Royal College - Colombo 07

Grade 13

01 E I

Final Term Test – October 2025

Physics I

$(g = 10\ Nkg^{-1})$

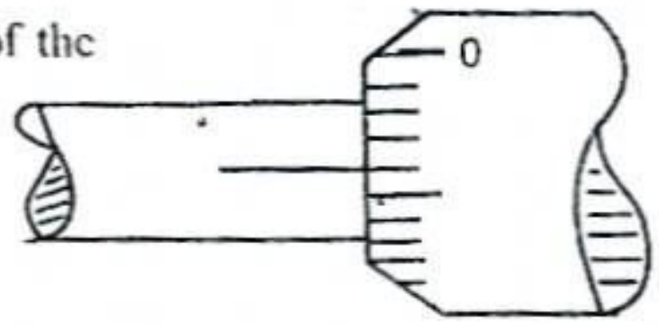
Time : 2 hours

❖ Answer all the questions.

(01) If the dimensions of electric potential and electric charge are A and B respectively, the dimensions of $\mu_0\xi_0$ are, (μ_0-permeability, ξ_0 permittivity)

1) $\frac{B}{A}$ 2) $\frac{A}{B}$ 3) $\left(\frac{B}{A}\right)^2$ 4) $\left(\frac{A}{B}\right)^2$ 5) $\sqrt{\frac{A}{B}}$

(02) In a micrometer screw gauge, the minimum measurement of the linear scale was 0.5 cm. When the zero error to be added was 0.01 cm, the circular scale and linear scale were as shown in the figure. the number of circular scale parts of this device can be



1) 25 2)50 3) 100 4) 200 5) 500

(03) When A and B are two vectors and C and D are two scalars, consider the following expressions

(P) $A + B = C$ (Q) $A \times B = \not{0}$ (R) $A \times C = B$ (S) $C + D = A$

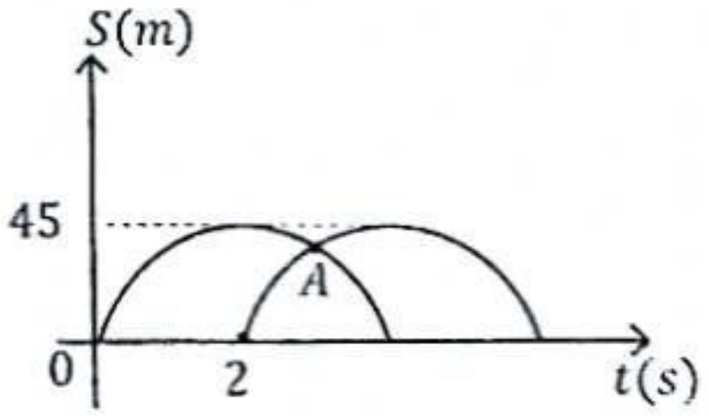
Of the above expressions

1) Only P and Q are true 2) Only Qand R are true 3) Only R and S are true

4) Only P and S are true 5) Only Q and S are true

(04) The figure shows the displacement-time graphs of two objects projected vertically upwards from the same point with the same initial velocity. The coordinates of the point of intersection of these two graphs (A) are,

1) 3,20
2) 4,40
3) 4,22
4) 3,40
5) 4,20



(05) Two metal rods A and B have initial lengths l and 2l respectively. The ratio between their coefficients of linear expansivity is 2:3 respectively. The ratio of the increase in length of the rods when they are subjected to the same temperature difference is,

1) 3:2 2) 2:3 3) 1:6 4) 6:1 5) 1:3

(06) Consider the following statements regarding radioactivity.

A) In the process of creating particles β^- electrons are removed from the unstable nucleus, and its atomic number remains constant.

B) When γ radiation is produced, the atomic number of the daughter nucleus increases by one more than the atomic number of the mother nucleus.

C) The particle α is identical to the atom in the helium nucleus.

Of the above statements,

1) Only A is true
2) Only B is true
3) Only C is true
4) Only A and B are true
5) Only A and C are true.

(07) Three identical springs A, B, C are connected as shown in figure A. When a 4 kg mass was suspended from spring A and the extension was 2 cm. When a mass of 8 kg is hung from point X, the total extension is

1) 2 cm
2) 4 cm
3) 6 cm
4) 8cm
5) 10cm

(08)

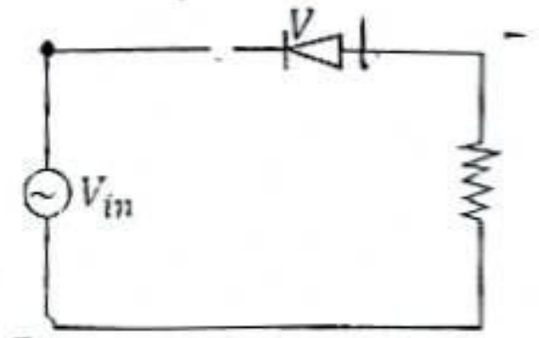


Fig. 1

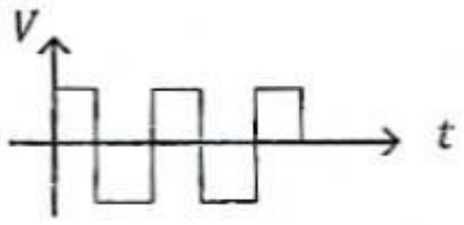
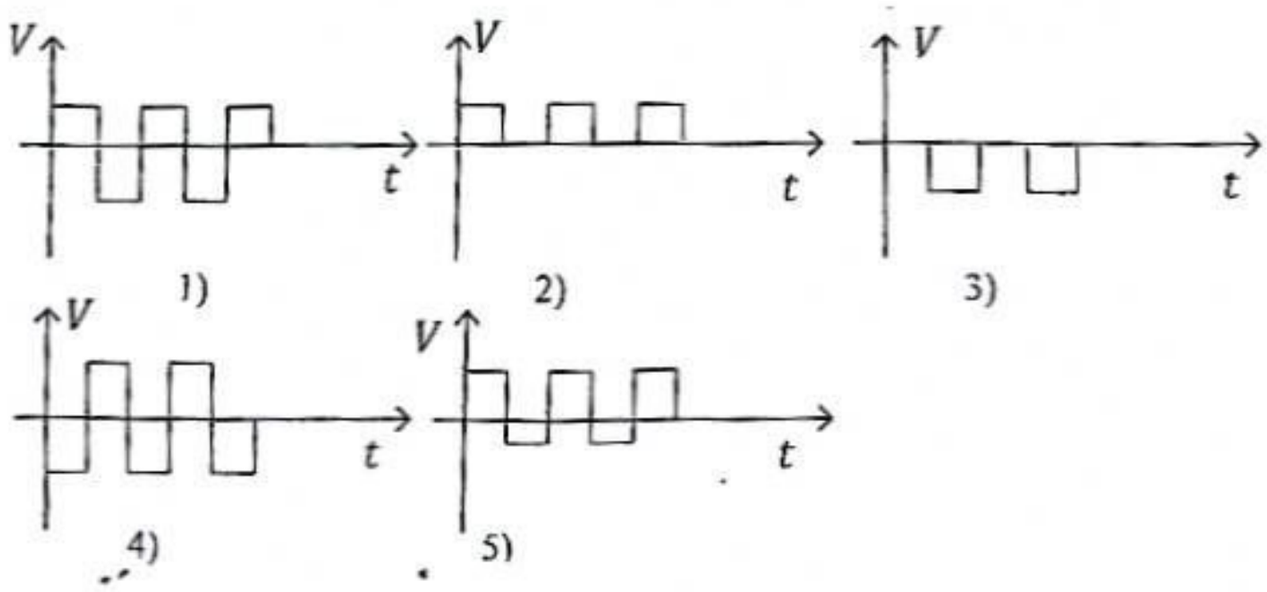


Fig. 2

Which of the following correctly shows how the potential difference across the non-ideal diode varies with time when an alternating voltage is applied to the circuit shown in Fig. 1 as shown in Fig. 2?



