# GCE A/L PHYSICS 1997

## PAPER I

01. Which one of the following is a unit of momentum?
(1) $Ns^{-2}$ (2) $Ns^{-1}$ (3) Ns (4) $Ns^{2}$ (5) $N^{2}s$

02. The quality of sound depends on its
(1) frequency. (2) amplitude. (3) wavelength. (4) loudness. (5) presence of overtones.

03. The velocity of transverse waves in a stretched string depends upon
(1) frequency of vibration. (2) wavelength of the wave. (3) amplitude of the wave.
(4) tension in the string. (5) length of the string.

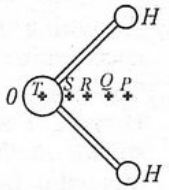
04. The intensity of sound from a source is increased by $10^{6}$ times its original intensity. The corresponding increase in sound intensity level in *dB* is
(1) 5. (2) 6. (3) 50. (4) 60. (5) 600.

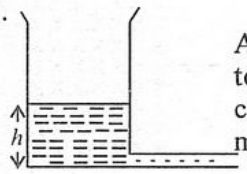
05. Focal length of a convex lens is 5 cm. The magnitude of the power of the lens in diopters is
(1) 0.025. (2) 0.2. (3) 5. (4) 10. (5) 20.

06. Which of the following statements made about X-rays is not true?
(1) In vacuum X-rays propagate with the speed of light.
(2) X-rays can be diffracted by a crystal lattice.
(3) X-rays can produce photoelectric effect.
(4) X-rays can be deflected by electric or by magnetic fields. (5) X-rays can ionise a gas.

07. The primary winding of an ideal transformer has 200 turns and its secondary winding has 50 turns. If the current in the secondary is 40A, the current in the primary is
(1) 5A. (2) 10A. (3) 80A. (4) 120A. (5) 160A.

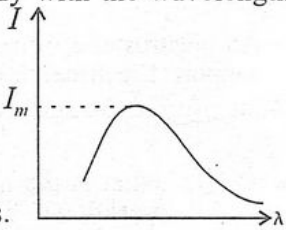
08. The water ($H_2O$) molecule has the shape shown in the figure. The centre of gravity of the molecule is most likely to be found at
(1) P. (2) Q.
(3) R. (4) S.
(5) T.




09. 

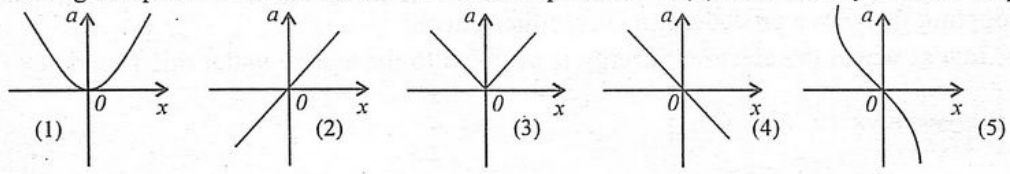

A tank carries a horizontal narrow tube at the bottom as shown in the figure. In order to maintain the water level at a height *h*, water should be supplied to the tank at a constant rate of *Q*. The rate at which the water should be supplied to the tank to maintain its water level at 2*h* is
(1) Q/2. (2) Q. (3) 2Q. (4) 3Q. (5) 4Q.

10. Figure shows the variation of the intensity of radiation *I* emitted by a black body with the wavelength λ. As the temperature of the black body increases the maximum intensity
(1) $I_m$ increases and the position of $I_m$ shifts towards longer wavelengths.
(2) $I_m$ increases and the position of $I_m$ shifts towards shorter wavelengths.
(3) $I_m$ decreases and the position of $I_m$ shifts towards longer wavelengths.
(4) $I_m$ decreases and the position of $I_m$ shifts towards shorter wavelengths.
(5) $I_m$ remains constant and the position of $I_m$ shifts towards shorter wavelengths.



