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NEET PHYSICS PAPER SOLUTION 2023

Conquer NEET PHYSICS 2023 WITH CONCEPTUAL CLARITY

The NEET Physics paper 2023 was both interesting and challenging. It featured questions from a wide range of topics, including mechanics, electricity, magnetism, optics, and modern physics. The paper was well-balanced in terms of difficulty, with some questions being more challenging than others. Furthermore, it was well-structured and organized, incorporating a good mix of multiple-choice and short-answer questions. The examiners also included questions that tested students' conceptual understanding of the subject. The timing of the paper was appropriate, allowing students enough time to answer all the questions. Overall, it was an effective assessment of the students' knowledge and understanding of the subject. The paper was well-balanced and provided students with an opportunity to showcase their grasp of the material.

Kumar Physics Classes has been providing high-quality education and guidance to students for over 15 years. The faculty at Kumar Physics Classes is highly experienced and possesses a deep understanding of the NEET syllabus. They have developed an effective teaching methodology and curriculum to ensure that their students receive the best guidance and achieve a thorough understanding of the topics. The teachers are regularly updated with the latest developments in the syllabus and also offer extra classes and practice sessions to ensure that their students are well-prepared for the exams. Additionally, Kumar Physics Classes provides comprehensive study materials, well-structured online courses, and mock tests to assist students in practicing and preparing for the exam. All these efforts have culminated in an unbeatable 100% success rate in the NEET Physics paper in 2023.

Conquer NEET Physics 2023 with Conceptual Clarity!

1. The work functions of Caesium (Cs), Pottassium (K) and Sodium (Na) are 2.14 eV. 2.30 eV and 2.75 eV respectively. If incident electromagnetic radiation has an incident energy of 2.20 eV. Which of these photosensitive surfaces may emit photoelectrons ?

(1) Both Na and K (2) K only (3) Na only (4) Cs only ✓

We know that

$h\nu = h\nu_0 + (KE)$

$h\nu$: INCIDENT RADIATION

$h\nu_0$: WORK Function

(KE) : KINETIC ENERGY

work function

$Cs \rightarrow 2.14\ eV$

$K \rightarrow 2.30\ eV$

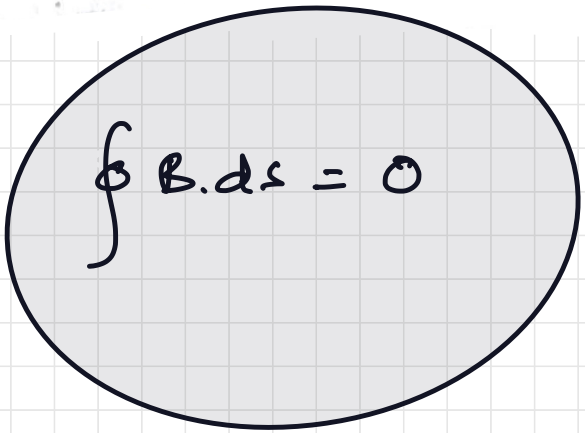
$Na \rightarrow 2.75\ eV$

INCIDENT ENERGY → 2.20 eV

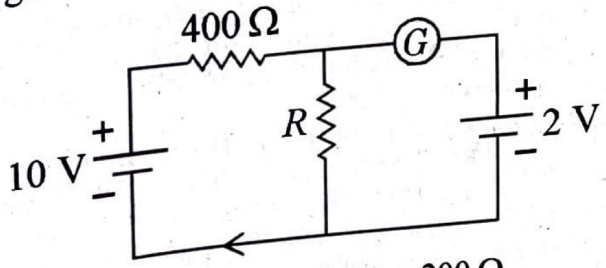
greater than work function of Cs

2 The net magnetic flux through any closed surface is :

(1) Negative
(2) Zero
(3) Positive
(4) Infinity

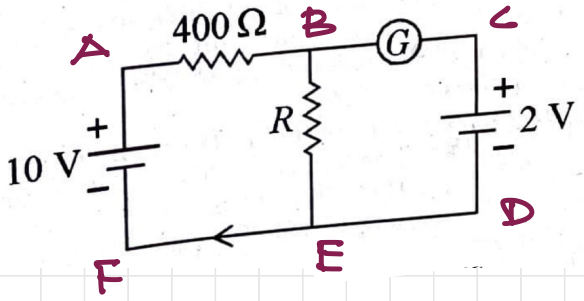


3 If the galvanometer G does not show any deflection in the circuit shown, the value of R is given by :



(1) 400 Ω (2) 200 Ω

(3) 50 Ω (4) 100 Ω ✓



Mesh ABEFA

$400I + IR - 10 = 0$ —— (1)

Mesh BCDEB

$IR = 2V$ —— (2)

$400I + 2 - 10 = 0$

$400I = 8 \Rightarrow I = \frac{8}{400}$ Amp

From equation (1)

$\frac{8}{400}(R) = 2$

$R = 100$ ohm

4 A 12 V, 60 W lamp is connected to the secondary of a step down transformer, whose primary is connected to ac mains of 220 V. Assuming the transformer to be ideal, what is the current in the primary winding?

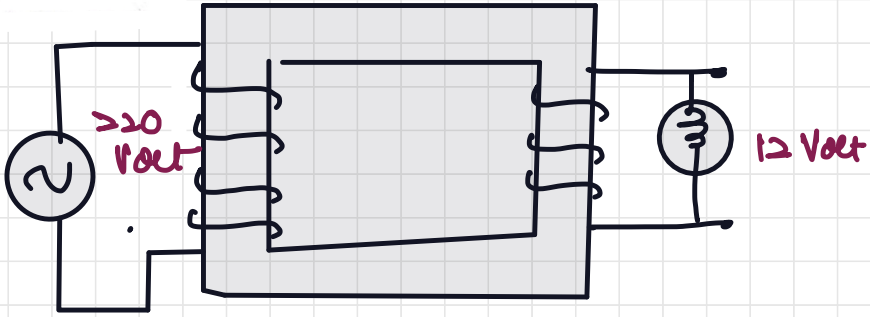
(1) 0.37 A (2) 0.27 A

(3) 2.7 A (4) 3.7 A

12 Volt 60 watt

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

$I = \frac{60}{12} = 5$ Amp



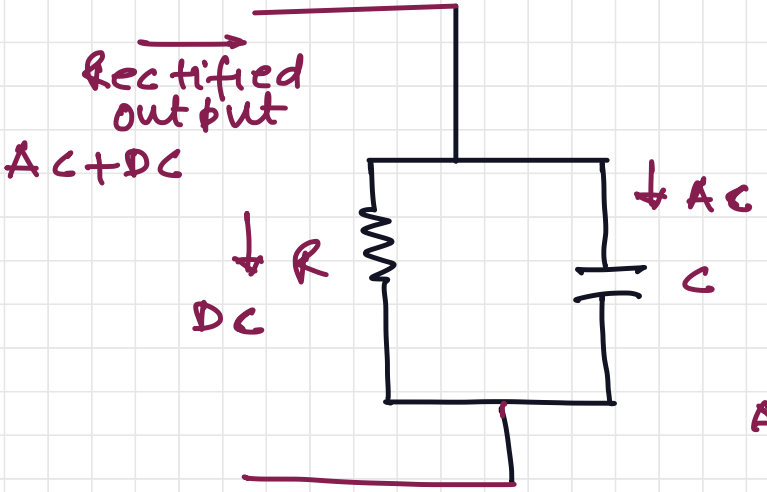
$$\frac{N_s}{N_p} = \frac{I_p}{I_s} = \frac{V_s}{V_p}$$ → Ideal transformer

