enables you to locate the image of O. [2]

(c) Draw an arrow to indicate the image. Label the image I. [1]

(d) Circle **two** words from the list which describe the image I.

enlarged **diminished** **same size** **inverted** **upright**

[2]

[Total: 6]

13. Nov/2022/Paper_41/No.6

The red light produced by a laser is monochromatic.

(a) State what is meant by monochromatic.

Light of single frequency (or wavelength)
eg red light has one one frequency. [1]

(b) The red light from the laser hits the curved surface of a semicircular transparent plastic block at point P and passes into the plastic.

The red light travels through the plastic and hits the straight edge of the block at its midpoint M. Fig. 6.1 shows that some of the light is reflected and that some light travels in the air along the straight edge of the plastic block.

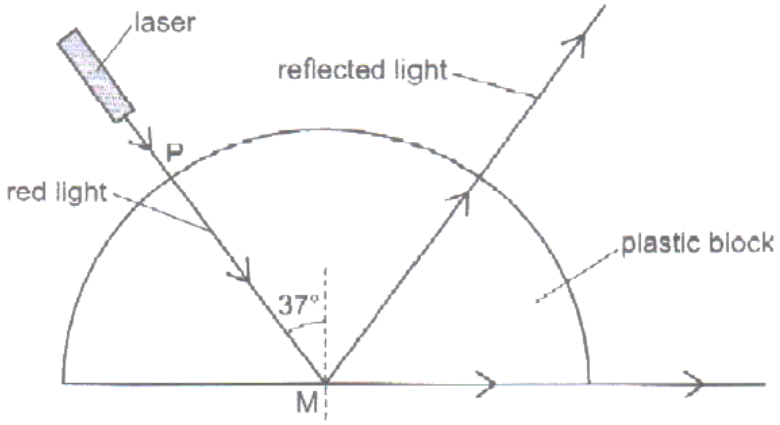


Fig. 6.1

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

(i) Explain why the red light does **not** change direction as it enters the plastic block.

- It enters at incidence angle of 0°
- So it does not get refracted. [2]

(ii) At M, the angle between the red light in the plastic and the normal is 37°.

Calculate the speed of the red light in the plastic.

37° is critical angle, c

$n = \frac{1}{\sin c}$

$n = \frac{1}{\sin 37°}$

$= 1.66$

$\simeq 1.7$ (2 s.f)

$n = \frac{\text{Speed in vacuum } v_c}{\text{Speed in plastic, } v_p}$

$v_p = \frac{v_c}{n} = \frac{3.0 \times 10^8}{1.7}$

$= 1.76 \times 10^8$ m/s

speed = 1.8×10^8 m/s [4]

(iii) In the plastic, blue light travels slightly slower than red light and so the critical angle for blue light is smaller than the critical angle for red light.

The laser that emits red light is replaced by one that emits blue light. Now blue light enters the block at P and hits the straight edge at M.

Explain what happens to the blue light after it hits the straight edge at M.

- Since critical angle of blue light is less than 37°
- So at 37° incidence angle will be greater than critical angle of blue light.
- Hence it will be totally internally reflected. [3]

[Total: 10]

- No blue light leaves the block at point M.

14. Nov/2022/Paper_42/No.6

(a) Fig. 6.1 shows a converging lens and an object OX. The focuses of the lens are labelled F.

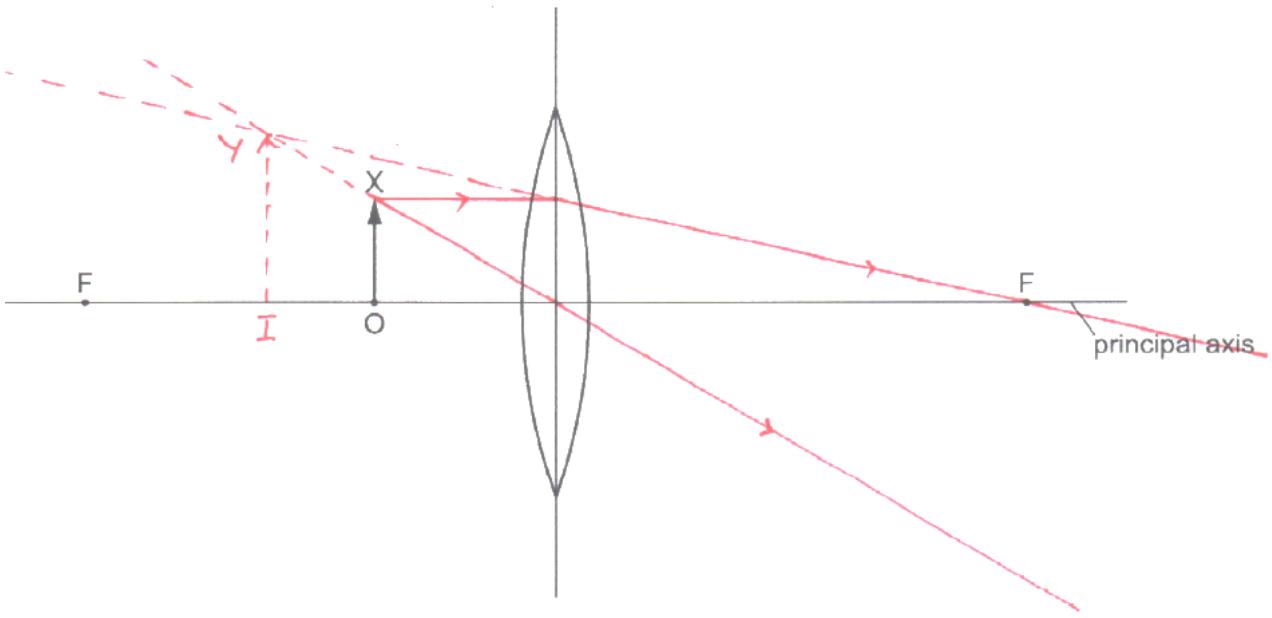


Fig. 6.1

(i) On Fig. 6.1, carefully draw **two** rays from X which locate the image of the object. Draw the image and label it IY.

Measure the distance from IY along the principal axis to the centre line of the lens.

distance = 4.0 cm. [4]

(ii) State **two** reasons why the image IY is virtual.

1. Actual rays do not meet at image.
2. Object and image are on same side of the lens [2]

(b) Fig. 6.2 shows a ray of green light passing into, through and out of a glass prism.

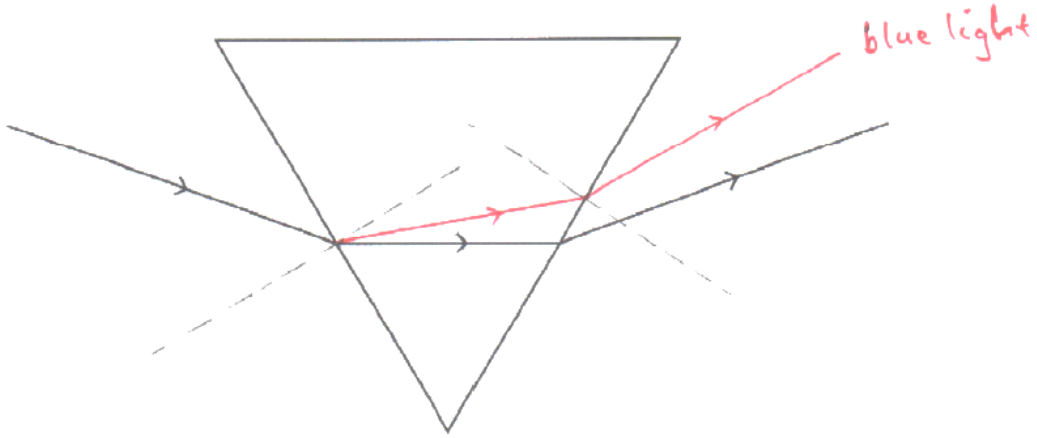


Fig. 6.2

A ray of blue light is incident on the prism on the same path as the incident ray of green light.

On Fig. 6.2, draw the path of the blue light through and out of the prism. [3]

[Total: 9]

ROYGBIV

↑

- blue light has smaller wavelength than green light
- So it bend more to the normal inside the prism and bend away more from normal as it exits the prism than the green light.

15. Nov/2022/Paper_43/No.7

(a) State what is meant by total internal reflection.

Occurs at boundary when light travels from a more to less dense medium at incidence angle greater than critical angle. [2]

(b) Fig. 7.1 shows a ray of light from a light source in a tank containing a liquid.

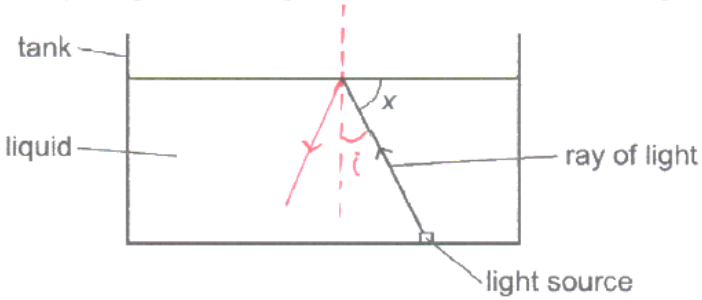


Fig. 7.1

i = incidence angle

x = 90 - i

The ray of light strikes the surface of the liquid at an angle *x*.

(i) The refractive index of the liquid is 1.5.

Calculate the largest value of *x* for which total internal reflection can occur.

$n = \frac{1}{\sin c}$

$\sin c = \frac{1}{n}$

$c = \sin^{-1}\left(\frac{1}{1.5}\right)$

$= 41.8$

$\simeq 42^\circ$

$\therefore x = 90^\circ - 42^\circ$

$= 48^\circ$

$x =$ 48° [3]

(ii) The speed of light in air is 3.0×10^8 m/s.

Calculate the speed of light in the liquid.

$n = \frac{\text{Speed in air}}{\text{Speed in liquid}}$

$\therefore \text{Speed in liquid} = \frac{\text{Speed in air}}{n}$

$\text{Speed in liquid} = \frac{3.0 \times 10^8 \text{ m/s}}{1.5}$

$= 2.0 \times 10^8$ m/s

speed = 2.0×10^8 m/s. [2]

[Total: 7]

Magnetism – 2022 November IGCSE 0625

1. Nov/2022/Paper_21/No.25

Which statement is **not** a method for magnetising an iron bar?

A Place the bar next to a magnet and hammer the bar. ✓

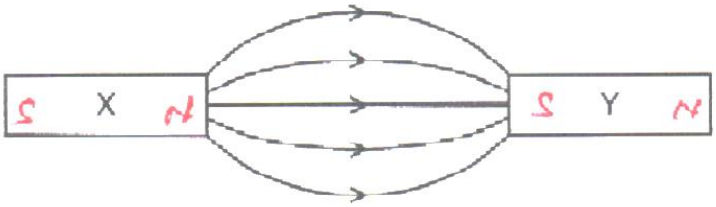
B Place the bar inside a solenoid. Switch on an alternating current (a.c.) in the coil and gradually reduce the current. ✗

C Place the bar inside a solenoid. Switch on a direct current (d.c.) in the coil and gradually reduce the current. ✓

D Stroke the bar repeatedly with a magnet. ✓

2. Nov/2022/Paper_22/No.25

Two magnets X and Y are placed end to end on a bench. The diagram shows the magnetic field pattern between the poles of the magnets.



Which row shows the direction of the forces exerted on X and Y by the magnetic field?

	force on X	force on Y
A	→	→
B	→	← ✓
C	←	→
D	←	←

X attracts Y

Y attracts X

unlike poles of magnet attract.

3. Nov/2022/Paper_23/No.25

A student is to demagnetise a bar magnet. She tries four different ways.

1 hammering the magnet

2 heating the magnet

3 passing direct current through the magnet

4 placing the magnet in water

Which methods will demagnetise the magnet?

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

Methods of demagnetising

1. Heating magnet
2. Hammering magnet along East-west direction
3. Placing the magnet in a coil with a.c current.

4. Nov/2022/Paper_31/No.7

Fig. 7.1 shows an arrangement that can produce a magnet.

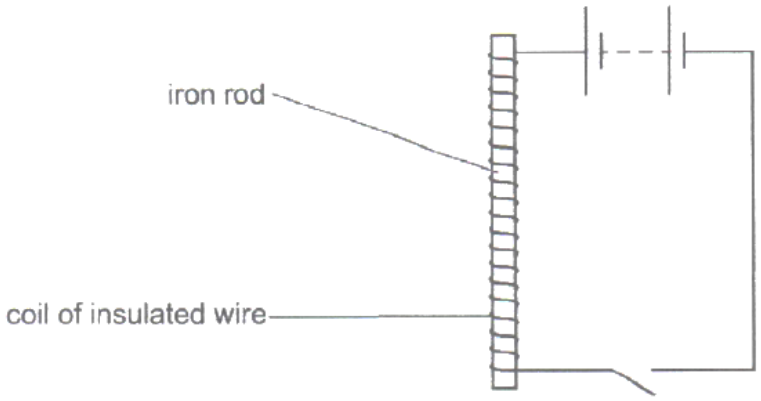


Fig. 7.1

(a) (i) State the name given to the type of magnet in Fig. 7.1.

Electromagnet ..... [1]

(ii) Suggest an advantage of this type of magnet in comparison with other types of magnet.

- It can be switched on and off
- Its strength can be varied ..... [1]

(iii) State **two** ways of increasing the strength of the magnet in Fig. 7.1.

1. Increase current ..... [1]
2. increase the number of turns ..... [1]

(iv) Suggest **one** use for this type of magnet.

used in loudspeakers ..... [1]

(b) (i) Compare the effect of using a steel rod instead of an iron rod in the arrangement in Fig. 7.1.
The steel rod is the same size as the iron rod.

Steel will get permanently magnetised .....

..... [1]

(ii) Compare the effect of using a copper rod instead of an iron rod in the arrangement in Fig. 7.1.
The copper rod is the same size as the iron rod.

- Copper is not magnetic material, so the strength of electromagnet will reduce. ..... [1]

[Total: 7]

5. Nov/2022/Paper_42/No.7

This question is about the magnetic fields around bar magnets. Fig. 7.1 shows two positions used by a student doing an experiment.

Fig. 7.1

(a) Fig. 7.2 shows a magnet, labelled magnet 1, placed on position 1.

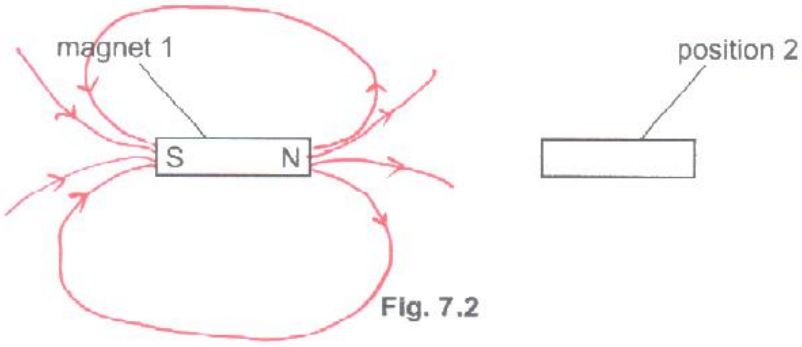


Fig. 7.2

On Fig. 7.2, draw lines to show the pattern of the magnetic field produced by magnet 1. Place arrows on the lines to show the direction of the field. [3]

(b) Magnet 1 is removed from position 1. Fig. 7.3 shows another magnet, labelled magnet 2, placed on position 2.

Fig. 7.3

On Fig. 7.3, draw, at the right-hand end of position 1, a line with an arrow to show the direction of the magnetic field produced by magnet 2. [1]

(c) Fig. 7.4 shows magnet 1 placed on position 1 and magnet 2 placed on position 2.

Fig. 7.4

(i) State the direction of the force that the N pole of magnet 2 exerts on the N pole of magnet 1.

force will be the left side ..... [1]

(ii) Justify your answer to **(c)(i)**.

The force will be in the direction of magnetic field of the N-pole of magnet 2. ..... [1]

[Total: 6]

Mass and Weight – 2022 November IGCSE 0625

1. Nov/2022/Paper_21/No.3

Which property of an object is a consequence of the effect of a gravitational field acting on it?

A density — mass per unit volume.

B mass — quantity of matter in an object

C volume — amount of space occupied by object

(D) weight — is the pull of gravity on an object

2. Nov/2022/Paper_22/No.3

Which statement describes the relationship between mass and weight?

A Mass is the effect of a gravitational field on a weight. $W = m \times g$

B Mass is the effect of a magnetic field on a weight.

(C) Weight is the effect of a gravitational field on a mass. ✓

D Weight is the effect of a magnetic field on a mass.

3. Nov/2022/Paper_23/No.3

Which property of a body results from the effect of a gravitational field on its mass?

A the ability of the body to resist a change in motion — Inertia

B the density of the body — $\rho = \frac{m}{v}$; mass per unit volume

C the volume of the body — space occupied by object.

(D) the weight of the body ✓ weight is pull of gravity on object.

4. Nov/2022/Paper_31/No.4(a)

(a) A student has an object with a mass of 5.0 kg.

Calculate the weight of the object.

$m = 5.0\ kg$

$g = 10\ N/kg$

$W = m \times g$

$= 5 \times 10$

$= 50\ N$

weight of object = ... 50 ..... N [2]

5. Nov/2022/Paper_32/No.1(c)

(c) The weight of the skydiver is 750 N.