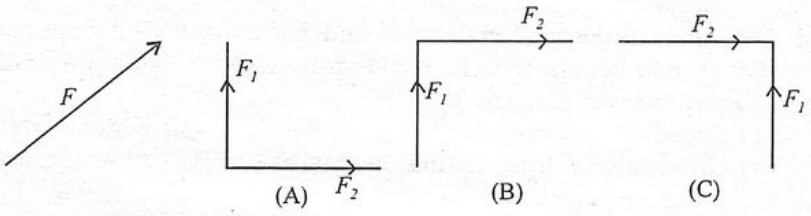

11. An eye a near point at 1 m. The lens needed to change this to 25 cm is a
(1) convex lens with focal length 25 cm. (2) concave lens with focal length 25 cm.
(3) convex lens with focal length 33.3 cm (4) concave lens with focal length 33.3 cm.
(5) convex lens with focal length 40 cm.

12. Which of the following sketches best represents the relation between the acceleration (*a*) of a body executing simple harmonic motion and the displacement (*x*) of the body from its equilibrium position?



13. An isolated parallel plate capacitor filled with air is charged to a potential difference of V. If the space between the plates is then filled with a medium of dielectric constant 2, the potential difference will be,
(1) $\frac{V}{2}$. (2) $\frac{V}{\sqrt{2}}$. (3) V. (4) $\sqrt{2}$ V. (5) 2 V.

14. The force F shows in the figure can be obtained by adding the forces $F_1$ and $F_2$ in
(1) A only (2) B only
(3) C only (4) A and B only
(3) all A, B and C




15. Consider the following statcmcnts regarding an intrinsic semiconductor.
(A) The electrical conductivity decreases with the increxsing temperatine
(B) The ratio of the number of free electrons to the number of boles remains constant with incessing temperature.
(C) Both the free electrons ad holes contribute to the electric conduction process.
Of the above statements.
(1) only A is true (2) only B is true (3) only C is true
(4) only B and C are true (5) all A, B, and c are true

16 A light string passing over a smooth polly carries a spring balance of mass 1 kg and two weights of masses 1 kg and 2 kg as shown in the figure. The reading on the balance will be.
(1) zero (2) 1 kg (3) 2 kg (4) 3 kg (5) 4 kg

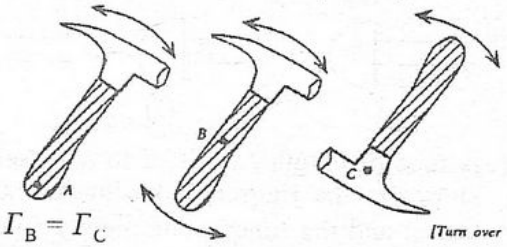



17 A crown of mass 1.4 kg has an apparent weight of 1.3 kg when submerged fully in water. The mean density of the material of the crown is (density of water = $10^3$ kg $m^{-3}$
(1) $1.1 \times 10^3$ kg $m^{-3}$ (2) $1.3 \times 10^3$ kg $m^{-3}$ (3) $1.4 \times 10^3$ kg $m^{-3}$
(4) $1.4 \times 10^4$ kg $m^{-3}$ (5) $2.7 \times 10^4$ kg $m^{-3}$

18. A $5 \times 10^{-2}$ kg lump of clay that is moving at a velocity of 10 $ms^{-1}$ in a horizontal direction to the left strikes a $6 \times 10^{-2}$ kg lump of clay moving in the same horizontal direction to the right at a velocity of 12 $ms^{-1}$. The two lumps stick together after they collide. The composite object will move at a velocity of
(1) 0. (2) 1 $ms^{-1}$ (3) 2 $ms^{-1}$ (4) 11 $ms^{-1}$ (5) 22 $ms^{-1}$

19. when the pressure of a given mass of an ideal gas is doubled while the volume is kept constant, the average translation Kinetic energy of a gas molecule will
(1) remain same (2) be halved (3) be doubled (4) be trebled (5) be quadrupled

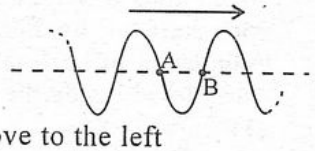
20. A hammer is made to swing with the same angular acceleration about the points A,B, and C as shown in the figure. If the respective torques required. If the respective torques required are $\Gamma_A$ $\Gamma_B$ and $\Gamma_C$ then,
(1) $\Gamma_A > \Gamma_B > \Gamma_C$ (2) $\Gamma_A > \Gamma_C > \Gamma_B$
(3) $\Gamma_C > \Gamma_B > \Gamma_A$ (4) $\Gamma_A = \Gamma_C < \Gamma_B$ (5) $\Gamma_A = \Gamma_B = \Gamma_C$




