සියලු ම හිමිකම් ඇවිරිණි]
முழுப் பதிப்புரிமையுடையது]
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ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம்
Department of Examinations, Sri Lanka

01 E I

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2009 අගෝස්තු
கல்விப் பொதுத் தராதரப் பத்திர(உயர் தர)ப் பரீட்சை, 2009 ஓகஸ்ற்
General Certificate of Education (Adv. Level) Examination, August 2009

භෞතික විද්‍යාව I
பௌதிகவியல் I
Physics I

පැය දෙකයි
இரண்டு மணித்தியாலங்கள்
Two hours

Important :

- *This question paper consists of* **60** *questions in* **11** *pages.*
- *Answer all the questions.*
- *Write your* ***Index Number*** *in the space provided in the answer sheet.*
- *Instructions are given on the back of the answer sheet. Follow those carefully.*
- *In each of the questions* **1** *to* **60**, *pick one of the alternatives from* (1), (2), (3), (4), (5) *which is correct or most appropriate and mark your response on the answer sheet with a cross* (×) *in accordance with the instructions given in the back of the answer sheet.*

Use of calculators is not allowed.

($g = 10\,\text{N kg}^{-1}$)

1. SI unit of 'activity' of a radioactive element is
   (1) Bq (2) Ci (3) Gy (4) Sv (5) rad

2. Energy E of a photon of frequency f is given by $E = hf$. The dimensions of h are
   (1) ML^2T^{-1} (2) $ML^{-1}T^{-2}$ (3) $ML^{-2}T^{-1}$ (4) ML^2T^{-2} (5) $ML^{-3}T^{-1}$

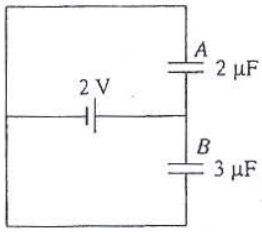
3. Astronomical telescope has an objective lens of focal length f_o and an eyepiece of focal length f_e. If the telescope is in normal adjustment, the total length and the magnifying power of the telescope are given respectively by
   (1) $2(f_o + f_e)$, and $\left(\frac{f_o}{f_e}\right)$
   (2) $2(f_o + f_e)$, and $\left(\frac{f_e}{f_o}\right)$
   (3) $(f_o + f_e)$, and $\left(\frac{f_e}{f_o}\right)$
   (4) $(f_o + f_e)$, and $\left(\frac{2f_o}{f_e}\right)$
   (5) $(f_o + f_e)$, and $\left(\frac{f_o}{f_e}\right)$

4. A metal plate is illuminated with light of a certain frequency. Which of the following determines whether electrons are emitted or not from the plate?
   (1) The intensity of the light
   (2) Time of exposure of the plate to the light
   (3) The thermal conductivity of the material of the plate
   (4) The area of the plate
   (5) The material of which the plate is made

5. A transformer having which of the following characteristics is suitable to reduce a 220 V ac voltage to 20 V ac?

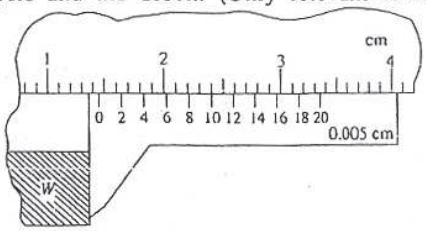
	Transformer type	$\frac{\text{Number of turns in secondary coil}}{\text{Number of turns in primary coil}}$
(1)	step-down	$\frac{1}{22}$
(2)	step-down	$\frac{1}{11}$
(3)	step-down	11
(4)	step-up	$\frac{1}{11}$
(5)	step-up	11

6. Magnitudes of charge stored in the two capacitors A and B shown in figure respectively are



(1) 0, 0 (2) 0, 6 μC (3) 4 μC, 0
(4) 4 μC, 4 μC (5) 4 μC, 6 μC

7. The length of a rectangular wooden block (W) is measured using vernier callipers. The figure shows the relevant sections of the vernier callipers and the block. (Only relevant divisions in the vernier scale are shown.)

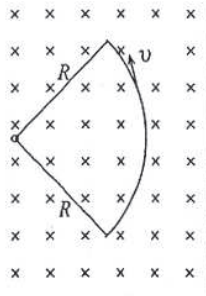


If there is no zero error in the vernier callipers, then the length of the wooden block is
(1) 1.30 cm (2) 1.35 cm (3) 1.45 cm (4) 1.50 cm (5) 1.55 cm

8. A person cannot see clearly the objects beyond a distance of 50 cm from his eyes. In order to see distant objects he must wear
(1) concave lenses of focal length 10 cm. (2) convex lenses of focal length 50 cm.
(3) concave lenses of focal length 50 cm. (4) convex lenses of focal length 100 cm.
(5) concave lenses of focal length 100 cm.

