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FWC

தேசிய வெளிக்கள நிலையம் தொண்டைமானாறு
ஆறாம் தவணைப் பரீட்சை - 2024
National Field Work Centre, Thondaimanaru
6th Term Examination - 2024

பௌதிகவியல் - I Physics - I	Two Hours Grade:- 13 (2024)	01	E	I

$g = 10ms^{-2}$

01) Choose a physical quantity which has unit but it hasn't dimension, from the followings,

(1) Magnification (2) Relative velocity (3) Intensity
(4) Intensity level (5) Relative humidity

02) Consider the following physical quantities

A - Latent heat of vaporization B - Kinetic energy per unit mass
C - Gravitational potential D - Specific heat capacity

Choose the quantities who have the same dimension?

(1) $A\ and\ B$ only (2) $B\ and\ D$ only (3) A, B, C only
(4) A, B, C, D all (5) None of A, B, C, D

03) Find the maximum resistance and minimum resistance, that are able to get from the resistors $2\Omega, 3\Omega, 6\Omega$ respectively?

(1) $15\Omega, 1\Omega$ (2) $6\Omega, 2\Omega$ (3) $11\Omega, 1.2\Omega$ (4) $11\Omega, 2\Omega$ (5) $11\Omega, 1\Omega$

04) Some transverse waves, without having a same plane are allowed to go through a narrow slit. While functioning this process intensity of waves decreases. Choose the correct name of this process?

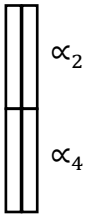
(1) Standing wave (2) Interference (3) Super position (4) Polarization (5) Beats

05) Choose the correct statement/s about body waves, from the followings?

A. P - waves only being seen in body waves.
B. Body waves are one of the type of waves in seismic waves.
C. Body waves move on through the inner layers of the earth

(1) A only (2) B, C only (3) C only
(4) A, C only (5) A, B, C all

06) Four metal bars having linear expansivities $\propto_1, \propto_2, \propto_3\ and\ \propto_4$, are being combined as shown in the figure. While heating the combined bar, it is changing an 'S' shape. So choose the correct relationship among $\propto_1, \propto_2, \propto_3\ and\ \propto_4$



(1) $\propto_2 < \propto_1\ and\ \propto_3 < \propto_4$ (2) $\propto_2 < \propto_1\ and\ \propto_4 < \propto_3$
(3) $\propto_1 < \propto_2\ and\ \propto_3 < \propto_4$ (4) $\propto_1 < \propto_2\ and\ \propto_4 < \propto_3$ (5) $\propto_3 < \propto_1\ and\ \propto_4 < \propto_2$

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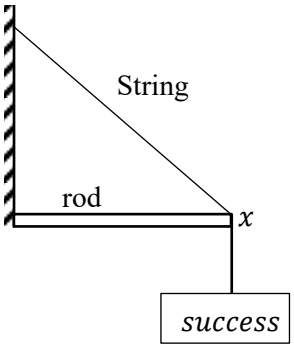
07) Choose the correct occasion where the relative humidity of a closed room cannot be increased,

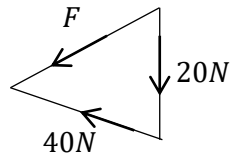
(1) Decreasing the room temperature.
(2) Injecting water vapour into the room.
(3) Increasing the pressure into the room
(4) Increasing the volume of the room at constant temperature
(5) Adding alcohol vapour that is in room temperature, into the room

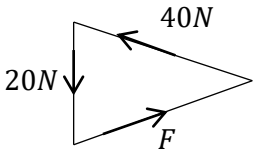
08) State the type of wave produced by a guitar chord and also the type of wave that travels to the air properly?

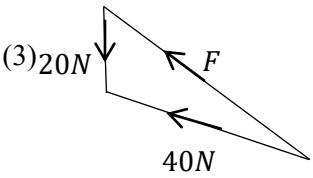
(1) Transverse standing wave, transverse progressive wave
(2) Longitudinal standing wave, longitudinal progressive wave.
(3) Transverse standing wave, longitudinal progressive wave
(4) Transverse progressive wave, longitudinal progressive wave
(5) Longitudinal progressive wave, transverse standing wave

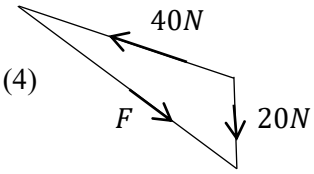
09) A name board of mass $20N$, is attached to a vertical wall with the help of a rod and a string, and hangs vertically as shown in the figure. The force exerted on the string at point X, by the rod is F. The tension in the string is $40N$. Choose the correct diagram which shows the forces acting on the point X.

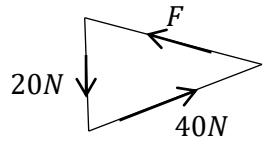


(1) 

(2) 

(3) 

(4) 

(5) 

10) If the root mean square velocity of an ideal gas at $0℃$ is, needed to doubled, then to what temperature it will be increased?

(1) $273℃$ (2) $546℃$ (3) $819℃$ (4) $1092℃$ (5) $1365℃$

11) The temperature of a uniform steel sphere of linear expansivity $\propto$ is raised by $2℃$. Find the ratio among the rate of increase in length, surface area and volume of the sphere?

