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முழுப் பதிப்புரிமையுடையது]
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இலங்கைப் பரீட்சைத் திணைக்களம் இலங்கைப் பரீட்சைத் திணைக்களம்
Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka
Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka

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අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2008 අගෝස්තු
கல்விப் பொதுத் தராதரப் பத்திர(உயர் தர)ப் பரீட்சை, 2008 ஓகஸ்ற்
General Certificate of Education (Adv. Level) Examination, August 2008

භෞතික විද්‍යාව I **பௌதிகவியல் I** **Physics I**	පැය දෙකයි இரண்டு மணித்தியாலங்கள் ***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 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*** (×) *on the number of the correct option in accordance with the instructions given on the back of the answer sheet.*

Use of calculators is not allowed.

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

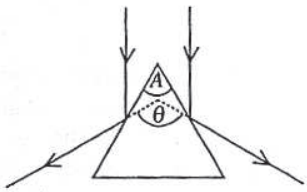
1. Dimensions of kilowatt-hour is

   (1) $[M][L]^2[T]^{-2}$ (2) $[M][L][T]^{-1}$ (3) $[M][L]^2[T]^{-3}$ (4) $[T]$ (5) $[T]^{-1}$

2. Consider the following statements made regarding the action force and the reaction force.
   (A) They are equal in magnitude.
   (B) They act on the same object.
   (C) They are opposite in direction to each other.

   Of the above statements,
   (1) only (A) 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.

3. A parallel beam of light is incident on a prism as shown in the figure. The angle θ between the two reflected beams is equal to



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

4. When the tension in a guitar string is doubled without changing its length the frequency of a given tone will
   (1) increase by a factor of 2. (2) decrease by a factor of 2.
   (3) increase by a factor of $\sqrt{2}$. (4) decrease by a factor of $\sqrt{2}$.
   (5) be the same.

5. A mass attached to one end of a vertical spring whose other end is fixed to a ceiling, is made to execute simple harmonic motion with amplitude a and maximum speed v. When the amplitude of the motion is increased to $2a$, the maximum speed will become

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

6. Two ideal gases A and B having same value for the ratio of principal specific heat capacities are kept at the same temperature. Mass of a molecule of gas A is four times the mass of a molecule of gas B.

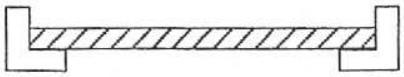
The ratio $\frac{\text{velocity of sound in gas } A}{\text{velocity of sound in gas } B}$ is equal to

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

7. A box of mass 5 kg is placed on a horizontal surface. The coefficient of static friction between the box and the surface is 0.3. If a horizontal force of 10 N is applied to the box, the magnitude of the frictional force acting on the box will be

(1) 1.5 N (2) 3 N (3) 4.5 N (4) 10 N (5) 15 N

8. A steel (Young's modulus = E, linear expansivity = α) beam of cross-sectional area A is clamped between two concrete supports as shown in the figure. When the temperature of the beam rises by ΔT, the force that must be exerted by the concrete supports to each end of the beam, in order to keep the beam without expanding is given by



(1) $AE\,\alpha\,\Delta T$ (2) $\frac{AE}{\alpha\Delta T}$ (3) $\frac{AE\alpha}{\Delta T}$ (4) $\frac{AE\,\Delta T}{\alpha}$ (5) $E\alpha\,\Delta T$

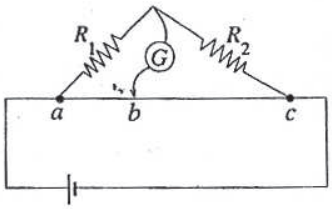
9. The two lowest values of the resistance that can be obtained by combining four 1 Ω resistors are

(1) 0.25 Ω and 1.0 Ω (2) 0.25 Ω and 1.33 Ω (3) 1 Ω and 2 Ω
(4) 1.2 Ω and 2.66 Ω (5) 1.33 Ω and 2.5 Ω

10. A galvanometer having an internal resistance of 200 Ω produces full-scale deflection when a current of 5 mA passes through it. In order to use this galvanometer as an ammeter which gives a full-scale deflection for 10 A, the approximate value of the external resistance needed, and the way in which it should be connected with the galvanometer are

(1) 0.2 Ω, in series. (2) 0.2 Ω, in parallel. (3) 2.0 Ω, in parallel.
(4) 0.1 Ω, in series. (5) 0.1 Ω, in parallel.

11. In the circuit shown ac is a uniform resistive wire of length 1 m. When the galvanometer reading is zero, the distance from point a to point b is 20 cm.



The ratio $\frac{R_1}{R_2}$ is

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

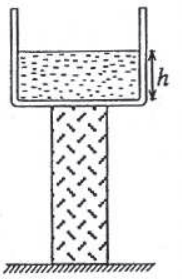
12. A heating element draws a current of 10 A when connected to 240 V power source. The wattage of the element is

(1) 2.4 W (2) 24 W (3) 240 W (4) 2.4 kW (5) 24 kW

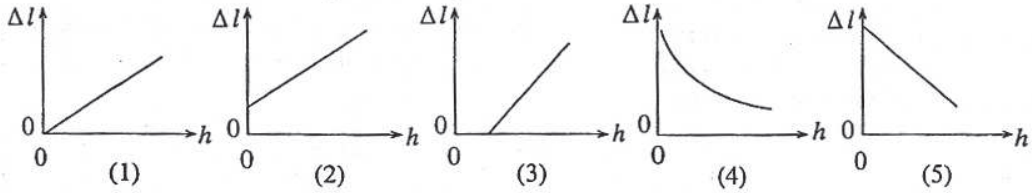
13. Blue and red light falling on a certain photocathode produce photoelectrons.
Which of the following statements is true?

(1) Maximum kinetic energy of the emitted photoelectrons is higher for blue light.
(2) Stopping potential is higher for red light.
(3) Work function of the material of the photocathode is higher for blue light.
(4) Number of emitting photoelectrons is **always** higher for blue light.
(5) Stopping potential is same for both colours.

14. A water tank is constructed on a steel pillar of original length l_0 and water is filled up to a height h as shown in figure.