9. Minimum amount of heat that is necessary to melt completely an ice cube of mass 30 g at 0°C is (specific latent heat of fusion of ice is 3.3×10^5 J kg^{-1})
(1) 11 J (2) 990 J (3) 1 100 J (4) 9 900 J (5) 11 000 J

10. Figure shows the path of an electron travelling along an arc of a circle of radius R with a speed v in a uniform magnetic field. The magnitude (B) of the magnetic flux density is given by (m = mass of an electron; e = charge of an electron)



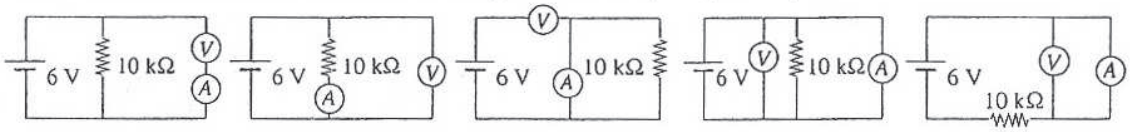
(1) $B = \sqrt{\frac{mv}{eR}}$ (2) $B = \left(\frac{mv}{eR}\right)^2$
(3) $B = \frac{mv}{2eR}$ (4) $B = \frac{mv}{eR}$
(5) $B = \frac{2mv}{eR}$

11. The moment of inertia of a certain spinning star has dropped to $\frac{1}{3}$ of its initial value due to contraction. The ratio, $\frac{\text{new rotational kinetic energy of the star}}{\text{initial rotational kinetic energy of the star}}$ is equal to
(1) $\frac{1}{9}$ (2) $\frac{1}{3}$ (3) 3 (4) 9 (5) 27

12. A uniform copper wire of cross-sectional area 10^{-7} m^2 carries a current of 1.6 A. If there are 10^{29} free electrons in 1 m^3 of copper, the drift velocity of electrons in the wire is (magnitude of the charge of an electron is 1.6×10^{-19} C)

(1) 1.0 mm s^{-1} (2) 1.6 mm s^{-1} (3) 2.0 mm s^{-1} (4) 10.0 mm s^{-1} (5) 20.0 mm s^{-1}

13. In the circuits shown below (A) and (V) represent an ammeter and a voltmeter respectively. In which circuit arrangement the ammeter will have the highest risk of getting damaged?

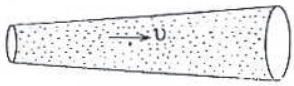


(1) (2) (3) (4) (5)

14. If the absolute value of the surface temperature of the sun were three times the existing value, the radiation of the sun would have been mostly in

(1) microwave range. (2) infrared range. (3) visible range.
(4) X-ray range. (5) ultraviolet range.

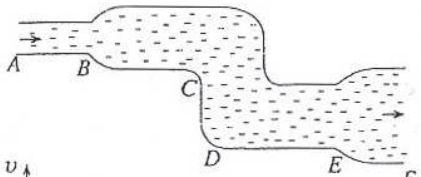
15. A non viscous fluid of density d has a streamlined flow through horizontal pipe of variable cross-section as shown in the figure.

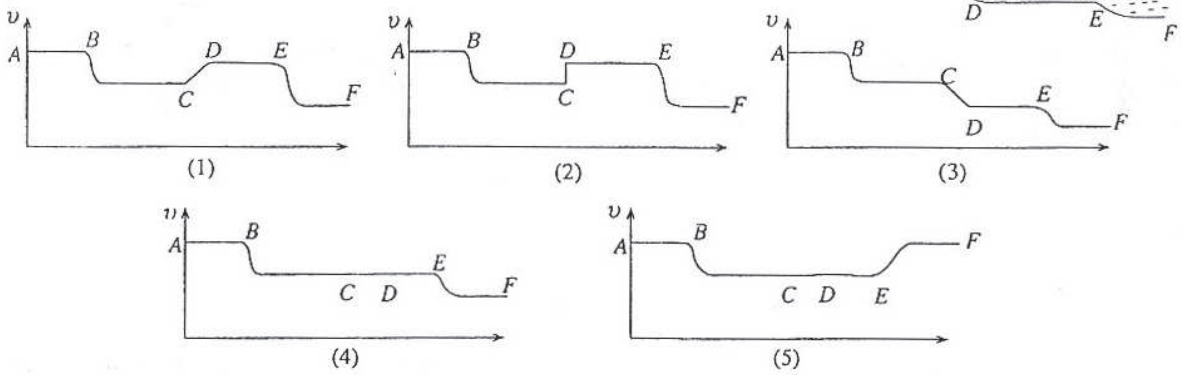


If the pressure of the fluid is P at a point where the velocity of flow is v, what is the pressure at another point where the velocity of flow is $3v$?

(1) $P - 3dv^2$ (2) $P - 4dv^2$ (3) $P + 4dv^2$ (4) $P + 8dv^2$ (5) $P - 8dv^2$

16. Non viscous, incompressible fluid flows steadily through the pipe shown in the figure. The variation of the flow speed v of the fluid along the tube from A to F is best represented by

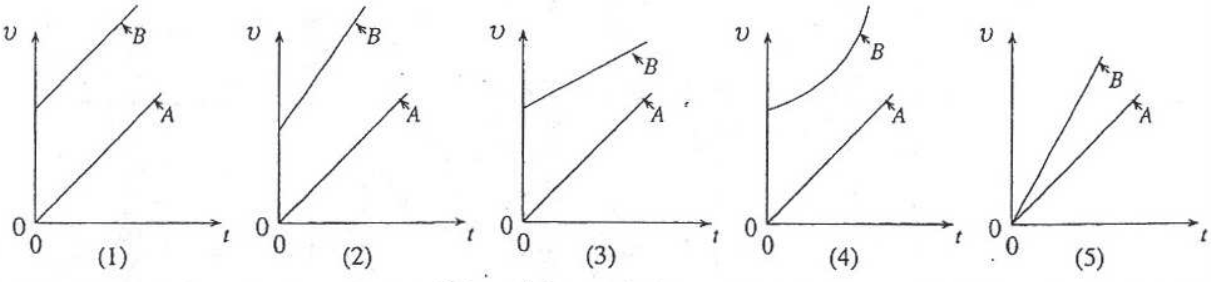




(1) (2) (3)

(4) (5)

17. A person simultaneously drops an object, and throws another object vertically downwards from a certain height. Which of the following graphs best represents the velocity (v) - time (t) curves for the two objects? (Curve A represents the dropped object and curve B represents the thrown object.)