(1) $1:2:3$ (2) $1:3:6$ (3) $3^2:2^2:1^2$ (4) $1:4:9$ (5) $\propto: \propto^2: \propto^3$

12) A gas molecule perform simple harmonic motion. At which distance from the oscillating centre, it has an equal amount of kinetic energy and potential energy? (Amplitude of the molecule is A)

(1) $\frac{A}{2}$ (2) $\frac{2A}{3}$ (3) $\frac{A}{\sqrt{2}}$ (4) $\sqrt{2}A$ (5) $\frac{A}{4}$

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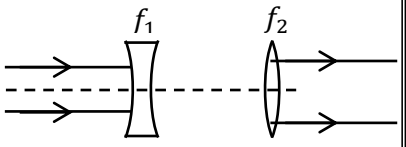
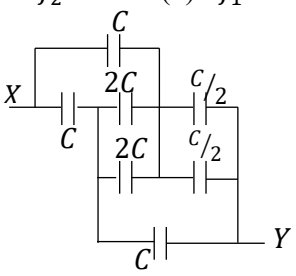
13) A concave lens of focal length f_1 and a convex lens of focal length f_2 are kept on a same principal axis as shown in the figure. A beam of light parallel to the principal axis falls on the concave lens and refracts through both of the lenses and leaves away from the convex lens, parallel to the principal axis again. Then find the separation between the lenses.



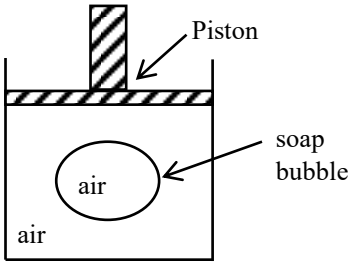
(1) $f_1 + f_2$ (2) $f_1 - f_2$ (3) $f_2 - f_1$ (4) $f_1 > f_2$ (5) $2f_1$

14) Find the equivalent capacitance between the points X, Y



(1) C *(2)* $2C$ *(3)* $4C$
(4) $6C$ *(5)* $\frac{3C}{2}$

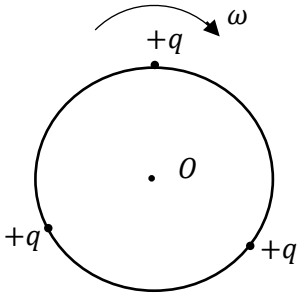
15) As shown in the figure a soap bubble is kept into the air, is trapped into a container. The pressure into the container and outside the bubble is doubled, without changing the temperature. Consider the following statements and choose the correct/s.



A. Diameter of the bubble stays at constant continuously.
B. Diameter of the bubble will increase.
C. Pressure into the bubble will increase.
D. Surface tension of the bubble will increase.

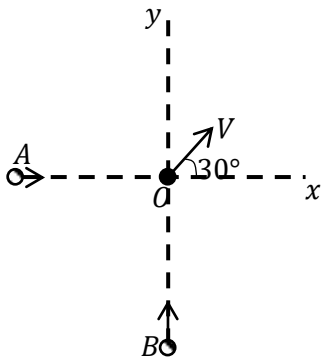
(1) A only (2) A, C only (3) B, D only
(4) C only (5) B, C, D only

16) Three point charges, having $+q$ charge each, kept on the circumference of an insulating circular disc as shown in the figure. While the disc is rotating about an axis through the centre O with an angular frequency ω clock wisely, find the magnetic field intensity at the point O.



(1) $\frac{3\mu_o q\omega}{4\pi r}\otimes$ (2) $\frac{3\mu_o q}{2r}\otimes$ (3) $\frac{3\mu_o q\omega}{2r}\otimes$
(4) $\frac{3\mu_o q\omega}{4r}\odot$ (5) $\frac{3\mu_o q\omega}{2\pi r}\odot$

17) Two objects A and B of masses 3kg and 2kg respectively moves along the positive OX direction and positive OY direction with velocities V_1 *and* V_2 respectively as shown in figure and they combining at O. After this process, the combined mass moves with a velocity V along a direction $30°$ inclined with OX, then find the ratio $\frac{V_1}{V_2}$,



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

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18) At a particular temperature a perfect blackbody emits a peak intensity at a wave length λ_m. If the temperature is being changed, the blackbody emits a peak intensity at a wavelength $\frac{\lambda_m}{4}$. Find the ratio of $\frac{\textbf{Intensity of radiation at a temperature corresponding wave length } \frac{\lambda_m}{4}}{\textbf{Intensity of radiation at a temperature corresponding wave length } \lambda_m}$,

(1) 4^2 (2) 4^3 (3) $\frac{1}{2^4}$ (4) $\frac{1}{4^4}$ (5) 2^8

19) Choose the correct statement about the minimum deviation angle of a prism, from the followings,

A - depends on the prism angle

B - depends on the refractive index of the prism material

C - depends on the refractive index of the medium where the prism is placed.

D - depends on the incident angle.

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

(4) A , B and C only (5) A, B, C and D all

20) A fast moving train blows the horn and passes a passenger who stands near a railway track. The ratio between the apparent frequencies heard by the passenger, when the train approaches him and the train leaves from him is $\frac{4}{3}$, then find the ratio between the velocities of train and sound in air?