Calculate the mass of the skydiver.

$m = \frac{W}{g}$

$= \frac{750}{10}$

$= 75\,kg$

mass = 75 kg [3]

[Total: 12]

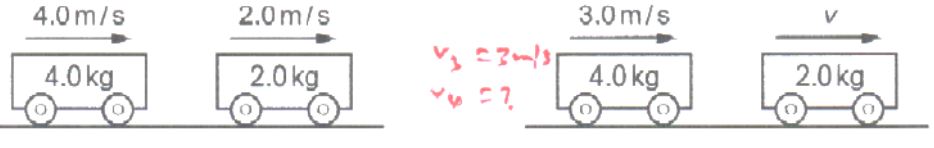
Momentum – 2022 November IGCSE 0625

1. Nov/2022/Paper_22/No.7

A trolley of mass 4.0 kg travelling with a velocity of 4.0 m/s collides with a trolley of mass 2.0 kg travelling with a velocity of 2.0 m/s in the same direction. After the collision, the velocity of the 4.0 kg trolley is reduced to 3.0 m/s.

$m_1v_1 + m_2v_2 = m_1v_3 + m_2v_4$

$m_1 = 4$ kg, $v_1 = 4$ m/s, $m_2 = 2$ kg, $v_2 = 2$ m/s



$v_3 = 3$ m/s, $v_4 = ?$

What is the velocity v of the 2.0 kg trolley after the collision?

$(4\times4) + (2\times2) = (4\times3) + 2\times v$

$16 + 4 = 12 + 2v$

$20 = 12 + 2v$

$2v = 20 - 12$

$2v = 8$

$v = 4$ m/s

A 0.25 m/s B 4.0 m/s ✓ C 5.0 m/s D 16 m/s

2. Nov/2022/Paper_23/No.7

A force F acts on a body of mass m for a time t. During this time, the velocity of the body increases from u to v.

Which equation relates F, m, t, u and v?

A $Fm = t(v - u)$

B $Fm = t(v + u)$

C $Ft = m(v - u)$ ✓

D $Ft = m(v + u)$

$F = \frac{mv - mu}{t}$

$F = \frac{m(v-u)}{t}$

$F \times t = m(v - u)$

3. Nov/2022/Paper_41/No.1(b)

(b) The mass of block A is 2.0 kg.

When the thread tightens, it pulls on block A which moves to the right at a speed of 0.60 m/s.

(I) Calculate the impulse exerted on block A as it accelerates from rest to 0.60 m/s.

$u = 0$
$v = 0.6$ m/s

Impulse $= \Delta p$

$= mv - mu$

$= m(v-u)$

$= 2.0 \times 0.6$

$= 1.2$ NS

impulse = 1.2 NS [3]

(II) Both of the blocks now move at a constant speed of 0.60 m/s until block B hits the ground and the thread becomes loose.

Explain the energy change that takes place in block A after block B stops moving.

- K.E of block A decreases due to friction.
- The K.E is turned to thermal energy as the block slows down. [3]

4. Nov/2022/Paper_43/No.2

Fig. 2.1 shows a tennis ball approaching a tennis racket.

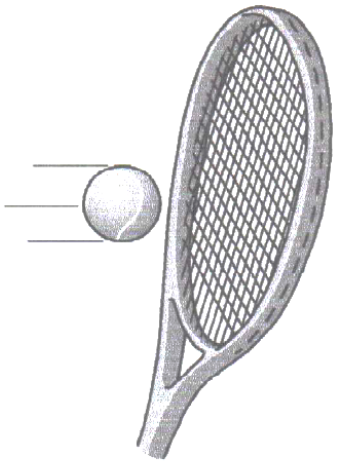


Fig. 2.1

The tennis ball hits the racket at a speed of 52 m/s. The average force on the ball during the time that it is in contact with the racket is 350 N. The speed of the ball after it leaves the racket is 26 m/s in the opposite direction to the initial speed of the ball. The mass of the ball is 58 g.

(a) (i) Calculate the change in momentum of the ball while it is in contact with the racket.

$\Delta p = mv - mu$

$= m(v - u)$

$= 0.058(-26 - 52)$

$= -4.524$ kg m/s

$\simeq 4.5$ kg m/s (25 ←)

change in momentum = ... [3]

(ii) State an equation which defines impulse in terms of force and time.

Impulse = force × time

..... [1]

(iii) Calculate the time that the racket is in contact with the ball.

Impulse = change in momentum

$Ft = 4.524$

$t = \frac{4.524}{F}$

$t = \frac{4.524}{350} = 0.0135$

time = ... [2]

(b) Calculate the difference between the values of the kinetic energy of the ball before and after the impact with the racket.

$\Delta K.E = \frac{1}{2} \times 0.058 \times 52^2 - \frac{1}{2} \times 0.058 \times 26^2$

$= \frac{1}{2} \times 0.058 (52^2 - 26^2)$

$= 58.812\ J$

$\approx 59\ J$

difference in kinetic energy = 59 J. [3]

[Total: 9]

Motion – 2022 November IGCSE 0625

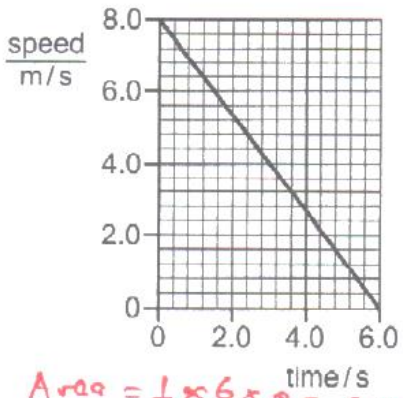
1. Nov/2022/Paper_22/No.2

The diagrams show speed–time graphs for four different bodies moving for 6.0 s.

Which body travelled the least distance?

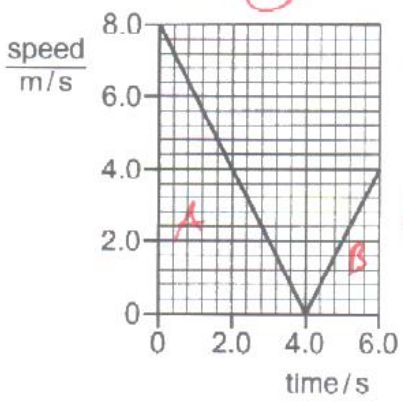
↑ area under graph

A



Area = $\frac{1}{2} \times 6 \times 8 = 24$ m

B ✓



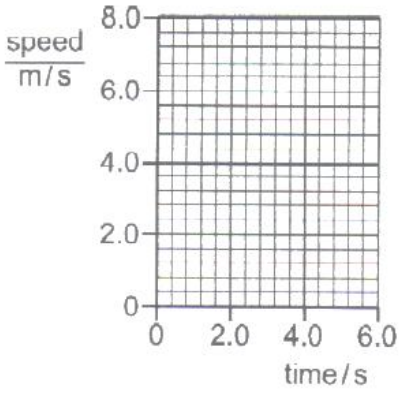
Area A
$= \frac{1}{2} \times 4 \times 8$
$= 16$

Area B
$= 2 \times 4 \times \frac{1}{2}$
$= 4$ m

Total area
$= 16 + 4$
$= 20$ m

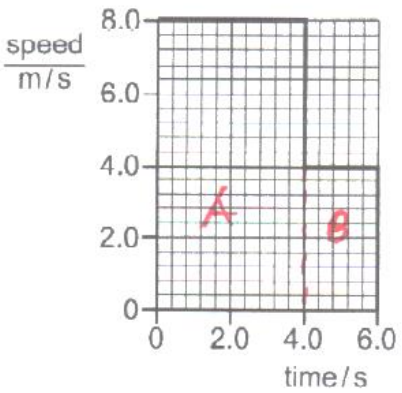
↑ least distance

C



Area = 6×8
$= 48$ m

D



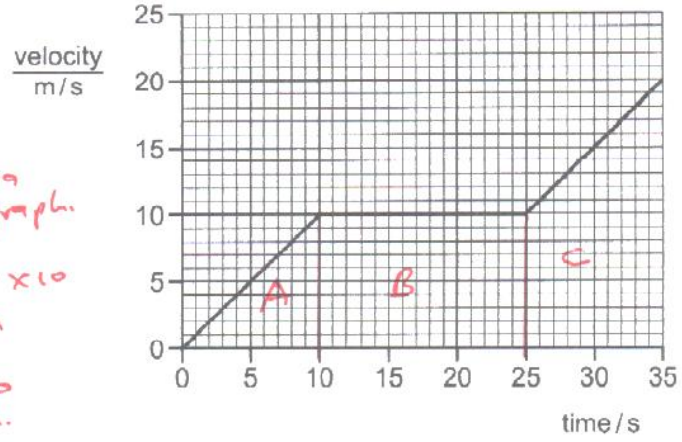
Area A $= 4 \times 8$
$= 32$

Area B $= 2 \times 4 = 8$

Total area $= 32 + 8$
$= 40$ m.

2. Nov/2022/Paper_23/No.2

2 The velocity–time graph for a car is shown.



distance is equal to area under the graph.

Area A = $\frac{1}{2}$ × 10 × 10
= 50 m

Area B = 15 × 10
= 150 m.

Area C = $\frac{1}{2}$ (10+20) × 10
= 150m

Total area
= 50 + 150 + 150
= 350 m

What is the distance travelled by the car in 35 s?

A 250 m B 350 m C 450 m D 700 m

3. Nov/2022/Paper_21/No.2

A car starts from rest.

The table shows the readings from its speedometer every 10 s.

time/s	0	10	20	30	40	50	60
speed / m/s	0	4	8	12	12	12	12

Which row describes the car's motion in the first 30 seconds and in the last 30 seconds?

	motion during first 30 s	motion during last 30 s
A	non-zero acceleration	at rest
B	zero acceleration	constant speed
C	zero acceleration	at rest
D	non-zero acceleration	constant speed

- 1st 30s the car is accelerating, speed is increasing
- Last 30s the speed remains same.

4. Nov/2022/Paper_31/No.2

Fig. 2.1 shows the horizontal forces acting on a car.

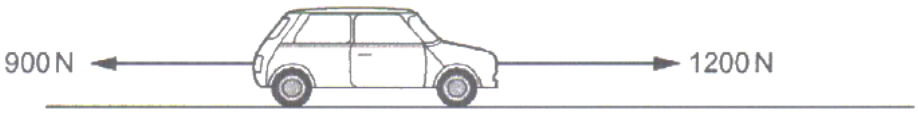


Fig. 2.1 (not to scale)

(a) Calculate the resultant horizontal force on the car.

R·F = 1200 − 900

= 300 N

size of force = ... 300 ..... N

direction ..... to the right .....

[3]

(b) A student uses a digital stop-watch to measure the time for the car to travel 100 m.

Fig. 2.2 shows the time reading on the stop-watch.

Fig. 2.2

(i) Using the information in Fig. 2.2, state the time taken to travel 100 m.

time to travel 100 m = ... 7·20 ..... s [1]

(ii) The car takes 12.8 s to travel the next 200 m.

Calculate the average speed of the car for this 200 m.

av. speed = $\frac{\text{Total distance}}{\text{total time}}$

= $\frac{200\text{ m}}{12.8\text{ s}}$

= 15.625

≈ 16 m/s

(2 s.f)

average speed = ... 16 ..... m/s [3]

5. Nov/2022/Paper_32/No.1(a)

(a) Using the information from Fig. 1.3:

(i) Describe the vertical motion of the skydiver between time = 0 and time = 20 s.

Accelevating ..... [1]

(ii) Determine the maximum vertical speed of the skydiver.

maximum speed = 50 m/s [1]

(iii) Determine the point, A, B, C, D or E, at which the skydiver opens her parachute.

C ..... [1]

(iv) Determine the distance the skydiver falls between time = 50 s and time = 80 s.

area under graph

Area = l x w

= 5 x (80 - 50)

= 5 x 30 = 150m distance = 150 m [3]

6. Nov/2022/Paper_33/No.1

Fig. 1.1 shows a tram. Trams carry passengers from one place to another.

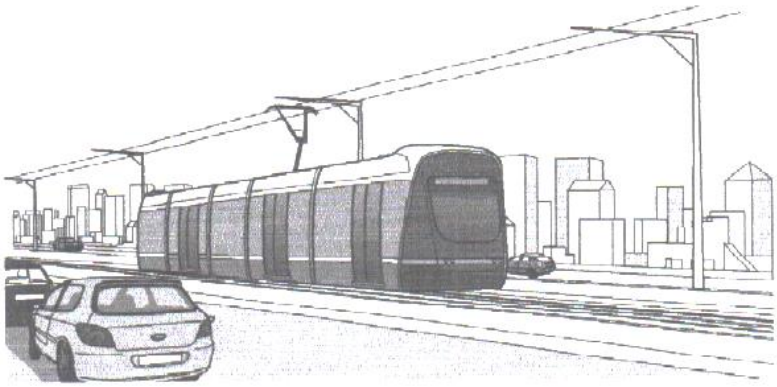


Fig. 1.1

A tram travels from A to E, stopping at B, C and D on the way.
Fig. 1.2 shows the speed–time graph for this tram journey.

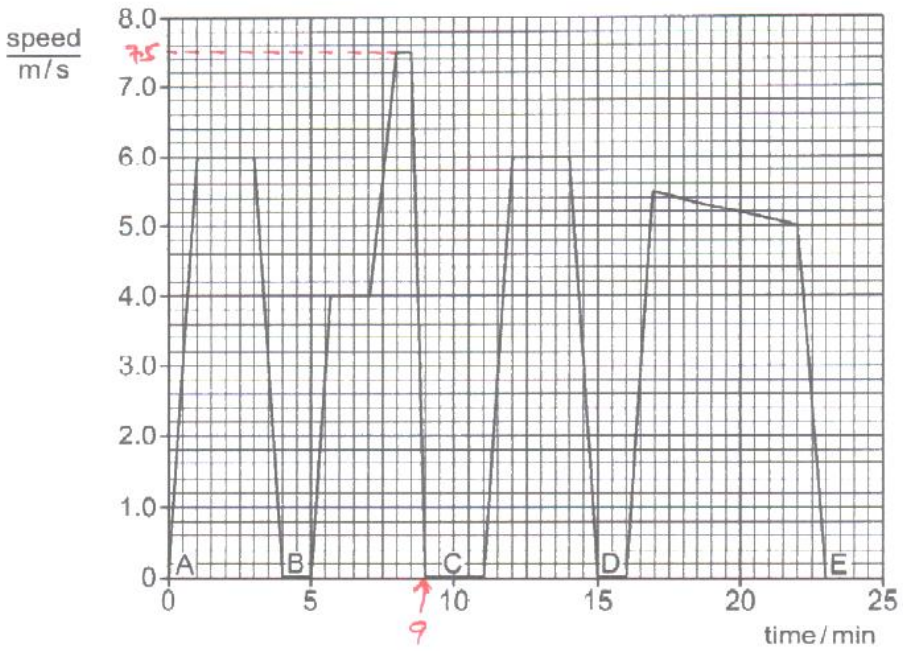


Fig. 1.2

(a) (i) Determine the time between the tram leaving A and arriving at C.

time = ... 9 ..... min [1]

(ii) Determine the maximum speed of the tram during the journey from A to E.

maximum speed = ... 7.5 ..... m/s [1]

(iii) The tram decelerates as it approaches each stop. Use information from Fig. 1.2 to identify the greatest deceleration. Give a reason for your answer.

Complete the sentence.

The greatest deceleration occurs as the tram approaches ..... C .

reason ..... The Slope at C is steepest .....

.....

[2]

(b) The total distance between A and E is 5200 m.
The tram takes 1380 s to travel from A to E.

Calculate the average speed of the tram between A and E.

$$\text{av. speed} = \frac{5200\ \text{m}}{1380\ \text{s}}$$

$$= 3.768$$

$$\simeq 3.8\ \text{m/s} \quad (2\ \text{s.f})$$

average speed = ... 3.8 ..... m/s [3]

[Total: 7]

7. Nov/2022/Paper_43/No.1(a)

An aeroplane accelerates along a horizontal runway before take-off.
The aeroplane accelerates for 35 s. The speed of the aeroplane when it takes off is 72 m/s.

Fig. 1.1 shows how the speed of the aeroplane varies between time $t = 0$ and $t = 35$ s.

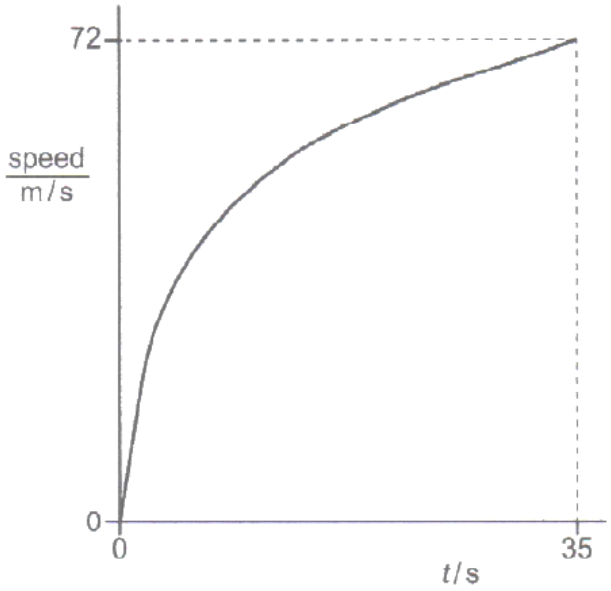


Fig. 1.1

(a) Define acceleration.

