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முழுப் பதிப்புரிமையுடையது]
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පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2004 අප්‍රේල්
විශேட பொதுத் தராதரப் பத்திர(உயர் தர)ப் பரீட்சை, 2004 ஏப்பிரல்
General Certificate of Education (Adv. Level) Examination, April 2004

හෞතික විද්‍යාව I
பௌதிகவியல் I
Physics I

පැ දෙකයි
இரண்டு மணித்தியாலம்
Two hours

Important : ❊ *This question paper consists of* **60** *questions in* **12** *pages.*
❊ ***Answer all the questions.***
❊ *Write your* ***Index Number*** *in the space provided on the answer sheet, and then indicate your Index Number by shading the appropriate numbers in the grid.*
❊ *Instructions are given on the back of the answer sheet. Follow them carefully.*
❊ *In each of the questions* 1 *to* 60, *pick one of the alternatives* (1), (2), (3), (4), (5) *which is* ***correct or most appropriate*** *and mark your response on the answer sheet* ***in accordance with the instructions given therein.***

Use of calculators is not allowed.

(g = 10 N kg^{-1})

1. In the following expression I and V represent current and voltage respectively. C is a constant.

$$C \log\left(\frac{I}{I_0}+1\right)=\frac{qV}{kT}$$

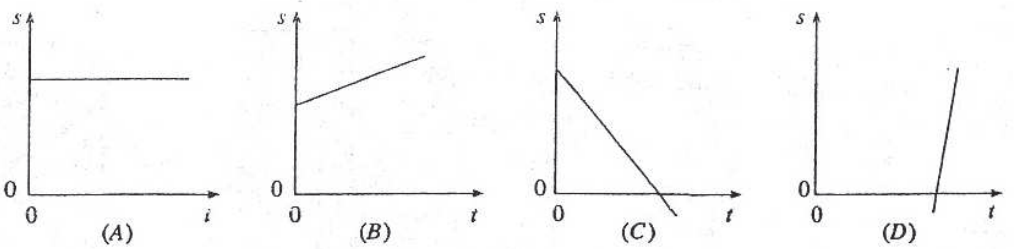
The term $\frac{kT}{q}$ has

(1) no dimensions.
(2) dimensions of resistance.
(3) dimensions of V^{-1}.
(4) dimensions of I.
(5) dimensions of V.

2. Consider the following statements made regarding plane electromagnetic waves propagating in a vacuum.
(A) Electromagnetic waves are transverse waves.
(B) The speed of electromagnetic waves is independent of the wavelength.
(C) The electric and magnetic fields associated with the wave are always directed along the direction of propagation of the wave.

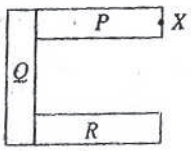
Of the above s
(1) only (A) is
(2) only (A) and (B) are true.
(3) only (A) and (C) are true
(4) only (B) and (C) are true.
(5) all (A), (B) and (C) are true.

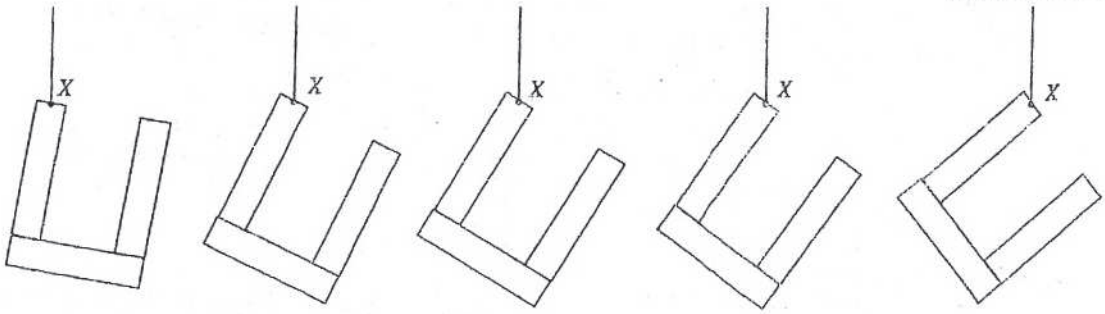
3.



Of the given distance (s) - time (t) graphs drawn to same scale, the magnitude of the velocity is
(1) minimum in A and maximum in C.
(2) minimum in C and maximum in D.
(3) minimum in A and maximum in D.
(4) minimum in B and maximum in C.

4. A frame is made by joining three uniform rods P, Q and R having identical geometrical dimensions as shown in the figure. Rods P and R are of the same mass, but the rod Q is twice as heavy as P or R. When the frame is suspended freely from the point X, its equilibrium position is most likely to be





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

5. When an object is made to perform simple harmonic motion,
   (1) the force acting on the object is proportional to the magnitude of its displacement from the equilibrium position.
   (2) the force acting on the object is always directed away from the equilibrium position.
   (3) the frequency of oscillation of the object is proportional to the amplitude of the oscillations.
   (4) the total energy of the object does not depend on the amplitude of oscillations.
   (5) the potential energy of the object is always constant.

6. Consider the following statements made about light passing through a prism.
   (A) Frequency of light changes when passing through a prism.
   (B) Light of different colours travel at different speeds inside a prism.
   (C) Blue light deviates more than red light when passing through a prism.