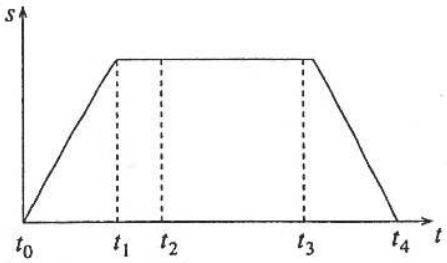


The variation of the compression (Δl) of the pillar from its original length with the height of water level h is best represented by



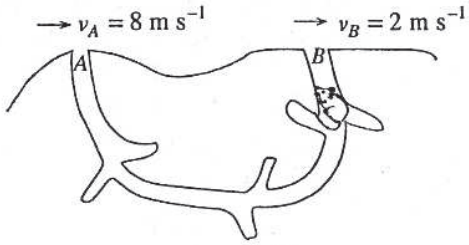
15. A blood vessel of length 0.1 m has a radius of 1.0×10^{-3} m. Blood of viscosity 3.0×10^{-3} Pa s flows through the vessel at a rate of $1.0\times10^{-7}\text{m}^3\text{s}^{-1}$. The pressure difference between the two ends of the vessel is (take $\pi = 3$)
(1) 80 Pa (2) 8 Pa (3) 0.8 Pa (4) 0.5 Pa (5) 0.1 Pa

16. Figure shows displacement (s) versus time (t) curve for a motion of a particle. Consider the following statements made about its motion.
(A) During the time period t_0-t_1 the particle moves at a constant acceleration and during t_2-t_3, it moves at a constant velocity.
(B) Particle comes to rest at time t_4.
(C) During the time period t_0-t_4, the total distance travelled by the particle is equal to the area under the $s-t$ curve.



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

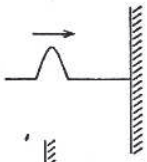
17. Figure shows a burrow of some animals living underground. The animals maintain the shapes of two entrances A and B to the burrow different from each other and because of this, air (density 1.3 kg m^{-3}) blows past the openings at different speeds of 8 m s^{-1} and 2 m s^{-1} as shown in the figure. If the openings are at the same level, the difference in air pressure between the openings and the direction of the air-movement in the burrow are,

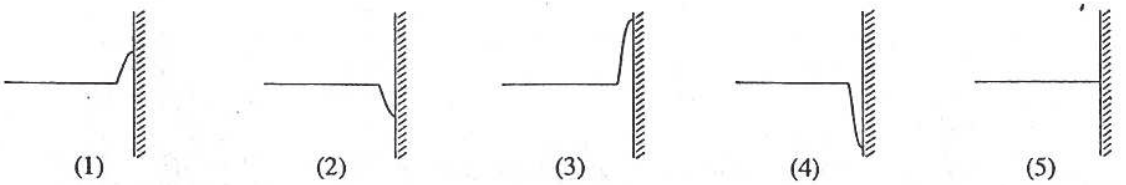


(1) 78 Pa and from B to A. (2) 78 Pa and from A to B.
(3) 39 Pa and from B to A. (4) 39 Pa and from A to B.
(5) 3.9 Pa and from B to A.

18. Both nodes and antinodes of a standing wave of period T have zero vertical displacements at time t_0. This will happen next at time
(1) $t_0+\frac{T}{4}$ (2) $t_0+\frac{T}{2}$ (3) $t_0+\frac{3T}{4}$ (4) t_0+T (5) $t_0+\frac{3T}{2}$

19. A symmetrical pulse shown in the figure is moving along a string towards a rigid boundary. Which of the following figures correctly shows the resultant pulse at the instant when exactly half of the pulse is reflected from the rigid boundary?

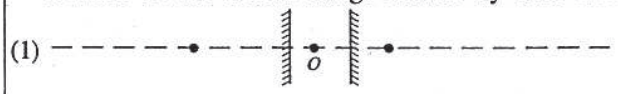


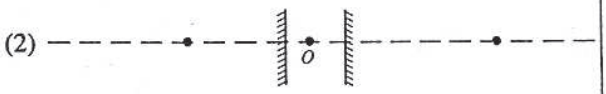


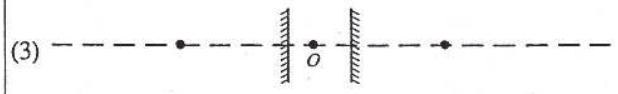
20. A box rests on the floor of an elevator. If the magnitudes of the minimum force required to slide the box on the floor when the elevator is stationary, accelerating upward, and accelerating downward are F_1, F_2 and F_3 respectively, then
(1) $F_2 > F_1 > F_3$ (2) $F_1 > F_2 > F_3$ (3) $F_3 > F_2 > F_1$ (4) $F_1 > F_3 > F_2$ (5) $F_1 = F_2 = F_3$

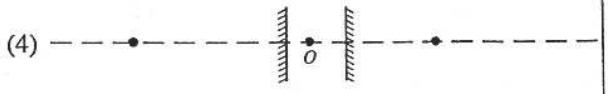
21. The far point of a near sighted eye is 50 cm, in front of the eye. To see clearly objects at infinity a lens is worn 2 cm in front of the eye. The lens should be a
(1) converging lens with a focal length of 50 cm.
(2) converging lens with a focal length of 48 cm.
(3) diverging lens with a focal length of 52 cm.
(4) diverging lens with a focal length of 50 cm.
(5) diverging lens with a focal length of 48 cm.

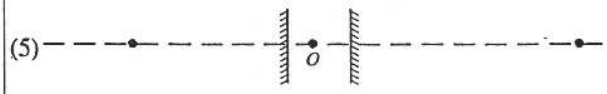
22. A point object O is placed between two parallel plane mirrors. Which of the following diagrams shows the location of the second image formed by each mirror?