[Turn over

21. A lead bullet moving at a speed of 130 $ms^{-1}$ is stopped inside a block of wood. The specific heat copacity of lead is 130 $1kg^{-1}$ $^0C$. If all the cnergy change goes into heating the bullet, the increase in temperature of the bullet is (1) $45^0C$ (2) $55^0C$ (3) $65^0C$ (4) $75^0C$ (5) $85^0C$

22. figure shows the instantaneous position of a trasverse wave travelling to the right on a water surface A and B are two small floating objects. As the wave travels away from this position to the right
(1) both A and B begin to move to the right (2) both A and B begin to move to the left
(3) both A and B begin to move downwards (4) A begins to move upwards and B begins to move downwards
(5) A begins to move downwards and B begins to move upwards



23. The weight of an object on the earth surface is 600N. At a height of one earth radius above the earth surface the weight of the object will be
(1) 150N (2) 240N (3) 300N (4) 600N (5) 2400N

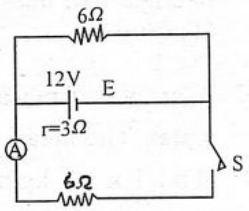
24. Two small objects of masses M and 2M are released from rest at heights 2 h and h respectively above the ground level. Which of the following is same for both masses just before hitting the ground (Neglect the air resistance)
(1) Speed (2) Kinetic energy (3) Time of travel
(4) Gravitational force acting on masses (5) Momentum

25 A spring a toy gun has to be compressed 5 mm in order to project a bullet vertically upwards to a height of 2 m. In order to project the same bullet for a vertical of 8 m the spring should be compressed by a minimum distance of
(1) 100mm (2) 80mm (3) 50mm (4) 20mm (5) 10mm

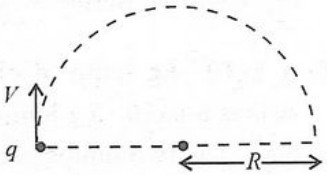
26. A converging lens of focal length 5cm is used as a magnitying lens. If the near point of the eye is 25cm, the maximum magnifying power that can be achieved is
(1) 4 (2) 5 (3) 6 (4) 8 (5) 10

27. A sound source moves towards a stationary observer with a speed ¼ of the speed of sound in air. The ratio $\frac{\text{apparent frequency heard by the obscrrer}}{\text{frequency cmitted by the source}}$ is
(1) ¼ (2) ½ (3) ¾ (4) 4/3 (5) 4

28. In the circuit shown, E is a call of e.m.f 12V and internal resistance 3Ω A is an ammeter of negligible. When the switch S is closed the reading of A is
(1) 0.5A (2) 1A (3) 2A (4) 4A (5) 8A

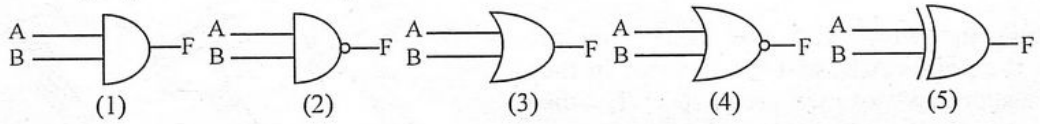



29 A charged particle having a velocity $V$ enters perpendicular to a uniform magnetic field of flux density $B$ and follows a circular path of radius $R$ as shown in the figure. If the charge on the particle is $q$, the mass of the particle is
(1) $\frac{BqR}{V}$ . (2) $\frac{Bq}{R}$ . (3) $\frac{BqR}{V^2}$ .
(4) $\frac{BqR^2}{V}$ . (5) $\frac{BqV^2}{R}$ .