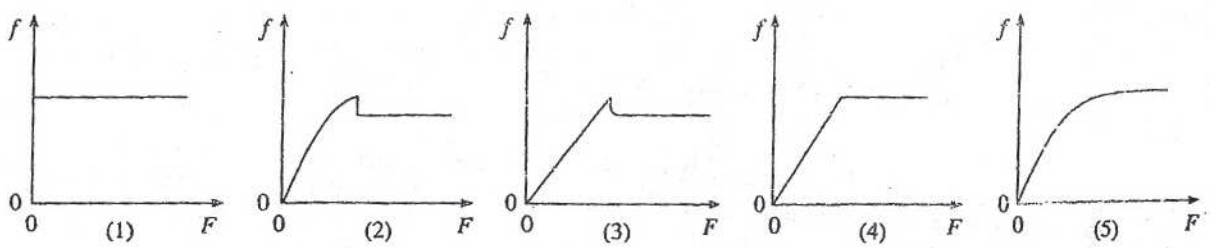
   Of the above statements
   (1) only (C) is true.
   (2) only (A) and (B) are true.
   (3) only (B) and (C) are true.
   (4) only (A) and (C) are true.
   (5) all (A), (B) and (C) are true.

7. The most appropriate fuse for an electric heater of 1 kW connected to the main house hold electric supply is
   (1) 1 A fuse. (2) 3 A fuse. (3) 4 A fuse. (4) 5 A fuse. (5) 15 A fuse.

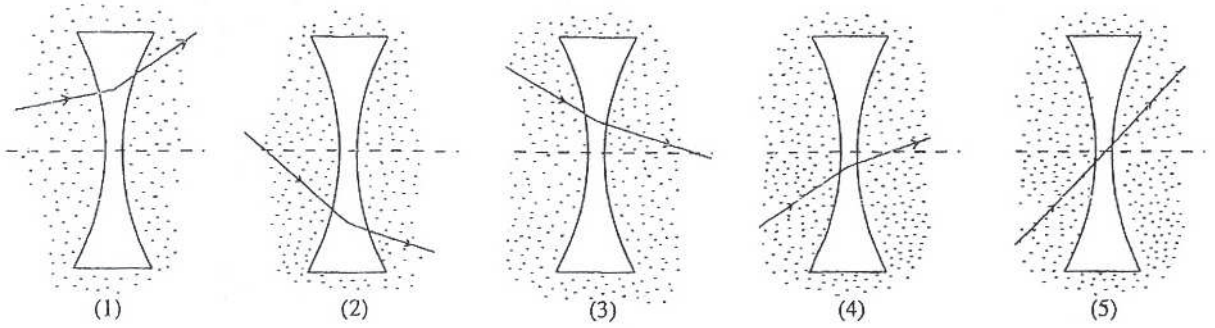
8. Total electric power generation capacity of Sri Lanka is approximately 2·1 GW. If this power is to be generated by converting mass into energy, how much mass per second should be converted into energy? (Velocity of light $= 3 \times 10^8$ m s^{-1})
   (1) 0·02$\flat$ mg/s (2) 23 g/s (3) 2·3 kg/s (4) 6·9 kg/s (5) 47·61 kg/s

9. A horizontal force of 10 N is applied for a period of 10 ms on a body placed on a smooth horizontal table. The change in momentum of the body in SI units will be
   (1) 10^{-3} (2) 0·1 (3) 1·0 (4) 10^2 (5) 10^3

10. An object lies on a horizontal table. When the object is pulled by a horizontal force F that increases uniformly from zero, the variation of the frictional force f acting on the object is best represented by the graph



11. A thin glass (refractive index = 1·5) lens is immersed in water (refractive index = 1·33). Which of the following ray diagrams is **wrong**?



12. A certain person cannot clearly see objects located beyond 1 m away from the eye. This defect can be corrected by wearing
    (1) a concave lens of focal length 1 m.
    (2) a convex lens of focal length 1 m.
    (3) a concave lens of focal length 0·5 m.
    (4) a convex lens of focal length 0·5 m.
    (5) a convex lens of focal length 0·25 m.

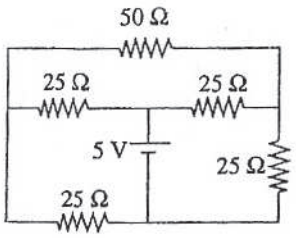
13. Among the following, identify the quantity which increases with temperature.
    (1) Resistivity of a copper wire
    (2) Resistivity of a piece of silicon
    (3) Surface tension of water
    (4) Viscosity of water
    (5) Relative humidity of air in a closed room

14. Which of the following responses contains **false** information regarding photons and electrons?

	Photons	Electrons
(1)	**Cannot** travel at different speeds in a vacuum.	Can travel at different speeds in a vacuum.
(2)	Can have different energies.	Can have different energies.
(3)	Can be deflected by electric fields.	Can be deflected by electric and magnetic fields.
(4)	Can behave as particles and waves.	Can behave as particles and waves.
(5)	Can eject electrons from materials.	Can eject photons from materials.

15. The magnitude of the magnetic force acting on a current carrying straight wire in a uniform magnetic field is determined by
    (1) the magnetic flux density, the current, the length of the wire and the angle between the magnetic field and the wire only.
    (2) the magnetic flux density, the current and the length of the wire only.
    (3) the magnetic flux density, the current and the angle between the magnetic field and the wire only.
    (4) the magnetic flux density and the length of the wire only.
    (5) the magnetic flux density and the current only.

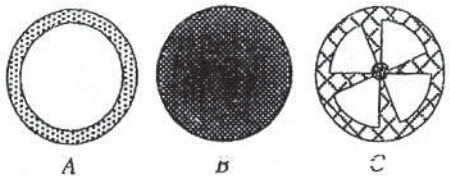
16. In the circuit shown, the current through 50 Ω resistor is
    (1) 0. (2) 0·1 A. (3) 0·2 A.
    (4) 0·4 A. (5) 0·5 A.



