G.C.E. (Advanced Level) Examination - August 2008

PHYSICS - I

Two hours

Important :

- This question paper includes **60** questions in **07** pages.
- Enter your **Index Number** in the space provided on the answer sheet.
- **Answer all the questions.**
- 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.**

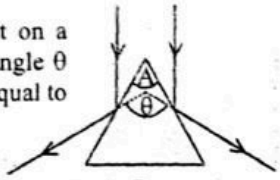
Use of calculators is not allowed.

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

01. 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) $[T]^{-1}$

02. 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.

03. 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

04. When the tension in a guitar string is doubled without changing its length the frequency of a give 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.

05. 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.

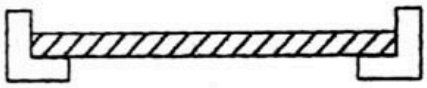
(1)4υ (2)2υ (3)υ (4) $\frac{\upsilon}{2}$ (5)$\frac{\upsilon}{4}$

06. Two ideal gases A and B having same value for the ratio of principal specific heat capacities are kept at the same tempera ture. 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

07. A box of mass 5kg 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 10N 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

08. A steel (Young' s modulus = E, linear expansivity = α) beam of cross sectional area A is clamped between two concrete sup ports 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



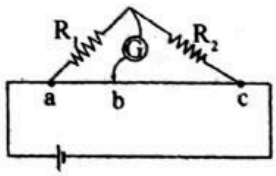
(1) $AE\alpha\Delta T$ (2) $\frac{AE}{\alpha\Delta T}$ (3) $\frac{AE\alpha}{\Delta T}$
(4) $\frac{AE\Delta T}{\alpha}$ (5) $E\alpha\Delta T$

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

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

10. A galvanometer having an internal resistance of 200Ω produces full-scale deflection when a current of 5mA passes through it. In order to use this galvanometer as an ammeter which gives a full-scale deflection for 10A, 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.

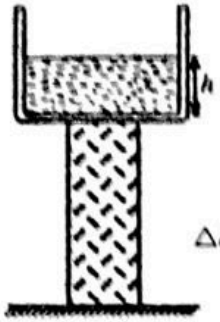
11. In the circuit shown ac is a uniform resistive wire of length lm. When the galvanometer reading is zero, the distance from point *a* to point *b* is 20 cm.
The ratio $\frac{R_1}{R_2}$ is



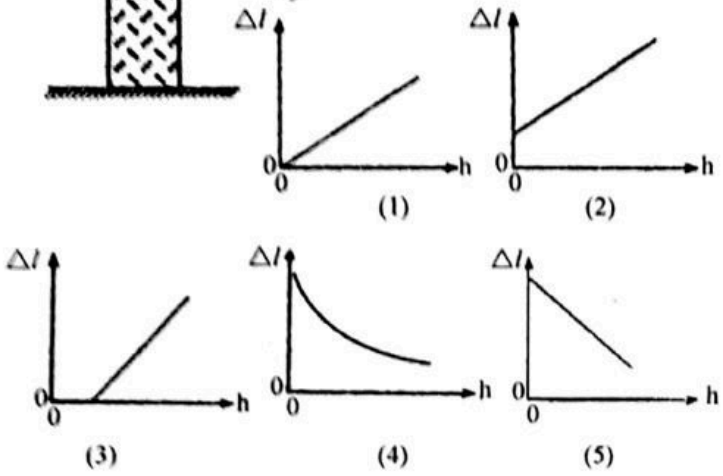
(1)5 (2)4 (3) $\frac{1}{4}$ (4) $\frac{1}{5}$ (5) $\frac{1}{10}$

12. A heating element draws a current of 10 A when connected to 240V powre 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.

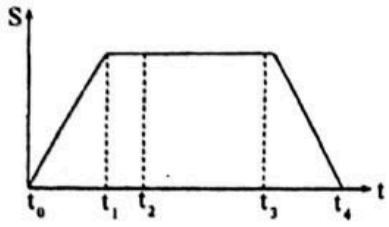
14. 