$\frac{I_p}{5} = \frac{12}{220} \Rightarrow I_p = \frac{12 \times 5}{220} = 0.27$ A

1. A full wave rectifier circuit consists of two p-n junction diodes, a center-tapped transformer, capacitor and a load resistance. Which of these components remove the ac ripple from the rectified output ?

(1) p-n junction diodes (2) Capacitor

(3) Load resistance (4) A center-tapped transformer



For capacitor

$X_C = \frac{1}{2\pi f C}$

$f_{DC} = 0$

$X_C \to \infty$

hence D.C will pass through Resistor

AC does not.

6 In a plane electromagnetic wave travelling in free space, the electric field component oscillates sinusoidally at a frequency of 2.0×10^{10} Hz and amplitude $48\,V m^{-1}$. Then the amplitude of oscillating magnetic field is : (Speed of light in free space = $3\times10^{8}\ m\ s^{-1}$)

(1) 1.6×10^{-6}T (2) 1.6×10^{-9}T

(3) 1.6×10^{-8}T (4) 1.6×10^{-7}T

$$c = \frac{E_0}{B_0}$$

$$B_0 = \frac{E_0}{c} = \frac{48}{3\times10^8}$$

$$= \frac{48}{3}\times10^{-8}$$

$$= 16\times10^{-8}\ T$$

$$= 1.6\times10^{-7}\ T$$

7 A metal wire has mass (0.4 ± 0.002) g, radius (0.3 ± 0.001) mm and length (5 ± 0.02) cm. The maximum possible percentage error in the measurement of density will nearly be:

(1) 1.4% (2) 1.2%

(3) 1.3% (4) 1.6%

$$d = \frac{m}{\pi r^2 l}$$

$$\frac{\Delta d}{d} \times 100\% = \frac{\Delta m}{m} \times 100\% + 2\frac{\Delta r}{r} \times 100\% + \frac{\Delta l}{l} \times 100\%$$

$$= \frac{.002}{0.4} \times 100\% + 2\left(\frac{.001}{0.3}\right) \times 100\% + \left(\frac{.02}{5}\right) \times 100\%$$

$$= 0.5\% + \frac{2}{3}\% + \frac{2}{5}\%$$

$$= 0.5\% + 0.66\% + 0.4\%$$

$$\simeq 1.6\%$$

8 Light travels a distance x in time t_1 in air and $10x$ in time t_2 in another denser medium. What is the critical angle for this medium?

(1) $\sin^{-1}\left(\frac{10t_1}{t_2}\right)$ (2) $\sin^{-1}\left(\frac{t_2}{t_1}\right)$

(3) $\sin^{-1}\left(\frac{10t_2}{t_1}\right)$ (4) $\sin^{-1}\left(\frac{t_1}{10t_2}\right)$

$$v_1 = \frac{x}{t_1}, \quad \mu_1 = \frac{ct_1}{x}$$

$$v_2 = \frac{10x}{t_2}, \quad \mu_2 = \frac{ct_2}{10x}$$

$$\mu_2 \sin c = \mu_1 \sin 90^\circ$$

$$\sin c = \frac{\mu_1}{\mu_2} = \frac{ct_1}{x} \cdot \frac{10x}{ct_2}$$

$$= \frac{10t_1}{t_2}$$

$$c = \sin^{-1}\left(\frac{10t_1}{t_2}\right)$$

9 An electric dipole is placed at an angle of 30° with an electric field of intensity $2\times10^{5}\,N\,C^{-1}$. It experiences a torque equal to 4 N m. Calculate the magnitude of charge on the dipole, if the dipole length is 2 cm.

(1) 2 mC (2) 8 mC

(3) 6 mC (4) 4 mC

$\tau = pE\sin\theta$

$\tau = q(2a)E\sin\theta$

$4 = q\times2\times10^{-2}\times2\times10^{5}\times\sin30$

$4 = q\times2\times10^{3}$

$q = 2\times10^{-3}$

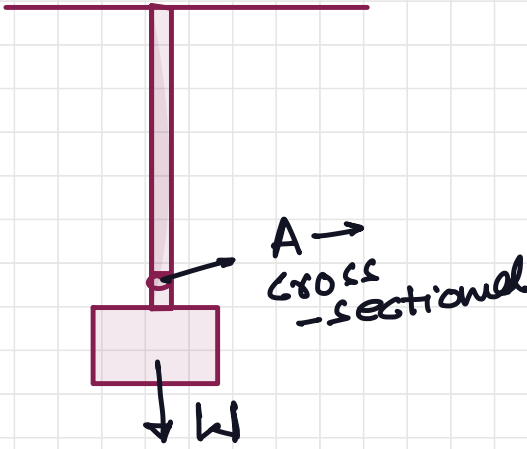
$q = 2\,mC$

10 Let a wire be suspended from the ceiling (rigid support) and stretched by a weight W attached at its free end. The longitudinal stress at any point of cross-sectional area A of the wire is :

(1) Zero (2) $2W/A$

(3) W/A (4) $W/2A$

$$\text{STRESS} = \frac{kl}{A}$$



11 In hydrogen spectrum, the shortest wavelength in the Balmer series is λ. The shortest wavelength in the Bracket series is :

(1) 16λ (2) 2λ

(3) 4λ (4) 9λ

$$\frac{1}{\lambda} = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

$$\frac{1}{\lambda_{Balmer}} = R\left(\frac{1}{2^2} - \frac{1}{\infty^2}\right)$$

$$\frac{1}{\lambda} = \frac{R}{4}$$

$$\lambda = 4/R$$

$$R = \frac{4}{\lambda}$$

$$\frac{1}{\lambda_{BRACKET}} = R\left(\frac{1}{(4)^2} - \frac{1}{\infty^2}\right)$$

$$\frac{1}{\lambda_{BRACET}} = \frac{R}{16}$$

$$\lambda_{BRACKET} = \frac{16}{R}$$

$$= \frac{4\cancel{16} \times \lambda}{\cancel{4}}$$

$$= (4\lambda)$$

12 The temperature of a gas is –50° C. To what temperature the gas should be heated so that the rms speed is increased by 3 times?