17. Which of the following procedures does **not** increase the accuracy of the indicated measuring quantity?

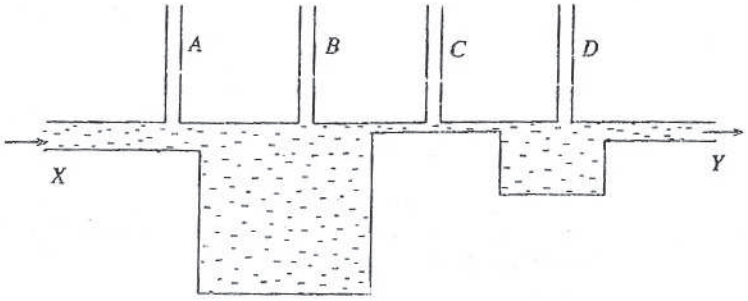
	Measuring Quantity	Procedure
(1)	Period of a simple pendulum	Measuring time for several oscillations
(2)	Thickness of a plate of uniform thickness	Measuring thickness with a micrometer screw gauge instead of a vernier callipers
(3)	Diameter of a wire	Taking several measurements at different positions
(4)	Balanced length of the potentiometer wire	Inserting a high resistance in series with the galvanometer
(5)	Current in a circuit	Using an ammeter having a smaller internal resistance

18. Three wheels A, B and C of the same mass and same external radius are made out of uniform sheets of different materials as shown in the figure. These wheels are released simultaneously from rest from the same height at the top of an inclined plane. The wheels roll down without slipping. The order that they will reach the bottom of the inclined plane as first, second and third respectively is



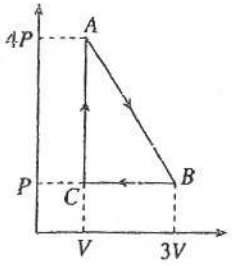
(1) A, B, C (2) B, C, A (3) C, A, B (4) B, A, C (5) A, C, B

19. A water-flow system consisting of manometer tubes A, B, C and D is shown in the figure. Water enters the system at X at a constant rate and at a pressure greater than the atmospheric pressure, and leaves at Y. If the heights of the water levels (not indicated in the diagram) in manometer tubes A, B, C and D are H_A, H_B, H_C and H_D respectively, then

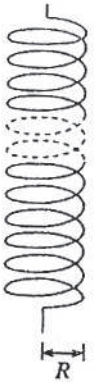


(1) $H_A = H_B = H_C = H_D$
(2) $H_C > H_A > H_D > H_B$
(3) $H_B > H_D > H_C > H_A$
(4) $H_D > H_C > H_A > H_B$
(5) $H_B > H_D > H_A > H_C$

20. Work done during the cyclic thermodynamic process $ABCA$ indicated in the P-V diagram shown is



(1) PV (2) $2\ PV$
(3) $3\ PV$ (4) $4\ PV$
(5) $5\ PV$

21. 

A coil of metal wire made of a material of linear expansivity $2 \times 10^{-5}\ K^{-1}$ has n turns. When the temperature of the coil is increased by 1 °C while keeping its radius R (see figure) constant, the number of turns becomes $n + 1$. The value of n is

(1) $2{\cdot}5 \times 10^9$ (2) 10^5 (3) 5×10^4
(4) $2{\cdot}5 \times 10^4$ (5) $\sqrt{5} \times 10^4$

22. When 1g of each of the gases helium (relative atomic mass = 4), neon (relative atomic mass = 20) and argon (relative atomic mass = 40) are separately enclosed in the same container at the same temperature, the ratio of pressures exerted by the gases respectively is

(1) $\frac{1}{4}:\frac{1}{20}:\frac{1}{40}$ (2) $4:20:40$ (3) $4^2:20^2:40^2$

(4) $\frac{1}{4^2}:\frac{1}{20^2}:\frac{1}{40^2}$ (5) $\frac{1}{\sqrt{4}}:\frac{1}{\sqrt{20}}:\frac{1}{\sqrt{40}}$

23. 

A thin metal plate PQ is inserted between the plates of a parallel plate capacitor of capacitance C, so that it is parallel to the capacitor plates as shown in the diagram. If the area of the plate PQ is same as that of a capacitor plate, the new capacitance of the system will be

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

24. The object A of mass m and velocity u moving on a smooth horizontal surface along positive x direction makes a perfectly elastic collision with an identical object B which is at rest as shown in the figure. After the collision, the velocities of A and B are,



(1) 0, and u along positive x direction respectively.

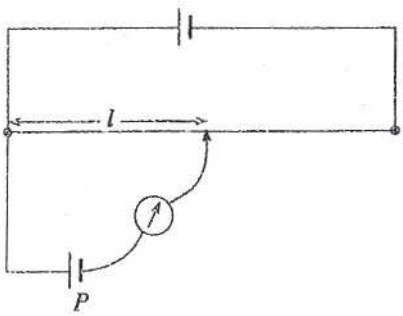
(2) $\frac{u}{2}$ along positive x direction, and $\frac{u}{2}$ along positive x direction respectively.

(3) $\frac{u}{2}$ along negative x direction, and $\frac{u}{2}$ along positive x direction respectively.

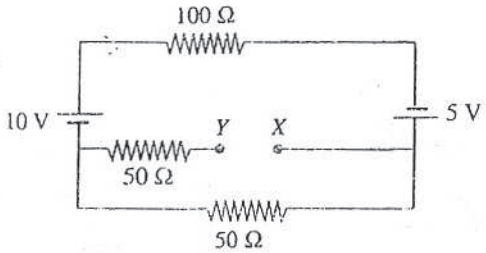
(4) u along negative x direction, and 0 respectively.

(5) 0, and $\frac{u}{2}$ along positive x direction respectively.

25. In the potentiometer circuit shown, the indicated balance length l is obtained for a cell P having an internal resistance. When another resistor is connected with P, the value of



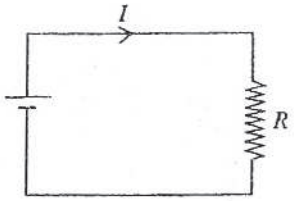
(1) l increases if the resistor is in parallel with P.
(2) l does not change if the resistor is in parallel with P.
(3) l increases if the resistor is in series with P.
(4) l decreases if the resistor is in series with P.
(5) l does not change if the resistance is in series with P.

