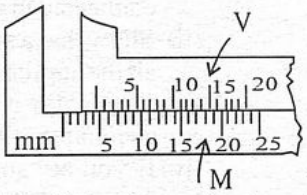
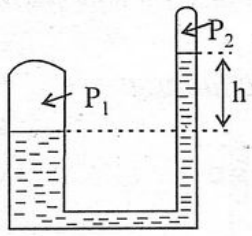
GCE A/L PHYSICS 1994

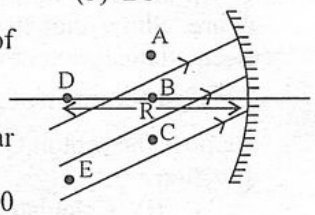
PAPER I

1. Which of the following quantities has units ?
   (1) Coefficient of friction (2) Strain (3) relative humidity
   (4) refractive index (5) expansivity
2. Which one of the following pairs contains one vector quantity and one scalar quantity ?
   (1) displacement, acceleration (2) power, speed (3) work, potential energy
   (4) force, kinetic energy (5) momentum, velocity
3. Figure shows the main scale, M, and the vernier scale, V, of a measuring instrument. The least count of the instrument is



   (1) 0.05 mm (2) 0.10 mm (3) 0.15 mm
   (4) 0.20 mm (5) 0.25 mm
4. 

The given J-tube has both ends sealed and contains a liguid of density ρ the broad arm has twice the cross-sectional area of that of the narrow arm. If P_1 and P_2 arethe pressures of the trapped air, P_1 is equal to
   (1) P_2. (2) $P_2 + h\rho g$. (3) $P_2 - h\rho g$.
   (4) $P_2 + 2h\rho g$. (5) $P_2 + \frac{1}{2} h\rho g$.
5. An object of mass 2 kg is accelerated from rest by a constant resultant force of 9 N. the speed of the object when it has travelled a distance of 4 m is
   (1) 72 ms^{-1} (2) 36 ms^{-1} (3) 9 ms^{-1} (4) 6 ms^{-1} (5) 3 ms^{-1}
6. The thermometric substance used in a thermometer must
   (1) remain a liquid over the entire range of temperature to be measured.
   (2) have a property whose value increases linearly with temperature.
   (3) have a property that varies with temperature.
   (4) obeys Boyle`s law (5) have a constant expansivity.
7. A cylinder. *A*, contains an ideal gas at a pressure of 600kPa. An identical cyliner, *B*, contains the same gas at a perssure of 200 kPa, and both cylinders are at the same temperature. the ratio.
   $\frac{\text{density of the gas in } A}{\text{density of the gas in } B}$ is equal to
   (1) $\frac{1}{\sqrt{2}}$. (2) 1. (3) $\sqrt{2}$. (4) $\sqrt{3}$. (5) 3.
8. A fixed mass of an ideal gas at pressure *P* is cooled at constant volume until the pressure becomes $\frac{P}{2}$. What will be the root mean square speed of the gas molecules if their r.m.s. speed was originally C?
   (1) $\frac{C}{4}$ (2) $\frac{C}{2}$ (3) $\frac{C}{\sqrt{2}}$ (4) $\sqrt{2}C$ (5) 2C
9. As shown in the figure, a beam of parallel rays is incident on a concave mirror of radius of curvature R. These rays will be converged to a point.



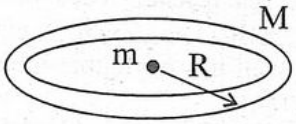
   (1) A. (2) B. (3) C. (4) D (5) E
10. The compound microscope objective that will produce the greatest angular magnification with a given eyepiece must be a
   (1) Concave lens of focal length 20 cm. (2) convex lens of focal length 20 cm.
   (3) convex lens of focal length 15 cm. (4) concave lens of focal length 10 cm.
   (5) convex lens of focal length 10 cm.
11. Two conductors A and B of uniform cross-section and made of the same material have equal volumes. If the area of cross-section of A is four times that of B and the resistance of A is 2 Ω , the resistance of B is
   (1) 2 Ω. (2) 4 Ω. (3) 8 Ω. (4) 16 Ω. (5) 32 Ω.
12. What is the order in decreasing frequency of the following electromagnetic waves?
   (A) visible light (B) VHF television waves (C) UHF television waves (D) FM radio waves
   (1) A,C,B,D (2) A,B,C,D (3) D,C,B,A (4) D,B,C,A (5) C,B,A,D