(1) $\frac{3}{4}$ (2) $\frac{4}{3}$ (3) $\frac{1}{7}$ (4) $\frac{7}{1}$ (5) $\frac{1}{1}$

21) Half-life of a radioactive sample is $1hr$. Initially at time $t = 0$, 8×10^{10} atoms are found in the sample. Find the number of decaying nuclei within the period of time from $2hr$ to $4hr$,

(1) 2×10^{10} (2) 3×10^{10} (3) 1.5×10^{10}

(4) 2.5×10^{10} (5) 4×10^{10}

22) A ball of mass m is thrown from the ground with an initial velocity U that inclined $45°$ from the horizontal. Find the change in momentum of the ball until it reaches the ground again?

(1) 0 *(2)* $\frac{mU}{2}$ *(3)* $\frac{mU}{\sqrt{2}}$ *(4)* mU *(5)* $\sqrt{2}\,mU$

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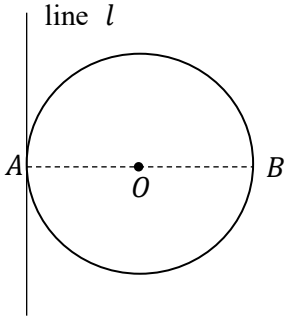
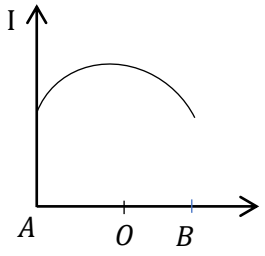
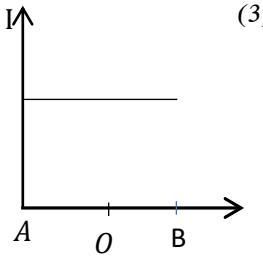
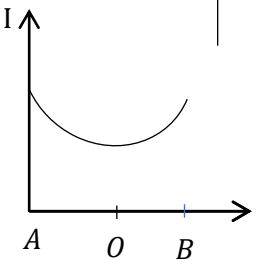
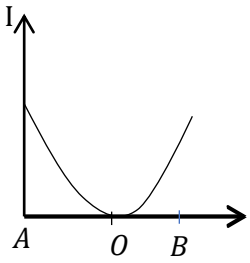
23) Line l be drawn as a tangent of a circular disc as shown in the figure. The line l is being moved from the point A to point B. And at the point B, it lies perpendicular to AOB. Find the correct graph for the variation of the moment of inertia of the disc about the moving line l.

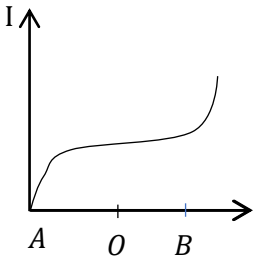


(1) 

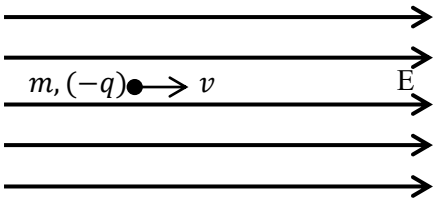
(2) 

(3) 

(4) 

(5) 

24) As shown in the figure a particle of mass m and charge $(-q)$ is being thrown with a velocity v into a uniform electric field that spread for a long distance with an electric field intensity E. Find the time taken for the particle to reach the initial position again?



(1) $\frac{mv}{Eq}$ (2) $\frac{2mv}{Eq}$ (3) $\frac{mv}{2Eq}$ (4) $\frac{Eq}{mV}$ (5) $\frac{2Eq}{mV}$

25) A soap film is formed between two parallel wires having length $10cm$ each, and a separation $0.5cm$ between them. Find the work done to increase the separation between the parallel wires by $1mm$. Surface tension of the soap solution is $72 \times 10^{-3} Nm^{-1}$)

(1) 7.2×10^{-6}J (2) 7.2×10^{-3}J (3) 1.44×10^{-4}J

(4) 7.2×10^{-5}J (5) 1.44×10^{-5}J

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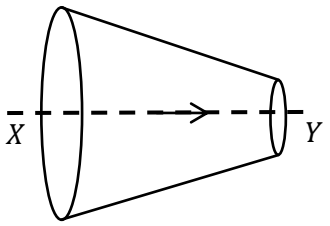
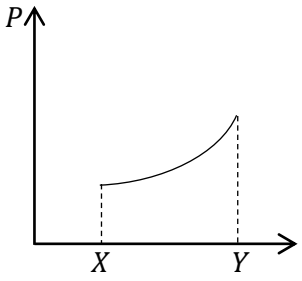
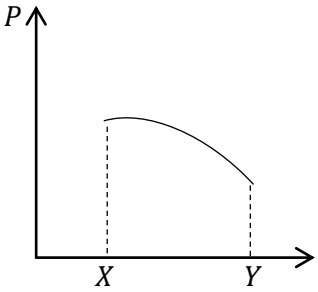
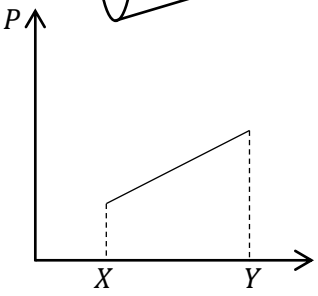
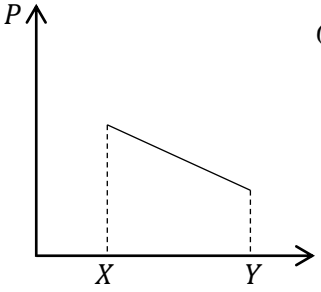
26) While a non-viscous and incompressible fluid flowing through a pipe in a streamline flow, then find the correct graph for the pressure of the fluid against the position from X and Y.