Change of velocity per unit time

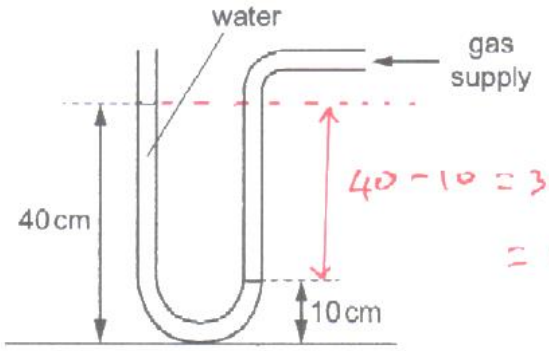
$a = \frac{v-u}{t}$

[1]

Pressure – 2022 November IGCSE 0625

1. Nov/2022/Paper_21/No.11

A manometer containing water is used to measure the pressure of a gas supply, as shown.



40 − 10 = 30 cm
= 0.30 m

The density of water is 1000 kg / m^3.

$P = \rho g h$ + atm pressure
= 1000 × 10 × 0.3 + atm
= 3000 Pa + atm pressure

What is the pressure of the gas supply?

A 300 Pa above atmospheric pressure

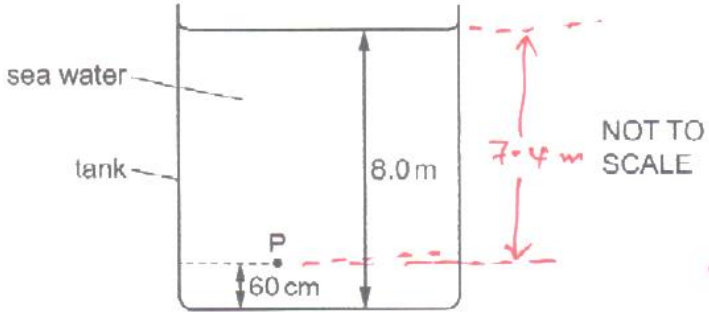
B 400 Pa above atmospheric pressure

C 3000 Pa above atmospheric pressure ✓

D 4000 Pa above atmospheric pressure

2. Nov/2022/Paper_22/No.11

The diagram shows a tank containing sea water.



8 − 0.6 = 7.4 m

The density of the sea water is 1020 kg / m^3.

✓ atm.

ρ = 1020 kg/m^3
g = 10 N/kg

What is the pressure at point P relative to atmospheric pressure?

$P = \rho g h$. h = 7.4 m.

A 7400 Pa above atmospheric pressure

B 7500 Pa above atmospheric pressure

C 75 000 Pa above atmospheric pressure ✓

D 82 000 Pa above atmospheric pressure

$P_{at\ P}$ = 1020 × 10 × 7.4 + atm pressure
= 75480 + atm pressure
≈ 75000 above atm. pressure.

3. Nov/2022/Paper_23/No.11

The speed of light in a vacuum is 3.0×10^8 m/s.

Which value is closest to the speed of light in air?

A 3.0×10^2 m/s

B 3.0×10^4 m/s

C 3.0×10^6 m/s

D 3.0×10^8 m/s ✓

Speed of light in vacuum is equal to speed of light in air.

4. Nov/2022/Paper_31/No.4(c)

(c) The weight of a table is 280 N. The table has four legs. The area of each table leg in contact with the floor is 18 cm^2.

Calculate the pressure of the table on the floor. Give the correct unit.

$F = 280\ N$

$A = (18 \times 4)\ cm^2$

$P = \frac{F}{A}$

$= \frac{280\ N}{(18 \times 4)\ cm^2}$

$= 3.888$

$\simeq 3.9\ N/cm^2$

pressure on the floor = 3.9 unit N/cm^2 [5]

5. Nov/2022/Paper_31/No.5(a)

An engineer measures the pressure of the gas in a gas bottle. Fig. 5.1 shows the measuring device he uses, connected to the gas bottle.

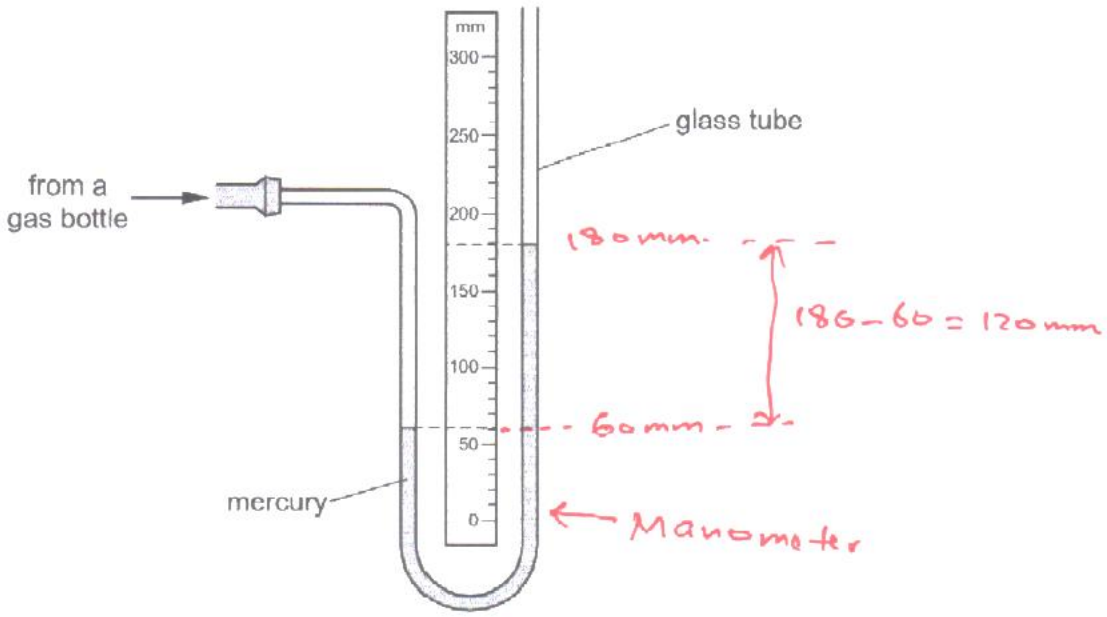


Fig. 5.1

(a) (i) Atmospheric pressure is 756 mm of mercury.

Calculate the pressure of the gas in the gas bottle.

$P = 180 - 60$

$= 120\ mmHg$

pressure of gas = 120 mm of mercury [3]

(ii) State the name of the measuring device shown in Fig. 5.1.

Manometer [1]

6. Nov/2022/Paper_32/No.2

A device for measuring gas pressure is connected to a gas supply as shown in Fig. 2.1

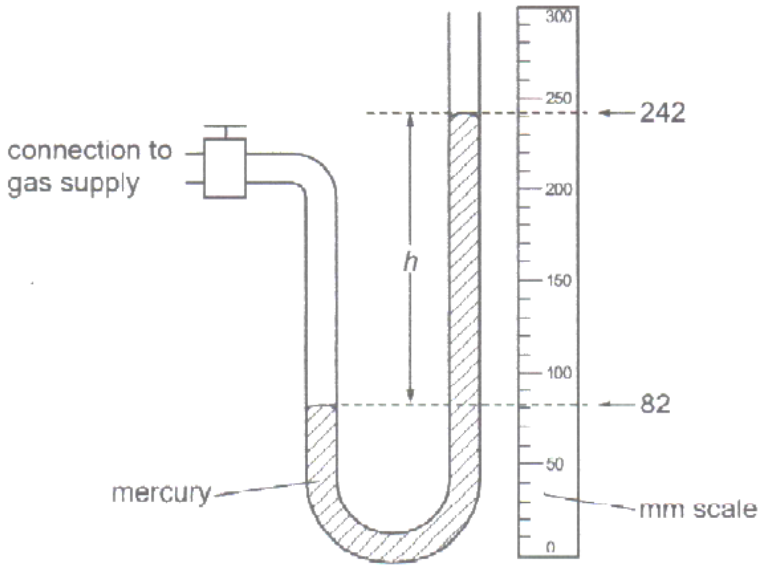


Fig. 2.1

(a) (i) State the name of the measuring device shown in Fig. 2.1.

Manometer ..... [1]

(ii) Determine the difference *h* between the mercury levels shown in Fig. 2.1.

242
− 82
160 mm

h = 160 mm [2]

(b) The atmospheric pressure is 760 mm of mercury.

Determine the pressure of the gas supply.

$P_g = 160 + 760$
$= 920\ mm\ Hg$

pressure of gas supply = 920 mm of mercury [1]

(c) Suggest why this measuring device uses mercury rather than coloured water.

Manometer will be too high since density of water is too small. [1]

(d) The gas supply is turned off and the device is disconnected from the gas supply. Both ends of the tube are open to the atmosphere.

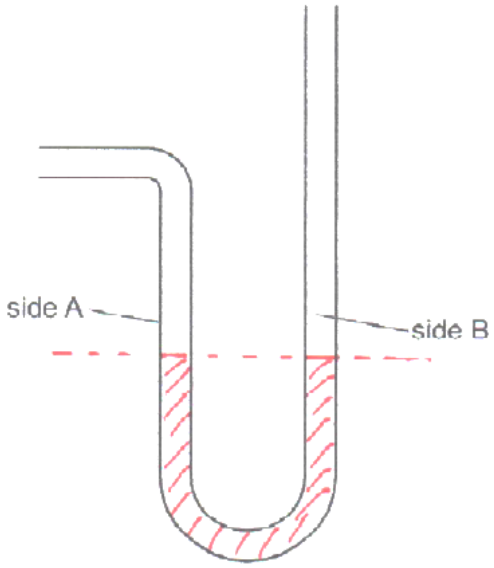


Fig. 2.2

On Fig. 2.2, draw and label the levels of mercury in side A and in side B of the tube. [1]

[Total: 6]

- Mercury levels in both tube will be at same level.
- This is because both open ends are experiencing equal pressure which is the atmospheric pressure.

7. Nov/2022/Paper_41/No.4(a)

A quantity of gas is trapped by a piston in a cylinder with thin metal walls. The piston is free to move without friction within the cylinder.

Fig. 4.1 shows the cylinder and piston.

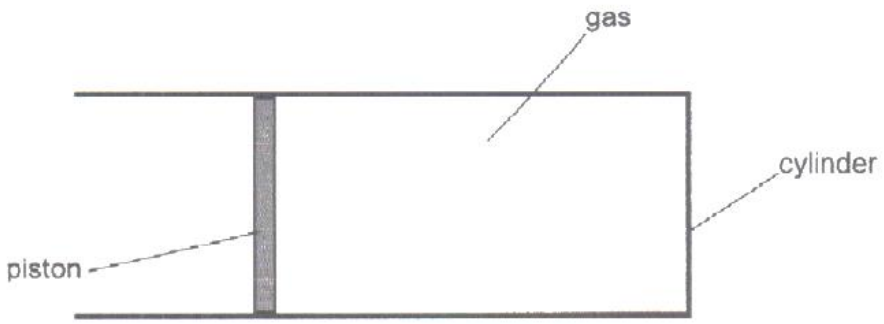


Fig. 4.1

The cylinder is placed inside a freezer.

(a) The air in the freezer is at atmospheric pressure, which is 1.0×10^5 Pa. The area of the piston in contact with the air in the freezer is 2.4×10^{-3} m^2.

(i) Calculate the force exerted on the piston by the air in the freezer.

$F = P \times A$

$= 1.0 \times 10^5 \times 2.4 \times 10^{-3}$

$= 240$ N

force = 240 N. [2]

(ii) When the cylinder is first placed into the freezer, the temperature of the gas in the cylinder decreases and the air pushes the piston into the cylinder.

Calculate the work done on the piston by the air in the freezer as the air pushes the piston a distance of 0.021 m into the cylinder.

$J = Nm$

$W = F \times d$

$= 240 \times 0.021$

$= 5.04$ J

$\simeq 5.0$ J (2SH)

work done = 5.0 J. [2]

8. Nov/2022/Paper_42/No.1(c)

(c) The water stops flowing. The depth of water in the tank is 0.800 m.

Calculate the pressure at the bottom of the tank due to the water.

$P = \rho g h$.

$= 1020 \times 10 \times 0.8$

$= 8160$

$\simeq 8200$ Pa

pressure = 8200 Pa ..... [3]

9. Nov/2022/Paper_42/No.4

(a) Explain, in terms of the momentum of particles, how a gas exerts a pressure.

- Momentum of the particles changes when they hit the wall of the container.
- Momentum change creates force on the wall.
- Pressure is force of particle per unit area of wall.

[3]

(b) The temperature of a sample of gas is increased at constant volume.

State and explain any change in the pressure of the gas.

- Pressure is directly proportional to temperature
- So pressure will increase, because there is greater change of the momentum of the particles, as they move faster and hit the wall harder.

[2]

(c) Another sample of gas is in a sealed container of volume 170 cm^3 and exerts a pressure of 9.0×10^4 Pa. The volume of the container decreases by 70 cm^3 at constant temperature.

Calculate the new pressure of the gas.

$V_2 = 100 cm^3$

$V_1 = 170 cm^3$

$P_1 = 9.0 \times 10^4$ Pa

$V_2 = 100 cm^3$

$P_2 = ?$

$P_2 = \frac{P_1 \times V_1}{V_2}$

$= \frac{9.0 \times 10^4 \times 170 cm^3}{100 cm^3}$

$= 153,000$ Pa

pressure = 1.5×10^5 Pa [3]

[Total: 8]

Radioactivity – 2022 November IGCSE 0625

1. Nov/2022/Paper_21/No.37

A very important experiment increased scientists' understanding of the structure of matter.

In the experiment, particles scattered as they passed through a thin metal foil.

Which particles were used, and to which conclusion did the experiment lead?

	particles	conclusion
A	alpha-particles	matter is made up of atoms
B	alpha-particles	atoms have a very small nucleus
C	beta-particles	matter is made up of atoms
D	beta-particles	atoms have a very small nucleus

α – particle Scattering experiment using thin gold foil.

2. Nov/2022/Paper_21/No.38

Polonium, Po, has a proton number equal to 84 and a nucleon number equal to 218.

Polonium changes into astatine, At, by emitting a β-particle.

Which equation represents this decay?

A $^{84}_{218}Po \rightarrow {}^{85}_{218}At + {}^{-1}_{0}\beta$

B $^{84}_{218}Po + {}^{-1}_{0}\beta \rightarrow {}^{85}_{218}At$

C $^{218}_{84}Po \rightarrow {}^{218}_{85}At + {}^{0}_{-1}\beta$

D $^{218}_{84}Po + {}^{0}_{-1}\beta \rightarrow {}^{218}_{85}At$

$^{218}_{84}Po \rightarrow {}^{x}_{y}At + {}^{0}_{-1}\beta$

$218 = x + 0$

$x = 218$

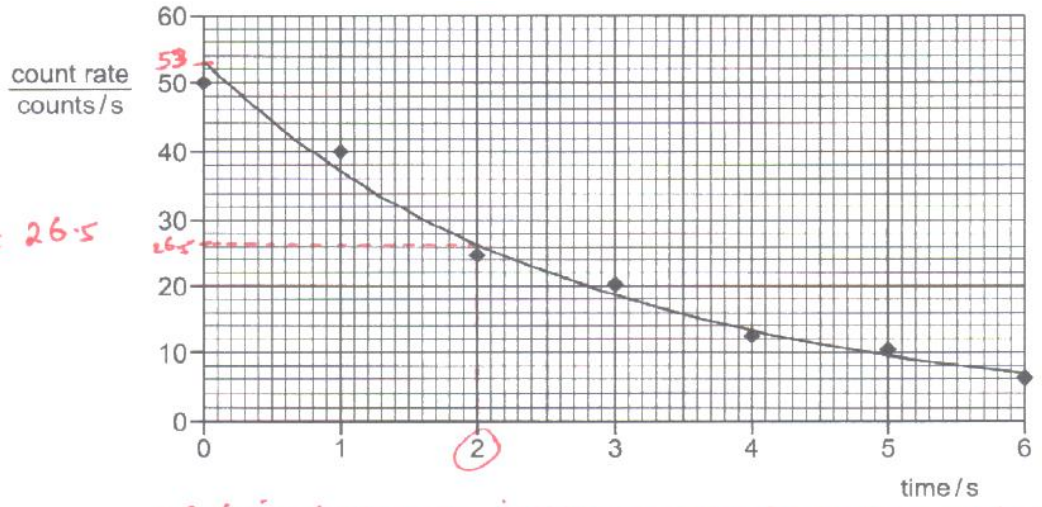
$84 = y - 1$

$y = 84 + 1$

$y = 85$

3. Nov/2022/Paper_21/No.39

The graph shows how the count rate from a radioactive isotope changes with time.



53/2 = 26.5

time taken for initial count rate to become half.

What is the half-life of this isotope?

(A) 2.0 s B 6.0 s C 12 s D 53 s

4. Nov/2022/Paper_21/No.40

What is the nature of α-emission?