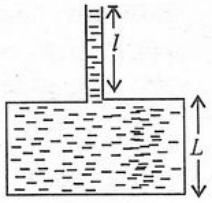



30. The logic gate which corresponds to the truth table shown is

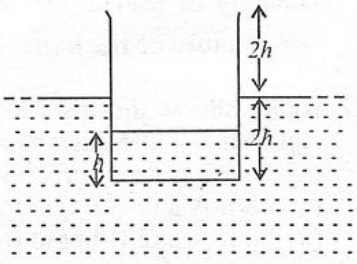
| A | B | F |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |




31 A tube of length $l$ is fitted to a vessel having a height $L$ and a bottom of area $A$ as shown in the figure. If the internal area of cross-section of the tube is '$a$' and the vessel and the tube is completely filled with a liquid of density $\rho$, the force acting on the bottom of the vessel by the liguid is
(1) $A\,(L + l)\,\rho g$ (2) $(A - a)\,L\rho g + a\,(L + l)\,\rho g$
(3) $Al\rho g$ (4) $a(L + l)\rho g$ (5) $(AL + al)\,\rho g$



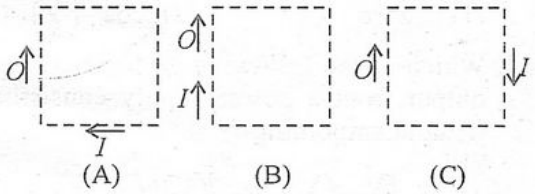

32. A cylindrical metallic vessel having thin walls of height $4h$ contains water upto a height $h$. When immersed in water, this cylinder floats with half of its height below the water surface as shown. If the cylinder is to be floated with its almost entire height under water, the water level inside the cylinder has to be raised $h$ to
(1) $\frac{4}{3}h$. (2) $2h$. (3) $\frac{8}{3}h$.
(4) $3h$. (5) $\frac{7}{2}h$.



33. A mercury-glass thermometer has a bulb of volume 0.5 $cm^3$ and a stem of internal cross-sectional area $4 \times 10^{-4}$ $cm^2$. If the distance between the 0°C and 100°C marks of the thermometer is 20 cm, the apparent volume expansivity of mercury in glass is approximately
(1) $8 \times 10^{-5}$ $°C^{-1}$ (2) $1.6 \times 10^{-5}$ $°C^{-1}$ (3) $8 \times 10^{-4}$ $°C^{-1}$
(4) $1.6 \times 10^{-4}$ $°C^{-1}$ (5) $3.2 \times 10^{-5}$ $°C^{-1}$

34. A rotating fly wheel of moment of inertia 2kg $m^2$ about its axis brought to rest in 20s by a constant couple of 20 Nm acting on the wheel. The initial angular velocity of the wheel in rad $s^{-1}$ is,
(1) 50 (2) 100 (3) 200 (4) 400 (5) 800

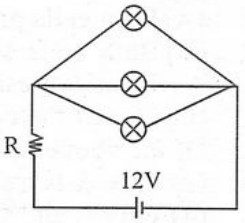
35. In the figures shown, *I* represents the image of an object O. Which of the images shown in figures can be realised by placing a right angled isosceles prism in the box.
(1) In B only (2) In A and C only
(3) In B and C only (4) In A and B only
(5) In all A, B, and C



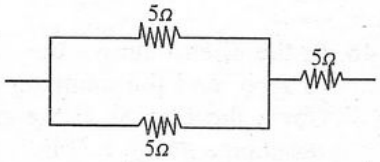
(A) (B) (C)

36. An organ pipe of length 50 cm is closed at one end. If the speed of sound in air is 300 $ms^{-1}$, the two lowest resonant frequencies produced when the pipe is sounded are
(1) 150Hz and 300Hz (2) 150 Hz and 450Hz (3) 300 Hz and 450 Hz
(4) 300 Hz and 900 Hz (5) 450 Hz and 1050 Hz

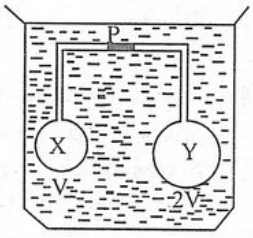
37. Three 1.5V, 0.50 A bulbs are connected as shown in the figure to a battery of e.m.f. 12V and negligible internal resistance. In order to light the bulbs with normal brightness, the resistance R should have a value of
(1) $5\Omega$ (2) $7\Omega$ (3) $15\Omega$
(4) $21\Omega$ (5) $30\Omega$




38. The maximum power that can be dissipated in each of the resistors in the resistor network shown in the figure is 20 W. The maximum power the network can dissipate is
(1) 20W (2) 30W (30 40W (4) 60W (5) 80W