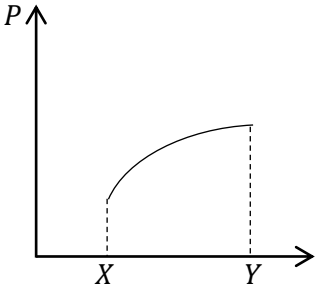


(1) 

(2) 

(3) 

(4) 

(5) 

27) Choose the incorrect statement about an n-channel junction field effect transistor,

(1) This transistor contains one $p-n$ junction.

(2) While functioning in the saturation region, drain current (I_D) contains the maximum value.

(3) On behalf of this transistor consists only electron as a charge carrier, it is called as unipolar device.

(4) The drain - source voltage (V_{DS}) controls the output current.

(5) While functioning this device, drain current (I_D) equates the source current (I_S)

28) Sound intensity level produced by an engine at a particular place is $50dB$. Find the intensity level produced by ten same engines at the same place? Find the intensity level produced by ten such engines at same place?

(1) $50dB$ (2) $60dB$ (3) $40dB$ (4) $70dB$ (5) $30dB$

29) Three wires made by a same material are connected parallelly across a cell of electro motive force E. The ratio among their length is $1:5:8$ and the ratio among their radius is $1:2:3$. Find the ratio among the heat energy produced by them?

(1) $40:32:45$ (2) $1:5:8$ (3) $36:45:32$ (4) $6:15:16$ (5) $40:16:15$

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30) While diving, a diver gradually change his body as shown in the figure(1) to figure (2). Then the moment of inertia of his body about the center of gravity G of him are $10kg\,m^2$ and $6kg\,m^2$ respectively. Find the percentage of increment in the rotational kinetic energy approximately?

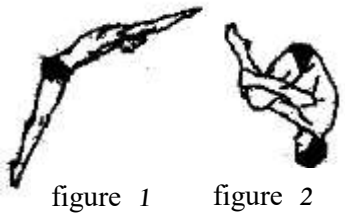


figure *1* figure *2*

(1) 12% (2) 33% (3) 60% (4) 67% (5) 88%

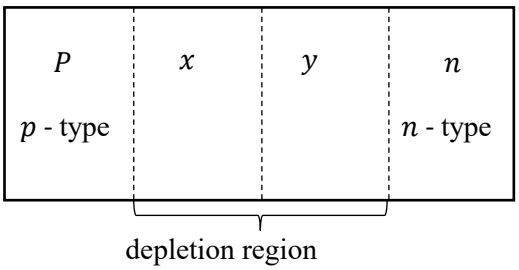
31) A small sphere of volume V and density ρ_1 is made to move into a liquid of density $\rho_2(<\rho_1)$. The viscous force F acting on it is given by a formula $F = Kv^2$, where V be the velocity of the sphere and K be a constant, $K > O$. Give an expression for the terminal velocity of the sphere?

(1) $\frac{Vg(\rho_1-\rho_2)}{K}$ (2) $\sqrt{\frac{Vg(\rho_1-\rho_2)}{2K}}$ (3) $\sqrt{\frac{Vg(\rho_1-\rho_2)}{K}}$

(4) $\frac{Vg(\rho_1-\rho_2)}{2K}$ (5) $\sqrt{\frac{2Vg(\rho_1-\rho_2)}{K}}$

32) A structure of a $p-n$ junction is given in the figure. Consider the following statements and choose the correct/s.

A - Positive (+) ions are found in the region p and negative(-) ions are found in the region n.
B - Negative (-) ions are found in the region x and positive (+) ions are found in the region y.
C - The electric field intensity in the depletion region is directed from n- type region to p - type region.

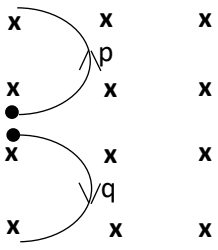


(1) A only (2) B only (3) A, B only
(4) B, C only (5) A, B, C all

33) A sonometer wire stretched by a tension synchronized with a tuning fork, in the fundamental stage, for the lengths 50cm and 51cm separately, forms beat sounds with beat frequency 2Hz. Find the frequency of the tuning fork?

(1) $202Hz$ (2) $100Hz$ (3) $102Hz$ (4) $204Hz$ (5) $200Hz$

34) As shown in the figure, there are two charged particles p and q enter into a uniform magnetic field with same velocity and fulfill their semicircular paths with same radius. Choose the correct statement from the following?