26. 

In the circuit shown the internal resistances of the cells are negligible. The voltage across XY is

(1) 1·6 V (2) 3·75 V (3) 5 V
(4) 7·5 V (5) 15 V

27. If the internal resistance of the cell in the circuit shown is negligible, current I in the circuit can be increased to $3I$ by connecting another resistor of value



(1) R in series with R. (2) $2R$ in series with R.
(3) R in parallel with R. (4) $2R$ in parallel with R.
(5) $\frac{R}{2}$ in parallel with R.

28. If the electrical energy costs Rs 5.00 per kilowatt-hour, the cost to operate an electric appliance of resistance 60 Ω for 6 minutes on a 240 V supply is

(1) Rs 0·08 (2) Rs 0·48 (3) Rs 0·50 (4) Rs 2·80 (5) Rs 480.00

29. The force required to increase the length of an elastic string by a unit length is given by k. Consider the following statements made about k.

(A) The value of k can be increased by increasing the Young's modulus of the material of the string.
(B) The value of k can be increased by increasing the cross-sectional area of the string.
(C) The value of k can be increased by decreasing the length of the string.

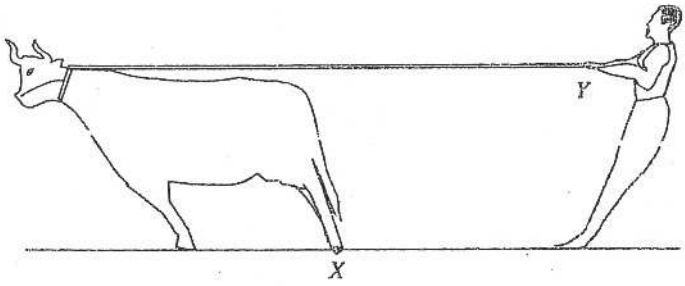
Of the above statements

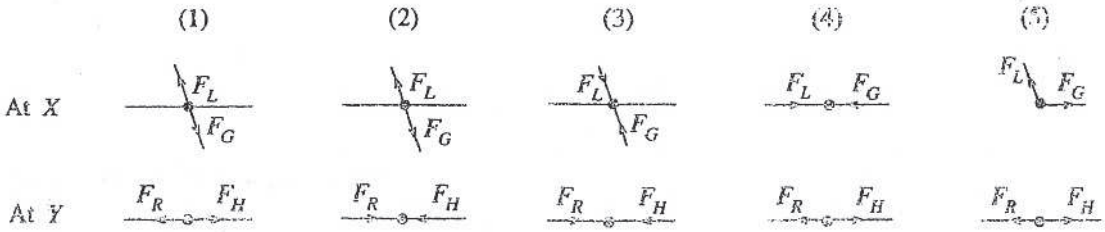
(1) only (A) is true.
(2) only (A) and (B) are true.
(3) only (B) and (C) are true.
(4) only (A) and (C) are true.
(5) all (A), (B) and (C) are true.

30. A loop made of a string of length l is kept on a soap film. When the section of the film inside the loop is broken, the tension of the string becomes T. If the length of the string is $2l$ then the tension of the string would be

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

31. Figure shows an attempt made by a man to hold a bull tied to a rope trying to escape. The force at X acting on the bull's leg is F_L and that on the ground is F_G. The force at Y acting on the rope is F_R and that on the hand of the man is F_H. The forces F_L, F_G, F_R and F_H are correctly represented by

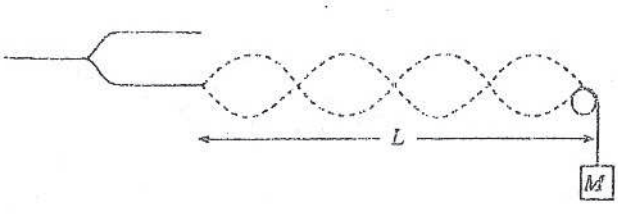




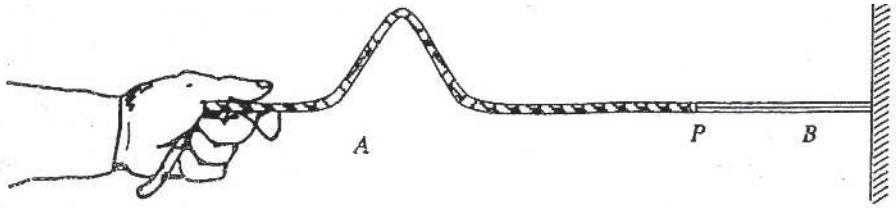
32. A beam of light that appears to be converging to a point on the axis 10 cm behind a lens is actually converged to a point on the axis 8 cm behind it. The lens is

(1) a convex lens of focal length 40 cm.
(2) a concave lens of focal length 40 cm.
(3) a convex lens of focal length 4·4 cm.
(4) a concave lens of focal length 4·4 cm.
(5) a convex lens of focal length 20 cm.

33. One end of a string of mass per unit length m is connected to a prong of a tuning fork and the other end is connected to a mass M after passing over a frictionless pulley as shown in the figure. When the tuning fork is vibrated, the string vibrates forming a standing wave as shown. The frequency of the tuning fork is



(1) $\frac{2}{L}\sqrt{\frac{Mg}{m}}$ (2) $\frac{2}{L}\sqrt{\frac{M}{m}}$ (3) $\frac{4}{L}\sqrt{\frac{Mg}{m}}$ (4) $\frac{1}{L}\sqrt{\frac{Mg}{m}}$ (5) $\frac{2}{L}\sqrt{\frac{m}{Mg}}$

34. 