13. Consider the following statements regarding electromagnetic waves.
    (A).They all have the same speed in any medium.
    (B) They are transverse waves.
    (C) A material medium is not essential for their propagation.
    Of the above statements.
    (1) only B is true. (2) only B and C are true. (3) only A and C are true.
    (4) only A and B are true. (5) all A,B and C are true.

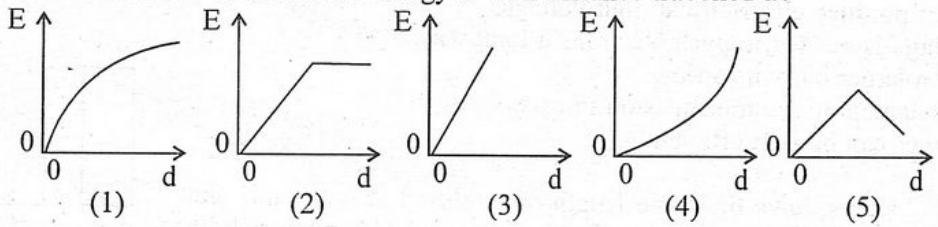
14. Consider the following statements made about magnets.
    (A) Most common permanent magnets are made from alloys containing Fe, with Ni or Co.
    (B) If a permanent magnet is heated it may loose its magnetism.
    (C) If a bar magnet is carefully broken into two equal halves along its axis of magnetisation, each piece will be an equally strong magnet.
    Of the above statements
    (1) only B is true. (2) only A and B are true. (3) only A and C are true.
    (4) only B and C are true. (5) all A,B and C are true.

15. Mercury will contract in volume by 0.01%, when subjected to a net pressure of 2.6×10^{6} Pa. the bulk modulus of mercury is
    (1) 2.6×10^{2} Pa (2) 2.6×10^{4}Pa (3) 2.6×10^{6} Pa (4) 2.6×10^{8} Pa. (5) 2.6×10^{10} Pa

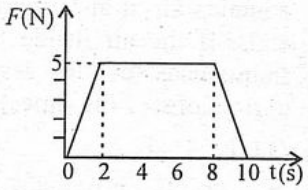
16. A particle of mass m lies at the centre of a uniform circular ring of mass M and radius R. The magnitude of the gravitational force acting on m due to M is
    (1) 0. (2) $\frac{GMm}{2R^2}$. (3) $\frac{GMm}{R^2}$.
    (4) $\frac{3GMm}{2R^2}$. (5) equal to infinity.



17. An object starts from rest and moves with a constant acceleration, which of the following graphs best represents the variation of its kinetic energy E with distance travelled d?



18. An object of mass 5 kg is subjected to a resultant force F which varies with time t as shown in the graph. the momentum gained by the object in the 10 s is
    (1) 0. (2) 5 Ns. (3) 40 Ns.
    (4) 50 Ns. (5) 60 Ns.

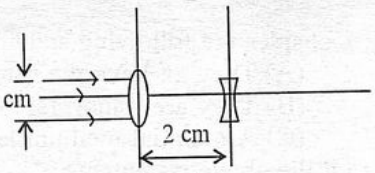


19. Two identical copper calorimeters of mass 100 g each contain 60 g of water and 140 g of another liquid respectively. the specific heat capacity of copper is 400 J kg^{-1} K^{-1} and that of water is 4200 J kg^{-1} K^{-1}. Under similar conditions, both calorimeters are found to take 40 minutes to cool from 67 ^{0}C to 27 ^{0}C, the specific heat capacity of the liquid is
    (1) 600 J kg^{-1} K^{-1} (2) 1200 J kg^{-1} K^{-1} (3) 1800 J kg^{-1} K^{-1}
    (4) 2400 J kg^{-1} K^{-1} (5) 3000 J kg^{-1} K^{-1}