(1) Particle p has a negative charge and the particle q has a positive charge.
(2) Mass of both p and q are the same.
(3) Charge of both p and q are the same
(4) The product of mass and charge of both are the same.
(5) The ratio of $\frac{\text{mass}}{\text{charge}}$ is same for both

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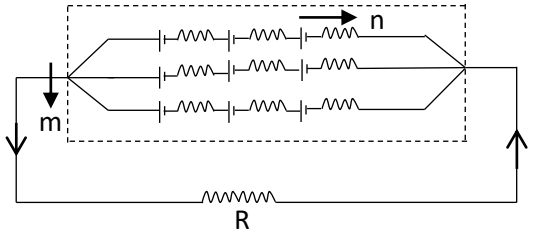
35) When two light waves of frequencies $f_1 \; and \; f_2$, incident on a photodiode separately, the photodiode emits photo electrons with maximum speeds $V_1 \; and \; V_2$ respectively. Mass of an electron is m and Plank constant be h. Choose the correct relationship from the followings,

(1) $V_1 - V_2 = \left[\frac{2h}{m}(f_1 - f_2)\right]^{\frac{1}{2}}$ (2) $V_1^2 - V_2^2 = \frac{2h}{m}[(f_1 - f_2)]$

(3) $V_1 + V_2 = \left[\frac{2h}{m}(f_1 + f_2)\right]^{\frac{1}{2}}$ (4) $V_1^2 - V_2^2 = \frac{2h}{m}[(f_1 + f_2)]$

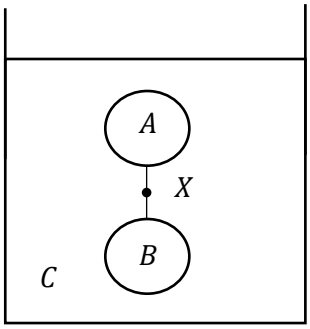
(5) $V_1^2 + V_2^2 = \left[\frac{2h}{m}(f_1 + f_2)\right]^{\frac{1}{2}}$

36) A system contains M number of rows in parallel as shown in the figure. A row has n number of electric cells with electromotive force E and internal resistance r, for each and the cells are connected seriesly. An external resistance R is connected across this system then find the current through the external resistance R and find the value of R at the maximum energy loss across the external resistance R.



(1) $\frac{(n+M)E}{(R+r)}, r$ (2) $\frac{nE}{(Mr+R)}, \frac{Mr}{n}$ (3) $\frac{MnE}{(MR+nr)}, \frac{nr}{M}$ (4) $\frac{(M+n)E}{(R+r)}, \frac{nr}{M}$ (5) $\frac{nE}{M}, \frac{nr}{M}$

37) Two spheres A and B of same volume are annexed by an inextensible light string tightly and they floats into a liquid C, in equilibrium as shown in the figure. $d_A, d_B \; and \; d_C$ are the densities of A, B and the liquid C. Consider the following statements and choose the correct/s,



A - $d_A < d_B$

B - $d_A + d_B = 2d_C$

C - If the string is being cut at the point X the size of the forces acting on A and B initially are the same.

(1) A only (2) C only (3) A, C only

(4) A, B only (5) A, B, C all

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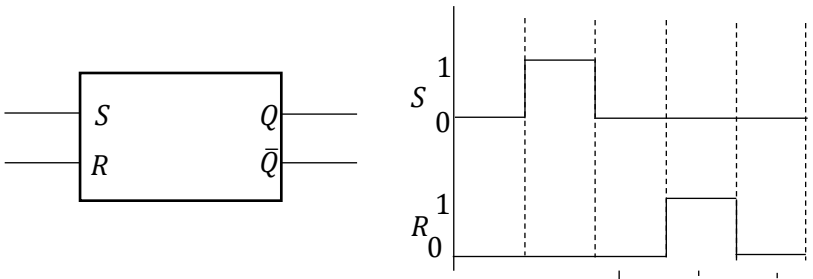
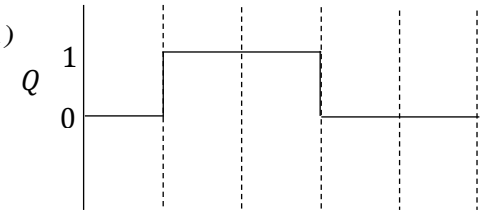
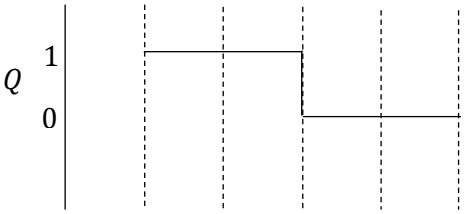
38) The input signals supplied to the S and R terminals for a flip flop circuit are given in the figure. Represent the correct output signal received at the terminal Q?