A electromagnetic waves
B negatively charged particles
(C) positively charged particles
D uncharged particles

α - particle are helium ion

$^{4}_{2}He^{2+}$ - positive ion.

5. Nov/2022/Paper_22/No.37

A thin metal foil is placed in a vacuum. α-particles are fired at the foil and most go straight through. A very small proportion of the α-particles are deflected through large angles.

What does this provide evidence for?

α Scattering experiment

A α-particles are very small.
B There are negative electrons in each atom.
(C) There is a tiny nucleus in each atom.
D There are neutrons in each atom.

6. Nov/2022/Paper_22/No.38

Thorium-230 is represented by the symbol $^{230}_{90}Th$. This isotope is radioactive and decays to radium by emitting α-particles.

Which nuclide is produced by this decay?

A $^{226}_{88}Ra$ B $^{230}_{89}Ra$ C $^{230}_{91}Ra$ D $^{234}_{92}Ra$

$^{230}_{90}Th \longrightarrow {}^{x}_{y}Ra + {}^{4}_{2}\alpha$

$^{226}_{88}Ra$

$230 = x + 4$

$x = 230 - 4$

$= 226$

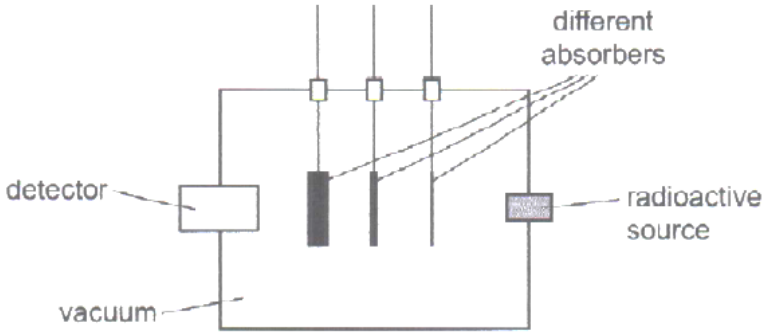
$90 = y + 2$

$y = 90 - 2$

$= 88.$

7. Nov/2022/Paper_22/No.39

The diagram shows a piece of apparatus used to determine the nature of the emissions from a radioactive source. The absorbers can be raised out of or lowered into the path of the radiation from the source to the detector. The apparatus is evacuated.



The table gives a set of results for a particular radioactive source.

absorber in use	count rate on detector (counts per second)
none	350
thin paper	350
1.0 mm aluminium	180
1.0 cm lead	23

Which types of radiation are being emitted by the radioactive source?

A α-particles and β-particles

B α-particles only

C β-particles and γ-rays ✓

D β-particles only

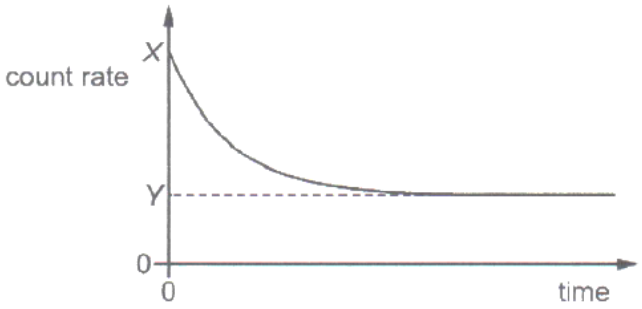
α - particle are not present because a thin paper should stop α, but the reading remains 350.

β - present because with Aluminium in the path, count rate decreases to 180.

γ - present because with lead in the path, count rate decrease further to 23 from 350.

8. Nov/2022/Paper_22/No.40

The graph shows the measured count rate of radiation from a source containing a radioactive isotope. The detector is in a laboratory, with no shielding from background radiation.



What is the measured count rate after a time of one half-life?

A $\frac{X}{2}$ **B** $\frac{Y}{2}$ **C** $\frac{(X-Y)}{2}$ **D** $\frac{(X+Y)}{2}$

9. Nov/2022/Paper_23/No.37

A thin metal foil is placed in a vacuum. α-particles are fired at the foil and most go straight through. A very small proportion of the α-particles are deflected through large angles.

What does this provide evidence for?

A α-particles are very small.

B There are negative electrons in each atom.

C There is a tiny nucleus in each atom. ✓

D There are neutrons in each atom.

Remember
α - particle scattering
experiment done
by Geiger and Masctene
Supervised by Rutherford.

10. Nov/2022/Paper_23/No.38

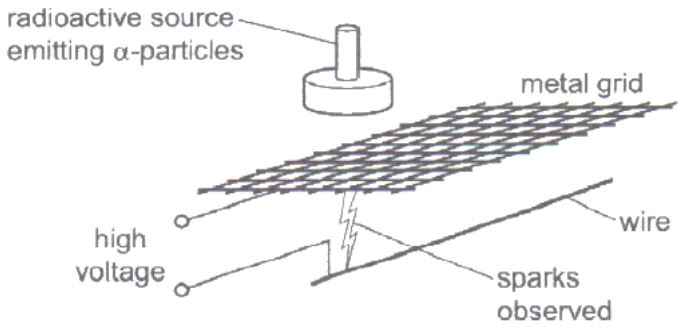
The table compares α-radiation, β-radiation and γ-radiation.

Which row is correct?

	α-radiation	β-radiation	γ-radiation
A	more ionising than β or γ	a proton	electromagnetic radiation
B	less ionising than β or γ	an electron	two protons and two neutrons
C	more ionising than β or γ	an electron	electromagnetic radiation
D	less ionising than β or γ	electromagnetic radiation	a proton

11. Nov/2022/Paper_23/No.39

A high-voltage power supply is connected to a metal grid and a wire, as shown.



When the radioactive source is placed close to the grid, sparks are observed in the position indicated.

Which statement explains why the sparks are formed?

A α-particles have a long range.

B α-particles have no charge.

C α-particles have no mass.

D α-particles are strongly ionising. ✓

α-particles will ionise air between grid and wire.
- So air will conduct, and spark will show

12. Nov/2022/Paper_23/No.40

A student investigates four different radioactive isotopes. The student places a detector near each radioactive material.

The background count rate is 36 counts per minute throughout the investigation.

$t_{1/2}$ - half-life

The table shows the detector readings at the start and after 8 hours.

Which isotope has a half-life of 4 hours?

No of $t_{1/2} = \frac{8}{4} = 2$

2 half-lives

	count rate at the start counts per minute	count rate after 8 hours counts per minute
A	150	36
B	212	53
C ✓	260	92 ✓
D	356	80

260 − 36 = 224 → 112 → 56 + 36 = 92

- 1st subtract background count rate from 260
- 2nd find the count of 224 after 2 half-lives
- 3rd add the background rate to 56 to get 92.

13. Nov/2022/Paper_31/No.10

(a) α (alpha)-particles, β (beta)-particles and γ (gamma)-rays have different characteristics.

Complete Table 10.1 by indicating with a tick (✓) the correct type of radiation for each characteristic. The first row is done for you.

Table 10.1

characteristic	type of radiation		
	α (alpha)-particles	β (beta)-particles	γ (gamma)-rays
electromagnetic wave			✓
least ionising			✓
least penetrating	✓		
a helium nucleus	✓		
negatively charged		✓	

[3]

(b) The nucleus of an isotope of plutonium has 94 protons and 147 neutrons. The chemical symbol for plutonium is Pu.

Write the nuclide notation that describes this nucleus.

$+\ \begin{matrix}147\\94\end{matrix}$

241 ← nucleons $p+n$

$^{241}_{94}Pu$

[2]

(c) A sample contains 8.0×10^{12} atoms of a radioactive isotope of plutonium.
The half-life of this isotope of plutonium is 14 years.

Calculate the number of atoms of this isotope of plutonium remaining in the sample after 28 years.

No of half-life $= \frac{28}{14} = 2$

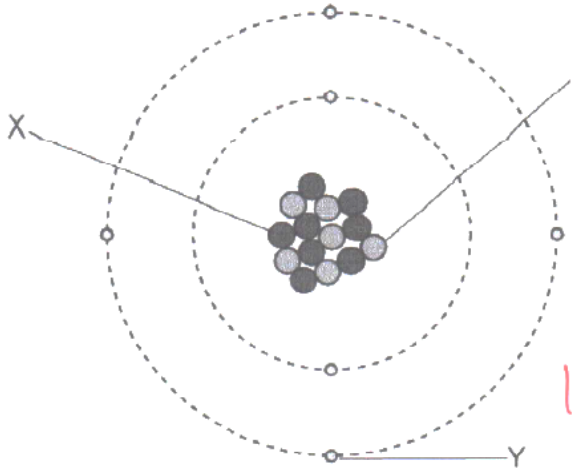
$8.0\times10^{12} \xrightarrow{(1)} \frac{8.0\times10^{12}}{2} = 4.0\times10^{12} \xrightarrow{(2)} 2.0\times10^{12}$ atoms

number of atoms of plutonium remaining = 2.0×10^{12} [3]

[Total: 8]

14. Nov/2022/Paper_32/No.11

Fig. 11.1 represents an atom of carbon-14.



6 - electrons
6 - protons
8 - neutrons

In a neutral atom
protons = electron

Fig. 11.1

(a) **(i)** State the name of the particle labelled X.

Neutron ..... [1]

(ii) State the name of the particle labelled Y.

electron ..... [1]

(iii) State the nucleon number of carbon-14.

nucleon = p + n
= 6 + 8
= 14

14 ..... [1]

(b) Carbon-14 decays by emitting a β (beta)-particle.

State the nature of a β (beta)-particle.

β - particle is an electron ..... [1]

(c) Scientists find an ancient wooden spoon. They find that the spoon contains 2000 atoms of carbon-14.

When the spoon was made, it contained 16 000 atoms of carbon-14.

The half-life of carbon-14 is 5800 years.

Calculate the age of the ancient spoon.

Find number of half-lives

16000 $\xrightarrow{①}$ 8000 $\xrightarrow{②}$ 4000 $\xrightarrow{③}$ 2000
÷2 ÷2 ÷2

- 3 half-lives

so 3 × 5800
= 17,400 years

age of spoon = 17,400 years [2]

[Total: 6]

15. Nov/2022/Paper_33/No.10

(a) State which radioactive emission:

(i) is the most penetrating ..... gamma ray ..... [1]

(ii) is the most ionising ..... alpha ..... [1]

(iii) has a positive charge. ..... alpha $^{4}_{2}He^{2+}$ ..... [1]

(b) Iodine-131 is a radioactive isotope that is commonly used in medicine.

The nuclide notation for a nucleus of iodine-131 is:

131 − 53 = 78

$^{131}_{53}I$

protons

(i) Determine the number of protons in one nucleus of iodine-131. ..... 53 ..... [1]

(ii) Determine the number of neutrons in one nucleus of iodine-131. ..... 78 ..... [1]

(c) Radioactive iodine-131 has a half-life of 8 days.

The activity of a sample of iodine-131 is 1600 counts/s.

Calculate the activity of this sample after 24 days.

No of half-life = $\frac{24}{8} = 3$

$1600 \xrightarrow{①} \frac{1600}{2} = 800 \xrightarrow{②} \frac{800}{2} = 400 \xrightarrow{③} \frac{400}{2} = 200$

activity = ... 200 ..... counts/s [2]

[Total: 7]

16. Nov/2022/Paper_41/No.9

Only one isotope of gold occurs naturally on Earth.

(a) State what this indicates about the nuclear structure of all the naturally occurring atoms of gold on Earth.

– They all have the same number of neutrons in their nucleus. [1]

(b) There are several artificially produced isotopes of gold.

Gold-198 ($^{198}_{79}Au$) is an artificial isotope which is used in medicine and in scientific research.

Gold-198 decays by β (beta)-emission to a stable isotope of mercury.

(i) Determine the number of protons and the number of neutrons in a nucleus of this isotope of mercury.

$^{198}_{79}Au \longrightarrow {}^{z}_{A}Hg + {}^{0}_{-1}\beta$

proton

number of protons = 80

number of neutrons = 118

[2]

$198 = z + 0$

$z = 198$ nucleons

$79 = A - 1$

$A = 79 + 1$

$= 80$ (protons)

Neutrons $= 198 - 80$

$= 118$

(ii) A sample of gold-198 is placed near to a radiation detector in a research laboratory. The count rate is recorded at the same time every day for 32 days.

The results are used to plot the graph shown in Fig. 9.1.

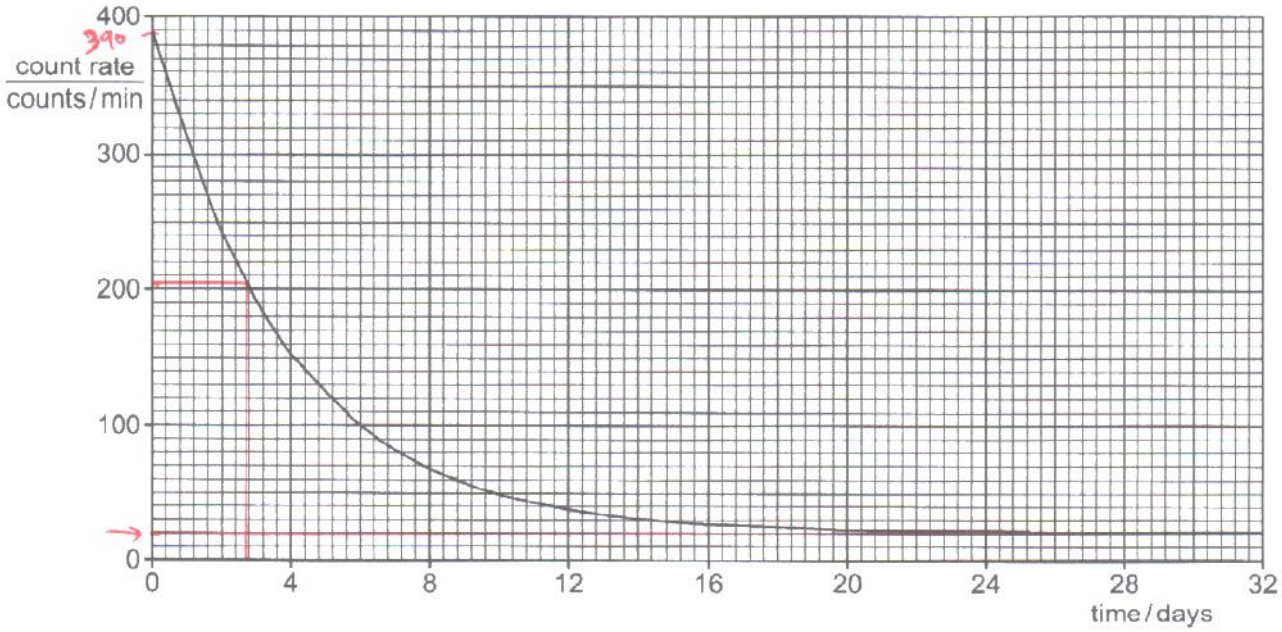


Fig. 9.1

Using Fig. 9.1, determine the background count rate in the research laboratory.

100 — 10
? — 1
$\frac{100 \times 1}{10} = 10$
$\therefore 2 \times 10 = 20$

count rate = 20 counts/minute [1]

(iii) Using Fig. 9.1, determine the half-life of gold-198.

Initial count rate = 390 − 20
= 370

At half life = $\frac{370}{2}$
= 185

Add background to 185 to get count rate at half-life
185 + 20 = 205

Then locate 205 from graph and get time at x-axis

4 day → 10 small squares
? → 7 s.s

$\frac{4 \times 7}{10} = 2.8$ days

half-life = 2.8 days [4]

[Total: 8]

17. Nov/2022/Paper_42/No.10

(a) The magnitude of the charge on a β (beta)-particle is 1.6×10^{-19} C.

nucleon number
$^{4}_{2}He^{2+} \rightarrow {}^{4}_{2}\alpha^{2+}$
proton number

(i) State the proton number and nucleon number of an α (alpha)-particle.

proton number ..... 2 .....

nucleon number ..... 4 .....

[2]

(ii) Determine the magnitude of the charge of an α (alpha)-particle.

charge ..... $+1 - 1.6 \times 10^{-19}$ C ..... 3.2×10^{-19} C

$\therefore +2 - 1.6 \times 10^{-19}$ C $\times 2 = 3.2 \times 10^{-19}$ C.

[1]

(b) A nucleus of radium-230 consists of 88 protons and 142 neutrons. Radium-230 is radioactive and decays by β (beta)-emission to an isotope of actinium. The symbol for radium is Ra and the symbol for actinium is Ac.

Write down the nuclide equation for this decay.

142
88
230

88 = 89 − 1
88 = 88.

$^{230}_{88}Ra \longrightarrow {}^{230}_{89}Ac + {}^{0}_{-1}\beta$

[3]

(c) The half-life of radium-230 is 93 min. A sample contains 9.6×10^{-12} g of radium-230.

Calculate the mass of radium in the sample after 279 min.

No of half-lives = $\frac{279}{93}$ = 3.

After each half-life, the mass decreases by ½.