(09) $10g$ of ice and $100g$ of water are in thermal equilibrium in a container at 0^0C. What is the minimum mass of steam at 100°C required to melt all the ice in the container? (The heat absorbed by the vessel is negligible)

Specific latent heat of fusion of ice $= 3x10^5\ Jkg^{-1}$

Specific latent heat of vaporization of water $= 2x10^6 Jkg^{-1}$

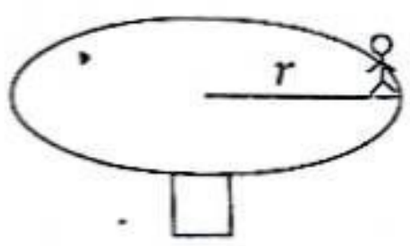
Specific heat capacity of water $= 4000\ Jkg^{-1}k^{-1}$

1) 1 g 2) 1.25 g 3) 1.5 g 4) 1.75 g 5) 2 g

(10) A circular disk of mass M and radius r is rotated smoothly about a perpendicular axis passing through the centre. When a child of mass m starts walking with speed v, how much time does it take him to return to the starting point? (moment of inertia of the disk= $\frac{1}{2}M\,r^2$)

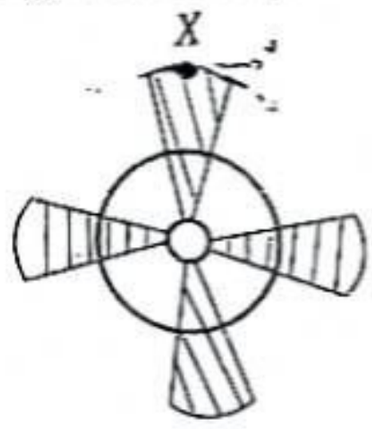
1) $\frac{\pi r\,M}{mv}$ 2) $\frac{2\pi r\,M}{mv}$ 3) $\frac{2\pi}{\frac{v}{r}(\frac{2m}{M}+1)}$

4) $\frac{2\pi}{\frac{v}{r}(\frac{2m}{M}-1)}$ 5) $\frac{2\pi}{\frac{v}{2}\,(M+M)}$



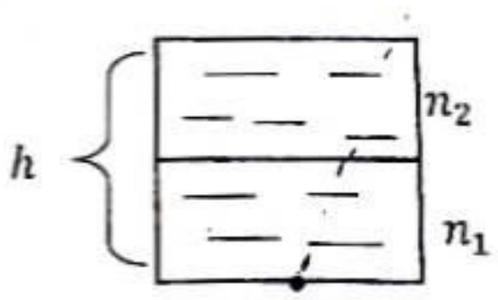
(11) The wind lobe shown in figure rotates clockwise with uniform angular velocity. It is most likely to be the direction of acceleration at point X

1) ↙
2) ↘
3) ↓
4) ←
5) →



(12) As shown in the figure, one half of a container of height h is filled with a liquid of refractive index n_1 and the other half is filled with a liquid of refractive index n_2. The vertical apparent depth of the bottom of the container is

1) $h\,(n_1+n_2)$
2) $h(\frac{1}{n_1}+\frac{1}{n_2})$
3) $\frac{h}{2}(n_1+n_2)$
4) $\frac{h}{2}(\frac{1}{n_1}+\frac{1}{n_2})$
5) none of the above.



(13) Consider the following statements regarding optical instruments.

A) Angular magnification is maximum at normal adjustment of the telescope.

B) Angular magnification is maximum when the focal length of the objective lens of the compound microscope is greater than the focal length of the eyepiece lens.

C) Short focal length lenses are used for the objective and eyepiece lenses of a compound microscope.

Of the above statements

1) Only A is true 2) Only B is true 3) Only C is true
4) Only A and B are true. 5) Only A and C are true.

(14) When a person wears a convex lens of focal length 150 cm, he sees from 25 cm to infinity. His range of vision without the lens is,

1) 30 cm to 150 cm 2) 30 cm to 200cm 3) 30 cm to $infinity$
4) 25cm to 200 cm 5) 25cm to $infinity$.

(15) An object is placed 30 cm from a convex lens of focal length 20 cm. Its image is formed on a screen. After moving the lens towards the screen without changing the position of the object or the screen, a clear image was obtained on the screen at another position. The distance the lens is moved towards the screen is,

1) 20cm 2) 30cm 3) 40 cm 4) 50cm 5) 60cm

(16)

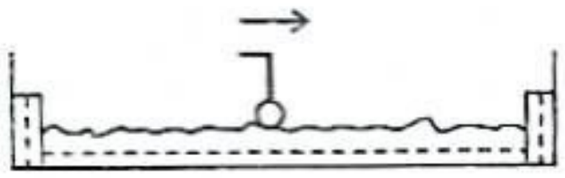


Figure 1

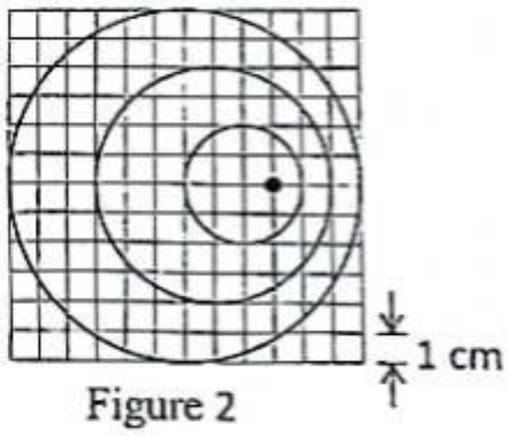


Figure 2

A dot vibrator is moving across the surface of water in a ripple tank with a steady speed as shown in figure 1. Figure 2 represents the water surface showing the pattern of the water waves against a background of squares. The speed of the water waves is 20 cms^{-1}. What is the speed of the dot vibrator?

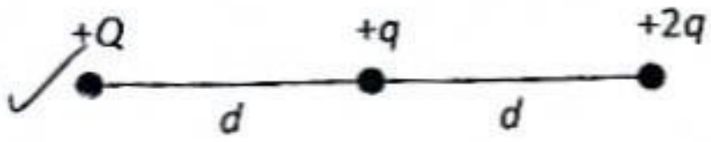
1) 10 cms^{-1} 2) 8 cms^{-1} 3) 5 cms^{-1} 4) 4 cms^{-1} 5) 2 cms^{-1}

(17) In the below arrangement, two small test charges $+q$ and $+2q$ are brought from infinity to the positions shown. The two charges are collinear with another charge $+Q$ and their mutual separation is d. Which of the following statements is/are correct?

(A) Charge $+q$ is at a higher potential than charge $+2q$

(B) The work done in bringing the charges $+q$ and $+2q$ from infinity to their respective positions is the same.

(C) The potential energy of the system would increase if d decreased.