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

18. A light ray deviates from a prism with the minimum deviation of 30°. If the angle of the prism is 60°, the refractive index of the material of the prism is

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

19. A light wave of frequency 4.5×10^{14} Hz has a wavelength of 4×10^{-7} m in a certain medium. If the velocity of light in vacuum is 3×10^{8} m s^{-1}, the refractive index of the medium for that light is

(1) $\frac{6}{5}$ (2) $\frac{4}{3}$ (3) $\frac{7}{5}$ (4) $\frac{3}{2}$ (5) $\frac{5}{3}$

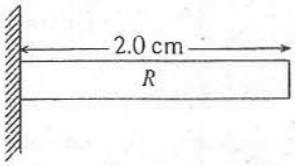
20. The best vacuum that can be achieved in a laboratory has a pressure of 10^{-13} Pa. The number of gas molecules present in 1 cm^3 of such a vacuum at 300 K is (take Boltzmann constant $= \frac{4}{3} \times 10^{-23}$ J K^{-1})

(1) 0 (2) 5 (3) 10 (4) 25 (5) 100

21. The motion of an insect living on sand generates transverse waves travelling at 50 m s^{-1} and longitudinal waves travelling at 150 m s^{-1} along the sand surface. A scorpion can estimate the location of the insect from the difference Δt in the arrival times of these waves. If $\Delta t = 4.0 \times 10^{-3}$ s, the distance from the scorpion to the insect is

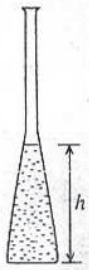
(1) 0.05 m (2) 0.10 m (3) 0.20 m (4) 0.30 m (5) 0.40 m

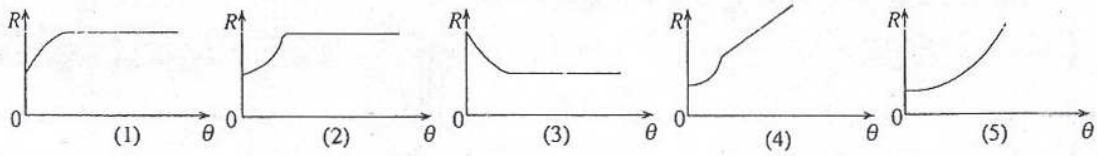
22. In a certain experiment the unclamped end of an aluminium rod R of length 2.0 cm has to be moved at a constant speed of 100 nm s^{-1}. The rate at which the temperature of the rod be increased for this to happen is (linear expansivity of aluminium = 2.0×10^{-5} °C^{-1})



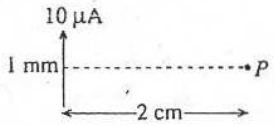
(1) 0.25 °C s^{-1} (2) 0.30 °C s^{-1} (3) 0.55 °C s^{-1} (4) 0.65 °C s^{-1} (5) 0.75 °C s^{-1}

23. A glass container with a narrow area of cross-section as shown in figure is filled with a liquid to a height h. If the expansion of the container is negligible, the **rate of change** (R) of h with temperature (θ) is best represented by





24. When a person performs a certain task a weak current of 10 μA is produced along a conducting path between brain cells. The figure shows such a small path of length 1 mm. The magnitude of the magnetic flux density produced by this current element at a point P at a distance of 2 cm from it is ($\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1})



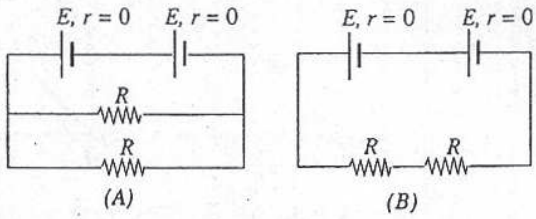
(1) 2.5×10^{-10} T (2) 1.0×10^{-10} T (3) 2.5×10^{-11} T
(4) 1.0×10^{-11} T (5) 2.5×10^{-12} T

25. The radius of a spherical asteroid is 60 km. The acceleration due to gravity on its surface is 3 m s^{-2}. The escape velocity at the surface of the asteroid is

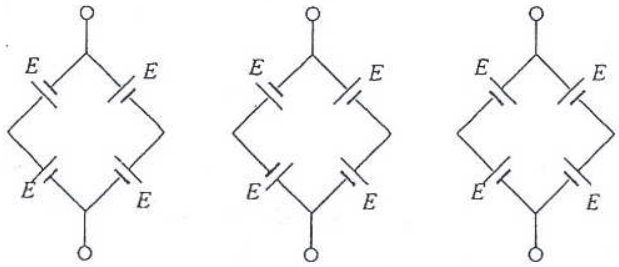
(1) 400 m s^{-1} (2) 600 m s^{-1} (3) 800 m s^{-1} (4) 1 200 m s^{-1} (5) 3 600 m s^{-1}

26. Power dissipation in circuit (B) can be made equal to that of (A) if the resistances in (B) are changed from R to

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



27. Four identical batteries with negligible internal resistances are connected as shown in figures (*A*), (*B*) and (*C*).



Currents through the batteries are zero in the arrangement/s

(1) (*A*) only. (2) (*C*) only. (3) (*A*) and (*C*) only.
(4) (*B*) and (*C*) only. (5) (*A*) and (*B*) only.

28. Two masses M and m, placed on a frictionless horizontal surface, are connected together as shown in figure using a spring whose mass is negligible. Two masses are first pressed together so that the spring is compressed, and then released. If the initial acceleration of mass m is a, what would be the magnitude of acceleration of mass M at that moment?