39. Two bulbs X and Y of volume V and 2V immersed in a constant temperature bath contain two ideal gases having relative molecular masses 2 and 28 respectively. Tow bulbs are connected by a narrow tube and the gases are separated by a small pellet of mercury (P) as shown in the diagram.
The ratio $\frac{\text{mass of gas in X}}{\text{mass of gas in Y}}$ is
(1) $\frac{1}{28}$ (2) $\frac{1}{7}$ (3) 7 (4) 14 (5) 28



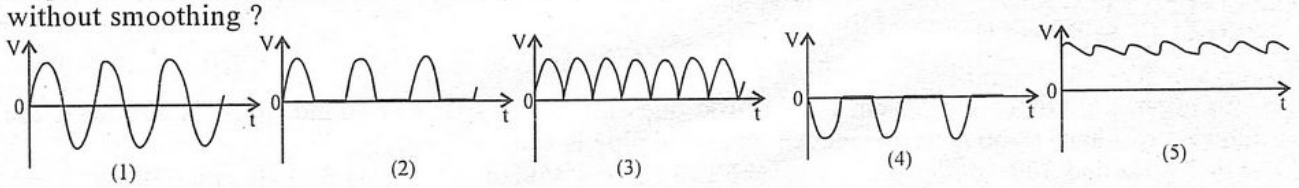

40 When a mercury-in-glass thermometer and a thermocouple were used to measure the temperature of a hot liquid. The thermocouple indicated a higher reading. The most appropriate reason for this is that
(1) the thermocouple is more sensitive than the mercury thermometer
(2) the thermocouple responds quicker than the mercury thermometer
(3) the thermocouple absorbs more heat than the mercury thermomerter to register a reading
(4) the volume of the liquid is very small
(5) Specific heat capacity of mercury is smaller than those of the metals used in the thermocouple

41. Consider the following statements made about an ideal gas undergoing a process.
(A) For a constant volume process $\Delta Q = \Delta U$.
(B) For an isothermal process $\Delta U$ is always zero.
(C) For an adiabatic compression $\Delta U > 0$.
Of the above statements
(1) only (A) is true (2) only (A) and (B) are true
(3) only (B) and (C) are true (4) only (A) and (C) are true (5) all (A), (B) and (C) are true

42. On a certain day, the dew point of a city $X$ is twice that of a city $Y$. Consider the following statements made about the two cities.
(A) The temperature of city $Y$ should be twice that of $X$
(B) The relative humidity of city $X$ should be twice that of $Y$.
(C) The absolute humidity of the city $X$ at its dew point should be greater than that of the city $Y$ at its dew point.
Of the above statements
(1) only A is true (2) only C is true (3) only A and C are true
(4) only B and C are true (5) all A, B and C are true

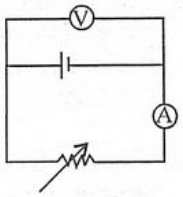
43. Capillary rise of water inside a metallic capillary tube of internal radius $R$ is found to be same as that of a glass capillary tube of internal radius $r$. If the angle of contact between water and glass is zero, the angle of contact between water and the metal is
(1) zero . (2) $\cos^{-1}\left(\frac{r}{R}\right)$. (3) $\cos^{-1}\left(\frac{R}{r}\right)$. (4) $\cos^{-1}\left(\frac{r}{2R}\right)$. (5) $\cos^{-1}\left(\frac{2R}{r}\right)$.

44. Which of the following graphs best represents the relationship between voltage ($V$) and time ($t$) for the output from a power supply consisting of an alternating current generator and a full wave rectifier without smoothing ?

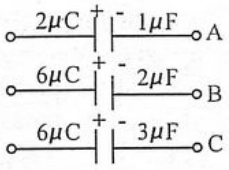



45. Consider the following statements made about two cells having same e.m.f., but one with a zero internal resistance and the other with a finite internal resistance.
(A) Both cells produce infinite currents when their termainals are short circuited.
(B) Both cells show same potential difference across the terminals when they are connected across identical resistors.
(C) One of the cells gets heated up when a large current is drawn from it
Of the above statements
(1) only A is true (2) only C is tue (3) only B and C are true
(4) only A and C are true (5) all A, B, and C are true

46. In the circuit shown the voltmeter reads 2V when the ammeter reading is made to zero, and the ammeter read 1A when the voltmeter reading is made to zero (for a short time). If the ammeter has negligible internal resistance, the internal resistance of the cell is
(1) 0 (2) $0.5\Omega$ (3) $1\Omega$ (4) $2\Omega$ (5) $3\Omega$