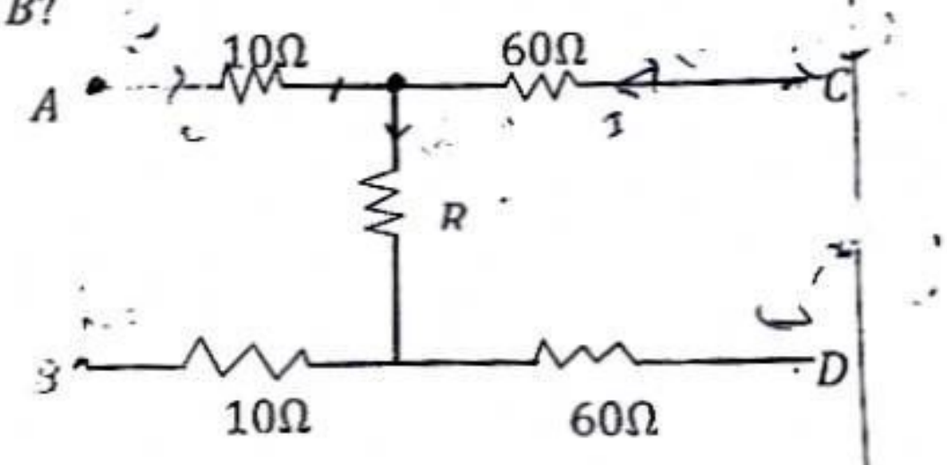


Of the above statements,

1) Only A is true
2) Only C is true
3) Only A and B are true
4) Only B and C are true
5) All A, B and C are true

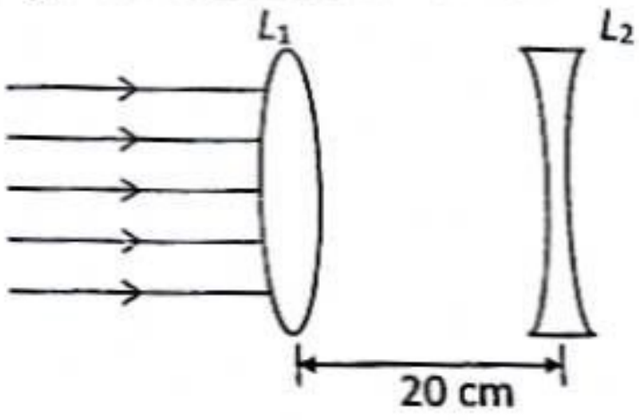
(18) The below figure shows a network of resistors. If 100 V is applied across terminals A and B, the potential difference between C and D is 80 V. If 100 V is applied across terminals C and D instead, what is the potential difference between A and B?

1) 80 V
2) 60 V
3) 40 V
4) 20 V
5) It cannot be found as the value of R is not known.



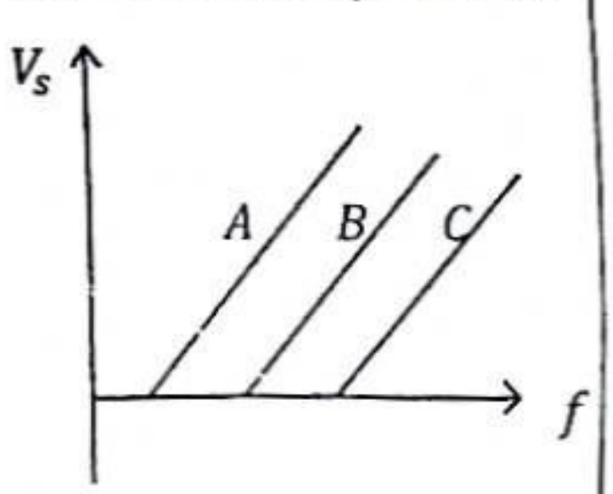
(19) In the figure, L_1 and L_2 are two thin lenses with the same focal length 40 cm placed coaxially 20 cm apart. A beam of light originating from a distant object is incident on L_1. Which of the following statements about the final image formed by the system of lenses is correct?

1) It is real and formed on the right of L_2.
2) It is real and formed between L_1 and L_2.
3) It is virtual and formed between L_1 and L_2.
4) It is virtual and formed on the left of L_1.
5) It is virtual and formed on the right of L_2.



(20) The figure below shows three graphs showing the variation between the stopping potential (V) and frequency (f) for three materials A, B, C. Choose the answer arranged in ascending order of the magnitudes of the threshold frequency of these three materials.

1) A, B, C
2) C, B, A
3) B, C, A
4) B, A, C
5) A, C, B



(21) Consider the following statements regarding the production of ....

(A) Population inversion is the existence of more electrons at a high-energy level.

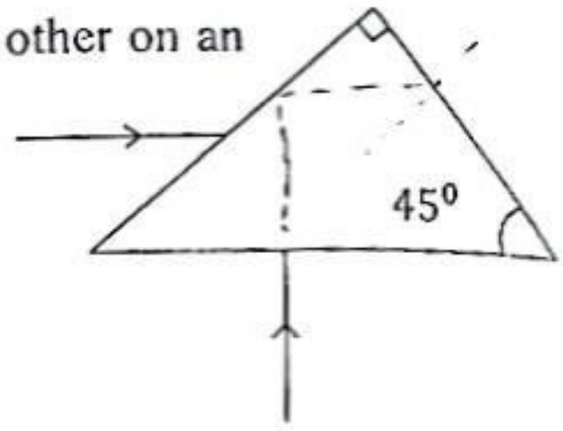
(B) Atoms stay longer in the metastable state, increasing the chance of stimulated emission.

(C) Stimulated emission is when electrons move from a higher energy level to a lower energy level by releasing energy.

of the above statements

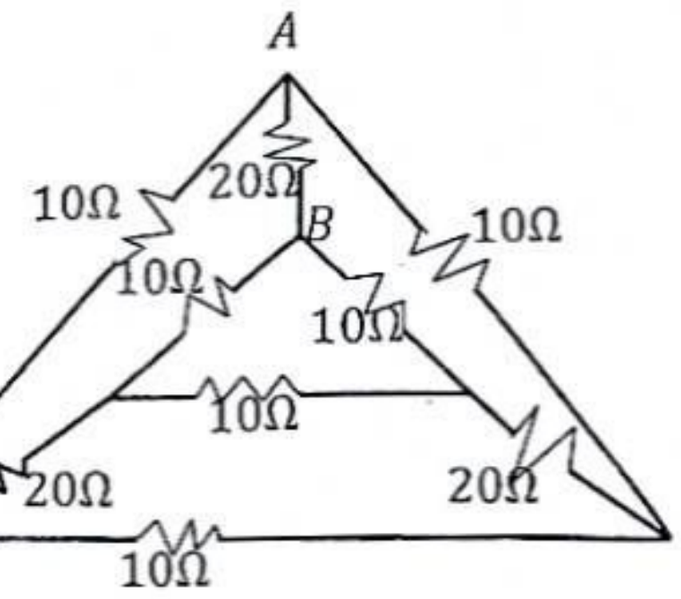
1) only A is true. 2) only B is true. 3) only A and C are true.
2) only A and B are true. 5) All A, B and C are true.

(22) The figure shows two rays of light incident perpendicular to each other on an isosceles right-angled prism. The angle between the two emergent rays is, (refractive index of glass =3/2)



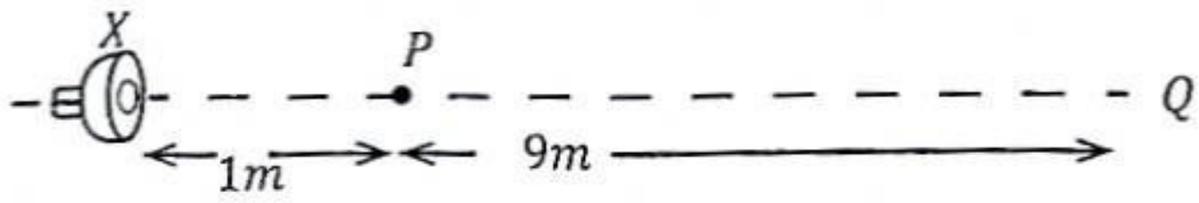
1) 0°
2) 45°
3) 90°
4) 180°
5) none of these.