9.6×10^{-12} g $\xrightarrow{(1)}$ $\frac{9.6 \times 10^{-12}}{2}$ g $= 4.8 \times 10^{-12}$ g $\xrightarrow{(2)}$ $\frac{4.8 \times 10^{-12}}{2}$ g $= 2.4 \times 10^{-12}$ g $\xrightarrow{(3)}$ $\frac{2.4 \times 10^{-12}}{2} = 1.2 \times 10^{-12}$ g

mass = ... 1.2×10^{-12} g ..... [2]

[Total: 8]

18. Nov/2022/Paper_43/No.10

(a) A cloud chamber can be used to detect α (alpha)-particles and β (beta)-particles. Alcohol in the cloud chamber exists as a vapour and condenses on ions produced in the air. This forms visible tracks.

Fig. 10.1 shows the tracks when a source of α-particles and β-particles is present in the cloud chamber.

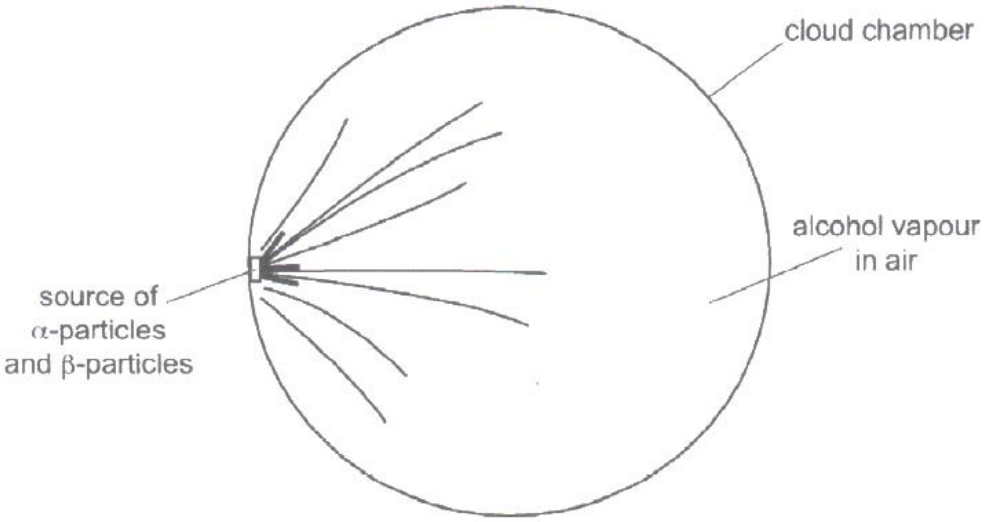


Fig. 10.1

Some of the tracks are short and thick. Other tracks are longer and thinner.

State and explain which tracks are produced by α-particles and which tracks are produced by β-particles.

α-particles ..... α-particle are short and thick, tracks α-particle are more ionising and have short range

β-particles ..... β-particles are longer and thinner track β-particles are less ionising and have longer range. [3]

(b) A radioactive isotope of sodium (Na) is used to detect leaks from water pipes. A nucleus of this isotope of sodium contains 11 protons and 13 neutrons. This nucleus decays by emitting a β-particle to form a nucleus of magnesium (Mg).

(i) Describe what is meant by an isotope.

Atoms of the same element with same number of protons but different number of neutrons. [2]

(ii) Write down the nuclide equation for the decay of this isotope of sodium to magnesium.

11 + 13 = 24 nucleons

$$^{24}_{11}Na \longrightarrow {}^{24}_{12}Mg + {}^{0}_{-1}\beta$$

24 = 24 + 0
24 = 24
11 = 12 − 1
11 = 11

[3]

(iii) This isotope of sodium has a half-life of 15 hours. The isotope of magnesium is stable and does not undergo radioactive decay.

Suggest why these properties of the isotope of sodium and the isotope of magnesium make this isotope of sodium suitable to detect leaks from water pipes.

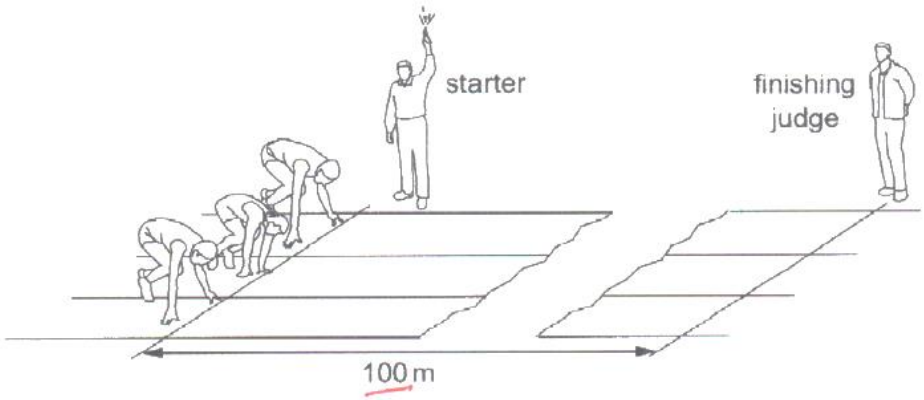
– Sodium isotopes short half-life means it will decay to a stable magnesium isotope and this reduces risk of exposure to hazardous Sodium radiation to humans. [2]

[Total: 10]

Sound – 2022 November IGCSE 0625

1. Nov/2022/Paper_23/No.24

A 100 m race is started by firing a gun. The gun makes a bang and a puff of smoke at the same time.



When does the finishing judge see the smoke and when does he hear the bang?

	sees the smoke	hears the bang
A	almost immediately	almost immediately
B	almost immediately	after about 0.3 s ✓
C	after about 0.3 s	almost immediately
D	after about 0.3 s	after about 0.3 s

- Light is faster than Sound.

time = distance / speed.

Speed of sound in air = 340 m/s

distance = 100 m.

$t = \frac{100}{340} = 0.29\,s$

$\simeq 0.3\,s$.

A student is to demagnetise a bar magnet. She tries four different ways.

2. Nov/2022/Paper_21/No.22

The speed of sound in air is 330 m/s.

How do the speeds of sound in concrete and water compare with this speed?

	speed in concrete	speed in water
A	greater ✓	greater ✓
B	greater ✓	less
C	less	greater ✓
D	less	less

- Sound is faster in solids than liquids and is slowest in air

Concrete > water > air

3. Nov/2022/Paper_21/No.24

An observer stands at the finish line of a 100 m race. He wants to time the winner's run. He starts his stop-watch as soon as he sees the smoke from the starting gun instead of when he hears the bang.

What is the reason for doing this?

A Light travels much faster than sound. ✓

B There is a risk he might respond to an echo from a wall.

C Humans react slower to sound than to light.

D Humans react more quickly to sound than to light.

Light is faster than Sound in air

Speed of light - 3.0×10^8 m/s

Speed of sound - 340 m/s

4. Nov/2022/Paper_22/No.17

A sound wave travels from air into water.

Which row describes what happens to the frequency and the wavelength of the wave?

	frequency	wavelength
A	decreases	increases ✓
B	decreases	stays the same
C	stays the same ✓	decreases
D	stays the same ✓	increases ✓

- From air to water, Sound will undergo refraction
- During refraction frequency remains constant.

Speed in air = 340 m/s

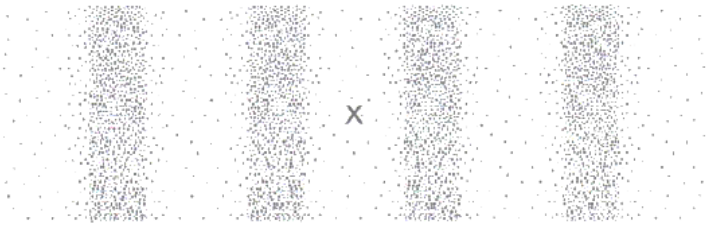
Speed of sound in water = 1600 m/s

- Speed of sound in water is higher than in air
- So the wavelength λ will increase.

$v = f \times \lambda$, if f is constant then $v \propto \lambda$.

5. Nov/2022/Paper_22,23/No.22

The diagram shows the air molecules in part of a sound wave at a particular moment in time.



Which statement is **not** correct?

In longitudinal wave, vibrations are parallel to direction of travel of wave.

A Earlier, there was compression at X. ✓

B Later, there will be a rarefaction at X. ✓

C This part of the wave is travelling horizontally across the page. ✓

D This part of the wave is travelling towards the top of the page. ✗

6. Nov/2022/Paper_33/No.7

Two students, A and B, determine the speed of sound.

They are standing side by side at a distance of 520 m from a wall, as shown in Fig. 7.1.

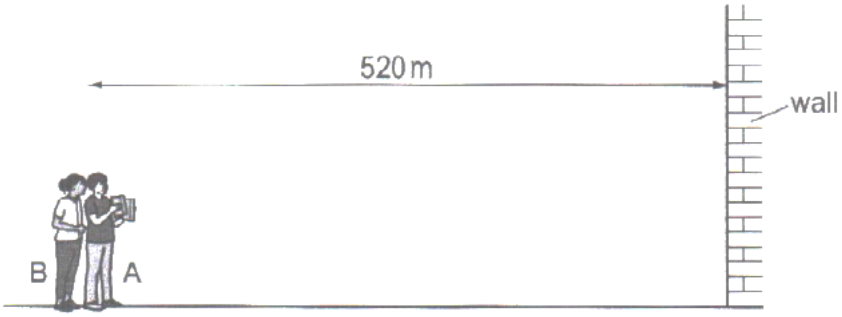


Fig. 7.1

Student A makes a loud sound by banging two blocks of wood together once. A short time later, both students hear the sound reflected from the wall.

(a) (I) State the term for the reflected sound.

Echo ..... [1]

(II) Table 7.1 lists properties of a sound wave.
Compare the properties of the original sound and the reflected sound. For each property, place a tick (✓) in one column.

The first property is done for you.

Table 7.1

property	same	different
speed	✓	
wavelength	✓	
loudness		✓
frequency	✓	
amplitude		✓
longitudinal	✓	

[3]

(b) Student B measures the time between the original sound and the reflected sound.

(i) Suggest a suitable device for measuring the time interval between hearing the original sound and hearing the reflected sound.

Stopwatch ..... [1]

(ii) The time interval between hearing the original sound and hearing the reflected sound is 3.1 s.
Use information shown in Fig. 7.1 to calculate the speed of sound.

$\text{Speed} = \frac{\text{distance}}{\text{time}} = \frac{2 \times 520}{3.1} = 335 \text{ m/s}$
$\simeq 340 \text{ m/s (2 s.f.)}$.

speed of sound = 340 ..... m/s [3]

[Total: 8]

- The sound travels twice the distance between wall and the Students.
- distance = (2×520) m.

Thermal Processes – 2022 November IGCSE 0625

1. Nov/2022/Paper_21/No.16

Four thermometers, with their bulbs painted different colours, are placed at equal distances from a radiant heater.

Which thermometer shows the slowest temperature rise when the heater is first switched on?

A dull black – is the best absorber of radiant thermal energy so it have the quickest temp rise.

B dull white

C shiny black

(D) shiny white ✓ – shiny white is worst absorber of radiant thermal energy

2. Nov/2022/Paper_22/No.16

Which piece of equipment is designed to produce a type of electromagnetic wave?

(A) electric fire ✓ Hot objects produce infrared waves which are EM wave

B electric generator

C electric motor

D electromagnet

3. Nov/2022/Paper_23/No.16

Which piece of equipment is designed to produce a type of electromagnetic wave?

(A) electric fire ✓ Hot objects produce infrared waves which are EM wave

B electric generator

C electric motor

D electromagnet

4. Nov/2022/Paper_32/No.4(b)

(b) A student designs a container to keep a hot liquid at a high temperature.
The container is shown in Fig. 4.2.

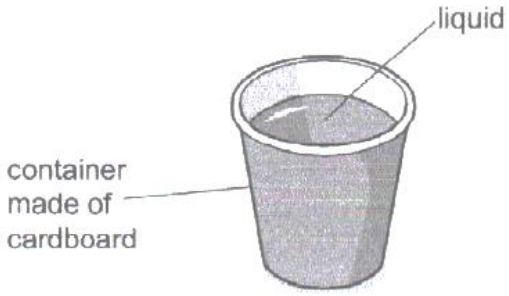


Fig. 4.2

He finds that the liquid cools too quickly.

Suggest **two** improvements to the design of the container which reduce the transfer of thermal energy from the hot liquid to its surroundings.
For each suggestion, state the thermal transfer process that it reduces.

suggestion 1 Insulate the container with cotton wool on the outside surface.

thermal transfer process conduction

suggestion 2 Cover container with a lid.

thermal transfer process convection and evaporation

[4]

5. Nov/2022/Paper_41/No.5

Fig. 5.1 shows a heater in a bathroom.

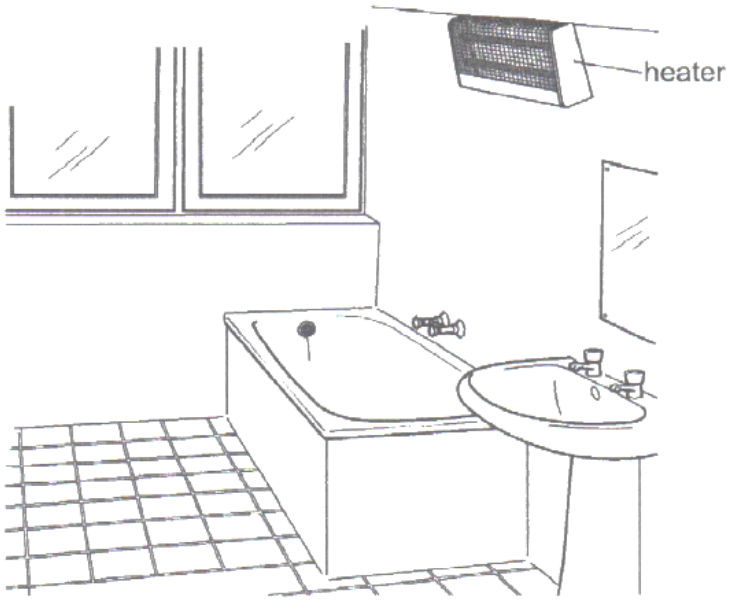


Fig. 5.1

The heater is at a very high temperature and it glows red. The manufacturer states:

> "The heater emits light and radiation and it transfers thermal energy by radiation."

(a) State the part of the electromagnetic spectrum that transfers thermal energy.

Infrared ..... [1]

(b) State:

(i) **one** way in which visible light and the radiation identified in **(a)** are similar

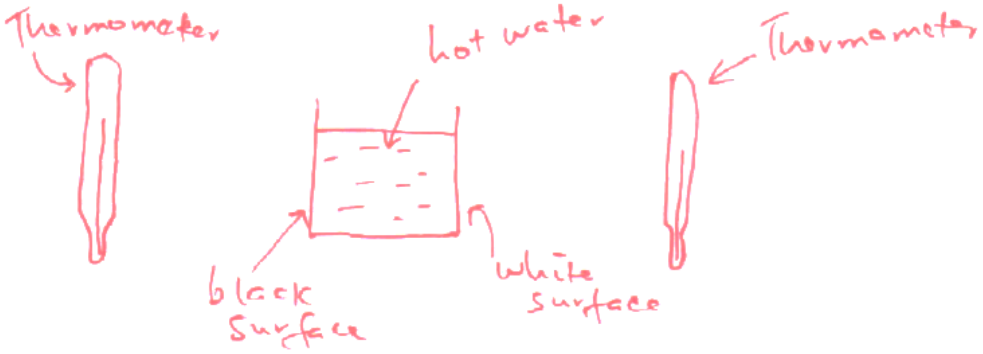
both are electromagnetic waves and are transverse. ..... [1]

(ii) **one** way in which visible light differs from the radiation identified in **(a)**.

visible light has a higher frequency than infrared radiation. ..... [1]

(c) Some surfaces are better at emitting radiation than others.

(i) Describe an experiment to show whether a black surface or a white surface is the better emitter of radiation. You may draw a diagram.



- Hot water is poured into a metal container with one side painted black and opposite side painted white.
- Thermometer are placed equidistance from the sides
- Thermometer reading rises higher on the side with better emission of thermal energy. [3]

(ii) To ensure that the conclusion reached in the experiment in **(c)(i)** is correct, several details of the experiment must be identical when testing the two different surfaces.

State **two** quantities in the experiment that you described that must be identical during the test.

1. Distance from each side to the thermometers
2. Initial temperature of water at each painted side.

[2]

[Total: 8]

6. Nov/2022/Paper_42/No.5(b_ c)

Fig. 5.1 shows an aluminium block after leaving a furnace in a factory.