(1) 

(2) 

(3) 

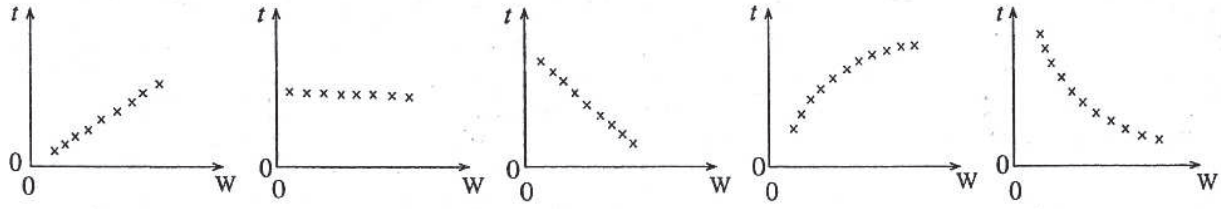
(4) 

(5) 

23. The planet Mars subtends an angle of 8.0×10^{-5} rad at an unaided eye. When Mars is viewed using an astronomical telescope in normal adjustment it subtends an angle of 2.4×10^{-3} rad at the eye. If the focal length of the eyepiece is 0.03 m, the focal length of the objective is

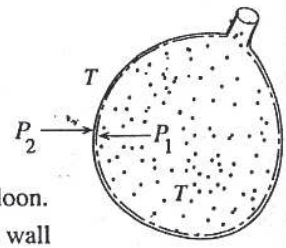
(1) 0.001 m (2) 0.01 m (3) 0.5 m (4) 0.9 m (5) 1.0 m

24. A set of identical kettles are fitted with heating coils of different wattages. If the kettles are used to boil same amount of water, which of the following curves best represents the variation of the time (t) that is required to raise the temperature of water up to its boiling point, with wattage (W) of the coils.



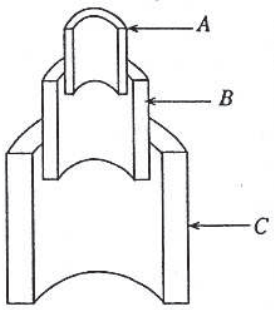
(1) (2) (3) (4) (5)

25. Consider a rubber balloon filled with air. Inside and outside pressures of the balloon are P_1 and P_2 respectively, and temperatures on either side remain the same. Which of the following statements is true?



(1) $P_1 = P_2$ as the temperatures on either side remain the same.
(2) $P_1 > P_2$ due to higher mean speeds of air molecules inside the balloon.
(3) $P_1 > P_2$ due to higher mean kinetic energy of air molecules inside the balloon.
(4) $P_1 > P_2$ due to higher rate of collisions of air molecules inside with the wall of the balloon.
(5) $P_1 > P_2$ due to lower mean kinetic energy of air molecules inside the balloon.

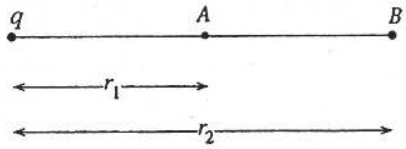
26. Figure shows a cross-sectional view of three hollow cylinders A, B and C made from different materials, lead, brass and steel. They barely fit one another at room temperature. If the cylinders are heated the cylinder C falls off, while cylinder A becomes tightly wedged to cylinder B.



If $\alpha_{lead} > \alpha_{brass} > \alpha_{steel}$, A, B and C cylinders are likely to be made of

	A	B	C
(1)	brass	lead	steel
(2)	steel	lead	brass
(3)	brass	steel	lead
(4)	steel	brass	lead
(5)	lead	brass	steel

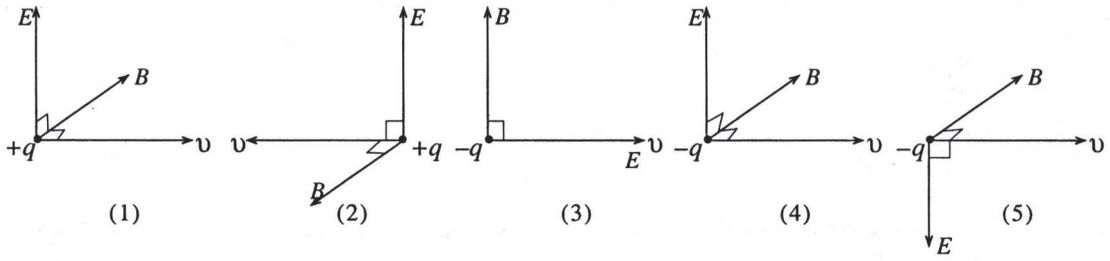
27. A point charge q_0 moves under the influence of the electric field created by another stationary point charge q. The change in the kinetic energy of q_0 when it moves from A to B is



(1) $\frac{qq_0}{4\pi\varepsilon_0}\left(\frac{1}{r_1}+\frac{1}{r_2}\right)$ (2) $\frac{qq_0}{4\pi\varepsilon_0}\left(\frac{1}{r_1}-\frac{1}{r_2}\right)$ (3) $\frac{qq_0}{4\pi\varepsilon_0}(r_1+r_2)$ (4) $\frac{qq_0}{4\pi\varepsilon_0}\left(\frac{1}{r_1^2}-\frac{1}{r_2^2}\right)$ (5) $\frac{q_0^2}{4\pi\varepsilon_0}\left(\frac{1}{r_1}+\frac{1}{r_2}\right)$

[see page five]

28. **The following figures shown the manner which two +q and -q chargers moving with a uniform velocity entering into a uniform electric field E and a uniform magnetic field B. E and B vectors are always perpendicular to each other while V vector is positioned either perpendicular to E and B or parallel to E. Which of the following orientaion allows the charge to move without changing its direction?**



29. **A spherical liquid dro has on electric capacity of C_1 while that of another drop made by the same liquid is C_2. If an one spherical drop is formed by combining these two drops, teh capacit of the newly formed drop is,**

(1) $C = C_1 + C_2$ (2) $C = \frac{C_1 C_2}{C_1 + C_2}$ (3) $C = \left(C_1^3 + C_2^3\right)^{\frac{1}{3}}$

(4) $C = \left(C_1^2 + C_2^2\right)^{\frac{1}{2}}$ (5) $C = \left(C_1 C_2\right)^{\frac{1}{2}}$

30. **Two sound systems A and B emitts sound with intencity levels of 90dB and 95dB respectively. If the respective intencities are I_A and I_B, the ratio I_A/I_B is equal to,**

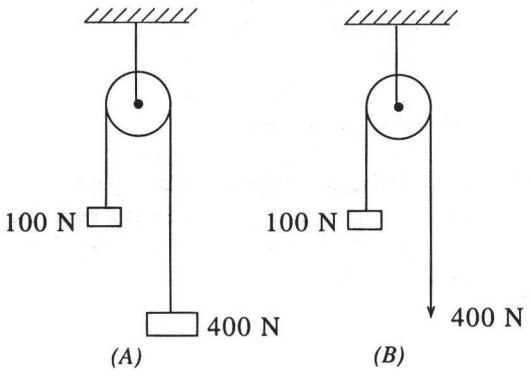
(1) 500 (2) 100 (3) $\sqrt{50}$ (4) $\sqrt{10}$ (5) $\sqrt{5}$