(23) Resistance across AB of the network shown is,



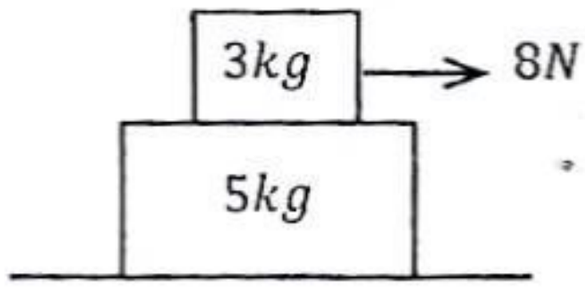
1) $10\,\Omega$
2) $40\,\Omega$
3) $\frac{40}{7}\Omega$
4) $\frac{60}{7}\Omega$
5) $50\,\Omega$

(24) A loudspeaker placed at point X creates a sound with a sound intensity level of 20dB at point P. If 100 such loudspeakers are placed, at point X, what will be the sound intensity level at point Q?



1) $20\,dB$ 2) $30\,dB$ 3) $40\,dB$ 4) $100\,dB$ 5) $200\,dB$

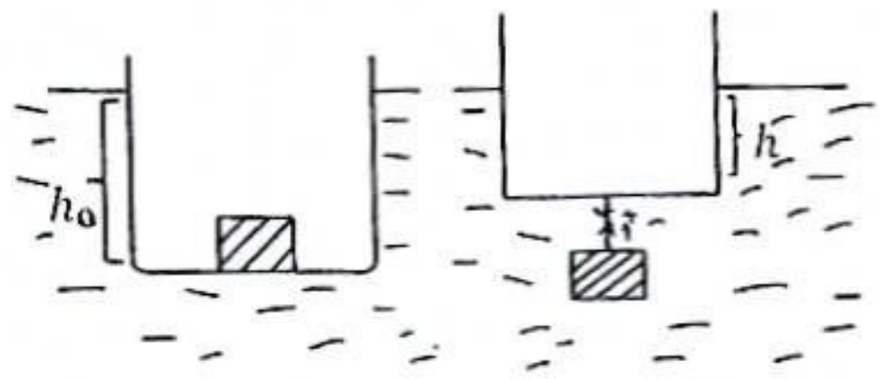
(25) If the coefficient of the friction between the two blocks which are kept on smooth surface is 0.5, Find the frictional force acting between the blocks.



1) $15N$ 2) $12N$
3) $10N$ 4) $8N$
2) $5N$

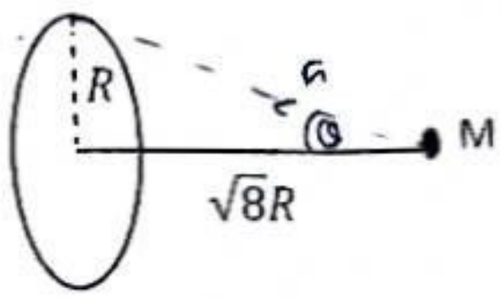
(26) An object is placed in a vessel of base area A, and it floats in a liquid such that a height h_o of the vessel is below the liquid surface. When the object is hung by a light thread as shown in the figure, the height of the vessel below the liquid surface is h. The volume of the object is,.

1) $\frac{Aho}{8}$
2) $\frac{Aho}{4}$
3) $\frac{A(ho-h)}{8}$
4) $A(ho-h)$
5) $\frac{A(ho-h)}{4}$



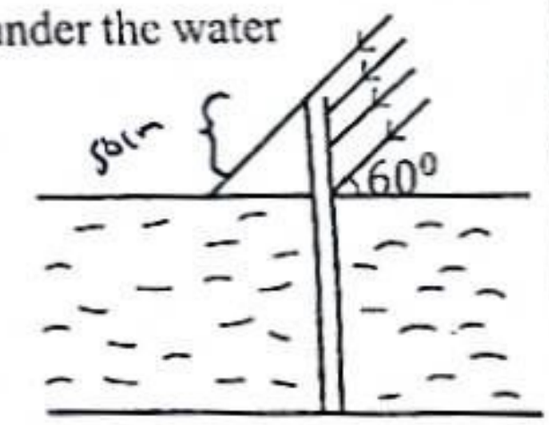
(27) The gravitational force acting on a point mass M at a distance $\sqrt{8}$ R from the centre of a ring which has a mass of m and radius R. is,

1) $\frac{2\sqrt{2}GMm}{27R^2}$
2) $\frac{GMm}{8R^2}$
3) $\frac{GMm}{9R^2}$
4) $\frac{\sqrt{2}GMm}{81R^2}$
5) 0



(28) A $50cm$ long piece of a $2m$ long stick is placed vertically above the water surface. The remaining length is submerged in water. The refractive index of water is $\frac{4}{3}$. If the light ray is incident at an angle of 60° with the horizontal, the length of the shadow of the stick under the water is ($Sin\ 22^0 = \frac{3}{8},\ tan\ 22^0 = 0.5,\ tan\ 60^0 = 2$)

1) 25 cm
2) 50 cm
3) 75 cm
4) 100 cm
2) 125 cm

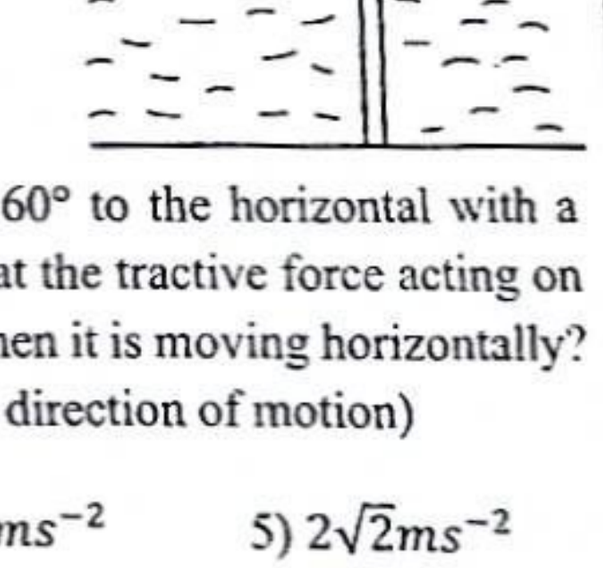


(29) An airplane of mass $2 \times 10^5 kg$ moves up with inclination of 60° to the horizontal with a constant speed using a constant tractive force. Now assuming that the tractive force acting on the plane is constant, what can be the acceleration of the plane when it is moving horizontally? (The force exerted on the plane by the air is perpendicular to the direction of motion)

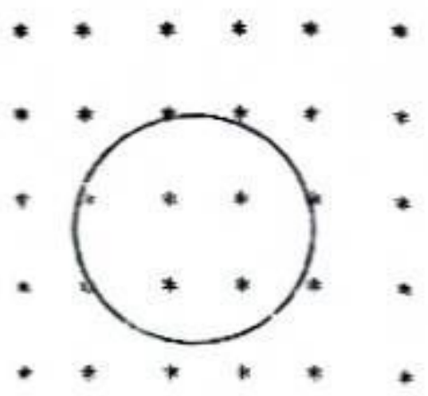
1) $\frac{1}{2}ms^{-2}$
2) $\frac{1}{\sqrt{2}}ms^{-2}$
3) $\sqrt{2}ms^{-2}$
4) $2\ ms^{-2}$
5) $2\sqrt{2}ms^{-2}$

(30) In the circuit shown, the E.M.F of the battery $14V$ and the internal resistance is 1 Ω. The reading of the ideal ammeter A is,

1) 2.0A
2) 3.5A
3) 4.5A
4) 1.5A
5) 2.5A



(31) A circular loop of conducting wire is placed in a uniform horizontal magnetic field as shown in the figure and released so that it can move vertically downwards. Which of the following statements is most true?