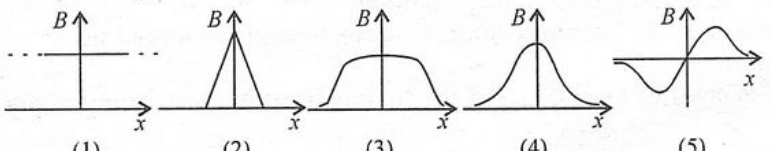


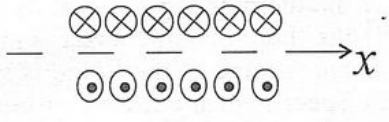

47. Three isolated capacitors having capacitances of $1\mu F$, $2\mu F$ and $3\mu F$ carry charges $2\mu C$, $6\mu C$ and $6\mu C$ respectively as shown in the figure. If the positive plates of the capacitors are connected together, the ptentials (in volts) at the other plate terminals, A,B and C with respect to the positive plates are



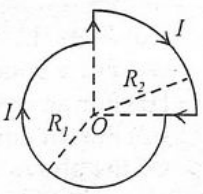

(1) -2, -3, -2 . (2) 2, 3, 2 . (3) $\frac{7}{3}, \frac{7}{3}, \frac{7}{3}$. (4) $-\frac{7}{3}, -\frac{7}{3}, -\frac{7}{3}$. (5) $\frac{77}{3}, \frac{77}{3}, \frac{77}{3}$.

48. The variation of magnetic flux density, $B$, along the axis of a short solenoid, shown in figure carrying a constant current is best represented by,



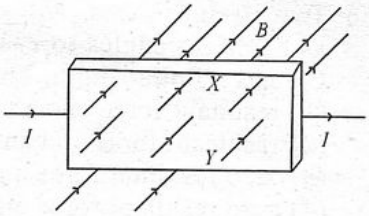

49. The loop shown in the figure carries a current $I$. The magnetic flux density at $O$ is




(1) $\frac{\mu_o I}{8}\left(\frac{3}{R_1}+\frac{1}{R_2}\right)$. (2) $\frac{\mu_o I}{4}\left(\frac{3}{R_1}+\frac{1}{R_2}\right)$. (3) $\frac{\mu_o I}{8}\left(\frac{1}{R_1}+\frac{1}{R_2}\right)$.

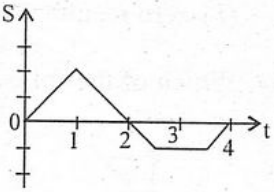
(4) $\frac{\mu_o I}{8(R_1+R_2)}$. (5) $\frac{\mu_o I}{2}\left(\frac{2}{R_1}+\frac{1}{R_2}\right)$

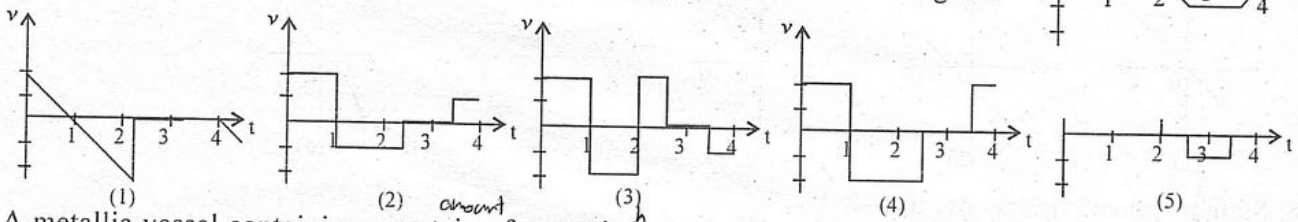
50. A flat copper plate is placed perpendicular to a uniform magnetic field $B$ and a current $I$ is passed through the plate as shown in the figure. At the steady state




(1) a current will flow from X to Y.
(2) a current will flow from Y to X
(3) a negative voltage will develop at X with respect of Y.
(4) a positive voltage will develop at X with respect of Y.
(5) neither a current flow nor a voltage drop will be resulted across X and Y.