31. **When a ball of mass 0.1 kg is verticaly projected up in a vacuum, it reaches to a maximum height of 5 m. When that ball is projected up in air with that same velocity, it reaches to a maximum height of 2m. The average velocity of the resistive force which acts on the ball by air is,**

(1) 1.5 N (2) 1.25 N (3) 1.0 N (4) 0.75 N (5) 0.5 N

32. **Figure (A) shows two blocks of weight 100N and 400N which are connected by a light string that passes over a friction less pulley. Figure (B) shows a situation where the heavier block in the system is removed and the string is pulled by a downward force of 400N. The respective accelerations of the 100N block in the two situations are given by**

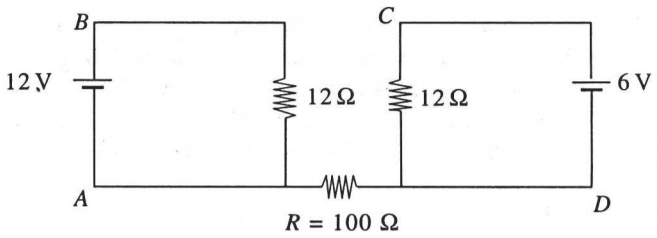
(1) 0.6 m s^{-2} and 3 m s^{-2}
(2) 6 m s^{-2} and 6 m s^{-2}
(3) 10 m s^{-2} and 10 m s^{-2}
(4) 6 m s^{-2} and 40 m s^{-2}
(5) 6 m s^{-2} and 30 m s^{-2}



33. **Two voltmeters A and B which are having internal resistances of 1500 Ω and 13500 Ω respectively are connected to a cell of e.m. force 10 V (a) in series and (b) in parallel. Which of the following shows the correct readings of voltages given by A and B.**

	(a) when A and B are series		(b) when A and B are parallel	
	reading of A (V)	reading of B (V)	reading of A (V)	reading of B (V)
(1)	10	10	10	10
(2)	1	9	10	10
(3)	10	10	9	10
(4)	9	10	1	9
(5)	1	9	9	10

34. **In the given circuit the batteries have negligible internal resistance. If the potentials at points A, B, C and D in the circuit is V_A, V_B, V_C and V_D respectively**



(1) $V_B - V_D = 18$ V

(2) $V_A \neq V_D$

(3) $V_B - V_C = \frac{6}{124}$ V

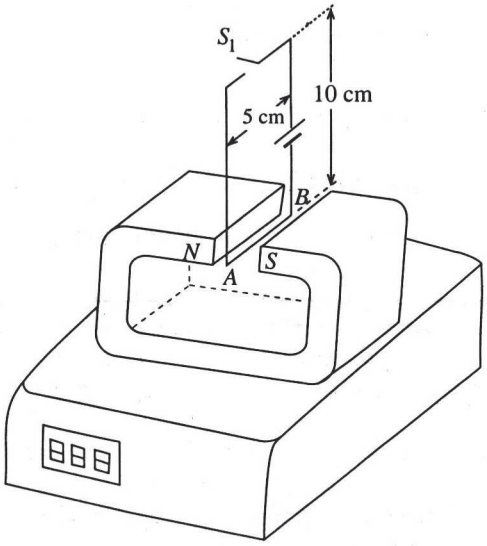
(4) $V_A - V_C = -6$ V

(5) $V_A - V_D = 0$ if and only if $R = 0$

35. **When a magnet is taken near 3 discs A, B, C which are rotating freely, having the same moment of inertia and the same angular velocities disc A comes to rest first, the disc B comes to rest and disc C rotates continously. What is correct from the below,**

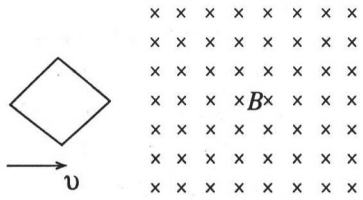
	Metal disc	Insulated metal disc	plastic disc
(1)	C	A	B
(2)	C	B	A
(3)	A	B	C
(4)	B	A	C
(5)	B	C	A

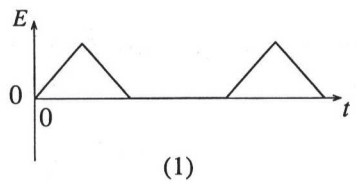
36. **A magnet having 1.0 T magnetic flux density between the poles is kept on a electronic balance. A battery of 40 V having zero internal resistance is connected to a 10Ω resistor containing rectangular wire loop, and the AB base of the loop is kept between the poles so that is totally inside the magnetic field. The plane of the loop is located perpendicularly to the magnetic field as given in the figure. And it is fixed rigular so that it cannot be moved. When the S_1 switch is closed. The reading of the electric balance.**



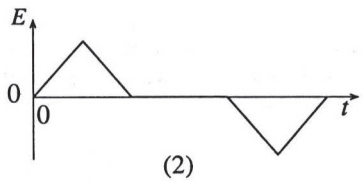
(1) Decreases by 200 g.
(2) Decreases by 20 g.
(3) Increases by 200 g.
(4) Increases by 20 g.
(5) No change occurs.