20. Which one of the following when doubled lead to the greatest increase in pressure of an ideal gas in a container ?
    (1) number of molecules of the gas (2) root mean square speed of the molecules
    (3) Kelvin temperature of the gas (4) volume of the container (5) mass of the gas

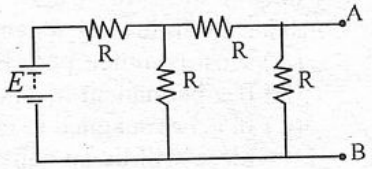
21. An astronomical telescope in normal adjustment consists of two lenses of focal length 80 cm and 4 cm. consider the following statements.
    (A) The eyepiece is the one with the least power.
    (B) The angular magnification of the telescope is 20.
    (C) The separation of the lenses is 84 cm.
    Of the above statements.
    (1) only A is true. (2) only B is true. (3) only A and B are true.
    (4) only B and C are true. (5) all A,B and C are true.

22. A convex lens of focal length 8 cm. is placed 2 cm to the left of a concave lens of focal length 6 cm, A parallel monochromatic ligth beam of diameter 1 cm is incident on the convex lens from the left as shown in the figure. the emergent beam from the concave lens will

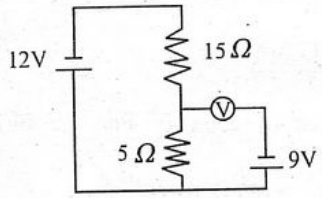


(1) diverge. (2) converge.
(3) be a parallel beam of diameter 1 cm. (4) be a parallel beam of diameter less than 1 cm.
(5) be a parallel beam of diameter greater than 1 cm.

23. A battery of negligible internal resistance and e.m.f. E is connected as shown, the potential difference acress A and B is.



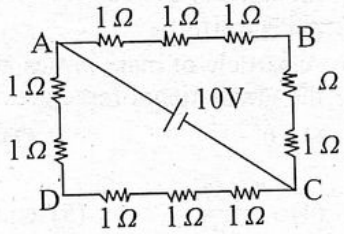
(1) $\frac{E}{8}$. (2) $\frac{E}{5}$. (3) $\frac{E}{4}$. (4) $\frac{E}{2}$. (5) E.

24. 

In the circuit shown each cell has negligible internal resistance. the reading in the voltmeter, V, is

(1) 0. (2) 3 V. (3) 6 V.
(4) 9 V. (5) 12 V.

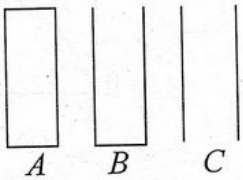
25. Ten resistors each of resistance 1 Ω are connected to form a closed loop ABCD as shown. A cell of e.m.f. 10 V is connected between A and C, If the cell has negligible internal resistance, the potential difference between D and B is.



(1) 2 V. (2) 4 V. (3) 6 V. (4) 8 V. (5) 10 V.

26. Electricity is transmitted across a country at a very high voltage. This is
(1) because generators produce electricity at high voltages.
(2) because high voltage is needed to push electrons a long way.
(3) because it allows a larger current to flow.
(4) to prevent people damaging the transmission lines.
(5) because more power can be sent efficiently.

27. Three pipes A,B and C shown have the same length. A is closed at both ends and contains air at atmospheric pressure. B is colosed at one end and C is open at both ends. If the air inside the pipes is made to vibrate, the ratio of the fundamental frequencies of the respective air columns in the pipes, is (neglect the end corrections of the pipes)



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

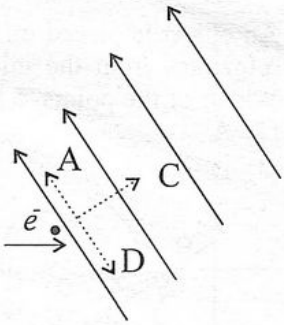
28. Consider the following statements made about vibrating air column inside a tube closed at one end.
(A) The frequency of the first overtone is twice that of the fundamental.
(B) The maximum air pressure occurs at the closed end of the tube.
(C) The wavelength of the air column changes with humidity.
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 false.