(1) 223 K
(2) 669° C
(3) 3295° C
(4) 3097 K

$$v = \sqrt{\frac{3RT}{M}}$$

$$v \propto \sqrt{T}$$

$$\frac{v_1}{v_2} = \sqrt{\frac{T_1}{T_2}} = \sqrt{\frac{273-50}{T_2}}$$

$$\frac{v}{4v} = \sqrt{\frac{223}{T_2}} \Rightarrow \frac{1}{16} = \frac{223}{T_2} \Rightarrow T_2 = 3568\ K^\circ$$

$$= 3568 - 273$$

$$= 3295^\circ C.$$

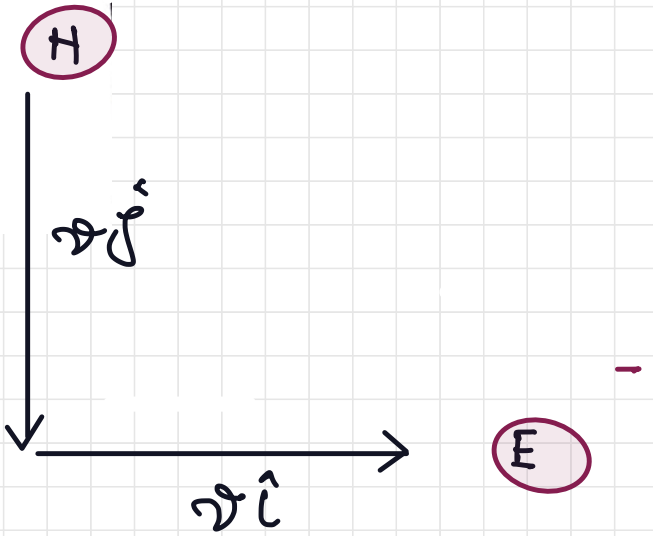
13 A football player is moving southward and suddenly turns eastward with the same speed to avoid an opponent. The force that acts on the player while turning is

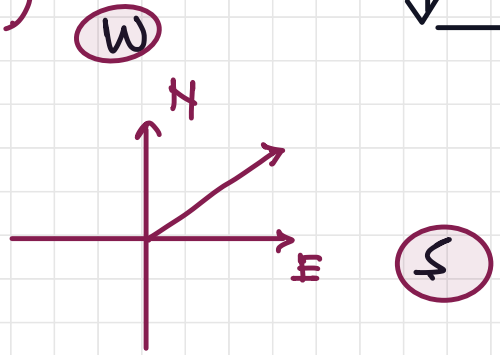
(1) along south-west
(2) along eastward
(3) along northward
(4) along north-east

$\Delta V = V_f - V_i$

$= v\hat{i} - (-v\hat{j})$

$\Delta V = v\hat{i} + v\hat{j}$

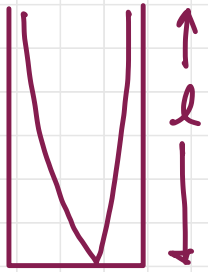


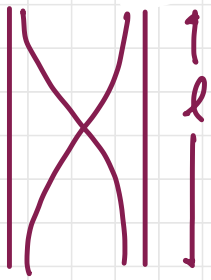


14 The ratio of frequencies of fundamental harmonic produced by an open pipe to that of closed pipe having the same length is :

(1) 3 : 1 (2) 1 : 2

(3) 2 : 1 (4) 1 : 3





$l = \frac{\lambda_1}{4}$

$\lambda_1 = 4l$

$f_1 = \frac{v}{\lambda_1} = \frac{v}{4l}$

$l = \frac{\lambda_2}{2} \Rightarrow \lambda_2 = 2l$

$f_2 = \frac{v}{\lambda_2} = \frac{v}{2l}$

$\frac{f_2}{f_1} = \frac{\frac{v}{2l}}{\frac{v}{4l}} = \frac{2}{1}$

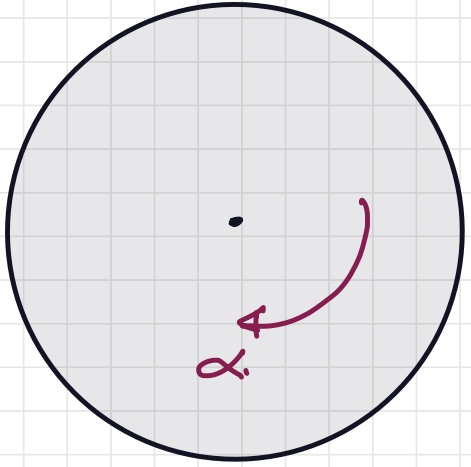
15 The angular acceleration of a body, moving along the circumference of a circle, is :

(1) along the axis of rotation

(2) along the radius, away from centre

(3) along the radius towards the centre

(4) along the tangent to its position



along the axis of rotation

16 Given below are two statements:

Statement I : Photovoltaic devices can convert optical radiation into electricity.

Statement II : Zener diode is designed to operate under reverse bias in breakdown region.

In the light of the above statements, choose the ***most appropriate*** answer from the options given below :

(1) **Statement I** is incorrect but **Statement II** is correct.

(2) Both **Statement I** and **Statement II** are correct.

(3) Both **Statement I** and **Statement II** are incorrect.

(4) **Statement I** is correct but **Statement II** is incorrect.

17 If $\oint_S \vec{E} \cdot \vec{dS} = 0$ over a surface, then :

(1) the electric field inside the surface is necessarily uniform.

(2) the number of flux lines entering the surface must be equal to the number of flux lines leaving it.

(3) the magnitude of electric field on the surface is constant.

(4) all the charges must necessarily be inside the surface.

$$\oint \bar{E}\, d\bar{s} = \phi$$

$$\bar{E} \cdot \bar{dA} = 0$$

$$\phi_{NET} = 0$$

18 Resistance of a carbon resistor determined from colour codes is $(22000 \pm 5\%)\ \Omega$. The colour of third band must be :

(1) Yellow (2) Red

(3) Green (4) Orange

$22 \times 10^3 \pm 5\%$

ORANGE

19 The magnetic energy stored in an inductor of inductance 4 μH carrying a current of 2 A is :

(1) 8 μJ (2) 4 μJ

(3) 4 mJ (4) 8 mJ

$$U = \frac{1}{2} L I^2$$

$$= \frac{1}{2} \times 4 \times 10^{-6} \times (2)^2$$

$$= 8 \times 10^{-6} \text{ J}$$

$$= 8 \mu\text{J}$$

20 In a series LCR circuit, the inductance L is 10 mH, capacitance C is 1 μF and resistance R is 100 Ω. The frequency at which resonance occurs is :