37. **As given in the figure a conducting wire having the shape of a parallelogram is inserted into a uniform magnetic field at a constant speed. The graph showing the correct variation of teh induced e.m.f. (E) of the loop with time (t) is,**

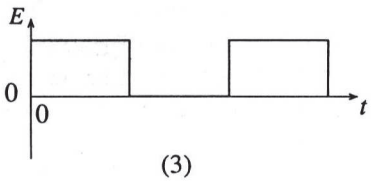




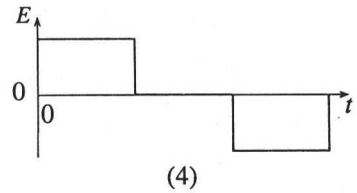
(1)



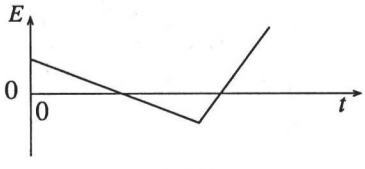
(2)



(3)



(4)



(5)

38. The temperature of a solar spot is 400 K while the surrounding temperature of the surface of sun is 6000 K. The ratio of, $\frac{\text{intencity of the solar spot}}{\text{surrounding temperature of the surface of the sun}}$ is equal to, (Assume that the surface emmisivity through out the surface of the sun is same)

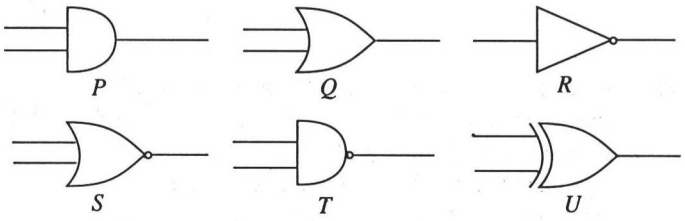
(1) $\frac{2}{3}$ (2) $\frac{1}{2}$ (3) $\frac{4}{9}$ (4) $\frac{8}{27}$ (5) $\frac{16}{81}$

39. When a β^- particle is emitted by a radio-active element, it converts into an atom of another element. A new element is formed like this due to,

(1) the emission of a proton from the nucleus of the radio-active element.
(2) the gaining of a neutron by the nucleus of the radio-active element.
(3) the proton in the nucleus of the radio active element is converted to a neutron.
(4) the neutron in the nucleus of the radio active element is converted to a proton.
(5) the removal of an electron from an outer shell of the atom of the radio-active element.

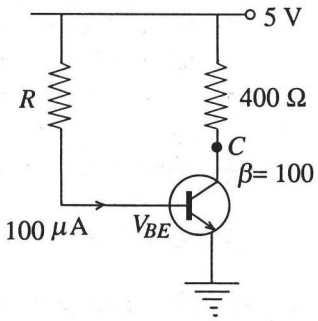
40. Which of the following two gates give binary 1 output when OO and 11 binar input combinations are given only to a circuit made by them ?

(1) *P* and *R* (2) *P* and *Q*
(3) *R* and *U* (4) *S* and *R*
(5) *T* and *Q*



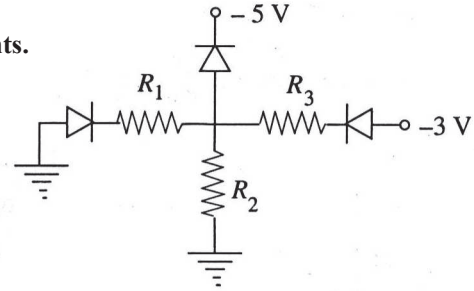
41. The base current of the given transistor is 100 μA while V_{BE} = 0.7 V in the circuit. If the current gain of the transistor is 100 voltage at C is,

(1) 0.1 V (2) 1 V (3) 2 V
(4) 4 V (5) 5 V



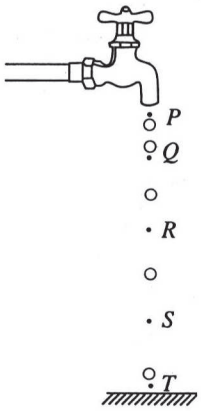
42. The R_1 , R_2 and R_3 given in the circuit are in kilohm amounts. A considered current.

(1) can present only across R_1 and R_3
(2) can present only across R_2 and R_3
(3) can present only across R_1 and R_2
(4) can present across all R_1 , R_2 and R_3
(5) cannot present across any resistor.

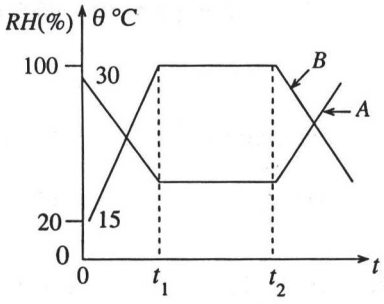


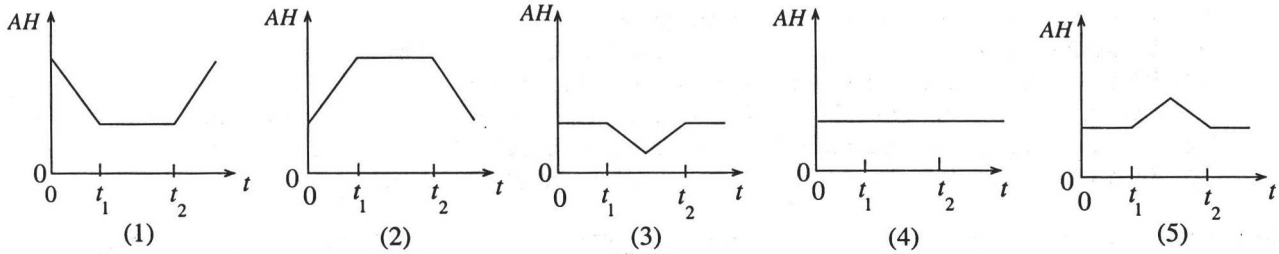
43. In the given figure, water drops are falling in a uniform rate. The point which can be considered to act the centre of gravity of the water drop system in the air is,

(1) *P* (2) *Q* (3) *R*
(4) *S* (5) *T*

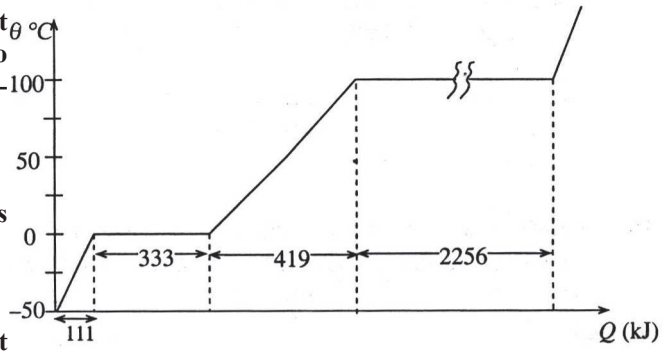


44. As given in the figure, when the temperature (θ) of a closed room is ratied with (+) according to the vurve A, the variation of relative humidity (RH) with time (t) changed according to the curve B. The correct graph which shows the variation of the absolute humidity (AH) of the room with time (t) is,