(1) $\frac{ma}{M+m}$ (2) $\frac{Ma}{M+m}$ (3) $\frac{ma}{M}$ (4) $\frac{Ma}{m}$ (5) $\frac{(M+m)a}{m}$

29.

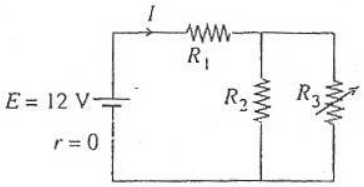


Fig. 1

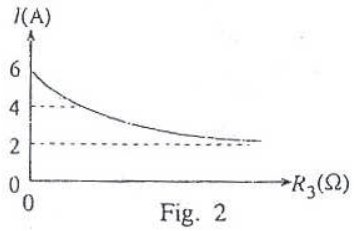


Fig. 2

Fig. 2 shows the variation of the current (I) through the battery with R_3 of the circuit shown in Fig 1. The values of R_1 and R_2 are respectively,

(1) 1 Ω, 2 Ω (2) 1 Ω, 3 Ω (3) 2 Ω, 4 Ω (4) 2 Ω, 6 Ω (5) 4 Ω, 8 Ω

30. A 6 km long underground cable AB consists of two parallel conducting wires of same dimensions and are separated from each other. A short circuit has occurred between the two wires at a single point inside the cable. In a test conducted in order to find the faulty position, the measured resistance between two wires at the end A of the cable was found to be 3 kΩ while the same measurement done at the end B of the cable gave 5 kΩ. The distance to the faulty position from the end A of the cable is

(1) 1.80 km (2) 2.25 km (3) 3.60 km (4) 3.75 km (5) 4.50 km

31. A cylindrical metal vessel of height 5 cm has a small circular hole of radius 0.2 mm at its bottom. This vessel is lowered vertically in a certain liquid of density 800 kg m^{-3}, keeping the bottom down. What should be the minimum value of the surface tension the liquid must have so that the vessel can be lowered up to the brim without liquid entering into the vessel through the hole?

(1) 0.02 N m^{-1} (2) 0.03 N m^{-1} (3) 0.04 N m^{-1} (4) 0.05 N m^{-1} (5) 0.06 N m^{-1}

32. A small metal sphere of mass 40 g is released from rest in a viscous medium. When the velocity of the sphere is 0.03 m s^{-1}, the viscous force on the sphere is found to be 0.1 N. If the buoyancy force is negligible, the terminal velocity of the sphere is

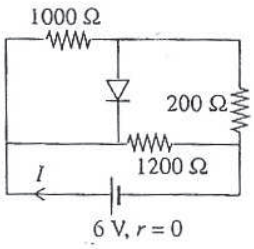
(1) 0.06 m s^{-1} (2) 0.09 m s^{-1} (3) 0.12 m s^{-1} (4) 0.15 m s^{-1} (5) 0.18 m s^{-1}

33. Radioactive element $^{232}_{90}Th$ transforms to stable $^{208}_{82}Pb$ after several radioactive decays. The number of α particles and the number of β^- particles emitted in these decays respectively are

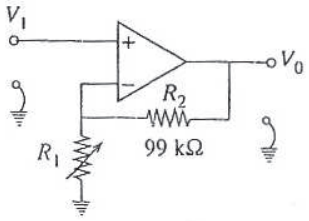
(1) 6, 2 (2) 6, 4 (3) 6, 12 (4) 4, 4 (5) 4, 8

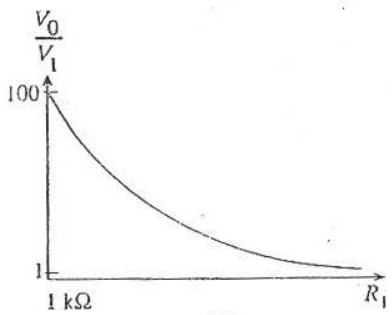
34. If the voltage necessary to forward bias the diode shown in figure is 0.7 V, the current (I) drawn from the battery would be

(1) 0 (2) 5 mA (3) 10 mA
(4) 30 mA (5) 60 mA

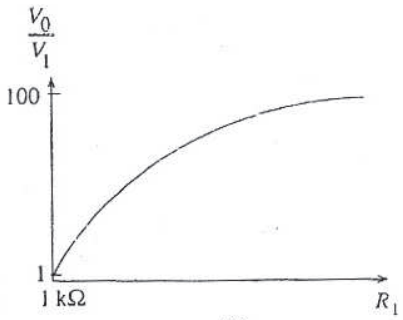


35. Which of the following curves correctly represents the variation of the voltage gain $\left(\frac{V_0}{V_1}\right)$ of the circuit shown when the value of R_1 is changed from 1 kΩ to infinity? $\left(\frac{V_0}{V_1}\right)$ is not drawn to scale.