Two strings, A and B are connected end-to-end at P as shown in the figure and the free end of the lighter string B is attached to a rigid vertical wall. The masses per unit length of A and B are 0·04 kg m^{-1} and 0·01 kg m^{-1}, respectively. The composite string is first pulled by hand to create a tension of 1 N and then a pulse is created at the free end of A. After the pulse has reached the point P

(1) a non-inverted pulse would have travelled along B to the right with speed 10 m s^{-1}.
(2) an inverted pulse would have travelled along B to the right with speed 10 m s^{-1}.
(3) a non-inverted pulse would have travelled to the left along A with speed 10 m s^{-1}.
(4) an inverted pulse would have travelled to the left along A with speed 5 m s^{-1}.
(5) **no** pulse would have travelled along A to the left.

35. A gas is confined to a closed container. Consider the following statements made regarding the speed of sound in the gas.

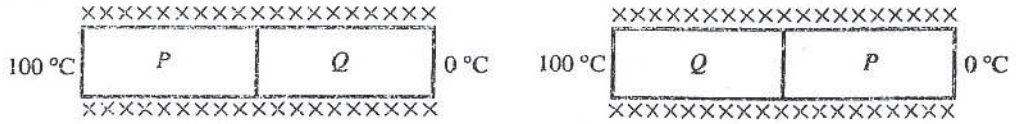
(A) The speed of sound does not change when the volume of the container is changed at a constant temperature.
(B) The speed of sound changes with temperature.
(C) The speed of sound changes when more gas is added to the container at a constant temperature.

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 true.

36. A driver sitting in a parked car, seeing another car moving directly towards his car, sounds his horn. The frequency of the horn of the parked car is 340 Hz and the speed of sound in air is 340 m s^{-1}. If the driver of the moving car detects the frequency of this sound as 348 Hz, the speed of his car is

(1) 2·0 m s^{-1} (2) 3·0 m s^{-1} (3) 4·0 m s^{-1} (4) 6·0 m s^{-1} (5) 8·0 m s^{-1}

37. 

(a) (b)

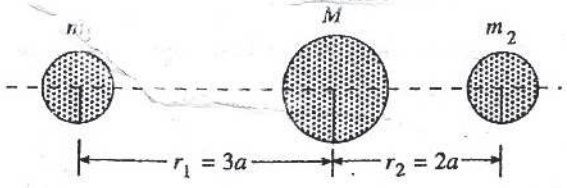
Temperatures at the two ends of a composite cylindrical rod made of two similar pieces of different metals P and Q are maintained at 100 °C and 0 °C in two different situations (a) and (b) as shown in figures. The composite rod is well lagged, and the thermal conductivity of the metal P is twice that of Q. Consider the following statements made regarding the system at the steady state.

(A) The temperature variation along the composite rod from hot end to cold end is the same in both situations (a) and (b).
(B) Temperature at the junction between two metals of the composite rod is higher in the situation (a) than in (b).
(C) The rates of flow of heat along the composite rod are the same in situations (a) and (b).

Of the above statements

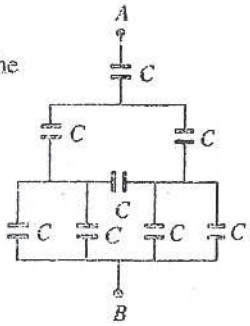
(1) only (C) is true. (2) only (A) and (B) are true.
(3) only (B) and (C) are true. (4) only (A) and (C) are true.
(5) all (A), (B) and (C) are true.

38. The figure shows an isolated system of three masses. The mass M is at rest under the influence of the masses m_1 and m_2, which are held in the positions indicated in the diagram. When mass m_1 is doubled, M will remain at rest if r_2 is changed to



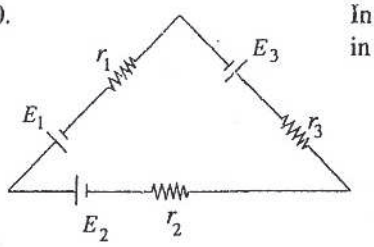
(1) $2\sqrt{2}\,a$ (2) $\sqrt{2}\,a$ (3) $2a$ (4) $4a$ (5) $3\sqrt{2}\,a$

39. The equivalent capacitance between points A and B of the network shown in the diagram is



(1) $8C$ (2) $2C$ (3) $\frac{7}{3}C$

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

40. 

In the circuit shown, the internal resistances of all the cells are negligible. Current in the circuit is I. Which of the following equations is true for the circuit?

(1) $E_1 + E_2 + E_3 = I(r_1 + r_2 + r_3)$

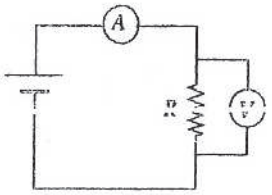
(2) $E_1 + E_2 + E_3 = I(-r_1 + r_2 + r_3)$

(3) $E_1 - E_2 - E_3 = I(r_1 - r_2 - r_3)$

(4) $-E_1 + E_2 + E_3 = I(r_1 + r_2 + r_3)$

(5) $-E_1 + E_2 - E_3 = I(-r_1 + r_2 - r_3)$

41. Consider the following statements made regarding the voltmeter V and the ammeter A in the circuit shown.



(A) Negative terminal of the ammeter and the positive terminal of the voltmeter should be connected together for proper operation.

(B) Internal resistance of the voltmeter should have a value lower than R for proper operation.

(C) If A and V are interchanged by mistake, the ammeter is now expected to read a smaller current than the reading obtained under proper operation.