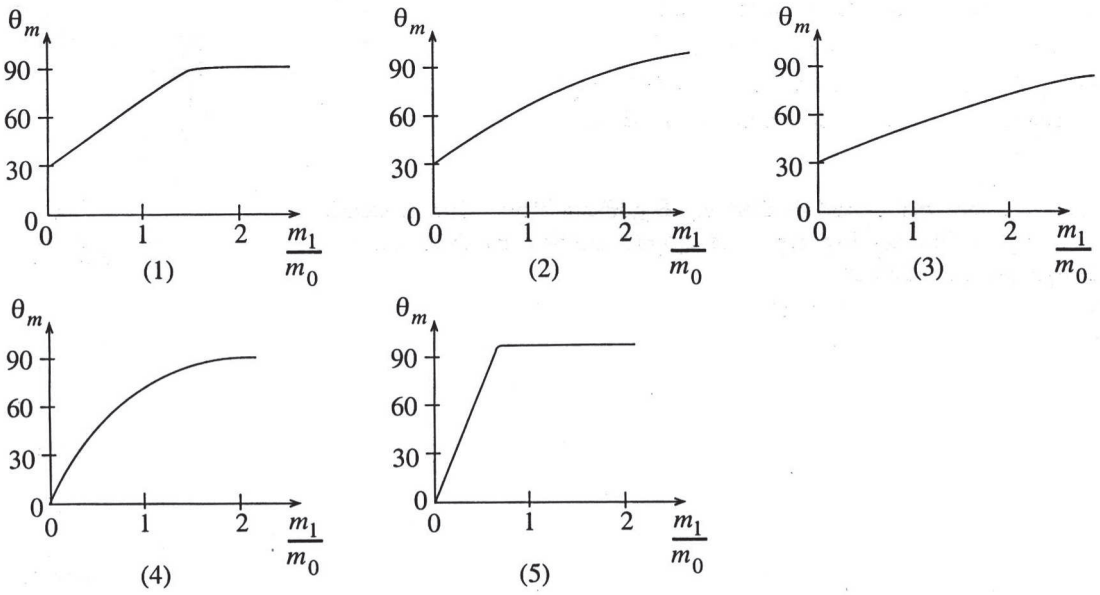


45. The amount of heat Q (in kJ) absorbed in different occasions. When ice of 1 kg is heated from - 50 ^{0}C to 100 ^{0}C is given in the figure. The incorrect statement is,

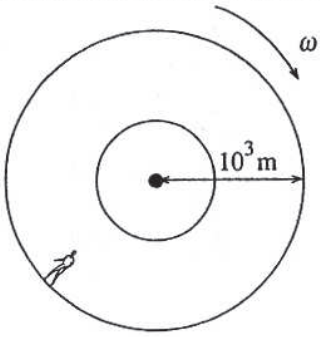


(1) The specific latent heat of fusion of ice is 333×10^3 Jkg^{-1}.
(2) The specific latent heat of vaporization of water is 2256×10^3 Jkg^{-1}.
(3) The specific heat capacity of ice is 1110 Jkg^{-1} ^{0}C^{-1}.
(4) The specific heat capacity of ice is lesser than that of water.
(5) The specific heat capacity of water is 4190 Jkg^{-1} ^{0}C^{-1}.

46. Inside a container having a neglegible heat capacity m_0 mass of water is present at 100 m temperature 30 ^{0}C. When m_1 mass of water at 100 ^{0}C is added to the container the maximum temperature of the mixture is θ_m. (Neglecting the heat loss) The correct variation of m_1/m_0 with θ_m is,

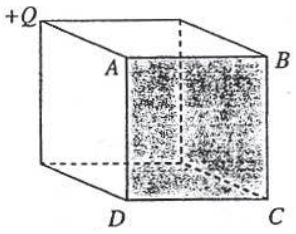


47. Figure shows a space colony of radius 10^3 m, rotating about its axis. At what angular speed (ω) must the space colony be rotated so that an astronaut standing on the floor of the colony experiences a push on his feet that equals his weight on the Earth?



(1) 0.1 rad s^{-1} (2) 1 rad s^{-1} (3) 2 rad s^{-1}
(4) 5 rad s^{-1} (5) 10 rad s^{-1}

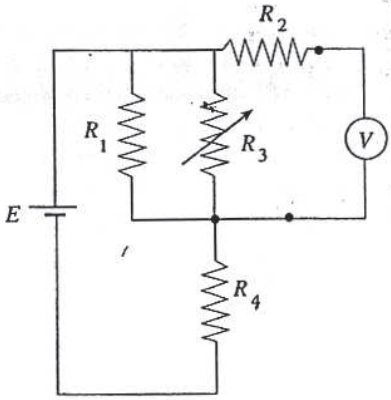
48. A point charge $+Q$ is placed at one of the corners of a cube as shown in the figure. The electric flux through the surface $ABCD$ of the cube due to the charge is



(1) $Q\left(\text{or}\frac{Q}{\varepsilon_0}\right)$ (2) $\frac{Q}{4}\left(\text{or}\frac{Q}{4\varepsilon_0}\right)$ (3) $\frac{Q}{6}\left(\text{or}\frac{Q}{6\varepsilon_0}\right)$
(4) $\frac{Q}{24}\left(\text{or}\frac{Q}{24\varepsilon_0}\right)$ (5) $\frac{Q}{36}\left(\text{or}\frac{Q}{36\varepsilon_0}\right)$

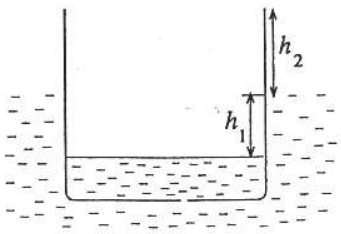
49. A radio is powered by six 1.5 V batteries, connected in series, whose internal resistance can be neglected. A single battery can provide a charge of 9600 C. If the batteries treat the radio as a resistance of 270 Ω at a certain sound level, the number of hours the radio can be operated at this sound level is
(1) 60. (2) 80. (3) 90. (4) 240. (5) 480.