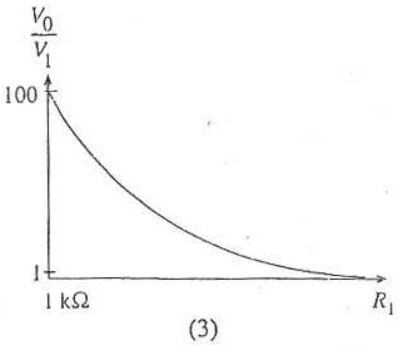




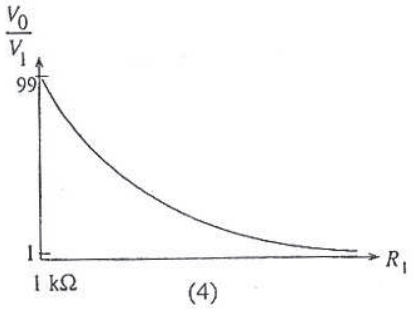
(1)



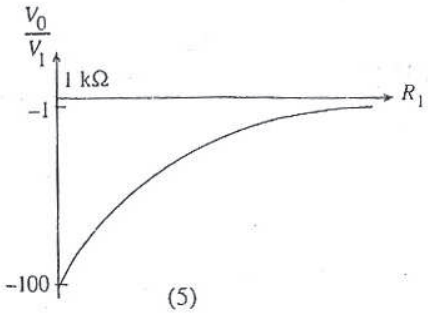
(2)



(3)

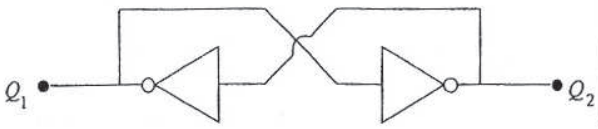


(4)



(5)

36. Two NOT gates are connected as shown in figure. Consider following combinations of logic levels for the outputs Q_1 and Q_2

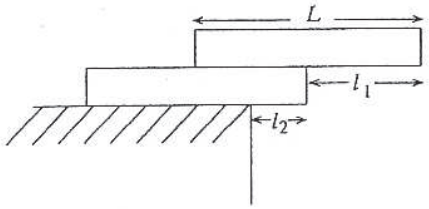


	Logic Level for Q_1	Logic Level for Q_2
(A)	0	0
(B)	0	1
(C)	1	0
(D)	1	1

Which of the above combination/s will provide stable logic levels for Q_1 and Q_2 outputs?

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

37. Two identical uniform bricks of length L are stacked without being toppled on a table as shown in figure. The respective maximum possible values for l_1 and l_2 are



(1) $\frac{L}{2}, \frac{L}{4}$ (2) $\frac{L}{2}, \frac{L}{6}$

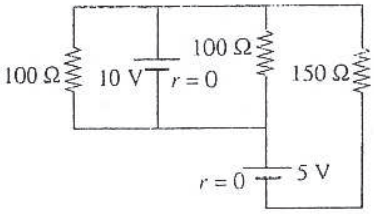
(3) $\frac{L}{2}, \frac{L}{8}$ (4) $\frac{L}{4}, \frac{L}{4}$

(5) $\frac{L}{4}, \frac{L}{6}$

38. A simple pendulum hung from the ceiling of an elevator has a period T when the elevator is at rest. Period of this pendulum when the elevator is moving upwards with an acceleration of 5 $m s^{-2}$ is

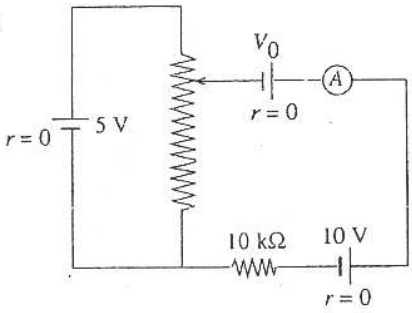
(1) $\sqrt{2}T$ (2) $\sqrt{\frac{3}{2}}T$ (3) $\frac{T}{2}$ (4) $\sqrt{\frac{2}{3}}T$ (5) $2T$

39. In the circuit shown the current through the 150 Ω resistor is



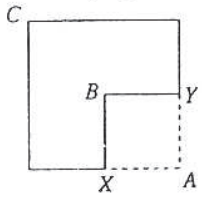
(1) 0.01 A (2) 0.05 A (3) 0.10 A
(4) 0.33 A (5) 0.50 A

40. In the circuit shown in figure, there is a possibility for a centre-zero ammeter A to indicate currents in either direction if V_0 is



(1) 1 V (2) 2 V (3) 4 V
(4) 5 V (5) 6 V

41. Figure shows a uniform square plate from which the part $XBYA$ has been removed. If the moment of inertia of the plate around axes perpendicular to the plate and through the points A, B and C are I_A, I_B and I_C respectively then

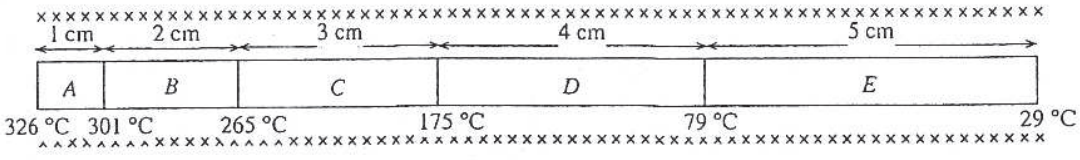


(1) $I_A = I_B = I_C$ (2) $I_A = I_B > I_C$ (3) $I_A > I_B > I_C$
(4) $I_A > I_C > I_B$ (5) $I_A < I_C < I_B$

42. When a guitar string sounds together with a tuning fork of frequency 191 Hz, at the room temperature, five beats per second are heard. When the tuning fork is heated up to a certain temperature, the beat frequency heard increased to eight beats per second. Frequency of the note produced by the guitar string at the room temperature is

(1) 181 Hz (2) 186 Hz (3) 191 Hz (4) 196 Hz (5) 201 Hz

43. Five cylindrical metal bars (A, B, C, D and E) are made from five different materials. All bars have the same cross sectional area but different lengths, and they are connected end to end as shown in figure. When the free ends are maintained at temperatures 326 °C and 29 °C, steady state temperatures at the interfaces are indicated in the figure. Assume that the system is fully lagged except its free ends. Which metal bar is made out of the material with the smallest thermal conductivity?