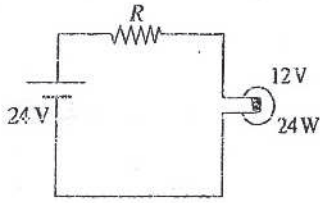
Of the above statements

(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. In the circuit shown, the bulb operates at the given rated values. Internal resistance of the cell is negligible. The value of R is



(1) 1 Ω (2) 3 Ω (3) 6 Ω

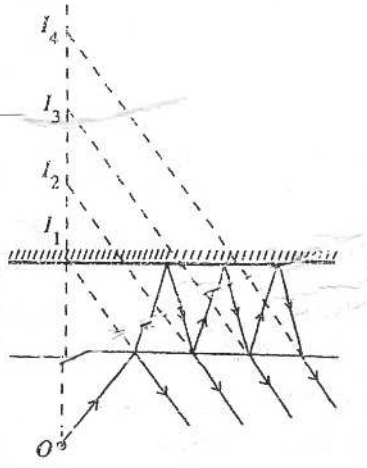
(4) 12 Ω (5) 18 Ω

43. 

Two wires of equal cross-sectional areas but having lengths l and $2l$, and resistivities ρ_1 and ρ_2 respectively, are connected end to end to form a composite wire as shown in the figure. The effective resistivity of the composite wire is

(1) $\frac{\rho_1 + \rho_2}{2}$ (2) $\frac{\rho_1 - \rho_2}{\rho_1 + \rho_2}$ (3) $\rho_1 + \rho_2$ (4) $\frac{\rho_1 \rho_2}{\rho_1 + \rho_2}$ (5) $\frac{\rho_1 + 2\rho_2}{3}$

44. When an object O is kept in front of a thick plane mirror formed by silvering one side of a thick glass plate as shown in the figure, a series of images $I_1, I_2, I_3, \ldots$ can be observed. Which of the following statements is correct?



(1) I_1 is the brightest and the intensities of images $I_2, I_3, \ldots$ decrease gradually.

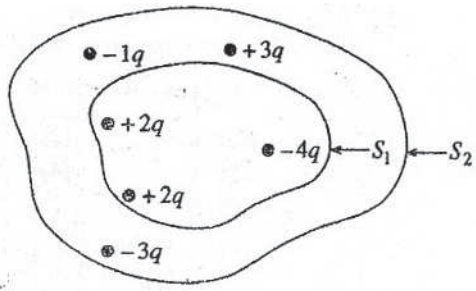
(2) I_2 is the brightest and the intensities of images $I_3, I_4, \ldots$ decrease gradually.

(3) I_2 is the brightest and intensities of images $I_3, I_4, \ldots$ are the same.

(4) I_3 is the brightest and intensities of images $I_2, I_4, \ldots$ are the same.

(5) I_1 is the brightest and intensities of images $I_2, I_3, \ldots$ are the same.

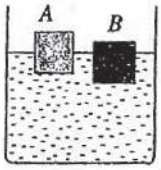
45. Consider the following statements made regarding the charge distribution shown.



(A) No electric field lines cross the closed surface S_1.
(B) Total electric flux due to the charge $+3q$ does not depend on the rest of the charges present.
(C) **Net** electric flux through the closed surface S_2 is **not** zero.

Of the above statements
(1) only (C) 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.

46. Two cubes A and B of the same geometrical dimensions float in water as shown in the figure.



Cube A has half of its volume above the water level whereas B has only $\frac{1}{4}$ of its volume above the water level. If the cube B is carefully placed on cube A, which of the following responses indicates the correct positions of the cubes A and B ?

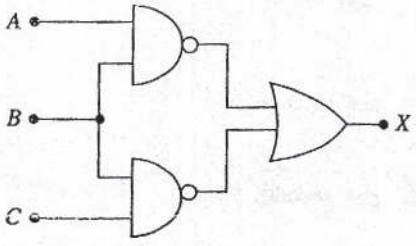
	Cube A	Cube B
(1)	$\frac{3}{4}$ of the volume is under water	Completely above the water level
(2)	Completely submerged	Completely above the water level
(3)	Completely submerged	$\frac{1}{4}$ of the volume is under water
(4)	Completely submerged	$\frac{1}{2}$ of the volume is under water
(5)	Completely submerged	$\frac{3}{4}$ of the volume is under water

47. A particle P moving with a uniform velocity of $4\ m\ s^{-1}$ along x-axis passes the origin O at time $t = 0$. A second particle Q moving along the same direction with a uniform velocity of $5\ m\ s^{-1}$ passes origin O at $t = 1$ s. Particle Q will reach the particle P when they have travelled a distance of
(1) 10 m from the origin.
(2) 16 m from the origin.
(3) 20 m from the origin.
(4) 25 m from the origin.
(5) 30 m from the origin.

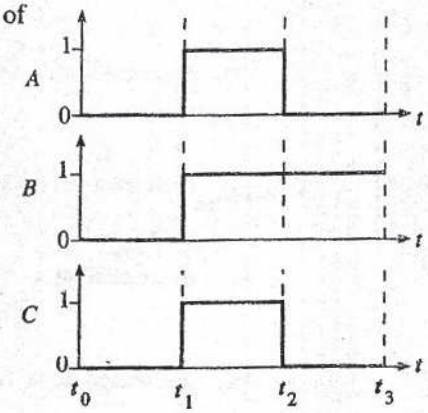
48. The intensity of sound emitted from a point source is inversely proportional to the square of the distance from the source. If the intensity level of sound at a distance of 1·0 m from a point source of sound is 50 dB, the sound intensity level at a distance of 10·0 m from the source will be
(1) 0·5 dB. (2) 3 dB. (3) 5 dB. (4) 30 dB. (5) 70 dB.

49. Figure (a) shows a digital circuit. The variations of the logic values of its inputs A, B and C with time (t) are shown in figure (b).