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



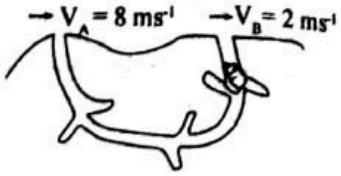
15. A blood vessel of length 0.1m has a radius of 1.0×10^{-3} m. Blood of viscosity 3.0×10^{-3} Pa s flows through the vessel at a rate of $1.0 \times 10^{-7} m^3 s^{-1}$. The pressure difference between the two ends of the vessel is (take $\pi = 3$)
(1) 80 Pa (2) 8 Pa (3) 0.8 Pa (4) 0.5 Pa (5) 0.1 Pa

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,

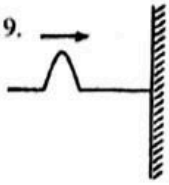


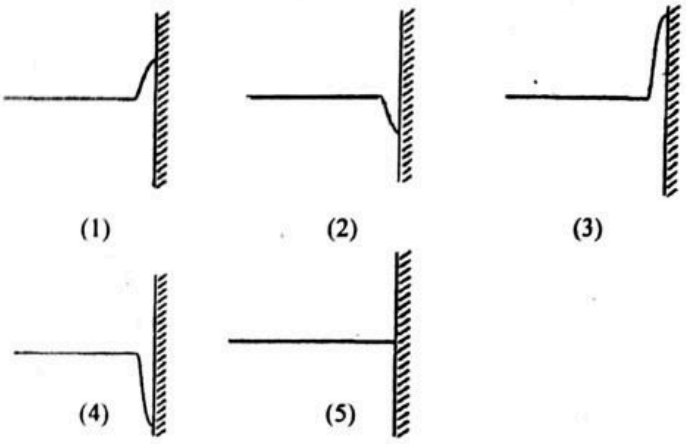
(1) only (A) is true (2) only (A) and (B) are true.
(3) only (B) and (C) are true. (4) all (A), (B) and (C) are true.
(5) all (A), (B) and (C) are **false.**

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 kgm-3) blows past the openings at different speeds of $8 ms^{-1}$ and $2 ms^{-1}$ 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?

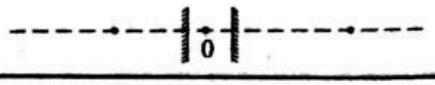


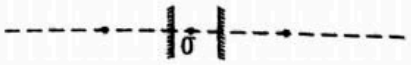
20. A box rests on the floor of an elevator. If the magnitudes of the minimum force required to slide the box on the floor when the elevator is stationary, accelerating upward, and accelerating downward are F_1, F_2 and F_3 respectively, then
(1) $F_2 > F_1 > F_3$ (2) $F_1 > F_2 > F_3$ (3) $F_3 > F_2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

21. The far point of a near sighted eye is 50cm, 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) 

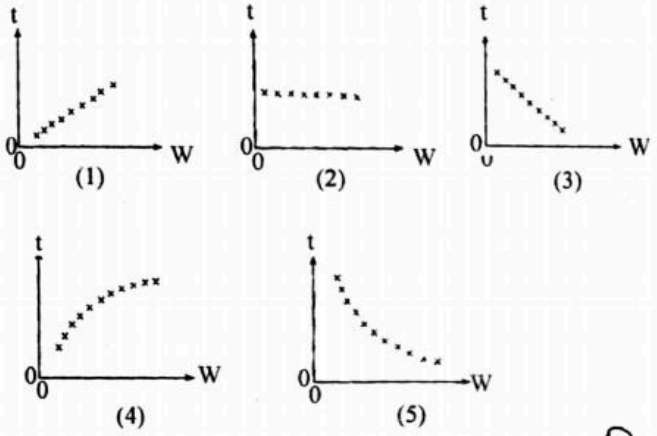
(3) 

(4) 

(5) 