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

44. Many rock musicians wear special ear-plugs to protect their hearing during performances. If an ear-plug decreases the sound intensity level by 20 dB, it reduces the intensity of sound waves by a factor of

(1) 10^4 (2) 10^3 (3) 10^2 (4) 10 (5) $\sqrt{10}$

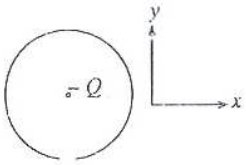
45. When a person wearing spectacles moves from room P to room Q he observed that a thin film of water is deposited on the lenses. Consider the following that are given as necessary conditions for this to happen.

(A) Temperature of room P > Temperature of room Q
(B) Temperature of room Q > Temperature of room P
(C) Relative humidity of room P > Relative humidity of room Q
(D) Relative humidity of room Q > Relative humidity of room P

Which of the above condition/s that should be satisfied for the above phenomenon to take place definitely?

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

46. A charge $+q$ is uniformly distributed along a very thin non-conducting circular ring of radius R and a charge $-Q$ is placed at the centre of the ring. Now, a very small part containing a charge Δq is removed from the ring as shown in figure. The electrostatic force acting on the charge $-Q$ at the centre of the ring is



(1) zero. (2) $\frac{1}{4\pi\varepsilon_0}\frac{Q(q-\Delta q)}{R^2}$ along $+y$ direction.

(3) $\frac{1}{4\pi\varepsilon_0}\frac{Q(q-\Delta q)}{R^2}$ along $-y$ direction. (4) $\frac{1}{4\pi\varepsilon_0}\frac{Q(\Delta q)}{R^2}$ along $+y$ direction.

(5) $\frac{1}{4\pi\varepsilon_0}\frac{Q(\Delta q)}{R^2}$ along $-y$ direction.

47.

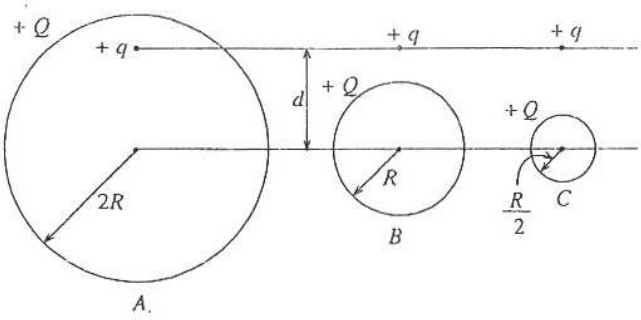
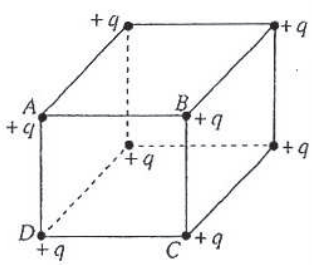


Figure shows three isolated systems (A, B and C) each having a point charge $+q$ and uniformly charged conducting shell of charge $+Q$. If the respective electrostatic forces between the point charge and the shell are given by F_A, F_B and F_C, then

(1) $F_A = 0, F_B > F_C$ (2) $F_A = 0, F_B = F_C$ (3) $F_A = 0, F_C > F_B$
(4) $F_A < F_B < F_C$ (5) $F_A = F_B = F_C$

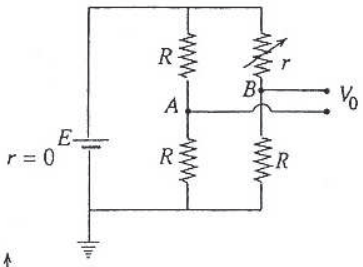
48. Eight $+q$ point charges are placed at the vertices of a cube as shown in the figure. The number of electric field lines passing through the face $ABCD$ due to charges is



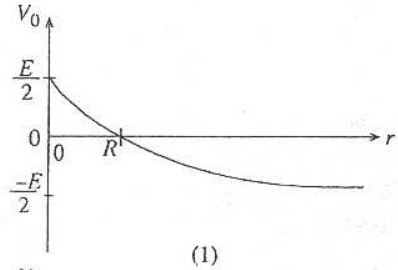
(1) $\frac{q}{3\varepsilon_0}$ (2) $\frac{q}{4\varepsilon_0}$ (3) $\frac{q}{6\varepsilon_0}$

(4) $\frac{q}{24\varepsilon_0}$ (5) $\frac{q}{48\varepsilon_0}$

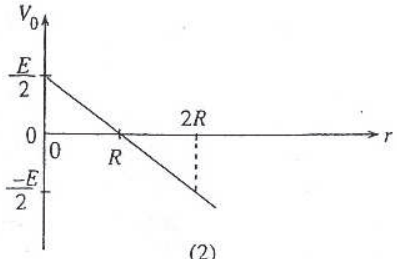
49. Three fixed resistors of value R and a variable resistor of resistance r are connected to a battery of e.m.f. E, with zero internal resistance as shown in the figure.