(1) 1.59 kHz (2) 15.9 rad/s

(3) 15.9 kHz (4) 1.59 rad/s

$$W = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{10\times10^{-3}\times1\times10^{-6}}}$$

$$= \frac{1}{\sqrt{10^{1-3-6}}} = \frac{1}{\sqrt{(10^{-4})^2}}$$

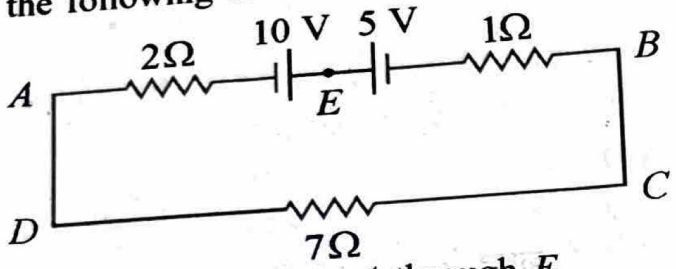
$$= \frac{1}{10^{-4}}$$

$$f = \frac{W}{2\pi} = \frac{10^4}{2\times3.14}$$

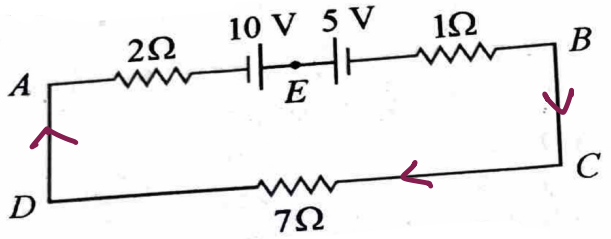
$$= \frac{10\times10^3}{2\times3.14}$$

$$= 1.59\ \text{kHz}$$

21 The magnitude and direction of the current in the following circuit is



(1) 1.5 A from B to A through E
(2) 0.2 A from B to A through E
(3) 0.5 A from A to B through E
(4) $\frac{5}{9}$ A from A to B through E



Mesh ABCDA

$2I - 10 + 5 + 1I + 7I = 0$

$10I = 5$

$I = 5/10 = \frac{1}{2} = 0.5$ A

From A to B

23 The errors in the measurement which arise due to unpredictable fluctuations in temperature and voltage supply are :

(1) Random errors
(2) Instrumental errors
(3) Personal errors
(4) Least count errors

24 For Young's double slit experiment, two statements are given below:

Statement I : If screen is moved away from the plane of slits, angular separation of the fringes remains constant.

Statement II : If the monochromatic source is replaced by another monochromatic source of larger wavelength, the angular separation of fringes decreases.

In the light of the above statements, choose the *correct* answer from the options given below:

(1) **Statement I** is false but **Statement II** is true.

(2) Both **Statement I** and **Statement II** are true.

(3) Both **Statement I** and **Statement II** are false.

(4) **Statement I** is true but **Statement II** is false.

STATEMENT-1

$$\beta = \frac{D\lambda}{d}$$

$$\theta = \frac{\beta}{D} = \frac{D\lambda}{dD} = \frac{\lambda}{d}$$

$\theta = \frac{\lambda}{d}$ → If D increases no effect on θ

CORRECT

STATEMENT-2

$\theta = \frac{\lambda}{d}$ If $\lambda \uparrow\uparrow$ then $\theta \uparrow\uparrow$

WRONG

25 A bullet is fired from a gun at the speed of 280 m s^{-1} in the direction 30° above the horizontal. The maximum height attained by the bullet is $\left(g = 9.8\ m\ s^{-2},\ \sin 30° = 0.5\right)$:

(1) 3000 m
(2) 2800 m
(3) 2000 m
(4) 1000 m ✓

$$H = \frac{u^2 \sin^2\theta}{2g}$$

$$= \frac{280 \times 280 \times \sin^2 30}{2 \times 9.8}$$

$$= \frac{280 \times 280}{4 \times 2 \times 9.8}$$

$$= 1000\ m$$

26 A Carnot engine has an efficiency of 50% when its source is at a temperature 327° C. The temperature of the sink is :

(1) 200° C (2) 27° C

(3) 15° C (4) 100° C

$$\eta = 1 - \frac{T_2}{T_1} \Rightarrow \frac{50}{100} = 1 - \frac{T_2}{273+327}$$

$$\frac{1}{2} = 1 - \frac{T_2}{600}$$

$$\frac{T_2}{600} = 1 - \frac{1}{2} = \frac{1}{2}$$

$$T_2 = 300\ K$$

$$T_2 = 300 - 273 = 27°C$$

27 The amount of energy required to form a soap bubble of radius 2 cm from a soap solution is nearly : (surface tension of soap solution = 0.03 N m^{-1})

(1) 50.1×10^{-4}J (2) 30.16×10^{-4}J

(3) 5.06×10^{-4}J (4) 3.01×10^{-4}J

$$E = S.\ \Delta A$$

$$= \cdot03 \times 2 \times (4\pi r^2)$$

$$= \cdot03 \times 2 \times 4 \times 3\cdot14 \times (2\times10^{-2})^2$$

$$= \cdot06 \times 4 \times 3\cdot14 \times 10^{-4} \times 4$$

$$= 3\cdot01 \times 10^{-4}\,J$$

28 The half life of a radioactive substance is 20 minutes. In how much time, the activity of substance drops to $\left(\frac{1}{16}\right)^{th}$ of its initial value?

(1) 80 minutes (2) 20 minutes
(3) 40 minutes (4) 60 minutes

$$A = A_0 \left(\frac{1}{2}\right)^n$$

$$\frac{A_0}{16} = A_0 \left(\frac{1}{2}\right)^n$$

$$\left(\frac{1}{2}\right)^4 = \left(\frac{1}{2}\right)^n$$

$$n = 4$$

$$T.T = (T_{1/2}) \times n = 20 \times 4$$

$$= 80 \text{ min}$$

29 The potential energy of a long spring when stretched by 2 cm is U. If the spring is stretched by 8 cm, potential energy stored in it will be :