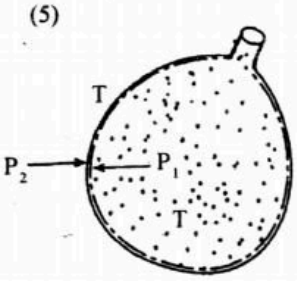
23. The planet Mars subtends as angle of 8.0×10^{-5} rad at an unaided eye. When Mars is viewed using an astronomical telescope in normal adjustment it subtends an angle of 2.4×10^{-3} rad at the eye. If the focal length of the eyepiece is 0.03m, the focal length of the objective is
(1) 0.001m (2) 0.01m (3) 0.5m (4) 0.9m (5) 1.0m

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.

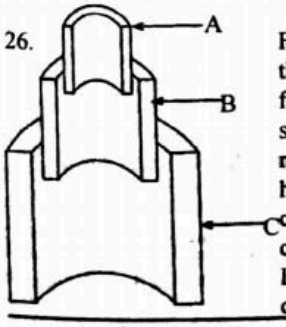
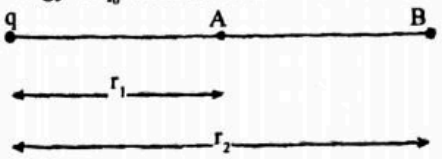
26. 

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

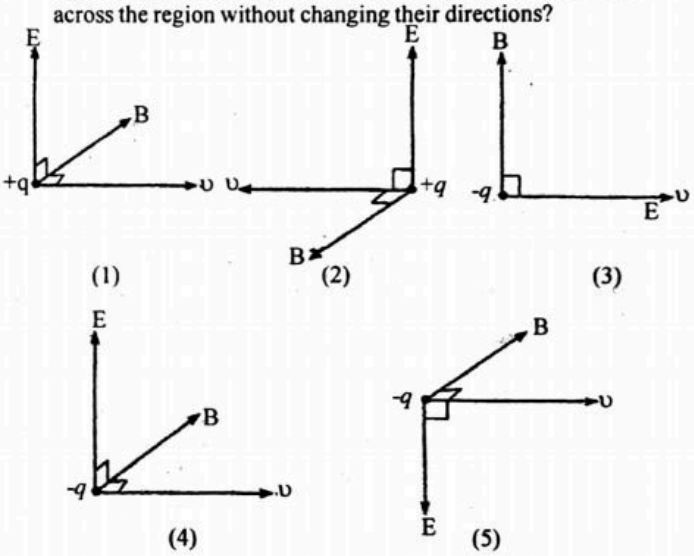
	A	B	C
(1)	brass	lead	steel
(2)	steel	lead	brass
(3)	brass	steel	lead
(4)	steel	brass	lead
(5)	lead	brass	steel

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

28. Diagrams below show situations where two charges +q and -q moving with a uniform velocity (υ) and separately entering five regions having a uniform electric field (E) and a uniform magnetic field (B). Vectors E and B are always perpendicular to each other, and the vector υ can be either perpendicular to E and b or parallel to E. Which of the following configurations may provide a possibility for charges to move across the region without changing their directions?



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

29. A spherical liquid drop has an electrical capacitance C_1 and another spherical drop made of the same liquid has a capacitance C_2. If these two liquid drops coalesce to form one spherical drop, the capacitance C of that drop is given by

(1) $C = C_1 + C_2$ (2) $C = \frac{C_1 C_2}{C_1 + C_2}$ (3) $C = (C_1^3 + C_2^3)^{\frac{1}{3}}$
(4) $C = (C_1^2 + C_2^2)^{\frac{1}{2}}$ (5) $C = (C_1 C_2)^{\frac{1}{2}}$