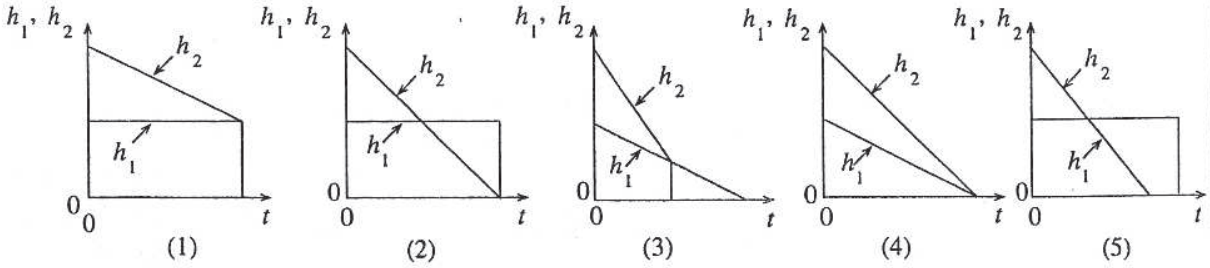
50. In the circuit shown E represents the e.m.f of a cell of negligible internal resistance. R_1, R_2 and R_4 are finite resistances. V is an ideal voltmeter connected across a variable resistance R_3. If the value of R_3 varies from zero to infinity, which of the following terms correctly predicts the readings of V when $R_3 = 0$ and $R_3 \to \infty$?



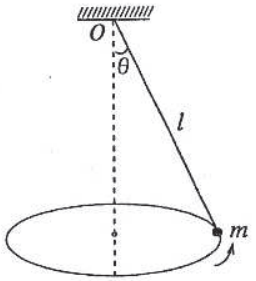
	When $R_3 = 0$	When $R_3 \to \infty$
(1)	0	$\left(R_4 + \frac{R_1R_2}{R_1+R_2}\right)E$
(2)	$\left(\frac{R_1}{R_1+R_4}\right)E$	$\left(\frac{R_4}{R_1+R_4}\right)E$
(3)	0	$\left(\frac{R_1}{R_1+R_4}\right)E$
(4)	$\left[\frac{R_1+R_2}{R_1+R_4}\right]E$	$\left(\frac{R_1}{R_1+R_4}\right)E$
(5)	0	$\left(R_1 + \frac{R_4R_2}{R_4+R_2}\right)E$

51. A thin walled cylindrical vessel is floating in a lake. At time $t = 0$, a small hole is made at the bottom of the vessel and water is allowed to flow into the vessel at a constant rate so that the vessel immerses with a constant velocity. If h_1 is the difference in heights of the water levels inside and outside the vessel and h_2 is the height of the brim above the outside water level at time t, which of the following curves best represents the variation of the heights h_1 and h_2 with time (t) until the vessel is fully immersed?





52. A small object of mass m is suspended by a string of length l, and is allowed to move in a horizontal circular path about the vertical axis passing through O, as shown in figure,

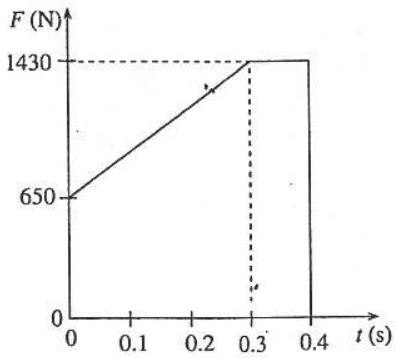


If the air resistance can be neglected, the speed of the object will be given by

(1) $\sqrt{lg\sin\theta\tan\theta}$ (2) $\sqrt{lg\sin\theta\cos\theta}$ (3) $\sqrt{lg\tan\theta}$

(4) $\sqrt{lg\sin\theta}$ (5) $\sqrt{lg\cos\theta}$

53. Figure shows the variation of the force (F) exerted by the floor on the feet with time (t) when a person jumps vertically upwards. The force (F) increases from a value which is equal to the person's normal weight of 650 N to 1430 N in 0.3 s, stays constant for 0.1 s, and then drops to zero as the feet lose contact with the floor. At what speed did the person leave the floor?



(1) $1\ m\ s^{-1}$ (2) $1.5\ m\ s^{-1}$ (3) $2\ m\ s^{-1}$

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

54. A source of sound (S), moving with velocity V_s, emits a sound wave of frequency f_0. An observer (O) moving with velocity V_0, as shown in the figure, determines the frequency of the sound as f'. Which of the following statement is true?



(1) If $V_s = 60\ m\ s^{-1}$ and $V_0 = 20\ m\ s^{-1}$ then $f' > f_0$

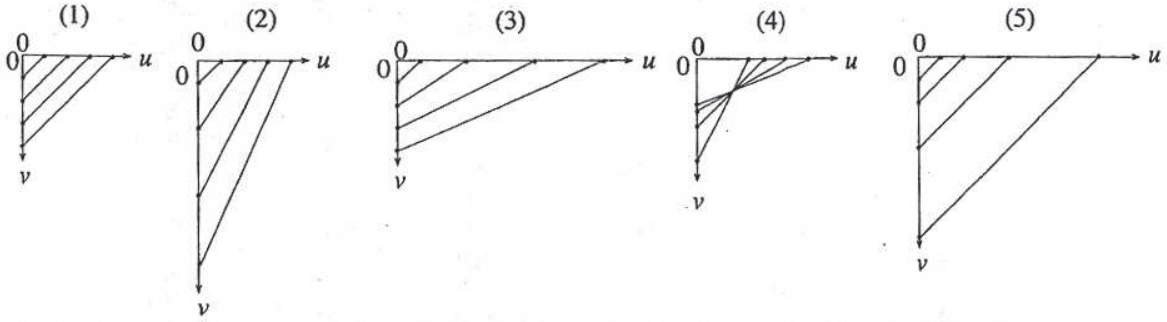
(2) If $V_s = 20\ m\ s^{-1}$ and $V_0 = 60\ m\ s^{-1}$ then $f' < f_0$

(3) If $V_s = -20\ m\ s^{-1}$ and $V_0 = -60\ m\ s^{-1}$ then $f' > f_0$

(4) If $V_s = -60\ m\ s^{-1}$ and $V_0 = -20\ m\ s^{-1}$ then $f' > f_0$

(5) If $V_s = 60\ m\ s^{-1}$ and $V_0 = -20\ m\ s^{-1}$ then $f' > f_0$

55. For real images produced by a convex lens, values of object distance (u) and image distance (v) are marked on the u-axis and v-axis respectively. Which of the following best represents the correct pattern when the corresponding u and v points are connected by straight lines?