(1) 16U (2) 2U

(3) 4U (4) 8U

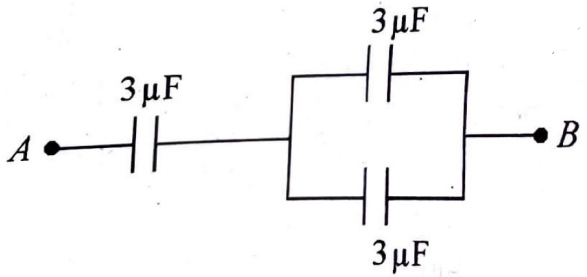
$$U = \frac{1}{2} k (2)^2$$

$$U' = \frac{1}{2} k (8)^2$$

$$\frac{U}{U'} = \frac{4}{8 \times 8}$$

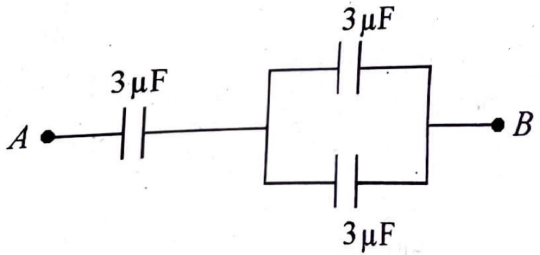
$$U' = 16\,U$$

30 The equivalent capacitance of the system shown in the following circuit is :



(1) 9 μF (2) 2 μF

(3) 3 μF (4) 6 μF



$$C_{eq} = \frac{6 \times 3}{6+3} = \frac{18}{9} = 2\,\mu C$$

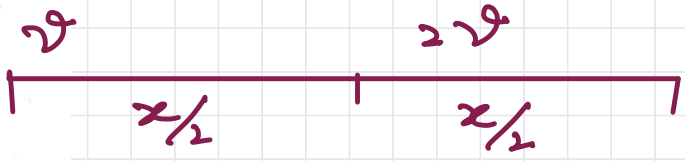
31 A vehicle travels half the distance with speed ϑ and the remaining distance with speed 2ϑ. Its average speed is:

(1) $\frac{3\vartheta}{4}$

(2) $\frac{\vartheta}{3}$

(3) $\frac{2\vartheta}{3}$

(4) $\frac{4\vartheta}{3}$



$$\text{speed} = \frac{x/2 + x/2}{\frac{x}{2\vartheta} + \frac{x}{4\vartheta}} = \frac{x}{\frac{x}{2\vartheta}\left(\frac{1}{2} + \frac{1}{4}\right)}$$

$$= \frac{x}{\frac{x}{2\vartheta}\left(\frac{6}{8}\right)} = \frac{16\vartheta}{6} = \frac{4\vartheta}{3}$$

32 The ratio of radius of gyration of a solid sphere of mass M and radius R about its own axis to the radius of gyration of the thin hollow sphere of same mass and radius about its axis is :

(1) 5 : 2

(2) 3 : 5

(3) 5 : 3

(4) 2 : 5

$\frac{2}{5} MR^2 = M k_s^2$

$\frac{2}{3} MR^2 = M k_h^2$

$\frac{\frac{2}{5} MR^2}{\frac{2}{3} MR^2} = \frac{k_s^2}{k_h^2}$

$\sqrt{\frac{3}{5}} = \frac{k_s}{k_h}$

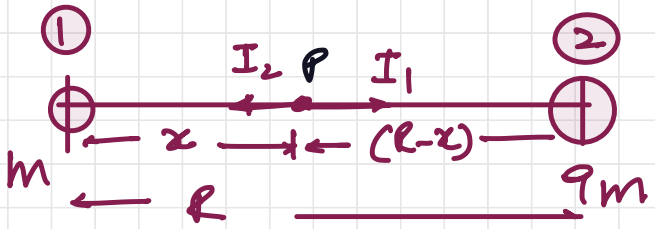
BONUS QUESTION

WRONG OPTIONS

33 Two bodies of mass m and $9m$ are placed at a distance R. The gravitational potential on the line joining the bodies where the gravitational field equals zero, will be (G = gravitational constant) :

(1) $-\frac{20\,Gm}{R}$ (2) $-\frac{8\,Gm}{R}$

(3) $-\frac{12\,Gm}{R}$ (4) $-\frac{16\,Gm}{R}$



$I_1 = I_2$

$$\frac{Gm}{x^2} = \frac{G\,9m}{(R-x)^2}$$

$$9x^2 = (R-x)^2$$

$$3x = R - x$$

$$4x = R \Rightarrow x = R/4$$

$$V_P = -\frac{Gm}{x} - \frac{Gm9}{(R-R/4)}$$

$$= -\frac{4Gm}{R} - \frac{Gm(4)(4)}{3R} = -\frac{4Gm}{R}(1+3) = -\frac{16Gm}{R}$$

34 The venturi-meter works on :

(1) The principle of perpendicular axes

(2) Huygen's principle

(3) Bernoulli's principle

(4) The principle of parallel axes

8(c) 17 **VENTURIMETER**

It is a device, used for measuring the rate of flow of liquid through pipes. Its working is based on Bernoulli's theorem.

Construction. It consists of two identical coaxial tubes A and C connected by a narrow co-axial tube B. Two vertical tubes D and E are mounted on the tubes A and B to measure the pressure of the flowing liquid, Fig. 7(c).14.

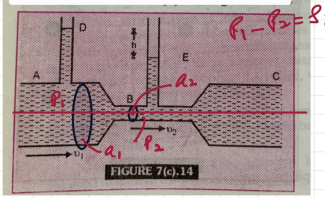


FIGURE 7(c).14

- Apply Bernoulli's theorem at point A & B

$P_1 + \frac{1}{2}\rho v_1^2 = P_2 + \frac{1}{2}\rho v_2^2$

$P_1 - P_2 = \frac{1}{2}\rho(v_2^2 - v_1^2)$

$\rho g h = \frac{1}{2}\rho\left[\frac{V^2}{a_2^2} - \frac{V^2}{a_1^2}\right]$

$P_1 - P_2 = \rho g h$

$V = a_1 a_2 \sqrt{\frac{2hg}{(a_1^2 - a_2^2)}}$

V - Volume of liquid flowing per second

$V = a_1 v_1 = a_2 v_2 \Rightarrow v_1 = V/a_1$, $v_2 = V/a_2$

Venturi-meter works on Bernoulli's principle

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35 An ac source is connected to a capacitor C. Due to decrease in its operating frequency :

(1) capacitive reactance remains constant

(2) capacitive reactance decreases.

(3) displacement current increases.

(4) displacement current decreases.

$$I_d = \frac{V}{X_c} = \frac{V}{(1/2\pi f C)} = 2\pi f C V$$

$f \downarrow$, $I_d \downarrow$

36 The radius of inner most orbit of hydrogen atom is 5.3×10^{-11} m. What is the radius of third allowed orbit of hydrogen atom?

(1) 4.77 Å (2) 0.53 Å

(3) 1.06 Å (4) 1.59 Å

$r \propto n^2$

$\frac{r_1}{r_3} = \frac{n_1^2}{n_3^2}$

$\frac{5.3\times10^{-11}}{r_3} = \frac{(1)^2}{(3)^2}$

$r_3 = 5.3\times9\times10^{-11}$ m

$= 47.7\times10^{-11}$ m

$= 4.77\times10^{-10}$ m.