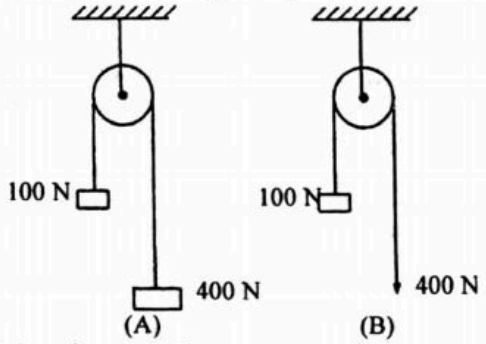
30. Two audio systems A and B produce sounds with intensity levels of 90dB and 95dB respectively. If the corresponding sound intensities are I_A and I_B respectively, the ratio of $\frac{I_B}{I_A}$ is equal to

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

31. When a ball of mass 0.1 kg is thrown vertically upward in a vacuum, it reaches a maximum height of 5.0m. When the ball is thrown upward with the same velocity in air it reaches a maximum height of 2.0m. The average resistive force exerted on the ball by the air is

(1) 1.5N (2) 1.25N (3) 1.0N
(4) 0.75N (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 frictionless 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



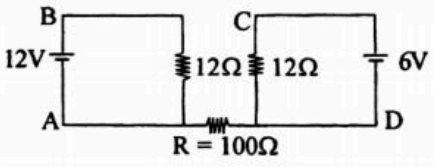
(1) 0.6 m s^{-2} and 3m s^{-2}
(2) 6ms^{-2} and 6ms^{-2}
(3) 10ms^{-2} and 10ms^{-2}
(4) 6ms^{-2} and 40ms^{-2}
(5) 6ms^{-2} and 30ms^{-2}

33. Two voltmeters A and B having internal resistances 1500Ω and 13500Ω respectively are connected (a) in series, and (b) in parallel with an ideal battery of e. m. f 10V. Which of the following correctly indicates the voltages read by A and B?

	(*a*) when A and (B) are in 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 circuit shown the batteries have negligible internal resistances. If V_A, V_B, V_C and V_D represent potentials at points A, B, C and D respectively of the circuit, then

(1) $V_B - V_D = 18$ V
(2) $R_A \neq V_D$
(3) $V_B - V_C = \frac{6}{124}$ V
(4) $V_A - V_C = -6$ V
(5) $V_A - V_D = 0$ only if R = 0

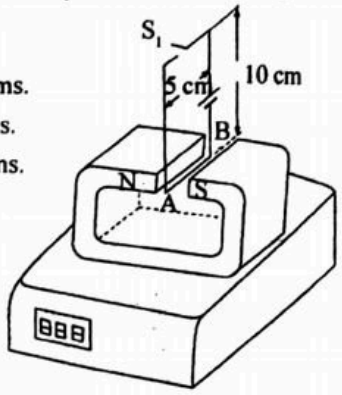


35. When a magnet is brought closer to three freely rotating discs A, B and C having same moment of inertia and same angular velocity, A is found to stop first followed by B, and C is found to rotate continuously. Which of the following is true?

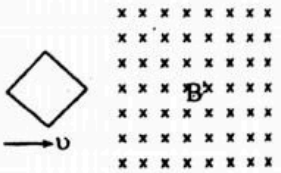
	Metal disc	Laminated metal disc	Plastic disc
(1)	C	A	B
(2)	C	B	A
(3)	A	B	C
(4)	B	A	C
(5)	B	C	A