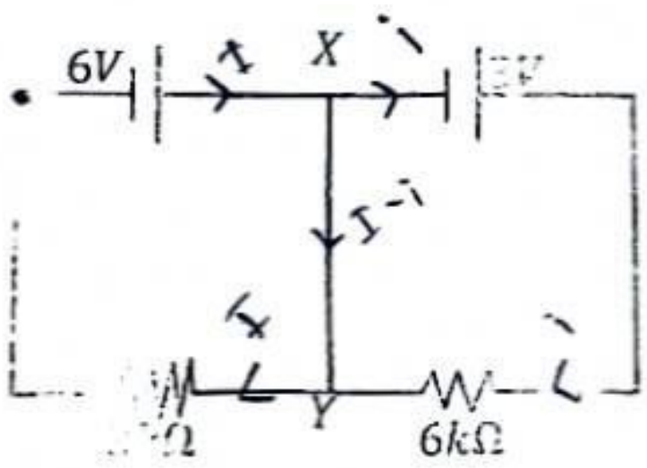
1) The loop of wire remains at rest
2) The loop of wire moves vertically downwards with uniform velocity
3) The loop of wire moves vertically downwards with gradually decreasing acceleration
4) The loop of wire moves vertically downwards with uniform acceleration.
5) The loop of wire moves vertically downwards with gradually increasing acceleration

(32) Water is supplied at a constant rate of $4\ kgs^{-1}$ into a device that heats water through a heating coil. The water at 50°C converts to steam at 100°C at the same rate. The minimum efficiency of the heating coil for this process is (specific heat capacity of water $4200\ Jkg^{-1}K^{-1}$, the latent heat of vaporization of water $2 \times 10^6 JKg^{-1}$)

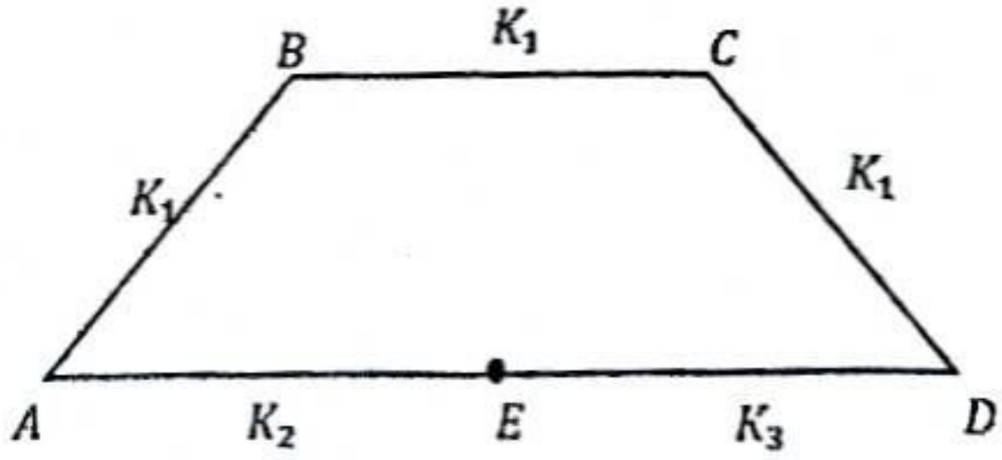
1) $8.4 X10^5 W$ 2) $16.8 \times 10^5\ W$ 3) $8 \times 10^6 W$ 4) $7.16 \times 10^6 W$ 5) $8.84 \times 10\ W$

(33) In the above circuit, the cells have negligible internal resistance. What is the potential difference between the points X and Y and the current in the wire connecting the two points?

	Potential difference	Current
1)	0 V	1.5 mA
2)	0 V	0 mA
3)	3 V	1.5 mA
4)	3 V	0.5 mA
5)	0 V	2 mA



(34) Five rods of equal dimensions are arranged as shown in the figure. Among them, the thermal conductivities of rods AB, BC and CD are k_1 each. The thermal conductivities of rods AE and ED are k_2 and k_3 respectively. A and D are at different temperatures. Which of the following expressions is correct if heat flows through paths ABCD and AED at the same rates



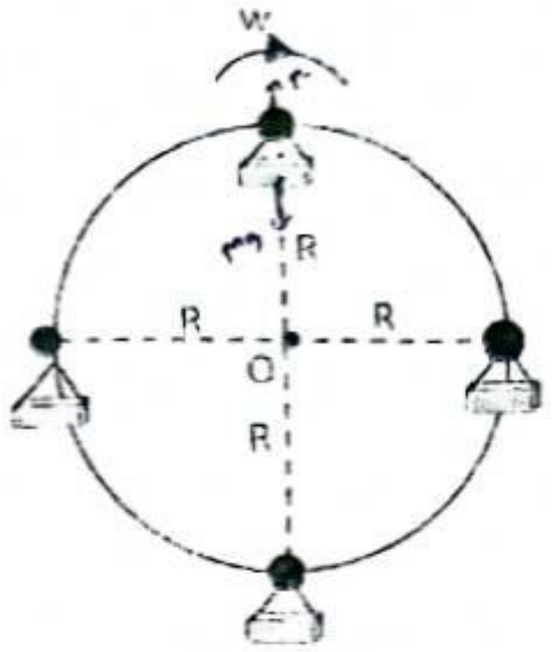
1) $k_1 = \frac{(k_2+k_3)}{3}$
2) $k_1 = \frac{9k_2k_3}{2(K_2+K_3)}$
3) $k_1 = \frac{3k_2k_3}{k_2+k_3}$
4) $k_1 = 3(k_2 + k_3)$
5) $k_1 = \frac{k_2+k_3}{2k_2k_3}$

(35) 64 uniform water drops fall vertically downwards in air with a terminal velocity of 0.1 ms^{-1}. If those water droplets join together to form a single large water drop, its terminal velocity is.

1) $0.8\ ms^{-1}$ 2) $1.3\ ms^{-1}$ 3) $0.4\ ms^{-1}$

4) $3.2\ ms^{-1}$ 5) $1.6\ ms^{-1}$

(36) A Ferris wheel of radius R rotates about O with a constant angular velocity. Four seats of mass m each inclined at 90°C to each other are pivoted smoothly as shown in the figure. What would be the force exerted on one seat by a pivot when it passes the highest point of the wheel?