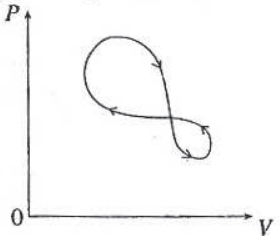


56. An ideal gas undergoes a cyclic process as shown in the figure. Consider the following statements.

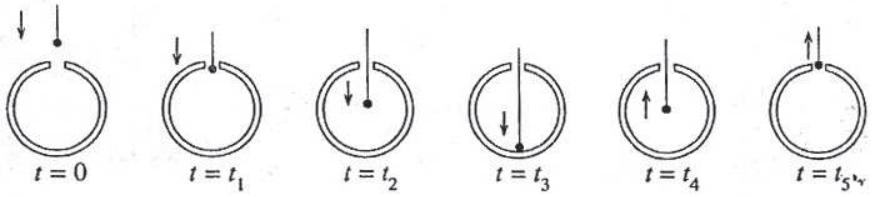
(A) Over a complete cycle a net work is done by the gas.
(B) Over a complete cycle a net heat goes out of the gas.
(C) The temperature of the gas remains unchanged throughout the cycle.

Of the above statements,

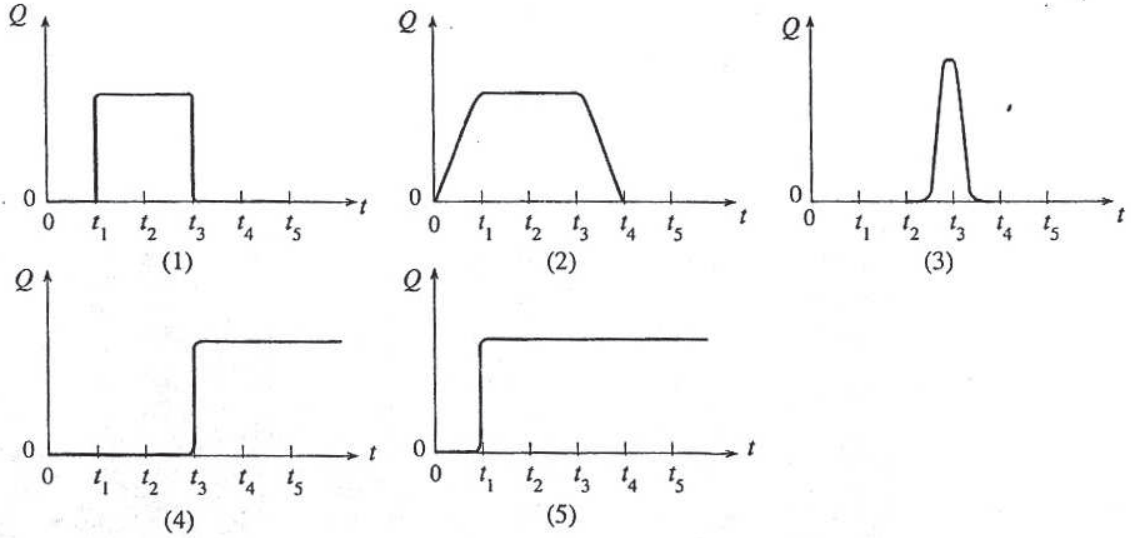
(1) only (A) is true.
(2) only (B) is true.
(3) only (A) and (B) are true.
(4) only (B) and (C) are true.
(5) all (A), (B) and (C) are true.



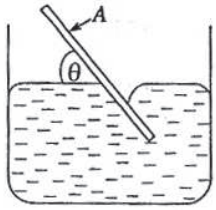
57. A small metal ball, suspended by a insulating thread and carrying a charge q is inserted gradually into an uncharged, conducting hollow sphere through a small hole until it touches the bottom and then it is removed in the same manner. Positions of the metal ball at different times $t = 0$, t_1, t_2, t_3, t_4 and, t_5 are shown in the figure.



Variation of the charge (Q) on the outer surface of the hollow sphere with time (t) is best represented by

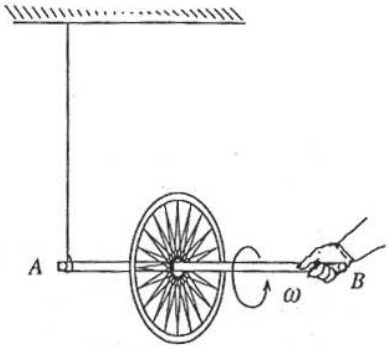


58. Figure shows a glass plate A dipped in a liquid. If the glass plate makes an angle θ with the horizontal, the angle of contact of the liquid with glass is



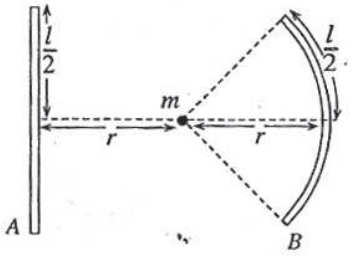
(1) 0
(2) θ
(3) $90° - \theta$
(4) $180° - \theta$
(5) $90° + \theta$

59. The figure shows a bicycle wheel, which is rotating with large angular velocity ω about the axle AB, hung from a string connected to the end A and holding from end B. If it is released from end B,



(1) the end B will fall down and the axle AB becomes vertical.
(2) the direction of AB remains unchanged.
(3) the axle will rotate about the vertical axis through A, while AB remains approximately horizontal.
(4) the end B will fall down and the wheel will start to oscillate like a pendulum.
(5) the end B will move upward first and then fall down and will start to oscillate like a pendulum.

60. A is a uniform metal rod of length l and mass M. The rod B is formed by bending another rod, which is identical to A, to form an arc of a circle of radius r. A point mass m has been placed in between A and B as shown in the figure.



If F_A is the magnitude of the gravitational force on m by A, and F_B is the magnitude of the gravitational force on m by B, then

(1) $F_A = F_B = \frac{GMm}{r^2}$
(2) $F_B < F_A = \frac{GMm}{r^2}$
(3) $F_A < F_B = \frac{GMm}{r^2}$
(4) $F_A < F_B < \frac{GMm}{r^2}$
(5) $F_B < F_A < \frac{GMm}{r^2}$

* * *