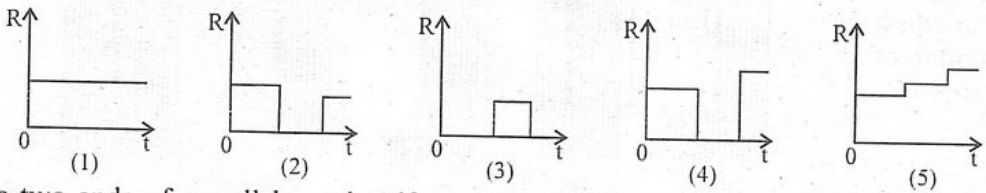
51. Which of the following curves correctly represents the corresponding velocity ($v$) - time ($t$) curve for the displacement ($s$) - time ($t$) curve show in the figure?



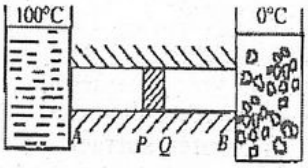

(1) (2) (3) (4) (5)

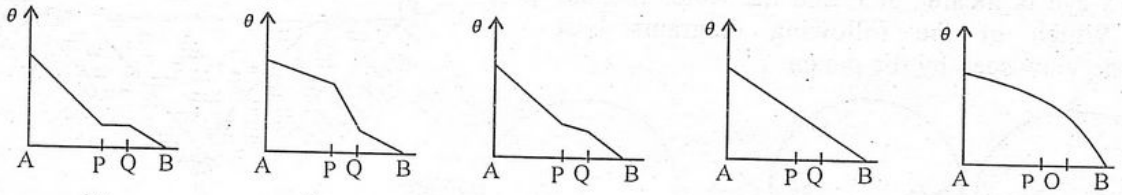
52. A metallic vessel containing a certain of water is heated uniformly at a constant rate. If the heat loss to the surroundings is neglected, then the rate of absorption of heat ($R$) by the vessel when plotted against time ($t$) is represented by




(1) (2) (3) (4) (5)

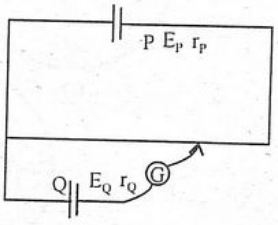
53. The two ends of a well lagged uniform rod APQB are maintained at 100 $^0$C and 0 $^0$C as shown in the igure. The portion PQ o the rod is made of a different material, the thermal conductivity of which is smaller than that of the rest of the material of the rod. Once the steady state is achieved, which of the following graphs best represents the variation of the temperature ($\theta$) along the ro?




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

54. In the potentiometer circuit shown, the cell P has e.m.f. $E_P$ and an internal resistance $r_p$ while the cell Q has an e.m.f. $E_Q$ and an internal resistance $r_Q$. Consider the following reasons given for not achieving a balance point in the above arrangement.

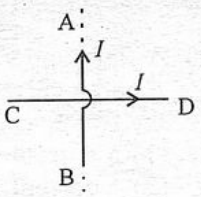



(A) $E_P > E_Q$ and $r_P = 0$, $r_Q > 0$
(B) $E_P < E_Q$ and $r_P > 0$, $r_Q = 0$
(C) $E_P = E_Q$ and $r_P > 0$, $r_Q > 0$
Of the above reasons
(1) only A is true (2) only B is true (3) only C is true
(4) only B and C are true (5) all A, B, and C are true

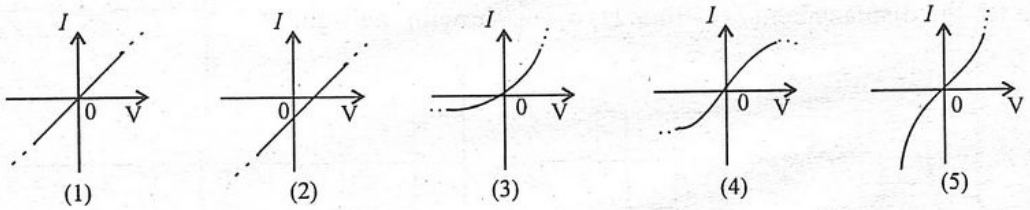
55. A student holds a thin strip of paper below his lower lip and blows air horizontally over it. If the surface area of one side of the paper is A and the mass of the strip is m the speed, $v$, with which the air should be blown in order to keep the strip horizontal is (the density of air = $\rho$)

(1) $v=\left(\frac{2mg}{\rho A}\right)^{1/2}$. (2) $v=\left(\frac{mg}{\rho A}\right)^{1/2}$. (3) $v=\left(\frac{mg}{2\rho A}\right)^{1/2}$. (4) $v=\left(\frac{3mg}{\rho A}\right)^{1/2}$. (5) $v=\left(\frac{mg}{3\rho A}\right)^{1/2}$.