29. Which one of the following statements is true regarding the capacitance of a parallel plate capacitor?
(1) It does not depend on the distance between the plates.
(2) It decreases when a dielectric is placed between the plates.
(3) It`s units is J C^{-1}
(4) It is independent of the charge.
(5) It is definde as the energy required to move a unit charge from one plate to the other.

30. Suppose a charged particle is found in the space between two parallel metal plates which are placed in an evacuated tube. If a constant potential difference is maintained between the plates and the separation between the plates, d, is varied, the electric force experienced by the charged particle is proportional to

(1) d^2 (2) d (3) $d^{½}$ (4) d^{-1} (5) d^{-2}

31. An electron moving horizontally enters a region of space with a uniform magnetic field acting at an angle with the horizontal as indicated in the figure. Due to the magnetic field the electron will experiences a force in a direction

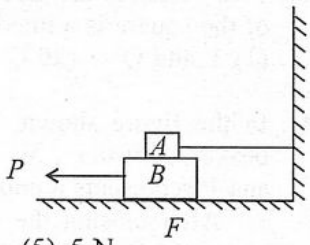


(1) Perpendicular and into the paper.
(2) perpendicular and out of the paper.
(3) towards A (4) towards C (5) towards D

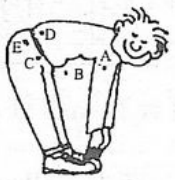
32. Which of the following can be measured in joules ?
(A) work done by a force.
(B) Gravitational potential energy.
(C) Moment of a force.
(1) A only. (2) A and B only. (3) B and C only.
(4) A and C only. (5) All A,B and C.

33. Which of the following sets of forces never produces a zero resultant?
(1) 5N, 5N, 5N (2) 5N, 5N, 10 N (3) 5N, 10N, 10N
(4) 10N, 10N, 20N (5) 5N, 10N, 20N

34. A block A, of weight 4 N is kept on another block, B, of weight 12 N which rests on floor F as shown in the figure,. A is connected to the wall by an inextensible light rod, If the coefficient of static friction berween A and B and, B and F are the same and is equal to $\frac{1}{4}$, the minimum force P required to drag B to the left is

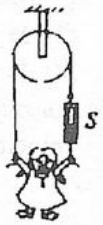


(1) 1 N. (2) 2 N. (3) 3 N. (4) 4 N. (5) 5 N.

35. 

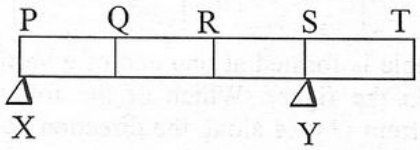
A person bends over and touches his toes as shown in the figure. the center of gravity of the person is most likely to be found at.
(1) A (2) B (3) C
(4) D (5) E

36. A child of weight W hangs at rest from the ends of a light inextensible rope as shown in the figure. if the weight of the spring balance, S is negligible, the reading on its scale is



(1) 0. (2) $\frac{W}{4}$. (3) $\frac{W}{2}$. (4) W. (5) $2W$.

37. The diagram shows a uniform rod resting horizontally on two supports X and Y. The lengths PQ, QR, RS and ST are equal . As Y moves from S to T, keeping X stationary, the reaction on the rod, due to X
(1) decreases and that due to Y increases.
(2) increases and that due to Y decreases.
(3) increases and that due to Y also increases.
(4) decreases and that due to Y also decreases.
(5) remains equal to that due to Y.



38. A uniform cylindrical vessel is filled with a liquid of volume expansivity γ to a height h_0. The linear expansivity of the material of the cylinder is α. If the temperature of the system is increased by θ, the new height h of the liquid level is given by

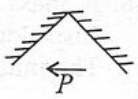
(1) $h=h_0\,(1+\alpha\theta)$ (2) $h = h_0\,[1+(\gamma-3\alpha)\theta]$