1) $\frac{1}{2}mR\omega^2$ 2) $mR\omega^2$

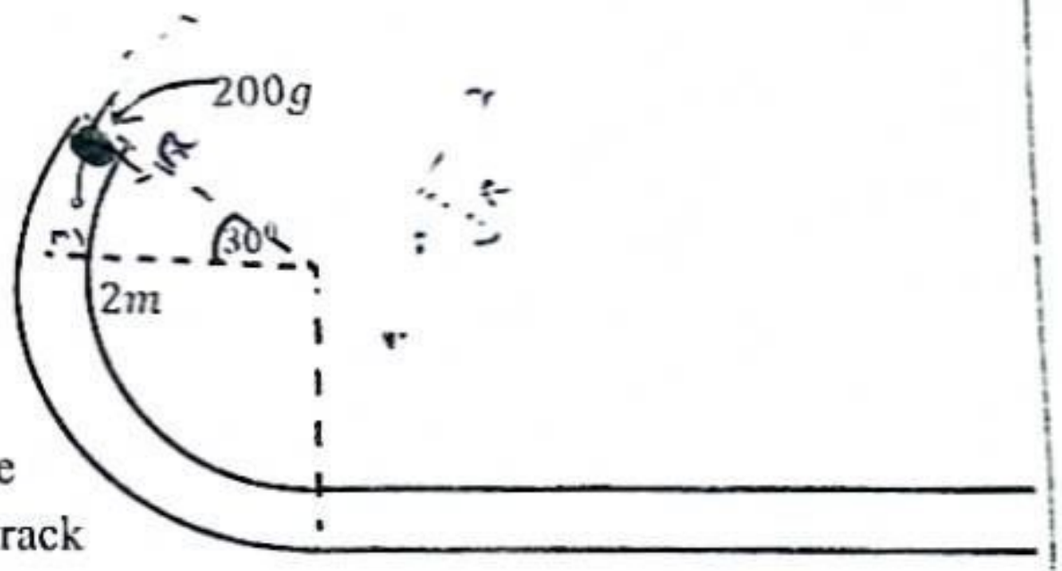
3) $mg - mR\omega^2$ 4) $mg + mR\omega^2$

5) mg

(37) Choose the answer which contains incorrect information about *n* and *p* semiconductors among the following answers

n-type semiconductor	p-type semiconductor
Can be made by doping arsenic with silicon	Can be made by doping boron with silicon
majority carriers are moveable electrons	majority carriers are holes
Both electrons and holes contribute to the formation of an electric current	Both holes and electrons contribute to the formation of an electric current
are electrically negatively charged	are electrically positively charged
It has higher conductivity than an intrinsic semiconductor	It has higher conductivity than a intrinsic semiconductor

(38) A mass of $200g$ is dropped from the top of a tube set up as shown. The horizontal section is rough, and the coefficient of friction of that section is 0.4. All curved segments are smooth, and the mean radius of the tube is $2\ m$. What is the total distance traveled by the mass as it moves along the track and comes to rest? ($\pi = 3$)



1) 3.5 m 2) 4 m 3) 7.5 m 4) 11.5 m 5) 12 m

(39) A current of 2 mA is induced in an X-ray tube operated at constant potential difference. What is the rate at which the electrons hit the target metal? ($e = 1.6 \times 10^{-19}C$)

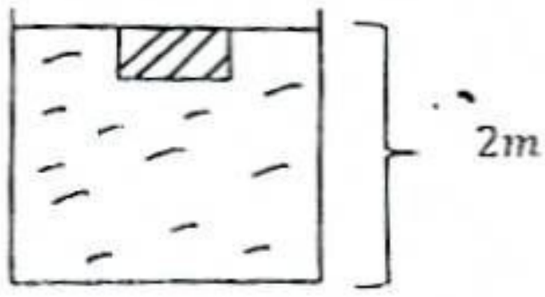
1) $3.2 \times 10^{22}S^{-1}$ 2) $3.2 \times 10^{-22}S^{-1}$ 3) $1.25 \times 10^{16}S^{-1}$

4) $1.25 \times 10^{-16}S^{-1}$ 5) $1.6 \times 10^{-19}S^{-1}$

2 X 10

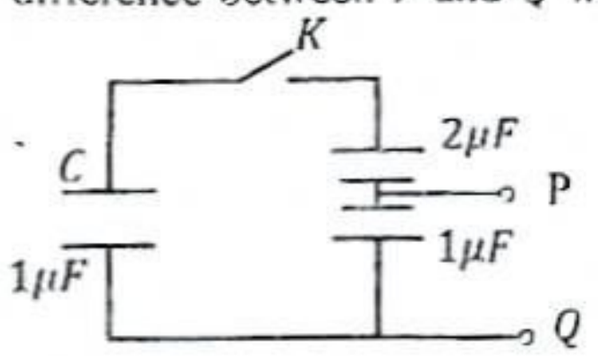
(40) An iron cube of volume $0.02m^3$ and height $0.2m$ is released from a position shown in the figure in a vessel filled with water to a height of $2\ m$. The increase in potential energy of the water when the cube reaches the bottom is,

1) 0
2) 320J
3) 360J
4) 380J
5) 400J



(41) In the circuit, capacitor C contains a charge of $5\mu C$. The other two capacitors are initially uncharged. After switch k is closed, what is the potential difference between P and Q when steady state is reached ?

1) 1 V 2) 2 V 3) 3 V
4) 4 V 5) 5 V

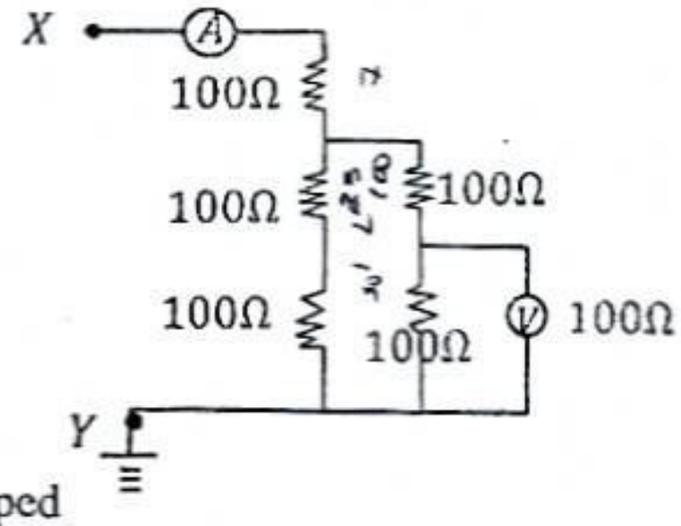


(42) The relative humidity in a closed room is 90%. 30 minutes after several men entered the room, the new relative humidity in the room was found to be 54%. The mass of water vapor inhaled by one person in 1s is the same as the mass 5×10^{-5} times of saturated water vapor at that temperature. The number of people who entered the room is,

1) 2 2) 3 3) 4 4) 5 5) 6

(43) In the circuit shown, the internal resistance of the voltmeter is 100Ω and ammeter is ideal. The terminal Y is connected to earth. If the reading of the voltmeter is $10\ V$, the voltage at point X and the reading of the ammeter are respectively.

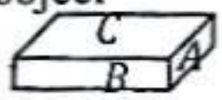
1) 30 V , 0.30 A
2) 30 V , 0.35 A
3) 65 V , 0.30 A
4) 65 V , 0.35 A
5) 65 V , 0.40 A

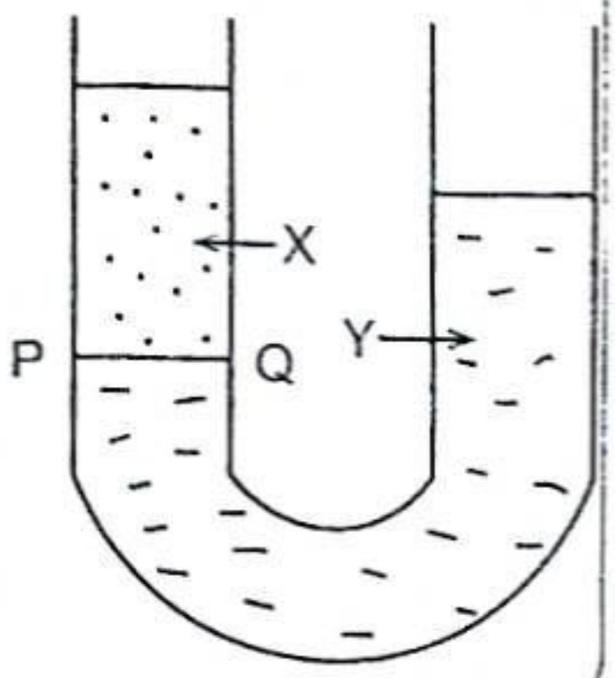


(44) A uniform u-tube is filled with liquids X and Y as shown, Cuboid shaped object X floated vertically in liquid X. When the cuboid is floated separately so that faces A, B and C are down, the changes in the interface PQ ΔA, ΔB and ΔC respectively. Which of the following relationships is most true?