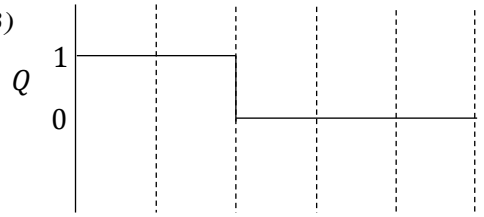
(1)



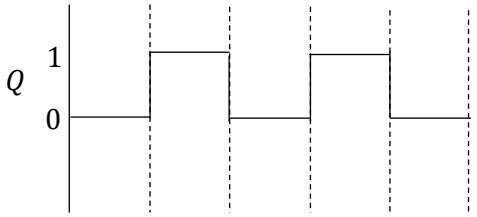
(2)



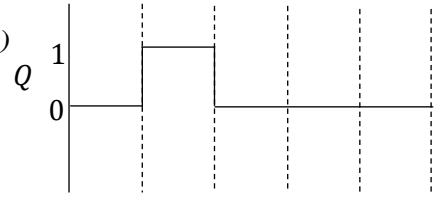
(3)



(4)

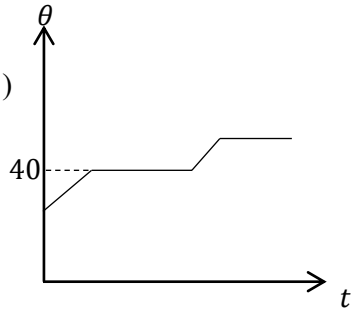


(5)

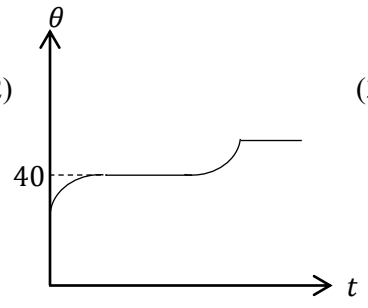


39) On a day, the room temperature is in 30℃, a solid wax at 20℃ temperature is taken into a non-insulated calorimeter, that has a negligible heat capacity at room temperature. If the heat energy supplied to the system at constant rate then choose the correct variation of the temperature of wax with time.

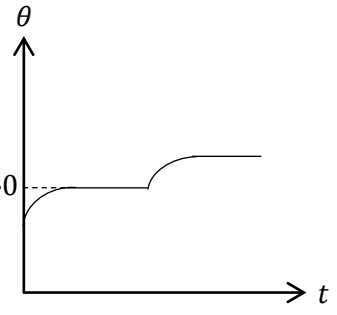
(1)



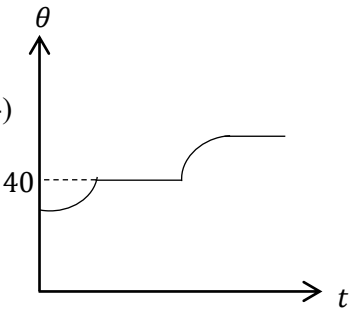
(2)



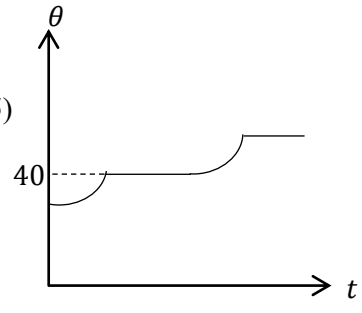
(3)



(4)



(5)



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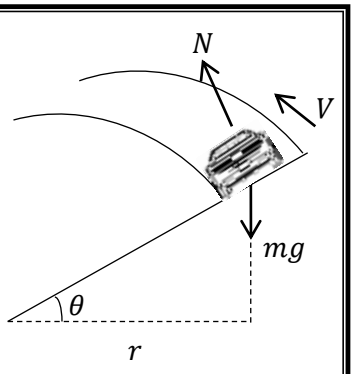
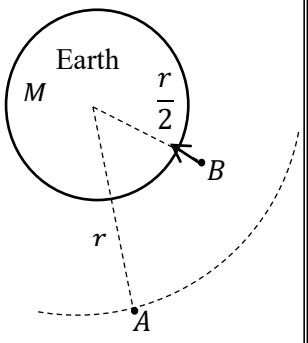
40) Figure shows a car of mass m moving along a banked path of inclination θ with horizontal, turns with velocity V. If the frictional force between the tyres of the car and the path is negligible find the an expression for the value of V?



(1) $\sqrt{gr\tan\theta}$ (2) $\sqrt{gr\sin\theta}$ (3) $\sqrt{gr\,/\tan\theta}$
(4) $\sqrt{gr\cos\theta}$ (5) $\sqrt{gr\,/\sin\theta}$

41) As shown in the figure a satellite A orbits around the earth along a circular path of radius r. At the same time an another satellite B with same mass moves towards the earth. While moving, the satellite B is at a distance $r/2$ from the center of the earth, the total energy of A and B are equal. Then find the velocity of B. (Mass of the earth is M)

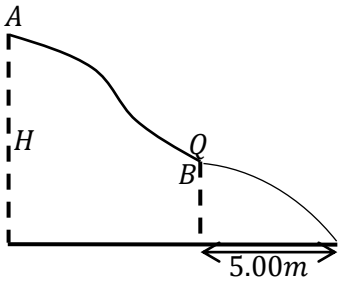


(1) $\sqrt{\frac{GM}{r}}$ (2) $\sqrt{\frac{2GM}{r}}$ (3) $\sqrt{\frac{GM}{2r}}$ (4) $\sqrt{\frac{3GM}{r}}$ (5) $\sqrt{\frac{3GM}{2r}}$

42) The nearest distance is 100cm for a person who has a long sight defect, wears a convex lens and he can see an object situated at 25cm in front of the eye. Find the focal length of the eye lens? [Least distance for the clear vision is 25cm. The distance between the eye lens and retina is 2.5cm]

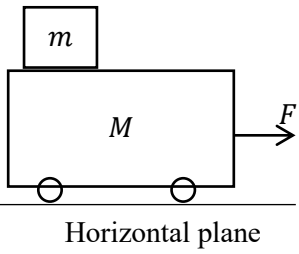
(1) $2.5cm$ (2) $2.4cm$ (3) $2.3cm$ (4) $2.2cm$ (5) $2.1cm$

43) A person starts to slide from the top A of a water slide and slides continuously until he reaches the end B. The person leaves from the end B and hits the water surface at a horizontal distance 5m and at a time 0.5s from B. Find the value H ?