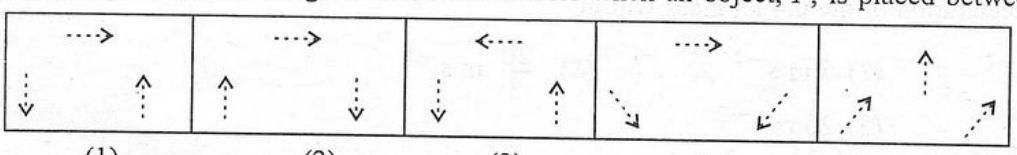
(3) $h = \dfrac{h_0}{(1+2\alpha\theta)}(1+\gamma\theta)$ (4) $h = h_0\,(1+\gamma\theta)$ (5) $h = h_0\,(1+2\alpha\theta)\,(1+\gamma\theta)$

39. The temperature of a hot liquid- wax in a container of negligible heat capacity falls at a rate 2 K per minute before it just begins to solidify. The temperature then remains steady for 10 min. by which time the liquid has all solidified. The ratio $\dfrac{\text{specific latent heat of fusion of wax}}{\text{specific heat capacity of liquid - wax}}$ is equal to

(1) $\frac{1}{20}$ K. (2) $\frac{1}{10}$ K. (3) 1 K. (4) 10 K. (5) 20 K.

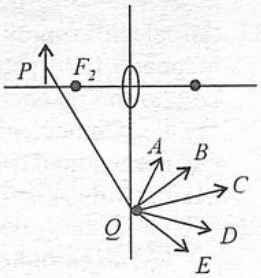
40. Two plane mirrors are set-up at right angles to each other as shown. which of the following diagrams best represents the images seen in the mirrors when an object, P, is placed between them?



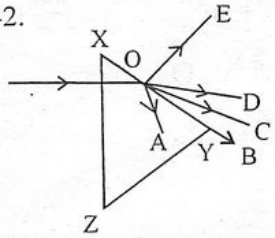


(1) (2) (3) (4) (5)

41. An object is placed on the principal axis of a convex lens. A ray of light PQ which originates from the mid- point, P, on the object is drawn as shown in the figure. Which of the points $A,B,C.D$ or E is the correct continuation of the ray PQ?



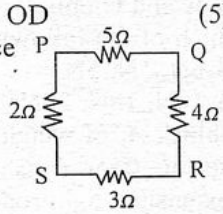
(1) A (2) B (3) C
(4) D (5) E

42. 

A narrow beam of white light falls normally on the surface XZ of a glass prism as shown in the figure. It subsequently makes an angle of incidence of 41^0 15' at the face XY of the prism, this being the critical angle for yellow light for the glass- air interface. The blue component of the white light travels along

(1) OA (2) OB (3) OC (4) OD (5) OE

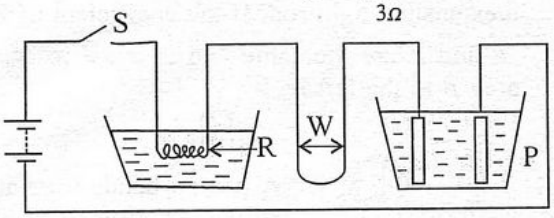
43. Four resistors are arranged to form a square as shown in the figure. The resistance of the square is a maximum across



(1) P and Q (20 Q and R (3) R and S (4) S and P (5) Q and S

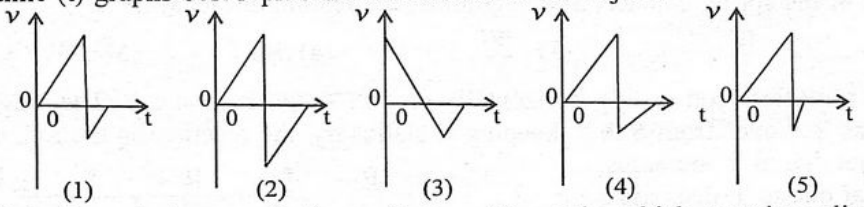
44. In the figure shown, R represents a coil immersed in a beaker of water , W represents two long parallel wires, and P represents a copper voltameter.

After closing the switch S it is observed that heat is generated in water at a rate H. the force between the wires is F, and copper is deposited in P at a rate M. which of the following proportionalities correctly connects H with M and F?