37 The resistance of platinum wire at 0°C is 2Ω and 6.8Ω at 80°C. The temperature coefficient of resistance of the wire is :

(1) $3\times10^{-1}\ °C^{-1}$ (2) $3\times10^{-4}\ °C^{-1}$

(3) $3\times10^{-3}\ °C^{-1}$ (4) $3\times10^{-2}\ °C^{-1}$

$R_t = R_0(1+\alpha\Delta T)$

$6.8 = 2(1+\alpha\times80)$

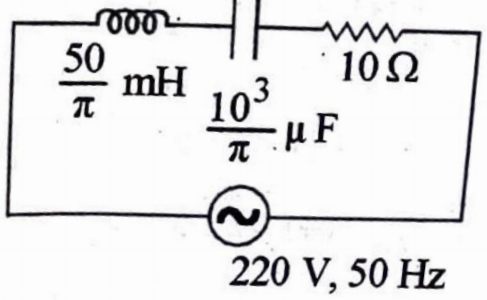
$\frac{6.8}{2} = 1+\alpha\times80$

$3.4 = 1+\alpha(80)$

$\frac{2.4}{80} = \alpha = .03\ °C^{-1}$

$= 3\times10^{-2}\ °C^{-1}$

38 The net impedance of circuit (as shown in figure) will be :



(1) $25\,\Omega$ (2) $10\sqrt{2}\,\Omega$

(3) $15\,\Omega$ (4) $5\sqrt{5}\,\Omega$

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$R = 10\text{-ohm}$

$X_L = 2\pi f L$

$= 2\pi \times 50 \times \frac{50}{\pi} \times 10^{-3}$

$= 100 \times 50 \times 10^{-3} = 5\,\Omega$

$$X_C = \frac{1}{2\pi f C}$$

$$= \frac{1 \times \pi}{2\pi \times 50 \times 10^3 \times 10^{-6}}$$

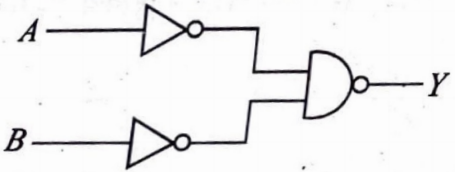
$$= \frac{1000}{100} = 10\,\Omega$$

$$Z = \sqrt{(10)^2 + (10-5)^2}$$

$$= \sqrt{100 + 25} = \sqrt{25 \times 5}$$

$= 5\sqrt{5}$-ohm

39 For the following logic circuit, the truth table is:



(1)

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

(2)

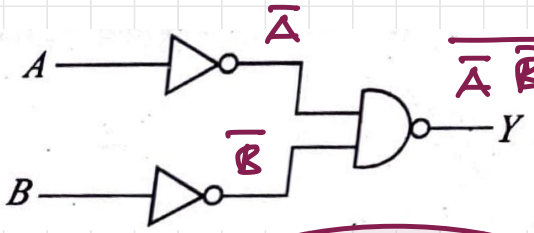
A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

(3) ✓

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

(4)

A	B	Y
0	0	1
0	1	0
1	0	1
1	1	0



$\overline{\bar{A}\,\bar{B}} = \bar{\bar{A}} + \bar{\bar{B}}$

$= A + B$

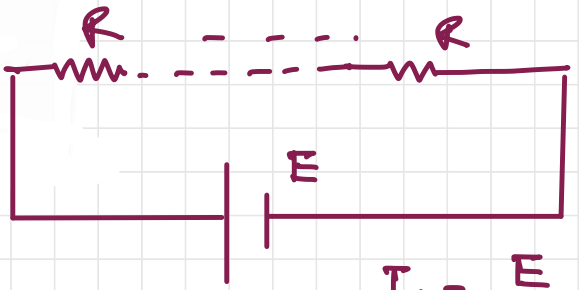
$Y = A + B$

OR- GATE

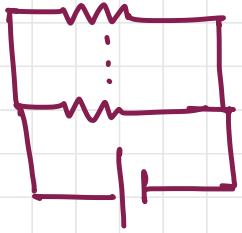
40 10 resistors, each of resistance R are connected in series to a battery of emf E and negligible internal resistance. Then those are connected in parallel to the same battery, the current is increased n times. The value of n is :

(1) 1000 (2) 10

(3) 100 (4) 1



$$I_1 = \frac{E}{10R}$$



$$I_2 = \frac{E}{R/10} = \frac{10E}{R}$$

$$I_2 = n I_1$$

$$\frac{10E}{R} = n\left(\frac{E}{10R}\right)$$

$$n = 100$$

41 Calculate the maximum acceleration of a moving car so that a body lying on the floor of the car remains stationary. The coefficient of static friction between the body and the floor is 0.15 ($g = 10\ m\ s^{-2}$).

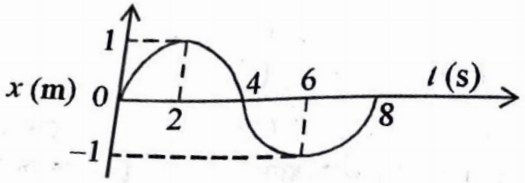
(1) $50\ m\ s^{-2}$ (2) $1.2\ m\ s^{-2}$

(3) $150\ m\ s^{-2}$ (4) $1.5\ m\ s^{-2}$

$$\mu m g = m a$$

$$a = \mu g = \frac{0.15 \times 10}{100} = 1.5\ m\ s^{-2}$$

42 The x-t graph of a particle performing simple harmonic motion is shown in the figure. The acceleration of the particle at $t = 2$ s is :



(1) $-\frac{\pi^2}{16}\,m\,s^{-2}$ (2) $\frac{\pi^2}{8}\,m\,s^{-2}$

(3) $-\frac{\pi^2}{8}\,m\,s^{-2}$ (4) $\frac{\pi^2}{16}\,m\,s^{-2}$

$A = -w^2 a \sin wt$

$= -\left(\frac{2\pi}{T}\right)^2 \times a \sin \frac{2\pi}{T}(t)$

$T = 8$ sec

$a = 1$ m

$t = 2$ sec

$A = -\frac{4\pi^2}{(8)^2} \times 1 \times \sin \frac{2\pi}{8} \times 2$

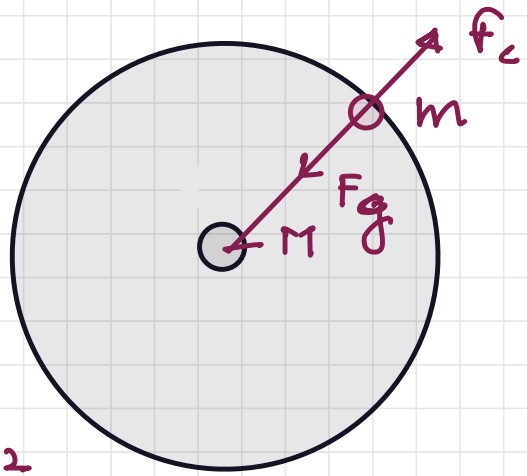
$= -\frac{4\pi^2}{64} \sin \pi/2$

$= -\frac{\pi^2}{16}\ m\,s^{-2}$

43 A satellite is orbiting just above the surface of the earth with period T. If d is the density of the earth and G is the universal constant of gravitation, the quantity $\frac{3\pi}{Gd}$ represents :