(1) $2.5m$ (2) $5m$
(3) $6.25m$ (4)$10m$
(5) $12.5m$

44) As shown in the figure a block of mass m is kept on a trolley of mass M. The trolley kept on a smooth horizontal plane but the block kept on a rough upper surface of the trolley. F be the maximum force applied to the trolley, until keeps the block at the verge of rest. Then find the maximum frictional force acting on the block?



(1) F (2) $\frac{mF}{M+m}$ (3) $\frac{mF}{M-m}$ (4) $\left(\frac{M-m}{M+m}\right)$ (5) $\frac{MF}{m+M}$

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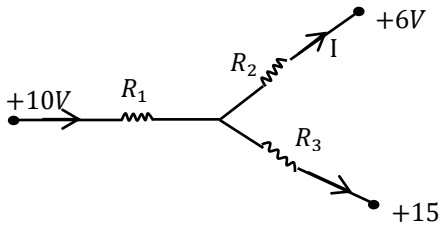
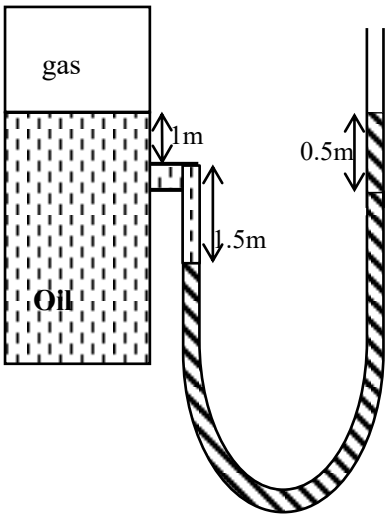
45)



In the above electrical circuit $R_1 = 10\Omega, R_2 = 20\Omega, R_3 = 30\Omega$. Find the current flow through the resistance R_2?

(1) $\frac{1}{55}A$ (2) $\frac{4}{110}A$ (3) $\frac{19}{110}A$ (4) $\frac{91}{110}A$ (5) $\frac{21}{110}A$

46) A large oil tank traps some gas itself, as shown in the figure. A $U-tube$ annexed with this tank contains an another liquid partially. Atmospheric pressure is $1 \times 10^5 Nm^{-2}$. Density of oil is $800 kgm^{-3}$. Find the pressure of the gas?

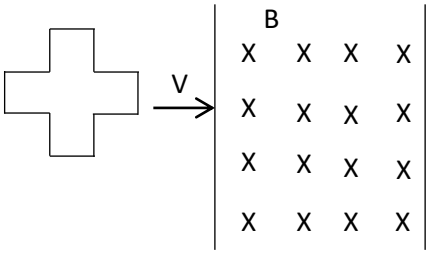


(1) $20 \times 10^5 Pa$ *(2)* $2.4 \times 10^5 Pa$

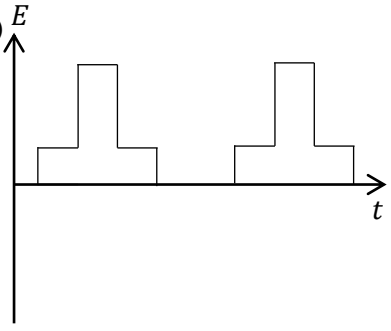
(3) $3.6 \times 10^5 Pa$ *(4)* 3.2×10^5Pa

(5) 2.8×10^5Pa

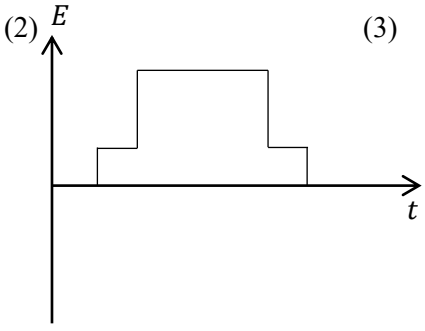
47) While a cross-shaped conductor is being moved with a velocity V, along a direction perpendicular to the uniform magnetic field that enters into the paper, find the graph which represents the induced electromotive force (E) versus time (t) graph precisely.