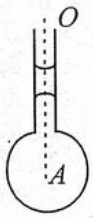
(1) $H \propto M^2$ and $H \propto F$ (2) $H \propto M$ and $H \propto F^2$ (3) $H \propto M^2$ and $H \propto F^2$
(4) $H \propto \sqrt{M}$ and $H \propto F$ (5) $H \propto M$ and $H \propto F$

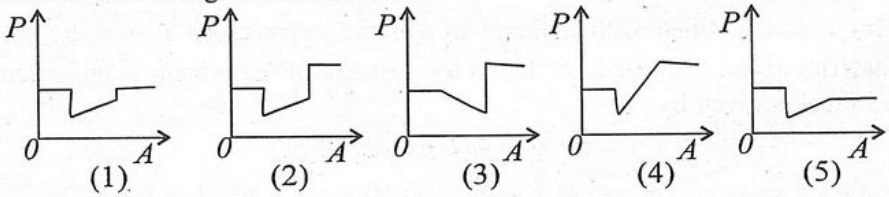
45. An object dropped from a height h bounces back from the floor to a height $\frac{h}{2}$. Which of the following velocity (v) time (t) graphs best represents the motion of the object?



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

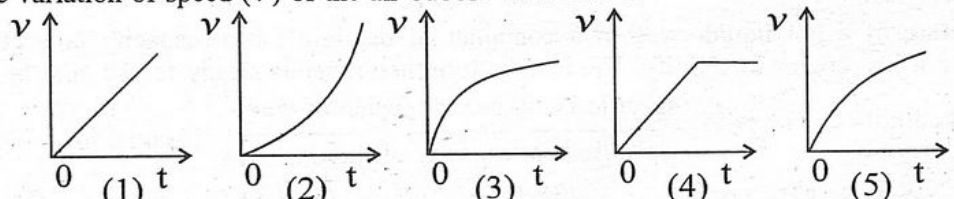
46. A soap bubble is formed at one end of a vertical capillary tube which contains a liquid column as shown in the figure. Which of the following graphs best represents the variation of the pressure P from O to A along the direction OA?





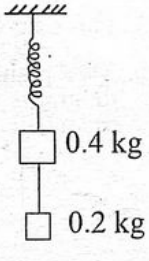
(1) (2) (3) (4) (5)

47. An air bubble liberated from the bed of a deep sea is moving upwards. Which of the following graphs best represents the variation of speed (v) of the air bubble with time t?



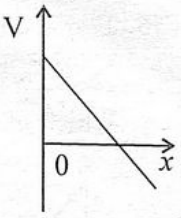
(1) (2) (3) (4) (5)

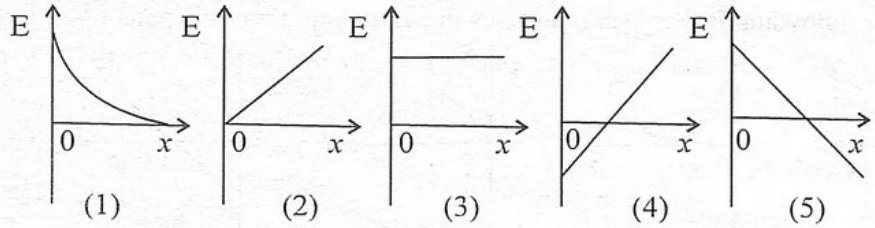
48. A mass of 0.4 kg is suspended from a light spring as shown. A second mass of 0.2 kg is suspended from the first by a thread. When the system is in equilibrium the thread is burnt. The initial acceleration of the 0.4 kg mass will be



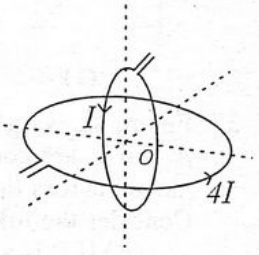
(1) $\frac{10}{3}$ m s^{-2} (2) 5 m s^{-2} (3) $\frac{20}{3}$ m s^{-2}
(4) 10 m s^{-2} (5) 20 m s^{-2}

49. Figure shows the variation of the electrostatic potential, V, along the x-direction. Which one of the following curves best represents the variation of the electric field intensity, E, along the same direction?