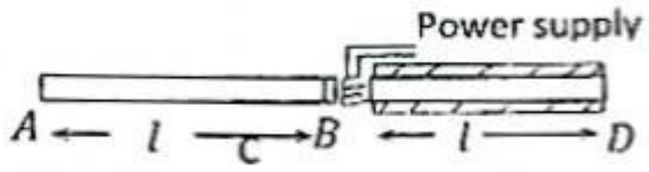
1) $\Delta A = \Delta B = \Delta C$ 2) $\Delta A > \Delta B > \Delta C$
3) $\Delta A > \Delta C > \Delta B$ 4) $\Delta C > \Delta B > \Delta A$
5) $\Delta A = \Delta B = \Delta C = 0$

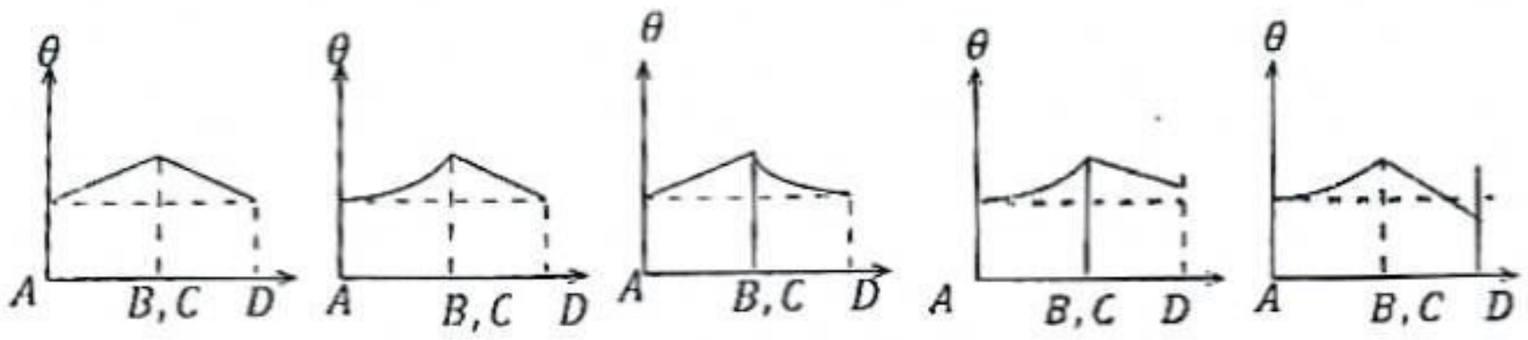
Cuboid shaped object





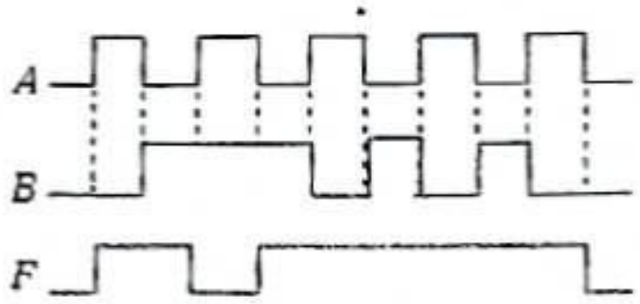
(45) AB and CD are two identical rods which conduct heat easily. CD is well-lagged and rod AB is not lagged. A heating coil is placed as shown in the figure to heat the rods. The correct graph showing the variation of temperature along the length of the rod after reaching a steady state is,

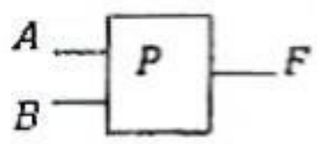




1) 2) 3) 4) 5)

(46)





The output signal of F according to the input signals of A and B is shown in the figure. Which of the following gates can exist in P?

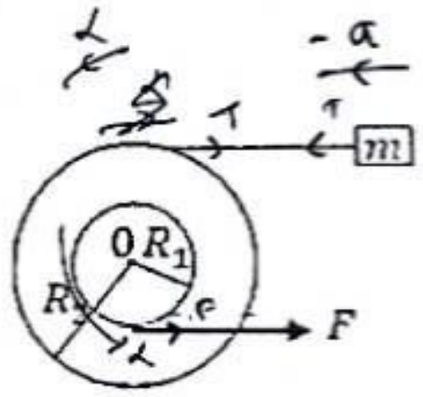
1) AND 2) OR 3) NOR 4) NAND 5) EX-OR

(47) A small disk of radius R_1 is connected coaxially to a larger disk of radius R_2. The compound object is placed on a horizontal smooth table so that it can rotate about an axis passing through the vertical center O. The moment of inertia of this combination is I. A mass m is attached to a string wrapped around the large disk is on the table. A force F is applied to the end of a string wrapped around the small disk as shown in the figure. The acceleration of mass m is,

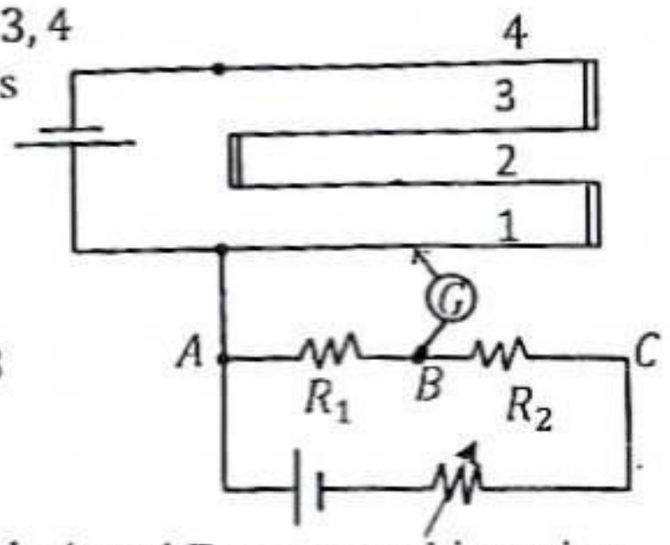
1) $\frac{R_1 F}{mR_2}$ 2) $\frac{R_1 R_1 F}{(I-mR_2)}$

3) $\frac{R_1 R_2 F}{(I+mR_2^2)}$ 4) $\frac{R_1 R_2 F}{(I-mR_1 R_2)}$

5) $\frac{R_1 R_2 F}{(I+mR_1 R_2)}$



(48) A $4m$ long potentiometer wire consists of four wires $1, 2, 3, 4$ each $1m$ long. The balance length with resistance R_1 is obtained at the middle of the second wire. The balance length with $(R_1 + R_2)$ is obtained at the middle of the third wire. The ratio of $\frac{R_2}{R_1}$ is,