(1) $\sqrt{T}$ (2) T

(3) T^2 (4) T^3



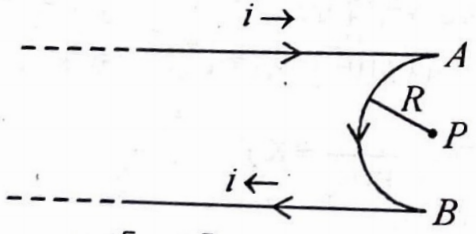
$$\frac{GMm}{r^2} = \frac{mv^2}{r}$$

$$\frac{GM}{r} = r^2\omega^2 = \frac{r^2 4\pi^2}{T^2}$$

$$\frac{G\frac{4}{3}\pi r^3 d}{r} = \frac{r^2 \cdot 4\pi^2}{T^2} \Rightarrow \frac{G\pi d}{3} = \frac{\pi^2}{T^2}$$

$$T^2 = \frac{3\pi}{Gd}$$

44 A very long conducting wire is bent in a semi-circular shape from A to B as shown in figure. The magnetic field at point P for steady current configuration is given by :

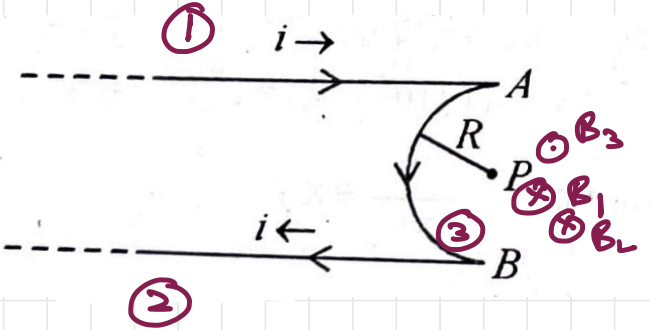


(1) $\frac{\mu_0 i}{4R}\left[1-\frac{2}{\pi}\right]$ pointed into the page

(2) $\frac{\mu_0 i}{4R}$ pointed into the page

(3) $\frac{\mu_0 i}{4R}$ pointed away from the page

(4) $\frac{\mu_0 i}{4R}\left[1-\frac{2}{\pi}\right]$ pointed away from page



$$B_{NET} = |B_1| + |B_2| - |B_3|$$

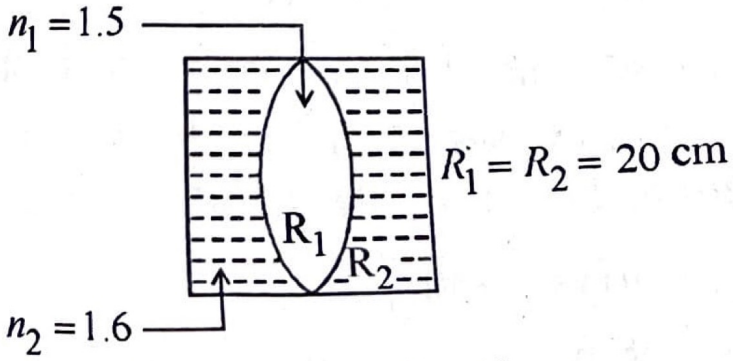
$$= \frac{\mu_0}{4\pi}\frac{I}{R} + \frac{\mu_0}{4\pi}\frac{I}{R} - \frac{\mu_0}{4\pi}\frac{I.\pi R}{R^2}$$

$$= \frac{\mu_0}{4\pi}\left(\frac{I}{R} + \frac{I}{R} - \frac{I\pi}{R}\right)$$

$$= \frac{\mu_0}{4\pi}\frac{I}{R}(2-\pi)$$

$$= \frac{\mu_0 I}{4R}\left(\frac{2}{\pi}-1\right)$$

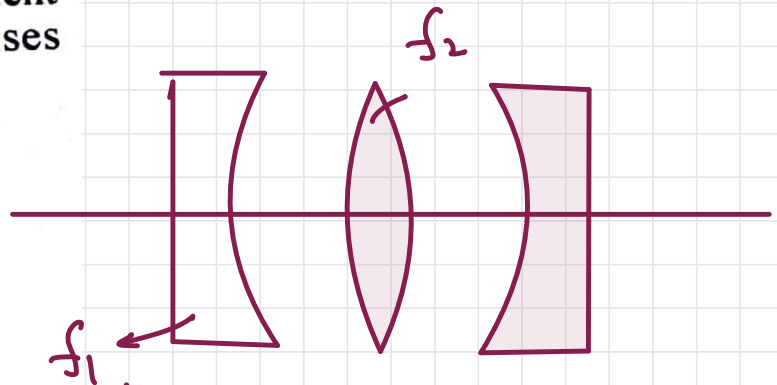
45 In the figure shown here, what is the equivalent focal length of the combination of lenses (Assume that all layers are thin)?



(1) -50 cm (2) 40 cm
(3) -40 cm (4) -100 cm

$\frac{1}{f_2} = (1.5-1)\left(\frac{1}{20} - \frac{1}{-20}\right)$

$\frac{1}{f_2} = (0.5)\left(\frac{2}{20}\right) \Rightarrow f_2 = 20\,cm$



$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3}$

$\frac{1}{f_1} = (1.6-1)\left(\frac{1}{\infty} - \frac{1}{20}\right)$

$\frac{1}{f_1} = (0.6)\left(-\frac{1}{20}\right) = \frac{-63}{100} = -\frac{3}{100}$

$f_1 = -\frac{100}{3}\,cm. = f_2$

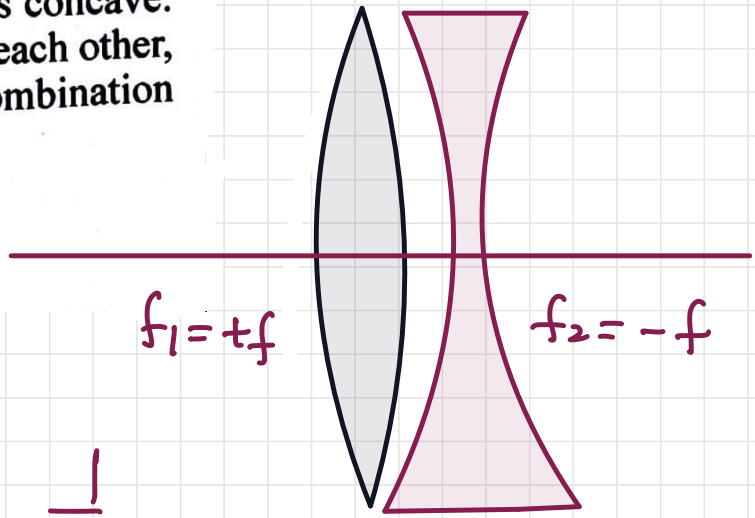
$\frac{1}{f_{NET}} = -\frac{3}{100} + \frac{1\times5}{5\times20} - \frac{3}{100} = \frac{-3+5-3}{100} = \frac{-1}{100}$