50. Two circular conducting loops are placed at right angles to each other as shown in the figure. The radius of the vertical loop is r and it carries a current I. The radius of the horizontal loop is $3r$ and it carries a current $4I$. The magnitude of the magnetic flux density at the common centre O is

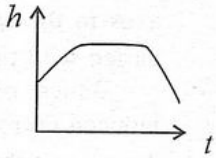


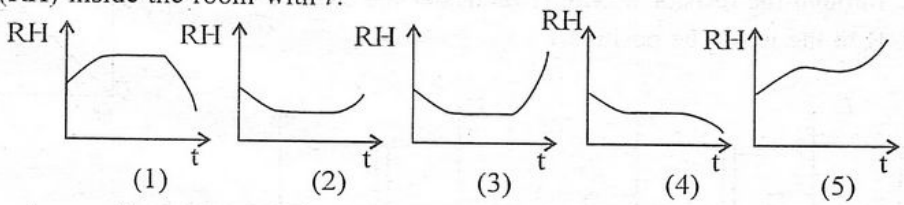
(1) $\frac{\mu_o I}{6r}$. (2) $\frac{\mu_o I}{3r}$. (3) $\frac{5\mu_o I}{6r}$. (4) $\frac{7\mu_o I}{6r}$. (5) $\frac{25\mu_o I}{18r}$.

51. Two small spheres of equal masses are suspended from two identical light inextensible strings. The free ends of the strings are connected to a common point at the ceiling . One sphere has a charge + Q and the other has a charge + 2Q. If the string attached to Q makes an angle θ with the vertical, the angle that the other string makes with the vertical is

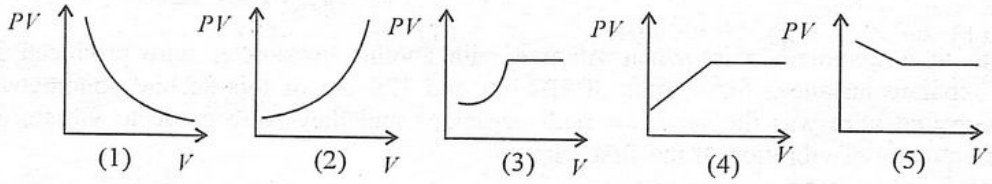
(1) 0. (2) $\frac{\theta}{4}$. (3) $\frac{\theta}{2}$. (4) θ. (5) 2θ.

52. Figure shows the variation of the difference, h, between the dry and wet bulb thermometer readings with time, t, inside a room which is kept at constant temperature. Which one of the following curves best represents the variation of the relative humidity (RH) inside the room with t?

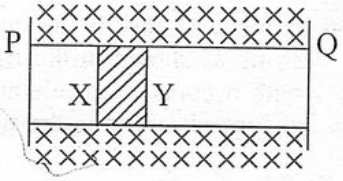




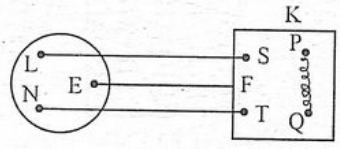
53. The total volume of a mixture of air and an unsaturated vapour is decreased at a constant temperature. If P is the total pressure and V is the volume of the mixture, which of the following best represents the variation of PV with V?



54. A metal bar PQ encloses a section XY of another material as shown in the figure. The ends of the bar are maintained at different temperatures. The temperature difference between XY at the steady state is independent of
(1) the temperature difference between P and Q
(2) the material of the bar PQ
(3) the length of XY
(4) the material of XY
(5) the position of XY along PQ



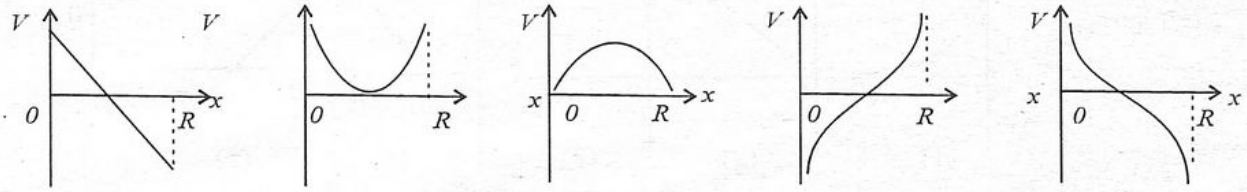
55. In the figure the points L,N and E represent the live, neutral and earth contacts of the 240 V a.c. socket. PQ is the heating element of a kettle, K and F is a contact on the metal casing of it. For the safety operation of the kettle, the switch has to be connected between.
(1) S and P (2) S and F. (3) T and Q.
(4) F and Q. (5) F and T.