(a)

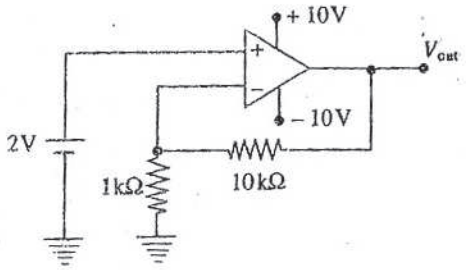


(b)



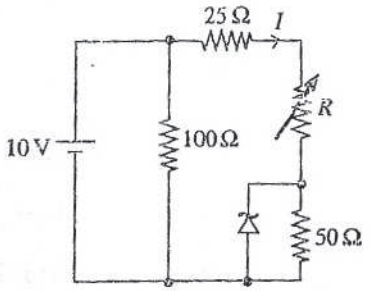
The output X will be 0 during the time interval/intervals
(1) from t_0 to t_1
(2) from t_1 to t_2
(3) from t_2 to t_3
(4) from t_1 to t_3
(5) from t_0 to t_1, and from t_2 to t_3

50. The operational amplifier circuit shown operates with +10 V and −10 V power supplies. What would be the approximate output voltage (V_{out}) of the circuit?



(1) +22 V (2) −22 V
(3) +20 V (4) +10 V
(5) −10 V

51. The breakdown voltage of the zener diode of the circuit shown is 5 V. The internal resistance of the cell is negligible. When the value of R is changed from 25 Ω to 0, the current I in the circuit will change from

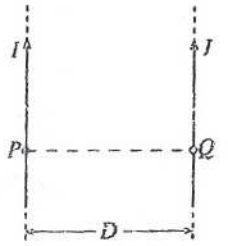


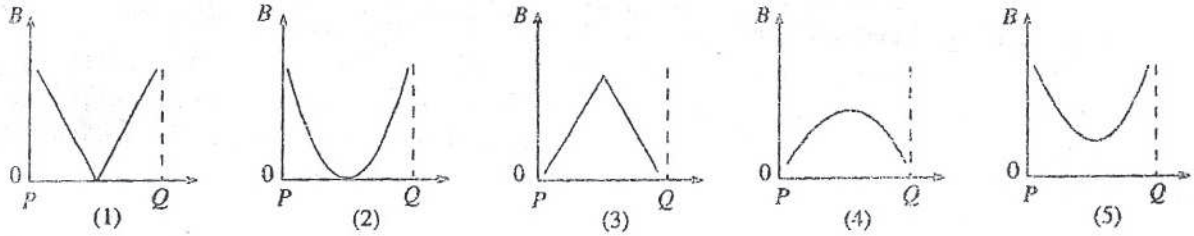
(1) 0·10 A to 0·13 A. (2) 0·20 A to 0·40 A.
(3) 0·13 A to 0·20 A. (4) 0·10 A to 0·20 A.
(5) 0·20 A to 0·27 A.

52. A metal sphere of radius r carrying a charge $+q$ is connected by a conducting wire to another metal sphere of radius $2r$ carrying a charge $+q$. After the connection, the amount of charge in the sphere of radius r is (Assume that the amount of charge residing in the connecting wire is negligible.)

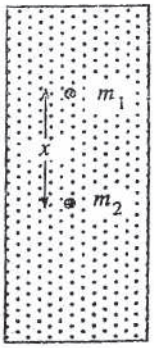
(1) 0 (2) $+\frac{q}{3}$ (3) $+\frac{q}{2}$ (4) $+\frac{2}{3}q$ (5) $+\frac{3}{2}q$

53. Two long, parallel, thin wires placed at a distance D apart as shown in the figure, carry equal currents I in the same direction. Variation of the magnitude of the resultant magnetic flux density B along the line PQ from P to Q, is best represented by





54. Two spheres each of radius a but of different masses m_1 and m_2, $(m_1 > m_2)$ move down at their terminal velocities in a liquid of viscosity η. At the instant shown in the figure, the separation x between the two spheres is being



(1) increased at a rate of $\frac{m_1 m_2}{6\pi a\eta}$ g per second.

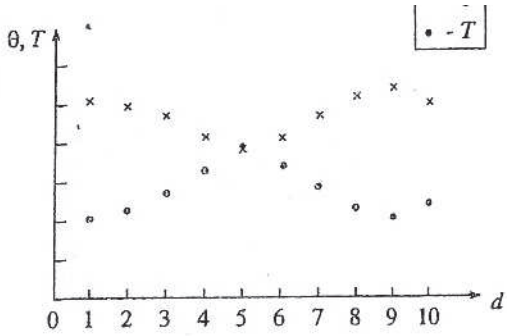
(2) decreased at a rate of $\frac{6\pi a\eta}{(m_1 - m_2)\,g}$ per second.

(3) increased at a rate of $\frac{(m_1 - m_2)\,g}{6\pi a\eta}$ per second.

(4) decreased at a rate of $\frac{(m_1 + m_2)g}{6\pi a\eta}$ per second.

(5) decreased at a rate of $\frac{(m_1 - m_2)g}{6\pi a\eta}$ per second.

55. The mean temperature (θ) and the dew point (T) of the atmosphere between 6.00 a.m. and 8.00 a.m. in 10 consecutive days (d), 1-10, are shown in the figure.



Consider the following statements made about the atmosphere.

(A) Relative humidity is maximum on day 9.

(B) Day 6 has more water vapour in the atmosphere than on day 8.

(C) Mist is possible in none of the days.