$f_{NET} = -100\,cm$

46 Two thin lenses are of same focal lengths (f), but one is convex and the other one is concave. When they are placed in contact with each other, the equivalent focal length of the combination will be :

(1) Infinite (2) Zero

(3) $f/4$ (4) $f/2$



$$\frac{1}{f_{NET}} = \frac{1}{f_1} + \frac{1}{f_2}$$

$$= +\frac{1}{f} - \frac{1}{f} = 0$$

$f_{NET} = \infty$

47 A wire carrying a current I along the positive x-axis has length L. It is kept in a magnetic field $\vec{B} = (2\hat{i} + 3\hat{j} - 4\hat{k})$ T. The magnitude of the magnetic force acting on the wire is :

(1) $\sqrt{3}\,IL$ (2) $3\,IL$

(3) $\sqrt{5}\,IL$ (4) $5\,IL$

$\vec{l} = L\hat{i}$

$\vec{B} = 2\hat{i} + 3\hat{j} - 4\hat{k}$

$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ L & 0 & 0 \\ 2 & 3 & -4 \end{vmatrix}$$

$= \hat{i}\,(0(-4) - 3(0))$

$+\hat{j}\,(0(2) + 4L) + \hat{k}\,(3L)$

$= 0\hat{i} + 4L\hat{j} + 3\hat{k}L$

$\vec{F} = I(\vec{l} \times \vec{B})$

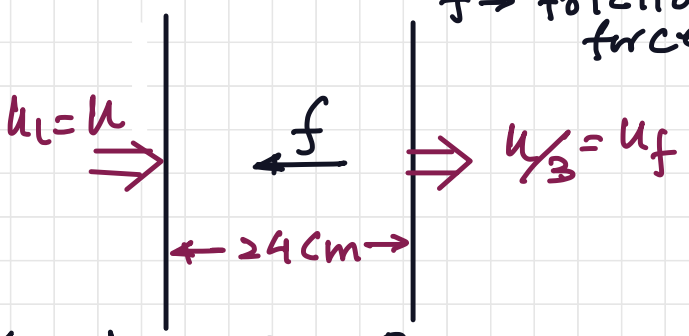
$= I\,5L = 5IL$

$|\vec{F}| = \sqrt{(4L)^2 + (3L)^2} = \sqrt{16L^2 + 9L^2} = 5L$

48 A bullet from a gun is fired on a rectangular wooden block with velocity u. When bullet travels 24 cm through the block along its length horizontally, velocity of bullet becomes $\frac{u}{3}$. Then it further penetrates into the block in the same direction before coming to rest exactly at the other end of the block. The total length of the block is :

(1) 30 cm (2) 27 cm
(3) 24 cm (4) 28 cm

f → frictional force



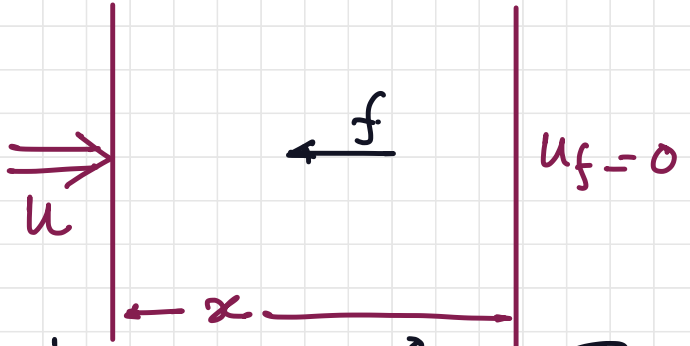
$K_f - K_i = W.D$

$\frac{1}{2}m\left(\frac{u}{3}\right)^2 - \frac{1}{2}mu^2 = fd\cos 180^\circ$ — (1)

$$\frac{\frac{1}{2}mu^2\left(\frac{1}{9}-1\right)}{-\frac{1}{2}mu^2} = \frac{fd\cos 180^\circ}{fx\cos 180^\circ}$$

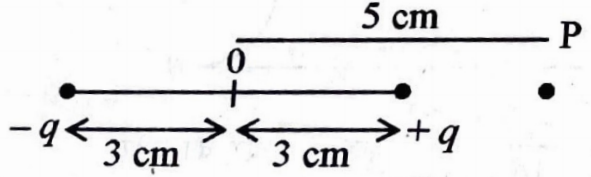
$$\frac{\left(-\frac{8}{9}\right)}{(-1)} = \frac{d}{x}$$

$$\frac{8}{9} = \frac{d}{x} \Rightarrow x = \frac{9d}{8} = \frac{9\times 24}{8} = 27\text{cm}$$



$\frac{1}{2}m(0)^2 - \frac{1}{2}mu^2 = fx\cos 180^\circ$ — (2)

49 An electric dipole is placed as shown in the figure.



The electric potential (in 10^2 V) at point P due to the dipole is (ϵ_0 = permittivity of free space and $\frac{1}{4\pi\epsilon_0} = K$):

(1) $\left(\frac{8}{3}\right)qK$ (2) $\left(\frac{3}{8}\right)qK$

(3) $\left(\frac{5}{8}\right)qK$ (4) $\left(\frac{8}{5}\right)qK$

$$V_P = \frac{1}{4\pi\epsilon_0}\frac{q}{2\times10^{-2}} + \frac{1}{4\pi\epsilon_0}\frac{(-q)}{8\times10^{-2}}$$

$$= \frac{q}{4\pi\epsilon_0\times10^{-2}}\left(\frac{1}{2} - \frac{1}{8}\right)$$

$$= \frac{kq}{10^{-2}}\left(\frac{8-2}{16}\right)$$

$$= kq\left(\frac{3}{8}\right)\times10^2$$

$$= \frac{3}{8}kq\times10^2 \text{ Volt}$$

50 A horizontal bridge is built across a river. A student standing on the bridge throws a small ball vertically upwards with a velocity $4\ m\ s^{-1}$. The ball strikes the water surface after 4 s. The height of bridge above water surface is (Take $g = 10\ m\ s^{-2}$) :

(1) 68 m (2) 56 m

(3) 60 m (4) 64 m

$$S_y = u_y t + \frac{1}{2} a_y t^2$$

$$-h = 4(t) - \frac{1}{2}(10)t^2$$

$$-h = 4(4) - \frac{1}{2} \times 10 \times 16$$

$$= 16 - 5 \times 16$$

$$= 16(1-5)$$

$$-h = -4(16) = -64$$