56. Two small spheres carrying charges + Q and - Q are placed at $x = 0$ and $x = R$ respectively as shown in the figure.

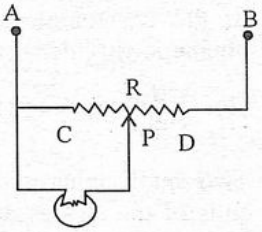


Which of the following graphs best represents the variation of electric potential V, with distance x.



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

57. Figure shows a circuit used to regulate the brightness of a bulb. Terminals A and B are connected to the main power supply and the sliding key P is moved across the resistor R.



Consider the following statements :

(A) If P is at C, the bulb glows with its full brightness.

(B) The power dissipation in R is same whether P is at C or D.

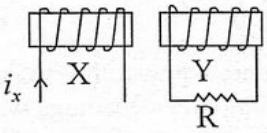
(C) The total power consumption is always the same.

Of the above statements

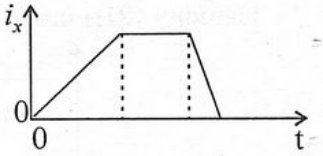
(1) only A is true. (2) only B is true. (3) only C is true.

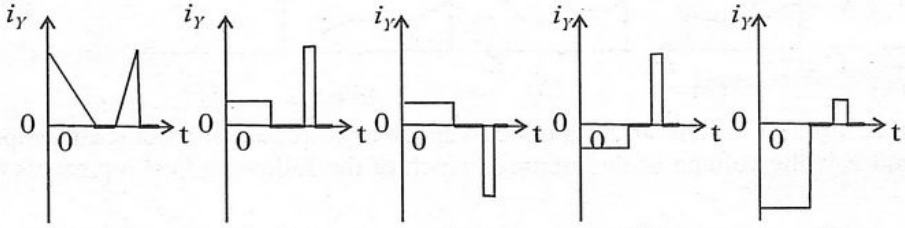
(4) only A and B are true. (5) all A,B and C are false.

58. Two conducting coils X and Y are placed close to each other with their axes in the same line as shown in the figure. The current, i_x in coil X is varied with time, t, as shown.



Which of the following graphs best represents the variation of the induced current, i_y. through the resistor R with t? (consider the direction of the current through R to the left to be positive.)



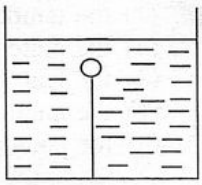


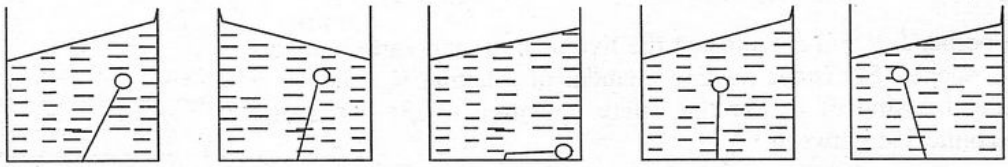
(1) (2) (3) (4) (5)

59. A certain length of a sonometer wire when vibrated with another sonometer wire produced 2 beats per second in two separate instances for lengths of 122 cm and 120 cm of this second sonometer wire. The tension of the second wire was the same for both occasions and they were made to vibrate at the same overtone. The frequency of vibration of the first wire is

(1) 238 Hz. (2) 240 Hz. (3) 242 Hz (4) 244 Hz. (5) 246 Hz.

60. A piece of cork is tied to the bottom of a container of water by a light inextensible string as shown in the figure. When the container is moved horizontally to the left with a constant acceleration, Which of the following diagrams best represents the changs observed in the water surface and the direction of the string?





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