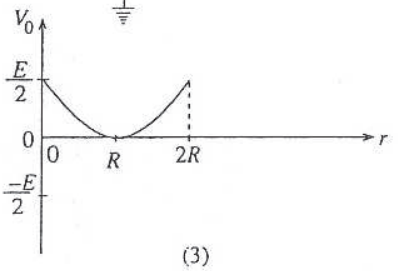
The variation of the potential difference (V_0) between points A and B with r is best represented by



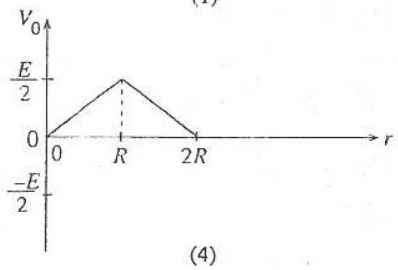
(1)



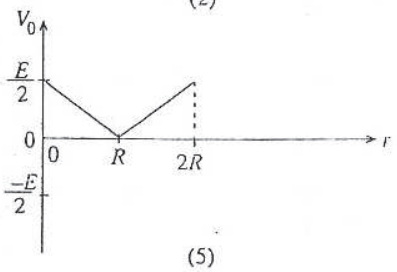
(2)



(3)

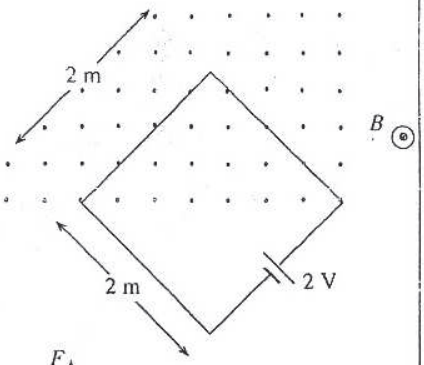


(4)



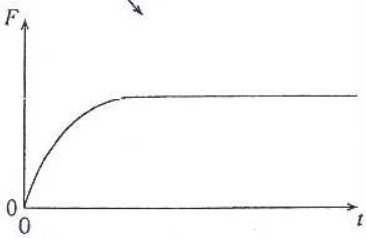
(5)

50. A part of a conducting square wire loop of side length 2 m is placed in a uniform magnetic field as shown in the figure. If the magnitude of the magnetic flux density decreases at a constant rate of $0.8\,\mathrm{T\,s^{-1}}$, the net e.m.f. in the circuit would be

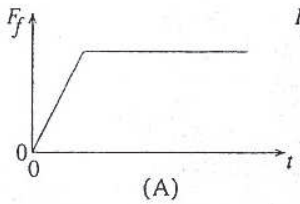


(1) 0.4 V (2) 1.2 V (3) 2.8 V
(4) 3.6 V (5) 5.2 V

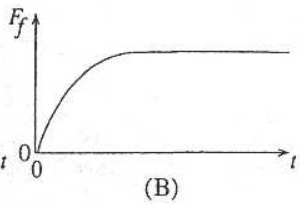
51. A box is placed on a horizontal surface and a horizontal force F is applied on the box. Variation of the magnitude of F with time is shown in the graph.



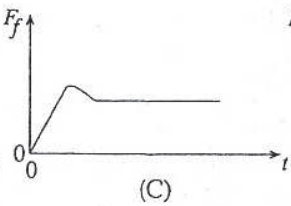
Which of the following graphs show/s the possible variations of the magnitude of the frictional force F_f acting on the box with time?



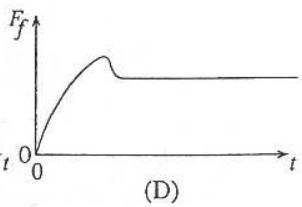
(A)



(B)



(C)



(D)

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

52. An oil drop falling through still air at its terminal velocity v suddenly explodes to form n number of identical droplets. The subsequent terminal velocity of the droplets would be

(1) $\frac{v}{n}$ (2) $\frac{v}{n^{\frac{2}{3}}}$ (3) $\frac{v}{n^2}$ (4) nv (5) $\frac{v}{n^{\frac{1}{3}}}$

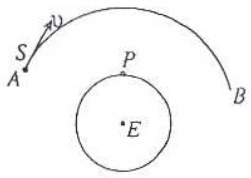
53. Water in a tank is uniformly bubbled with small identical air bubbles each having volume v_0 as shown in the figure.

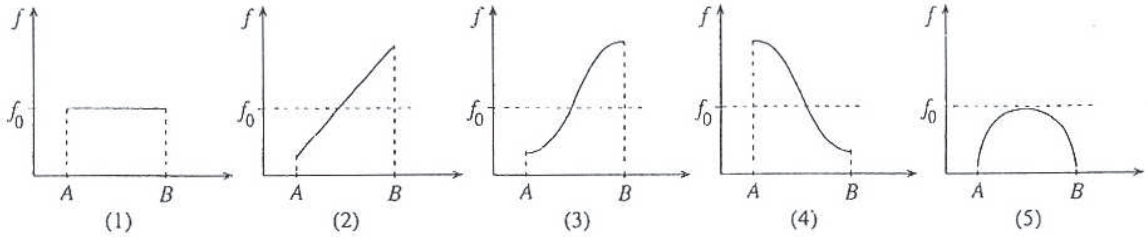


A sphere of mass M and volume V floats in water as shown due to the attachment of certain number of air bubbles on its surface. If d_w is the density of water, and the minimum number of air bubbles that is needed to be attached to keep the sphere floating in water is n, then

(1) $n = \frac{M - Vd_w}{v_0 d_w}$ (2) $n > \frac{M - Vd_w}{v_0 d_w}$ (3) $n < \frac{M - Vd_w}{v_0 d_w}$ (4) $n > \frac{v_0 d_w}{M - Vd_w}$ (5) $n < \frac{v_0 d_w}{M - Vd_w}$

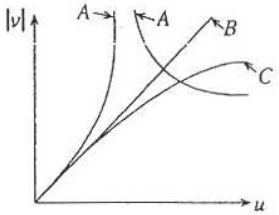
54. A satellite S is moving with constant speed v relative to the earth (E) along a fixed circular orbit as shown in figure. The satellite is emitting radio signals of frequency f_0. A station located at P on the earth detects these radio signals. The variation of the frequency f of the detected signal as the satellite moves from A to B is best represented by





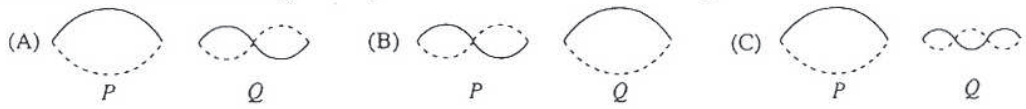
55. The figure shows three curves (A, B and C) of object distance (u) and corresponding magnitudes of image distance ($|v|$) for three types of mirrors.