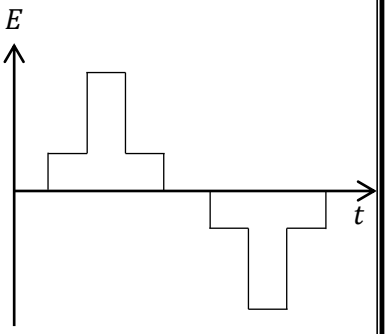
(1)



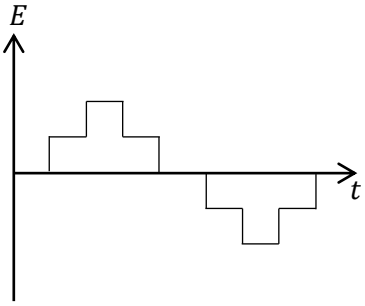
(2)



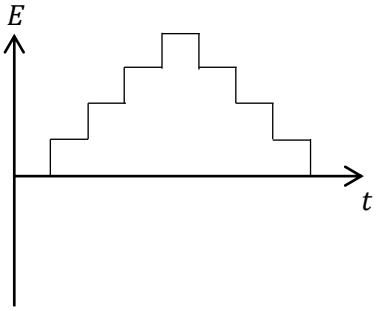
(3)



(4)



(5)



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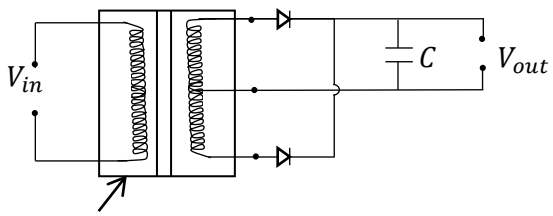
48) In the figure (a) an electrical circuit, connected with center tapped transformer, two silicon diodes and a capacitor is given. While an input V_{in} , shown in the figure(b) is supplied to the center tapped transformer, find the graph of output V_{out} versus time?



center tapped transformer
figure a

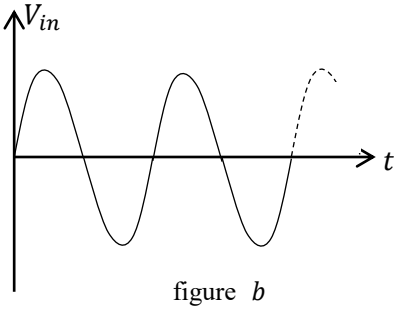
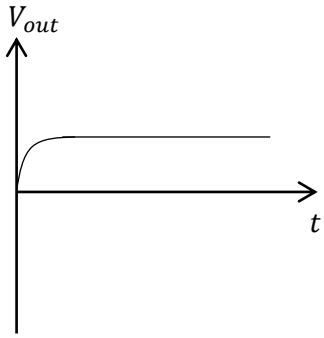
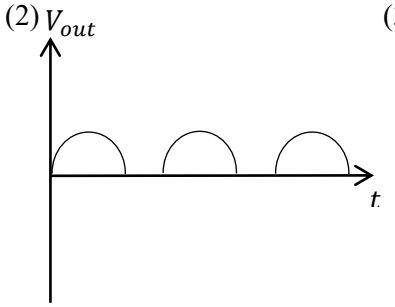
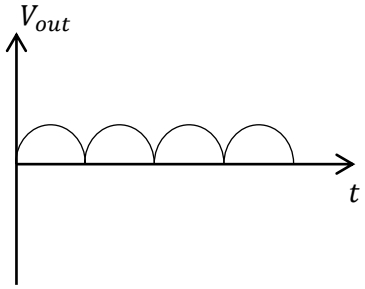
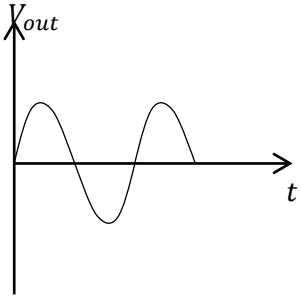


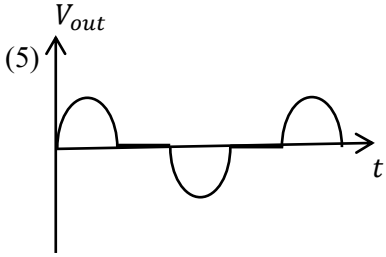
figure b

(1) 

(2) 

(3) 

(4) 

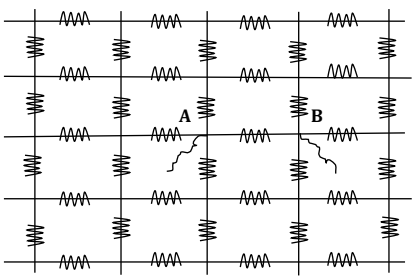
(5) 

49) A pendulum of period T is made by a string of cross-sectional area A. When an additional mass m is added to the bop the new period is T_0 . The young's modulus of the material, that made the pendulum string is Y. Give an expression for $\frac{1}{y}$?

(1) $\left[\left(\frac{T_o}{T}\right)^2 - 1\right]\frac{A}{mg}$ (2) $\left[\left(\frac{T_o}{T}\right)^2 - 1\right]\frac{mg}{A}$ (3) $\left[1 - \left(\frac{T_o}{T}\right)^2\right]\frac{A}{mg}$

(4) $\left[1 - \left(\frac{T}{T_o}\right)^2 - 1\right]\frac{A}{mg}$ (5) $\left[\left(\frac{T}{T_0}\right)^2 - 1\right]\frac{A}{mg}$

50) A square shaped resistance network is constructed with the help of an infinite number of resistors of resistance r and length l for each, as shown in the figure. Find the resultant resistance across A and B?



(1) $r/8$ *(2)* $r/4$ *(3)* $2r$ *(4)* r *(5)* $r/2$