Of the above statements

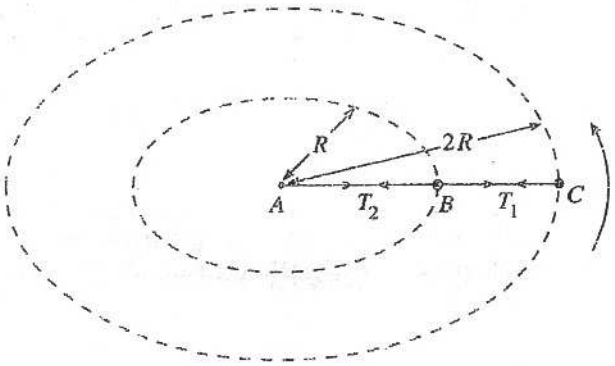
(1) only (B) is true.
(2) only (A) and (B) are true.
(3) only (B) and (C) are true.
(4) only (A) and (C) are true.
(5) all (A), (B) and (C) are true.

56. A mass m_i of ice at 0 °C is added to a mass m_w of water at the room temperature of 30 °C, and the mixture is stirred until the ice is completely dissolved in water. If the minimum temperature of the mixture is found to be 10 °C, the amount of heat absorbed by the mixture from the container and the environment is

(Specific heat capacity of water = S_w, Latent heat of fusion of ice = L)

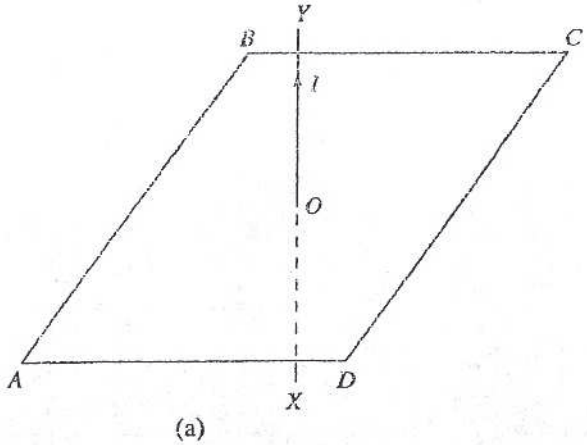
(1) $\dfrac{m_i(L+10S_w)}{20m_wS_w}$
(2) $m_i(L+10S_w)-20m_wS_w$
(3) $10m_wS_w+m_i(L+10S_w)$
(4) $m_i(L+10S_w)-10m_wS_w$
(5) $20m_wS_w-m_i(L+10S_w)$

57. Two small objects of equal masses are attached to each other by a light string BC, and this system is connected to a fixed point A with another light string AB as shown in the figure. The masses are then made to move in horizontal circular paths of radii R and $2R$ (see figure) with the same angular speed so that points A, B and C are always in a straight line. If T_1 and T_2 are the tensions of the strings BC and AB respectively, then

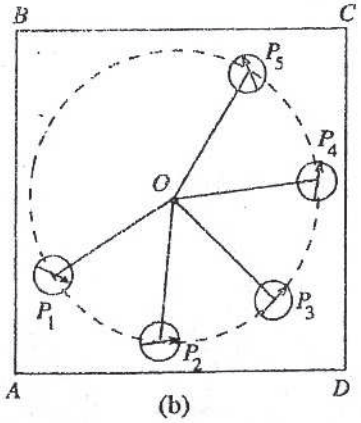


(1) $T_2=\frac{1}{2}T_1$ (2) $T_2=\frac{2}{3}T_1$ (3) $T_2=T_1$ (4) $T_2=\frac{3}{2}T_1$ (5) $T_2=2T_1$

58. XY is a long vertical wire carrying a current I in the upward direction as shown in figure (a). $ABCD$ is a horizontal plane perpendicular to the wire. The directions of the magnet of a compass kept at positions P_1, P_2, P_3, P_4 and P_5 on the plane $ABCD$ near the wire are shown in figure (b).



(a)

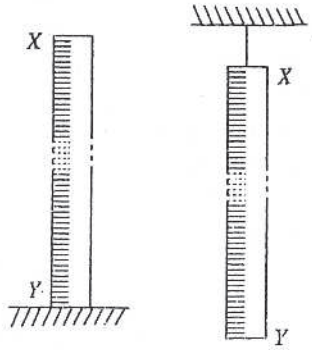


(b)

The position at which the direction indicated by the magnet of the compass is the same as the direction of the horizontal component of the earth's magnetic field is

(1) P_1 (2) P_2 (3) P_3 (4) P_4 (5) P_5

59.

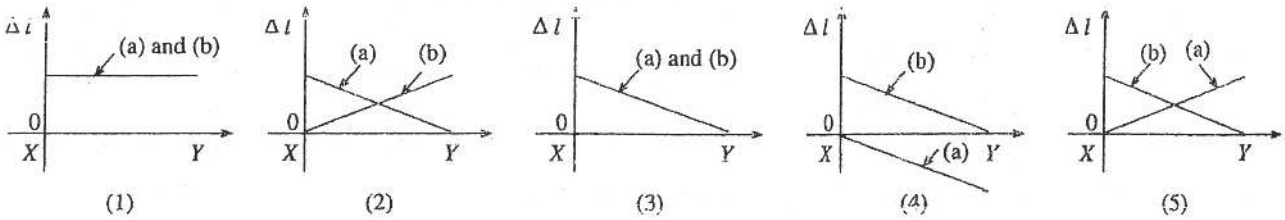


(a) (b)

A 1 m long cylindrical copper rod XY of mass M is accurately calibrated in (standard) millimetres when it is in horizontal position. In two separate occasions, this rod is kept in vertical position by placing on a horizontal platform [see figure (a)], and by hanging from a ceiling [see figure (b)]. If

'the distance between two consecutive millimetre marks' – 'length of a standard millimeter' = Δl,

then the variation of Δl along the rod in the occasions (a) and (b) is best represented by



60. A closed rectangular wire loop (W) falls vertically through two uniform magnetic field regions of flux density B as shown in the figure. If viscous and upthrust forces on the loop are negligible, the velocity (v) - time (t) graph of the loop is best represented by