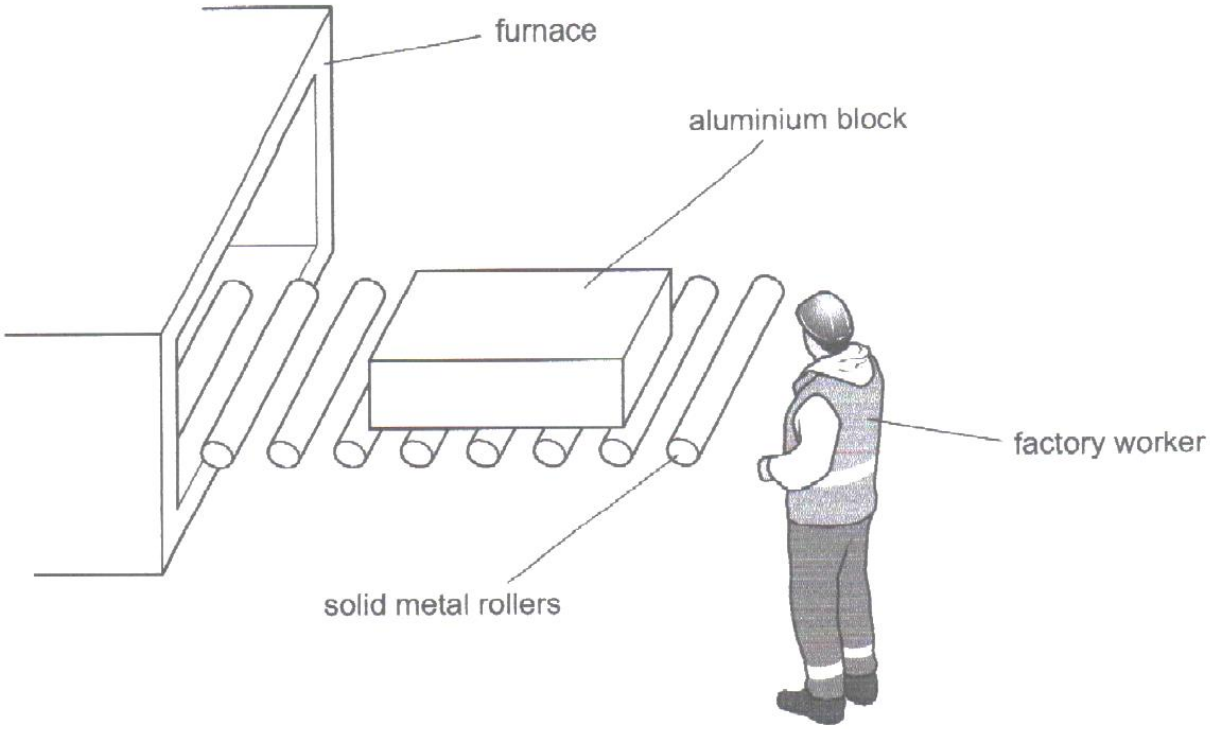


Fig. 5.1

(b) Fig. 5.1 shows a factory worker standing 3 m from the block.

State and explain the main process by which thermal energy is transferred to the worker.

- By thermal radiation
- Radiation is transferred by electromagnet infrared from the block to the worker through the air, though does not require a medium, since it can pass through vacuum. [3]

(c) State and explain the main process by which thermal energy is transferred from the outer surface of the solid metal rollers to their interior.

- By conduction
- Delocalised electron gain heat at the outer surface and move to the interior where they collide with inner particles transferring energy by conduction. [3]

[Total: 9]

The Properties and Temperature – 2022 November IGCSE 0625

1. Nov/2022/Paper_21/No. 14

The diagram shows a liquid-in-glass thermometer.

Which change increases the sensitivity of the thermometer?

A a narrower capillary tube ✓ or a bigger bulb.

B a wider capillary tube

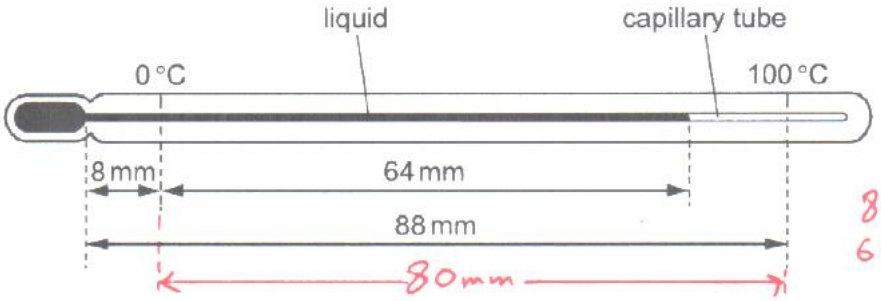
C thicker glass around the bulb

D thinner glass around the bulb

Sensitivity is ability to detect small temperature changes.

2. Nov/2022/Paper_21/No. 15

The diagram shows a liquid-in-glass thermometer with a uniform capillary tube.



NOT TO SCALE

88 − 8 = 80mm

80 → 100 °C

64 → ?

$\frac{64 \times 100}{80} = 80^{\circ}C$

Which temperature is indicated by the thermometer?

A 73 °C **B** 80 °C ✓ **C** 82 °C **D** 90 °C

3. Nov/2022/Paper_22,23/No.14

Which change in the design of a liquid-in-glass thermometer makes it more sensitive?

A a larger liquid reservoir ✓

B a longer tube

C a smaller liquid reservoir

D a wider tube

Sensitive means quick to detect slight change in temperature

– large bulb
– thin capillary

} make thermometer sensitive

4. Nov/2022/Paper_22/No.15

A scientist is determining the specific latent heat of vaporisation of a liquid.

He puts the liquid in a vacuum flask and heats it with a 100 W heater. The mass of liquid in the vacuum flask when it starts to boil is 300 g. He continues to heat the liquid for a further 12 minutes after which the mass of the remaining liquid is 100 g.

What is the specific latent heat of vaporisation of the liquid?

(Assume that all the thermal energy from the heater is used to vaporise the liquid.)

A 6000 J/kg

B 240 000 J/kg

C 360 000 J/g

D 360 000 J/kg ✓

E = Power × time
= 100 × 12 × 60
= 72,000 J.

$E = L_v \times m$.
$\therefore L_v = \frac{E}{m}$.

$m = 300 - 100$
$= 200$ g
$= 0.2$ kg

$L_v = \frac{72,000\ J}{0.2\ kg}$
$= 360,000$ J/kg

5. Nov/2022/Paper_23No.15

An ice cube of mass 12 g at 0 °C absorbs thermal energy from the surroundings at a rate of 3 J/s. The specific latent heat of fusion of ice is 330 J/g.

How long will it take for the ice cube to melt?

Energy to melt 12 g = $330\ \frac{J}{g} \times 12$ g
$= 3960$ J.

3 J → 1 s; 3960 J → ?
$\frac{3960 \times 1}{3}$
$= 1320$ s

A 82.5 s B 1320 s ✓ C 3960 s D 11 880 s

Which piece of equipment is designed to produce a type of electromagnetic wave?

6. Nov/2022/Paper_32/No.3

(a) A liquid-in-glass thermometer has a scale with marks from –10 °C to 110 °C.
A student checks the accuracy of the thermometer.

Describe how to check the accuracy of:

(i) the 100 °C mark on the thermometer scale

- place thermometer bulb above pure boiling water in the steam. [1]

(ii) the 0 °C mark on the thermometer scale.

- Place bulb in the mixture of melting ice and pure water. [1]

(iii) State the importance of the 0 °C and 100 °C marks on a thermometer scale.

they are used for calibrating thermometer. [1]

(b) We can measure temperature by using physical properties that vary with temperature.

(i) State the physical property that we use to measure temperature in a liquid-in-glass thermometer.

expansion and contraction of liquid [1]

(ii) State another physical property that we use to measure temperature.

e.m.f. (as in a thermocouple thermometer) [1]

[Total: 5]

7. Nov/2022/Paper_33/No.4(a_ b)

(a) During an experiment, a heater supplies thermal energy to a substance. Initially, the substance is a solid. The substance is heated until it becomes a gas.
The temperature of the substance varies with time as shown in Fig. 4.1.

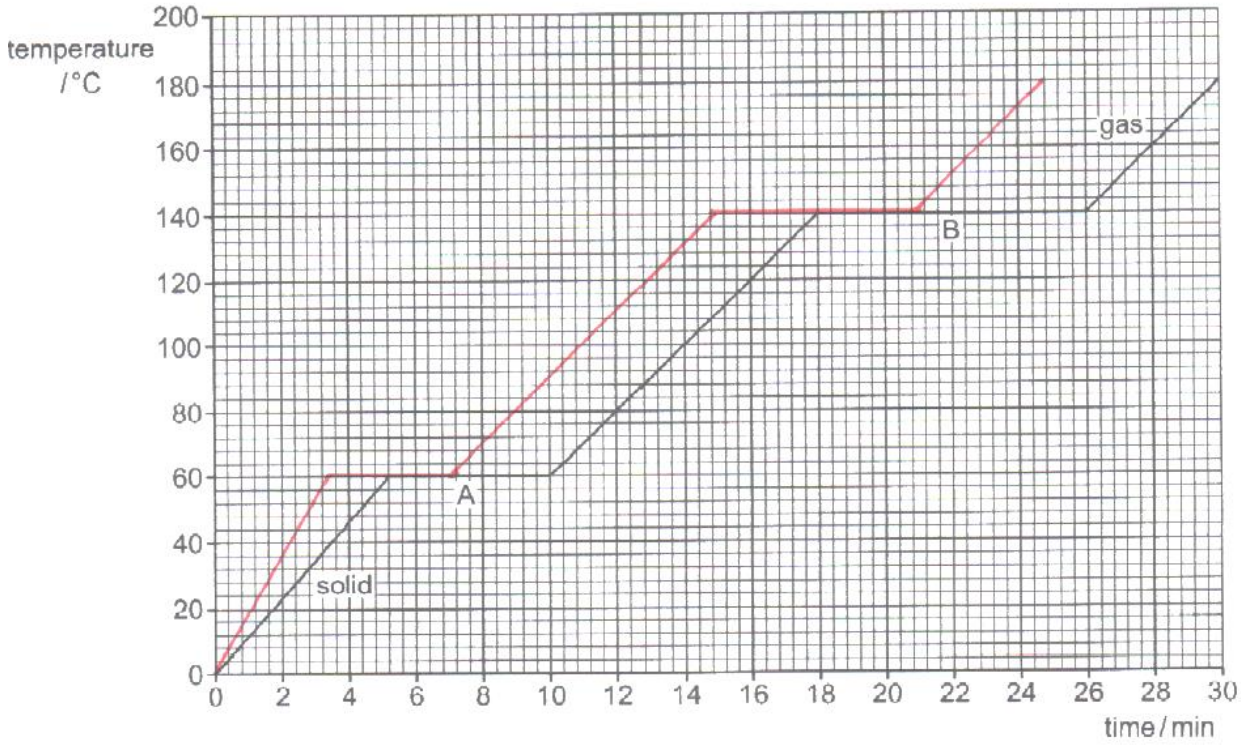


Fig. 4.1

(i) Give the state of the substance between A and B on Fig. 4.1.

Liquid ..... [1]

(ii) State the process that is occurring at:

A Melting (solid changing to liquid)

B Boiling (liquid changing to gas)

[2]

(b) The experiment is repeated using a heater with a greater power output. All other variables are kept constant.

Suggest how the temperature of the substance varies with time. Draw on Fig. 4.1. [3]

- Takes less time to reach b.p and m.p
- Takes less time to melt and to boil

8. Nov/2022/Paper_41/No.4(b)

(b) The initial temperature of the cylinder and the gas is 21 °C and, in the freezer, the temperature of the cylinder decreases to −18 °C.

The thermal capacity of the cylinder is 89 J/°C.

↑ T·C

Calculate the change in the internal energy of the cylinder.

$T \cdot C = \frac{E}{\Delta T}$

$\therefore E = T \cdot C \times \Delta T$

$E = 89 \times (21 - (-18))$

$= 89 \times 39$

$= 3471\ J$

change in internal energy = 3500 J [2]

9. Nov/2022/Paper_42/No.5(a)

Fig. 5.1 shows an aluminium block after leaving a furnace in a factory.

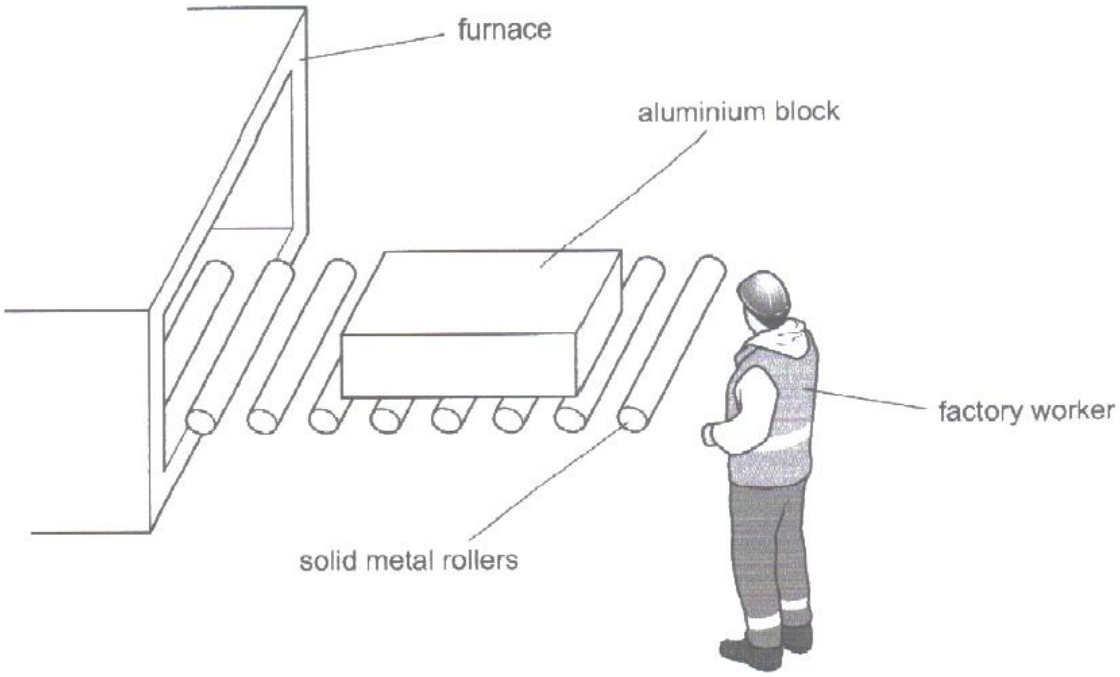


Fig. 5.1

(a) The mass of the block is 1200 kg and it is heated in the furnace from 20 °C to 380 °C. The aluminium block does not melt.
The specific heat capacity of aluminium is 960 J/(kg °C).

Calculate the thermal energy gained by the block in the furnace.

$\Delta E = mc\Delta T$.

$= 1200\,\text{kg} \times 960\,\frac{\text{J}}{\text{kg °C}} \times (380 - 20)\,\text{°C}$

$= 414,720,000\,\text{J}$

$\simeq 4.1 \times 10^8\,\text{J}$

thermal energy = 4.1×10^8 J. [3]

10. Nov/2022/Paper_43/No.4

(a) Fig. 4.1 shows a liquid-in-glass thermometer labelled thermometer X.

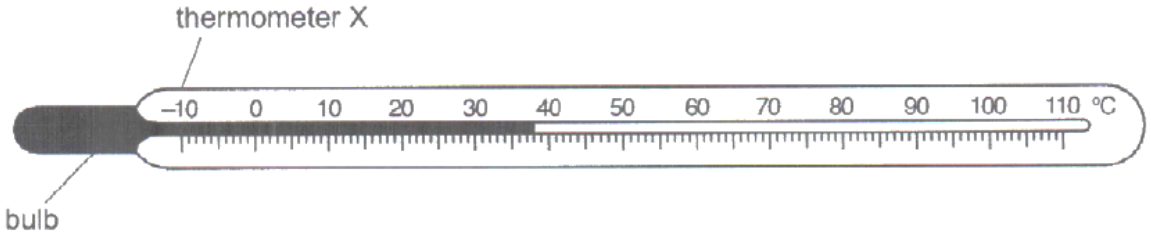


Fig. 4.1

(i) State the physical property which varies with temperature in a liquid-in-glass thermometer.

Volume of liquid ..... [1]

(ii) Thermometer Y has a bulb that contains twice the volume of liquid compared to thermometer X.

State and explain how the sensitivity of thermometer Y compares with the sensitivity of thermometer X.

statement Y is more sensitive

explanation There is more liquid to expand, so it gives a larger change in the level of liquid per unit °C. [2]

(iii) State and explain **one** change that can be made to the design of thermometer X to increase its range. Increase the temp it can measure.

statement Increase the capillary tube

explanation So liquid can expand further to give a higher temperature [2]

(b) A liquid-in-glass thermometer cannot measure a temperature of 1300 °C.

State a physical property which varies with temperature in a thermometer which can measure a temperature of 1300 °C.

electromotive force (emf) or voltage. ..... [1]

- The thermometer is called the thermocouple.

[Total: 6]

11. Nov/2022/Paper_43/No.5

(a) Three identical dishes, A, B and C, contain an equal volume of water.

Dish A is outside in sunlight and experiences no wind during the day. Dish B is outside in sunlight and experiences a strong wind during the day. Dish C is in a dark room.

Water evaporates from each dish. After 12 hours, a student measures the volume of water in each dish. Dish C contains the largest volume of water and dish B contains the smallest volume of water.

Explain, in terms of particles, why the three dishes have different volumes of water.

- High temperature and wind increase the rate of evaporation.
- Energy from Sun is absorbed by water particle and have higher K.E.
- The particle with higher K.E escape from the surface at higher rate in dish A and B.
- Wind in dish B remove the molecules from above the dish so they do not return to liquid again.

[4]

(b) Define specific latent heat of vaporisation.

Energy needed to change 1kg of liquid to gas at constant temperature.

[2]

(c) Fig. 5.1 shows an insulating beaker, crushed ice, an immersion heater and a thermometer.