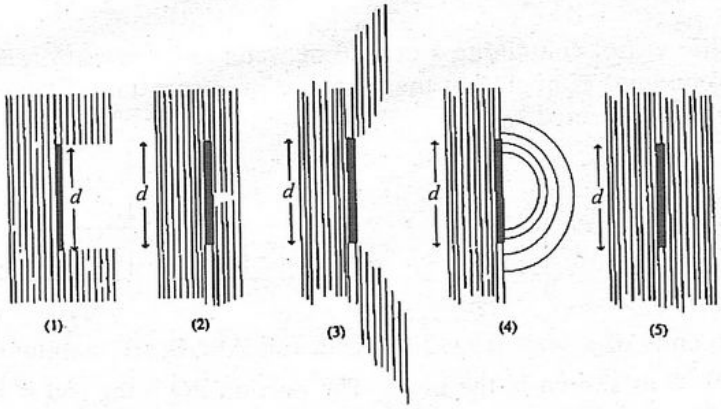
56. Two straight wires, AB and CD carrying equal curente I are placed symmetrically and at right angles to each other as shown in the figure. AB is infinitely long and CD has a fmite length. The magnetic effecl on CD due to AB gives rise to a
(1) resultant force and a clockwise couplc
(2) resulcant force and an anti-clockwise couple
(3) zero resultant force and a clockwise couple
(4) zero resultant force and an anti-clockwise couple
(5) zero resultant force and a zero couple



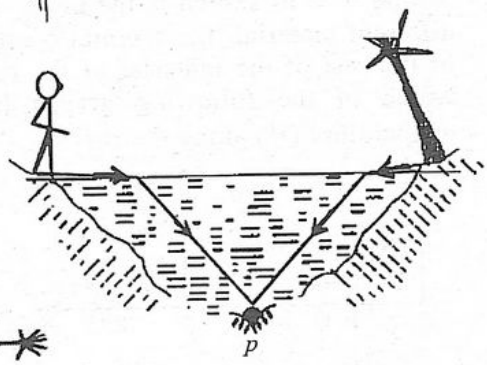

57. Which of the following $I$ - $V$ carves is for a filament electric bulb?

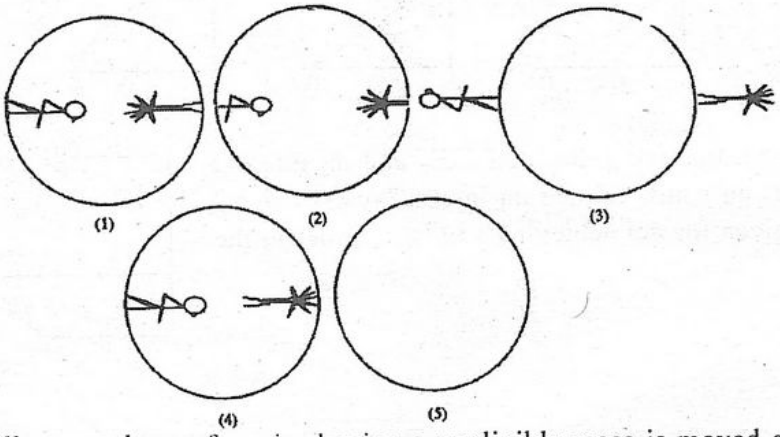



58. Staight wave fronts of a wave of wavelength $\lambda$ are incident on an obstrucation of width $d$. Which one of the following diagrams best represents the behaviour of the wavefronts if $d >> \lambda$




59. A person who is at a river bed looks upwards through the water surface of the river as shown in the figure. The person's eye is located at $P$ and the water is clear and still. Which of the following diagrams best represents the view seen by the person ?




60. A small square loop of a wire having a negligible mass is moved at a constant velocity V across a uniorm magnetic field as shown in the figure. The variation of the external force $F$ that has to be applied to maintain its constant velocity V with time ($t$) is best represented by