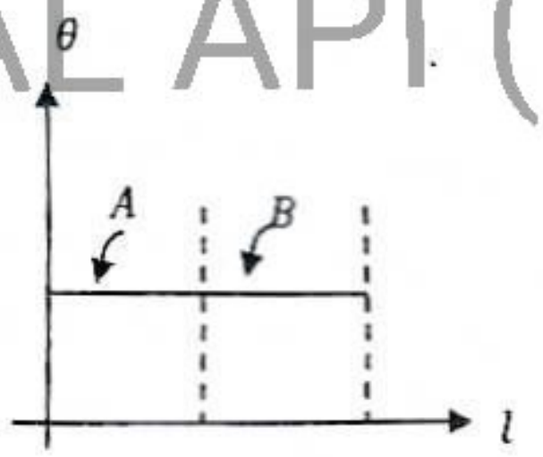


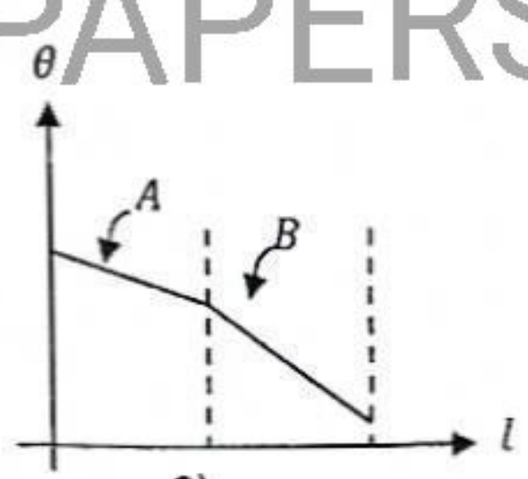
1) $\frac{2}{3}$ 2) $\frac{3}{2}$ 3) $\frac{4}{3}$ 4) $\frac{5}{3}$ 5) 3

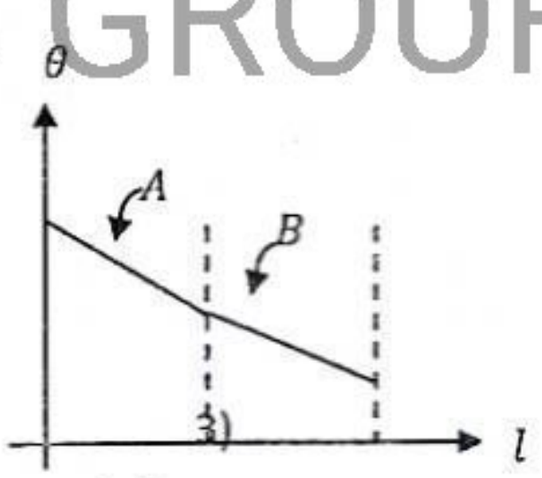
(49) The following data are given for two thermally insulated rods A and B connected in series.

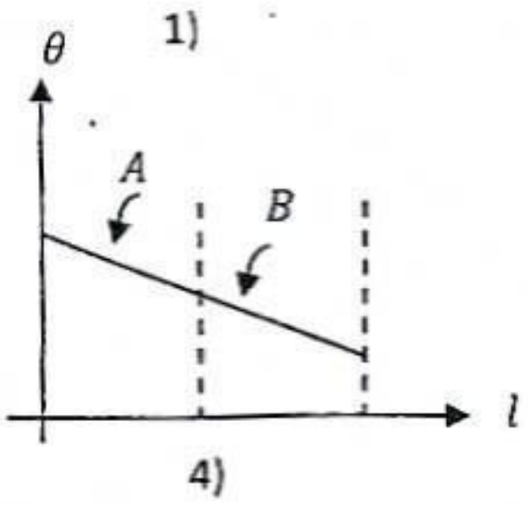
	Rod A	Rod B
Cross-sectional area	$4\ cm^2$	$2\ cm^2$
Coefficient of thermal conductivity	$0.2\ Wm^{-1}K^{-1}$	$0.4\ Wm^{-1}K^{-1}$

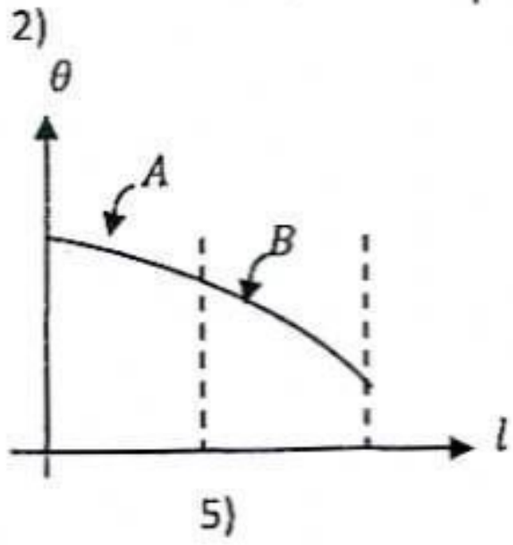
From the data given the variation of temperature with length(l) along the rod at steady state is best represented by

1)


2)


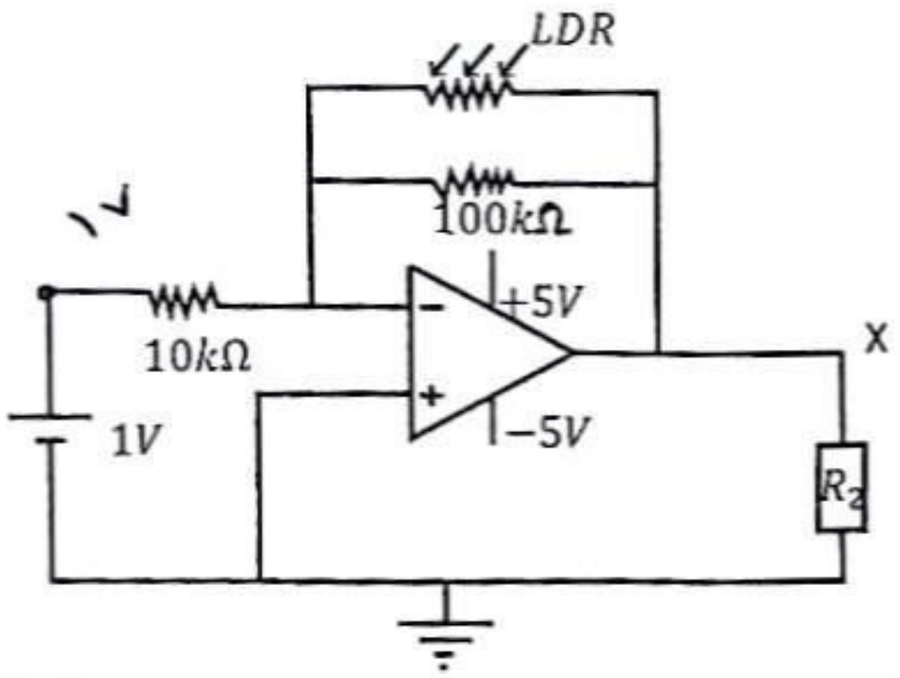
3)


4)


5)


(50) In the circuit shown in the figure, LDR is a light sensitive resistor, and its resistance is $100\ \Omega$ and $100\ M\Omega$ in light and dark respectively. Select the answer that most closely represents the potential (V_x) of X in the dark and in the light when a direct voltage of $1V$ is applied to the circuit.

	in the light	in the dark
(1)	$0.01V$	$5V$
(2)	$-0.01V$	$-5V$
(3)	$-0.01V$	$-1000\ V$
(4)	$-5V$	$-0.01V$
(5)	$5V$	$0.01V$



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