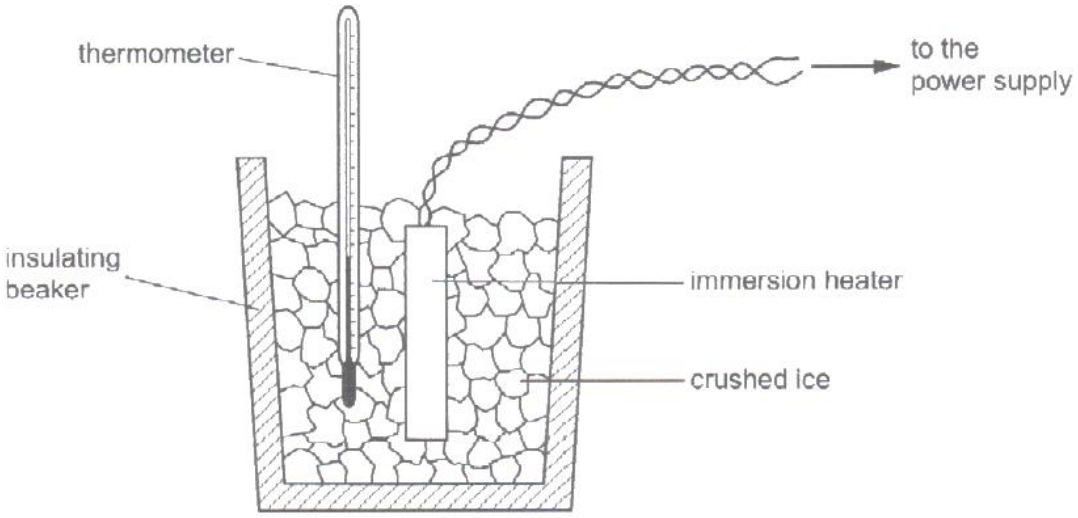


Fig. 5.1

The initial temperature of the ice is –60 °C.
The immersion heater is switched on and the temperature is recorded at equal intervals of time.
Fig. 5.2 shows the temperature–time graph.

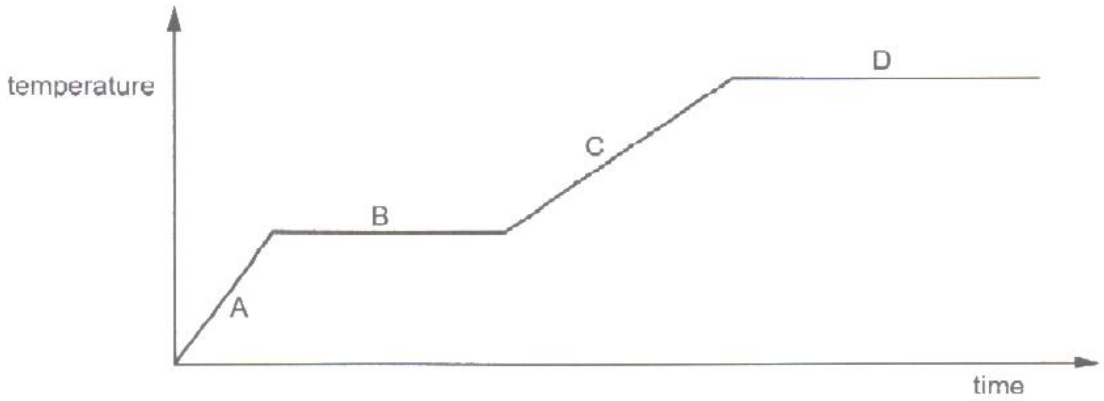


Fig. 5.2

Describe what occurs in each of the sections A, B, C and D.

A temperature of ice increases

B temp remain constant as ice changes to liquid

C temp of liquid water increases

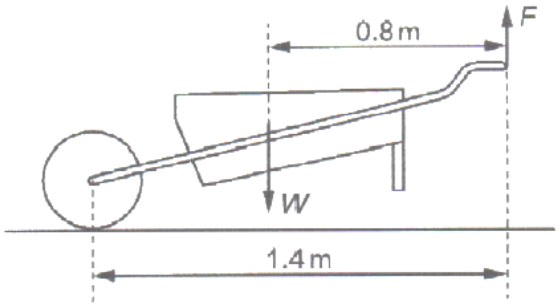
D temp remain constant at boiling point as water liquid changes to steam. [3]

[Total: 9]

Turning Effect of Force – 2022 November IGCSE 0625

1. Nov/2022/Paper_21/No.5

A wheelbarrow has a weight *W* of 140 N.



1·4
−0·8
0·6 m.

Which vertical force *F* is needed to support the wheelbarrow in the position shown?

A 60 N ✓ **B** 80 N **C** 140 N **D** 245 N

$140 \times 0.6 = F \times 1.4$

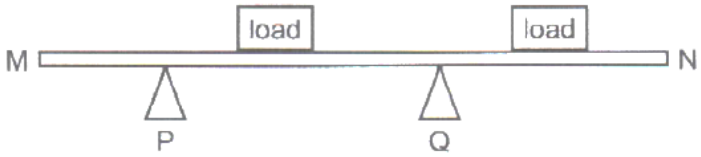
$F = \frac{140 \times 0.6}{1.4}$

$= 60\ N$

2. Nov/2022/Paper_22/No.5

The diagram shows a metre rule MN on two supports, P and Q.

Two loads are placed on the rule, as shown.



The rule rests steadily on the supports.

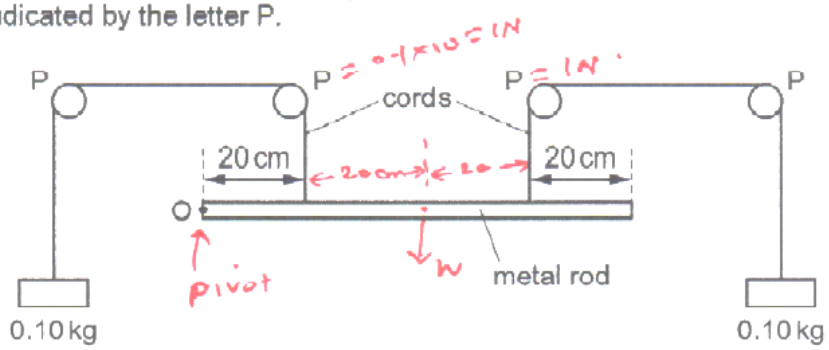
- Rule is at equilibrium so no turning effect acting on it at any point, since all moments cancel out.

Which row is correct?

	total moment about M	total moment about N
A	is clockwise	is anticlockwise
B	is clockwise	is zero
C	is zero	is clockwise
D ✓	is zero	is zero

3. Nov/2022/Paper_23/No.5

A metal rod of length 80 cm is pivoted at point O. Its centre of mass is at its mid-point. Four pulley wheels are indicated by the letter P.



The rod is in equilibrium, as shown.

What is the weight of the rod?

A 0.20 N **B** 1.0 N **C** 2.0 N **D** 4.0 N

$W \times 40 = (1 \times 20) + 1 \times 60$

$W \times 40 = 20 + 60$

$W = \frac{80}{40}$

$= 2N$

4. Nov/2022/Paper_31/No.3

A sailor uses a winch to raise a sail on a boat. Fig. 3.1 shows the sailor turning the winch.

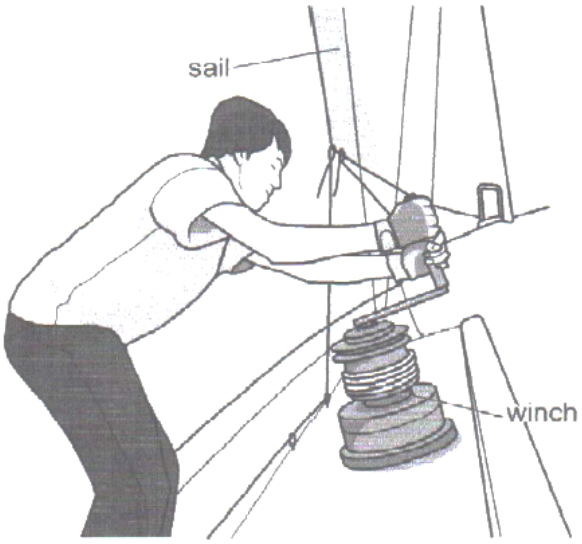


Fig. 3.1

(a) The sailor applies a force of 200 N at a distance of 30 cm from the pivot in the winch, as shown in Fig. 3.2.

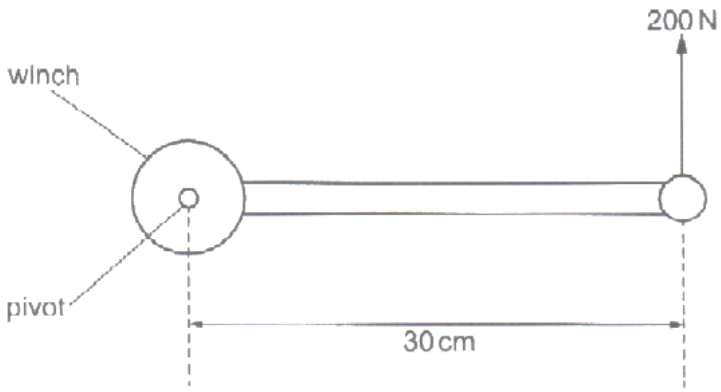


Fig. 3.2

Calculate the moment of this force about the pivot.

Moment = Force x distance

= 200 N x 30 cm

= 6000 N cm

moment of force = ... 6000 ..... N cm [3]

(b) (i) Describe **two** useful energy transfers when the sailor uses the winch to raise the sail.

1 Chemical energy to Kinetic energy

2 K.E to gravitational potential energy of sail.

[2]

(ii) Describe **one** non-useful energy transfer when the sailor uses the winch to raise the sail.

chemical energy to Sound energy. [1]

[Total: 6]

5. Nov/2022/Paper_41/No.3

A rock climber, of total mass 62 kg, holds herself in horizontal equilibrium against a vertical cliff. She pulls on a rope that is fixed at the top of the cliff and presses her feet against the cliff.

Fig. 3.1 shows her position.

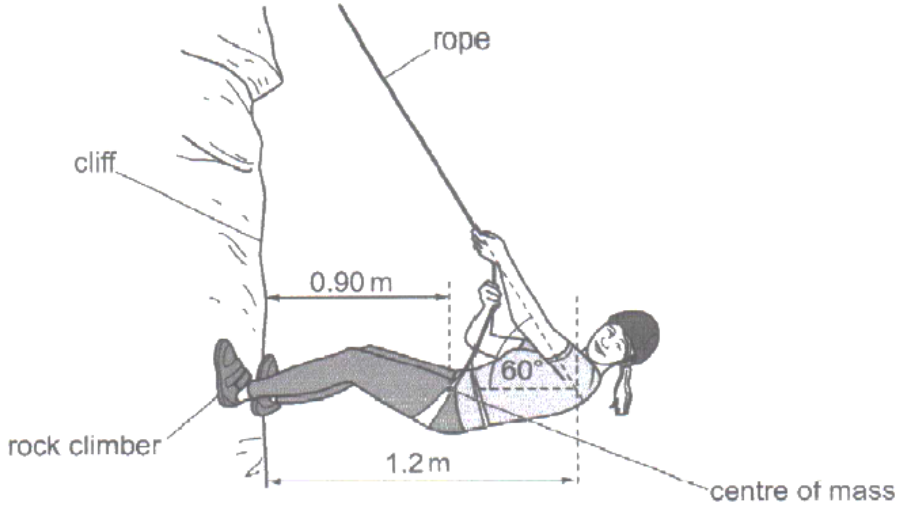


Fig. 3.1 (not to scale)

(a) Calculate the total weight of the climber.

$W = m \times g$
$= 62 \times 10$
$= 620\,N$

weight = 620 N [1]

(b) State the **two** conditions needed for equilibrium.

1. Resultant force is zero
2. No resultant moment

[2]

(c) The climber's centre of mass is 0.90 m from the cliff.

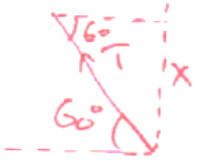
(i) Calculate the moment about her feet due to her weight.

$M = F \times d$
$= 620\,N \times 0.90\,m$
$= 558\,Nm$
$= 560\,Nm$ (2 s.f.)

moment = 560 Nm [2]

(ii) The line of the rope meets the horizontal line through her centre of mass at a distance of 1.2 m from the cliff, as shown in Fig. 3.1. The rope is at an angle of 60° to the horizontal.

Determine the tension in the rope.



since she is at equilibrium, then

clockwise moment = anticlockwise moment

$T \times 1.2 \sin 60° = 558$

$T = \frac{558}{1.2 \sin 60°} = 536\,N \simeq 540\,N$

$\sin 60° = \frac{x}{T}$

$x = T \sin 60°$

Moment $= T \sin 60° \times 1.2$

$= T \times 1.2 \sin 60°$

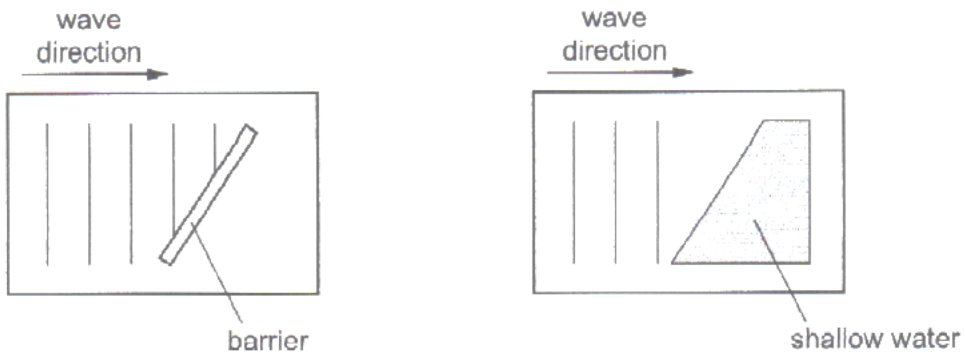
tension = ... 540 N ..... [3]

[Total: 8]

Waves – 2022 November IGCSE 0625

1. Nov/2022/Paper_21/No.18

The diagrams show two sets of wavefronts in a ripple tank.



A student makes two statements about the waves.

1 When the waves reflect from the barrier the direction changes but the wavelength remains the same.

2 When the waves refract as they enter the shallow water the direction remains the same, but the wavelength changes.

Which statements are correct?

A statement 1 and statement 2

B statement 1 only ✓

C statement 2 only

D neither statement 1 nor statement 2

Refraction is change of both direction and wavelength as the wave slows down in shallow water.

2. Nov/2022/Paper_21/No.17

A wave source produces 3000 crests every minute. The wave has a speed of 300 m/s.

What is the wavelength of the wave?

1m = 60s

A 0.10 m B 0.17 m C 6.0 m ✓ D 10.0 m

$f = \frac{3000}{60}$

$= 50\ Hz$

$v = f \times \lambda$

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

$\lambda = \frac{300\ m/s}{50\ Hz}$

$= 6.0\ m$

3. Nov/2022/Paper_22/No.17

A sound wave travels from air into water.

Which row describes what happens to the frequency and the wavelength of the wave?

	frequency	wavelength
A	decreases	increases ✓
B	decreases	stays the same
C	stays the same ✓	decreases
(D)	stays the same ✓	increases ✓

- From air to water, sound will undergo refraction
- During refraction frequency remains constant.

Speed in air = 340m/s

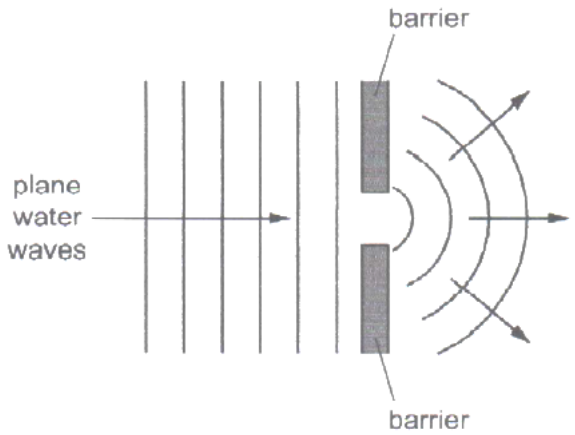
Speed of sound in water = 1600m/s

- Speed of sound in water is higher than in air
- So the wavelength λ will increase.

$v = f \times \lambda$, if f is constant then $v \propto \lambda$.

4. Nov/2022/Paper_22/No.18

The diagram shows plane water waves in a ripple tank passing through a gap between two barriers and spreading out.



bending of wavefront as it goes through a gap

Which name is given to this effect?

(A) diffraction ✓

B reflection — bouncing of light off a surface

C refraction — bending of light at interface between 2 media

D total internal reflection — from more to less dense medium at incidence angle greater than critical angle

5. Nov/2022/Paper_23/No.17

A passing boat causes a floating object on a lake to bob up and down 18 times in 12 s. The wavelength of the wave created by the boat is 48 cm.

$v = f \times \lambda$; $v = 1.5 \times 48$

What is the velocity of these water waves?

$f = \frac{18}{12} = 1.5\ Hz$; $= 72\ cm/s$

A 32 cm/s B 72 cm/s C 576 cm/s D 864 cm/s

6. Nov/2022/Paper_23/No.18

Wavefronts are incident on a boundary.