Which curve corresponds to which mirror?



	A	B	C
(1)	convex	plane	concave
(2)	concave	plane	convex
(3)	plane	concave	convex
(4)	plane	convex	concave
(5)	convex	concave	plane

56. Two strings P and Q are identical, and string P is under greater tension than string Q. Figures show three situations in which standing wave patterns exist on the two strings.



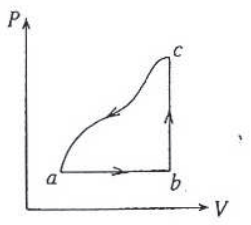
Which of the above situation/s could represent/s the strings vibrating at the same frequency?

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

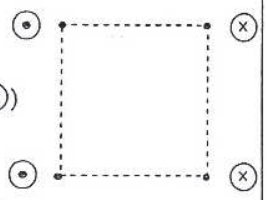
57. Figure shows a closed $P - V$ cycle for an ideal gas. The change in internal energy along path ca is -160 J.

The heat transferred to the gas is 200 J along path ab, and 40 J along path bc. The work done by the gas along path ab is

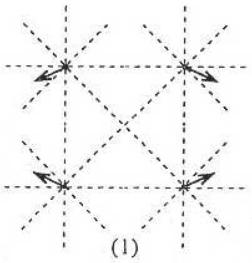
(1) 80 J (2) 100 J (3) 280 J
(4) 320 J (5) 400 J

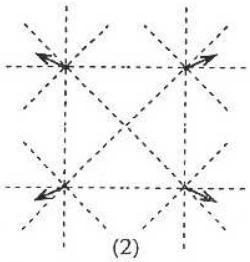


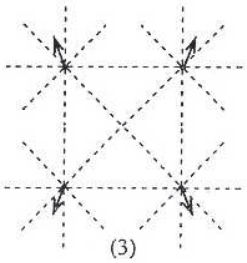
58. Four long, parallel, straight wires run normal to the plane of the paper through vertices of a square as shown in the figure.

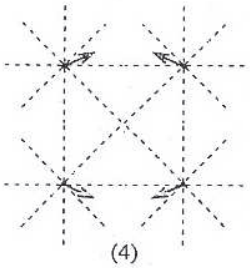


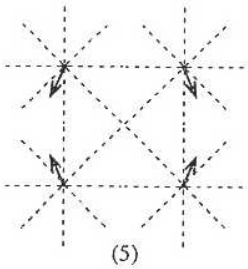
If currents of equal magnitude are set up in the wires along the directions (⊙ or ⊗) shown, and if the wires are free to move, the arrows in which of the following diagrams correctly represent the directions that the wires will tend to move?


(1)

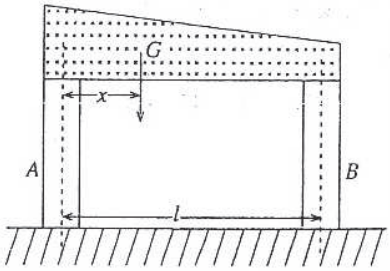

(2)


(3)


(4)


(5)

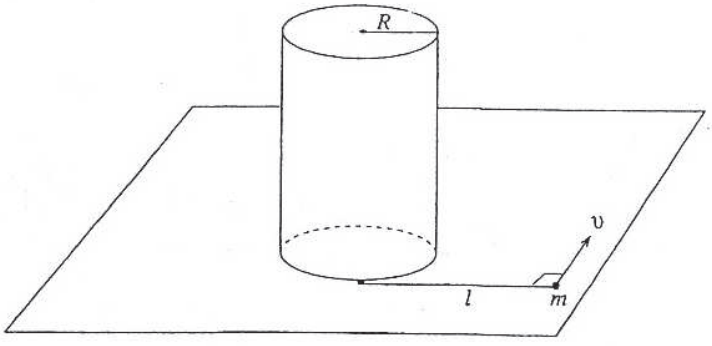
59. A and B are two iron columns with exactly the same length. A has a square cross-section of side length a, while B has a circular cross section of diameter a. One end of both A and B are firmly fixed on horizontal ground. A non-uniform concrete beam is placed over two columns as shown in figure. If the lower side of the concrete beam remains horizontal, the distance x to the centre of gravity of the beam from the axis of A is given by, $(a << l)$



(1) $x = \frac{4l}{(\pi+4)}$ (2) $x = \frac{2l}{(\pi+1)}$ (3) $x = \frac{l}{(\pi+1)}$

(4) $x = \frac{\pi l}{(\pi+1)}$ (5) $x = \frac{\pi l}{(\pi+4)}$

60. One end of a thin inelastic string of length l is attached to a small object of mass m resting on a frictionless horizontal surface and the other end is fixed to a point on the surface of a vertical cylindrical pillar of radius R, so that the string remains horizontal. A velocity v is given to the object, perpendicular to the string and along the surface as shown in the figure.



The angular velocity of the object around the axis of the pillar when it hits the pillar is

(1) 0 (2) $\frac{v}{R}$ (3) $\frac{v}{l}$ (4) $\frac{v}{\sqrt{R^2+l^2}}$ (5) $\frac{2v}{R}$

* * *