What is needed for the wave to refract at the boundary?

A a shiny surface at the boundary

B a small gap in the boundary – diffraction occurs not refraction

C different mediums either side of the boundary in which the frequency of the wave is different

D different mediums either side of the boundary in which the speed of the wave is different

- During refraction, frequency of wave remain same.
- Only wavelength changes.
- If λ changes, then wave speed will also change, hence refraction.
- Remember, refraction is change of speed as wave moves from one medium to another.

7. Nov/2022/Paper_43/No.6

Fig. 6.1 shows wave crests and the direction of travel for a water wave approaching a barrier in a large ripple tank.

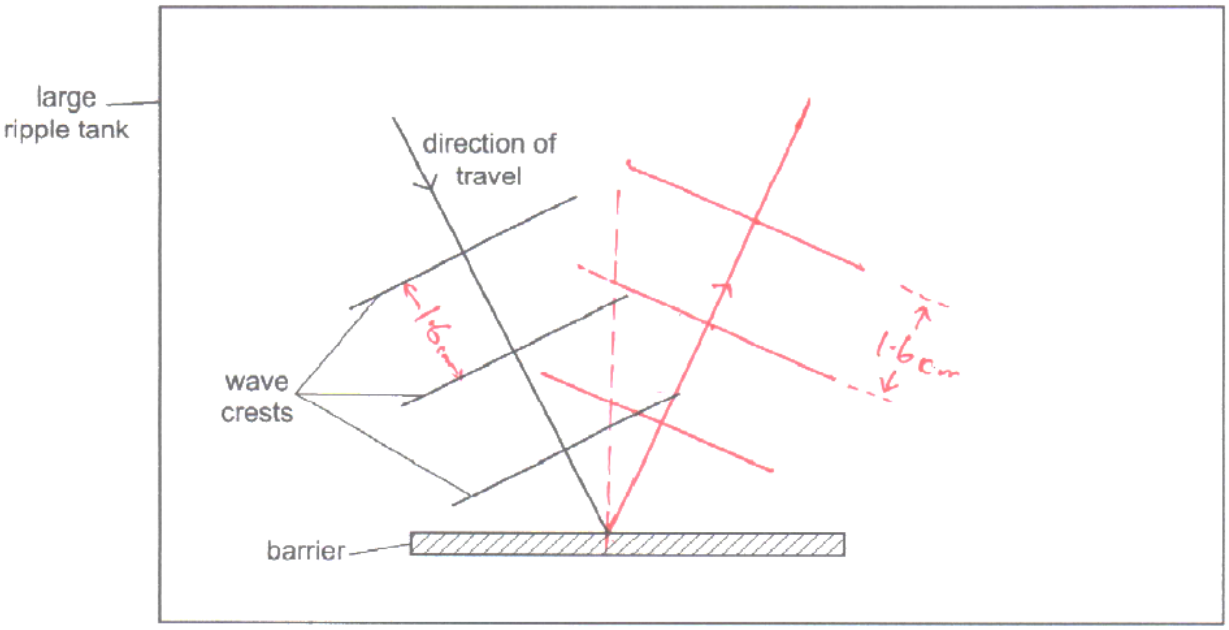


Fig. 6.1

The wavelength of the wave is 1.6 cm.

(a) On Fig. 6.1, draw:

(i) the direction of travel of the reflected wave [1]

(ii) **three** successive reflected wave crests. [2]

- Wave crest are perpendicular to the direction of wave travel.
- Measure the wavelength which is 1.6 cm.
- Draw the wave crests with the same 1.6 cm wavelength

(b) Fig. 6.2 shows an identical wave approaching a barrier with a gap of 1.3 cm.

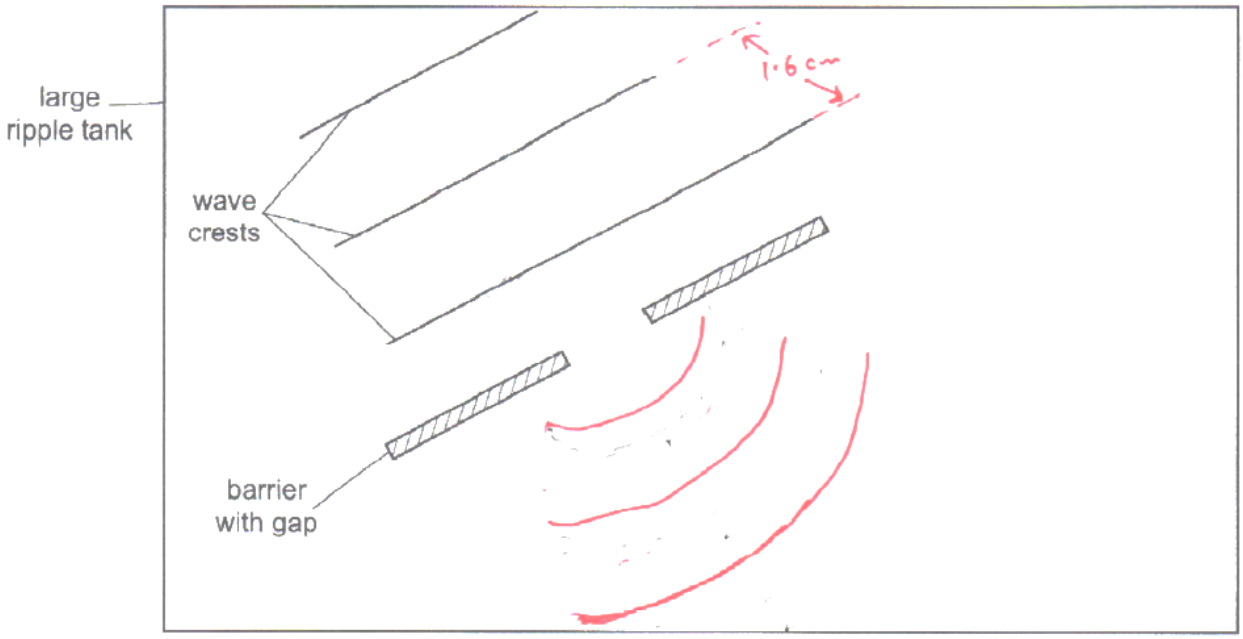


Fig. 6.2

On Fig. 6.2, draw **three** successive wave crests after they pass through the gap in the barrier. [3]

(c) The frequency of the wave is 4.0 Hz.

Calculate the speed of the wave.

$\lambda = 1.6$ cm.

$f = 4.0$ Hz

$v = f \times \lambda$.

$= 4.0 \times 1.6$

$= 6.4$ cm/s

speed = 6.4 cm/s [2]

[Total: 8]

Work, Energy and Power – 2022 November IGCSE 0625

1. Nov/2022/Paper_21/No.8

Brakes are used to slow down a moving car.

Into which form of energy is most of the kinetic energy converted as the car slows down?

A chemical

B elastic

C thermal ✓

D sound

K.E is converted to thermal energy in the brake pad.

2. Nov/2022/Paper_21/No.9

An object has kinetic energy of 200 J.

A constant resultant force of 190 N is applied in the direction of its motion through a distance of 10 m.

What is the final kinetic energy of the object?

A 390 J B 1700 J C 2000 J D 2100 J ✓

W = F x d
= 190 x 10
= 1900 J

1900 + 200 = 2100 J

3. Nov/2022/Paper_21/No.10

The statements describe what happens when the power of a machine is increased.

✗1 The work done in a given time decreases.

✓2 The work done in a given time increases.

✓3 The time taken to do a given quantity of work decreases.

✗4 The time taken to do a given quantity of work increases.

Which statements are correct?

A 1 and 3 B 1 and 4 C 2 and 3 ✓ D 2 and 4

$\text{Power} = \frac{\text{Work done}}{\text{time}}$

Power ∝ W.d.

$\text{Power} \propto \frac{1}{t}$.

- W.d increase
- time decreases

4. Nov/2022/Paper_22/No.8

An object falls towards the Earth's surface.

v = 4 m/s

What happens to the gravitational potential energy and to the kinetic energy of the object?

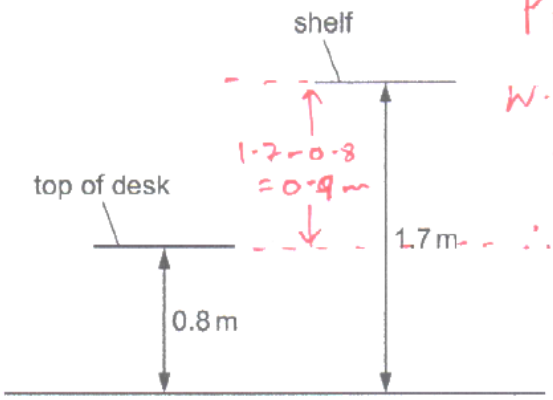
	gravitational potential energy	kinetic energy
A	decreases ✓	decreases
B	decreases ✓	increases ✓
C	increases	decreases
D	increases	increases ✓

gpe – decreases

K.E – increases

5. Nov/2022/Paper_22/No.9

A boy takes 0.60 s to lift a book of mass 0.60 kg from the top of a desk and place it on a shelf. The top of the desk is 0.80 m above the floor, and the shelf is 1.7 m above the floor. The gravitational field strength is 10 N/kg.



Power = Work done / time

$W \cdot d = F \times d$

$F = m \times g$

$= 0.6 \times 10 = 6\,N$

$1.7 - 0.8 = 0.9\,m$

$\therefore W \cdot d = 6 \times 0.9$

$= 5.4\,J$

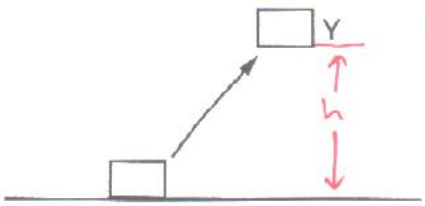
$P = \frac{5.4}{0.6} = 9\,W$

Which power does the boy develop?

A 0.9 W **B** 1.7 W **C** 9.0 W **D** 17 W

6. Nov/2022/Paper_22/No.10

A mass is lifted from rest on the ground to Y. There is no air resistance.



both gpe and k.e increase as mass is lifted to Y

gpe = mgh.

h has increased.

$K.E = \frac{1}{2}mv^2$

mass is moving

P is the increase in gravitational energy of the mass.

Q is the kinetic energy of the mass at Y.

Which expression is equal to the mechanical work done on the mass?

So work done = P + Q.

A P + Q **B** P − Q **C** Q − P **D** P × Q

7. Nov/2022/Paper_23/No.8

An object falls towards the Earth's surface.

What happens to the gravitational potential energy and to the kinetic energy of the object?

	gravitational potential energy	kinetic energy
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

gpe – decrease since h is decreasing

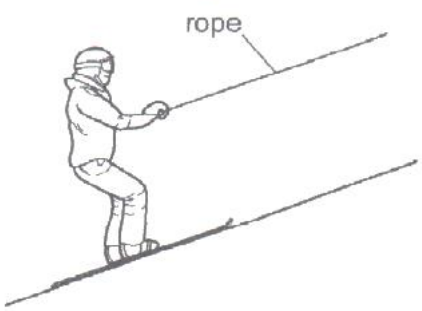
gpe = mgh.

k.e – increases, since objects speed increase at at falls towards Earth's surface

$K.E = \frac{1}{2}mv^2$

8. Nov/2022/Paper_23/No.9

A skier is pulled up a short straight slope at constant speed by a rope.



$W.d = F \times d.$

$F = 100N$

$d = 10m.$

$W.d = 100 \times 10$

$= 1000J$

The tension in the rope is 100 N and there is a combined frictional and air resistance force of 20 N acting on the skier.

The slope is 10 m long and the skier rises 1.5 m vertically.

How much work is done by the rope pulling the skier up the slope?

- At constant speed, force acting on him is 100 N.
- He moves 10m in the direction of force.

A 120 J B 150 J C 1000 J D 1200 J

9. Nov/2022/Paper_23/No.10

In some situations, a force does work.

Which set of conditions increases the quantity of work done by the force?

	magnitude of force	distance moved by the force
A	decreases	decreases
B	decreases	stays the same
C	increases ✓	increases
D	stays the same	decreases

Work done = F × d.

W · d ∝ F

W · d ∝ distance

both increase of F and d will increase W · d.

10. Nov/2022/Paper_31/No.4(b)

(b) The student lifts the 5.0 kg object from the floor onto a table. He does 75 J of work on the object in lifting it onto the table.

State the amount of gravitational potential energy gained by the object due to being lifted onto the table.

gpe = work done

= 75 J

gravitational potential energy gained by object = 75 J [1]

11. Nov/2022/Paper_32/No.3(b)

(b) We can measure temperature by using physical properties that vary with temperature.

(i) State the physical property that we use to measure temperature in a liquid-in-glass thermometer.

expansion and contraction of liquid [1]

(ii) State another physical property that we use to measure temperature.

e.m.f. (as in a thermocouple thermometer). [1]

12. Nov/2022/Paper_33/No.3

(a) Table 3.1 contains incomplete information about the input energy and the useful output energy for a number of devices. The table is only complete for the microphone.

Complete Table 3.1 by writing in each blank space.

Table 3.1

device	input energy	useful output energy
microphone	sound	electrical
electric fire	electrical	thermal
wind turbine	Kinetic	electrical
Loudspeaker	electrical	sound

[3]

(b) A tennis player hits a ball over the net and it bounces as shown in Fig. 3.1.

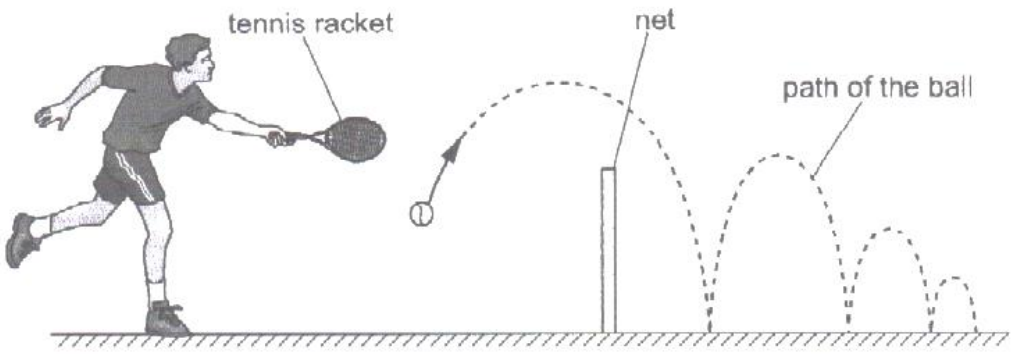


Fig. 3.1

(i) Complete the sentences about energy transfers.

1. When the player swings the tennis racket, his body converts ..chemical.. energy to ..Kinetic.. energy. [1]

2. When the tennis ball is moving upwards, the ball gains ..gravitational.. energy. [1]

(ii) Explain why the height gained by the ball decreases with each successive bounce.

Energy is transferred to ground as thermal and sound energy. [1]

[Total: 6]

13. Nov/2022/Paper_41/No.1(a)

Two blocks, A and B, are joined by a thin thread that passes over a frictionless pulley. Block A is at rest on a rough horizontal surface and block B is held at rest, just below the pulley.

Fig. 1.1 shows the thread hanging loose.

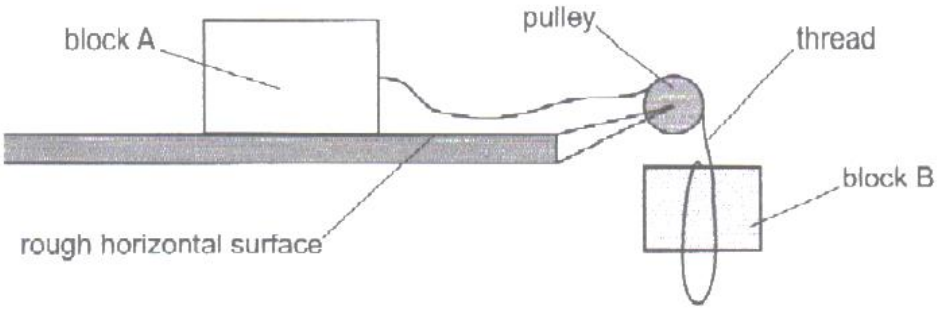


Fig. 1.1 (not to scale)

Block B is released and it falls vertically. The thread remains loose until block B has fallen a distance of 0.45 m.

The mass of block B is 0.50 kg.

(a) Calculate the change in the gravitational potential energy (g.p.e.) of block B as it falls through 0.45 m.

$\Delta gpe = mgh$

$= 0.5 \times 10 \times 0.45$

$= 2.25$ J

$\simeq 2.3$ J (2 s.f)

change in g.p.e. ..... 2.3 J. ..... [2]

14. Nov/2022/Paper_42/No.1(b)

(b) The height of the water decreases by 0.420 m as it flows down the channel.

Calculate the decrease in gravitational potential energy of the water each second.

$gpe = mgh$; $m = \frac{800\ kg}{60}$; $gpe = 13.33 \times 10 \times 0.42$

$1\ min = 60\ s$; $= 13.33\ kg$; $= 56$ J

$60\ s \gtrsim 800\ kg$

$1\ s \rightarrow ?$

decrease in gravitational potential energy = ... 56 J ..... [3]