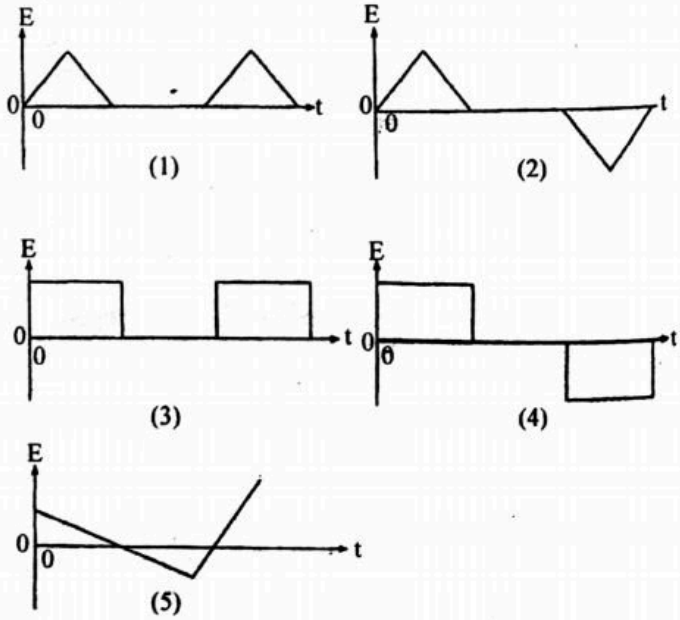
36. A magnet with magnetic flux density of 1.0 T between the poles is placed on an electronic balance. A rectangular wire loop of resistance 10Ω, which is connected to a 40V battery with zero internal resistance, is placed in between the poles of the magnet so that the side AB of the loop is completely inside the magnetic field and the plane of the loop is perpendicular to the magnetic field, as shown in the figure. The loop is firmly fixed to avoid any movement. When the switch S_1 is closed, the reading of the electronic balance.

(1) will decrease by 200 grams.
(2) will decrease by 20 grams.
(3) will increase by 200 grams.
(4) will increase 20 grams.
(5) will not change.



37. A conducting wire loop bent in the shape of a parallelogram enters a uniform magnetic field with a constant speed as shown in the figure. The variation of the induced e.m.f (E) in the loop with time (t) is best represented by





38. The temperature of a sunspot is 4000K while the surrounding solar surface is at 6000K. The ratio

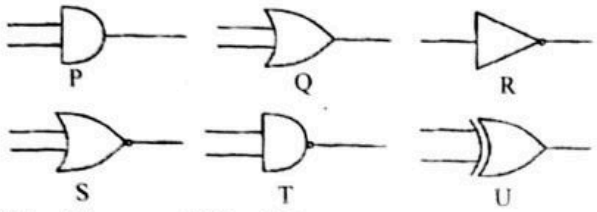
$$\frac{\text{The intensity of the sunspot}}{\text{The intensity of the surrounding solar surface}}$$

is (assume that the surface emissivity is the same throughout the sun's surface.)

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

39. When an atom of a radioactive element emits a β⁻ Particle, it is transformed into an atom of a different element. A different element is formed in this manner because,
(1) the nucleus of the radioactive element emits a proton.
(2) the nucleus of the radioactive element gains a neutron.
(3) a proton in the nucleus of the radioactive element changes into a proton.
(4) a neutron in the nucleus of the radioactive element changes into a proton.
(5) the radioactive atom emits one of its electrons from an outer orbit.

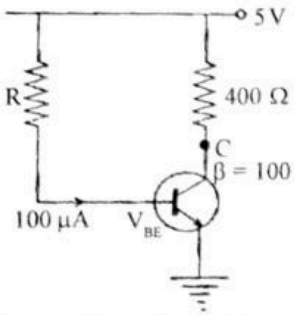
40. Which of the two gates shown can be combined to construct a circuit in order to obtain a binary output of 1 for input binary digit combinations of 00 and 11 only?



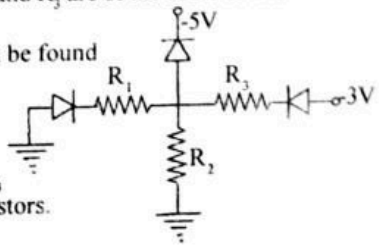
(1) P and R (2) P and Q (3) R and U
(4) S and R (5) T and Q

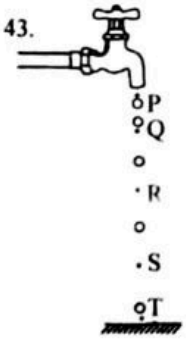
41. In the circuit shown base current to the transistor is 100μA, and V_{BE} = 0.7V. If the current gain of the transistor is 100, then the voltage at C is

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



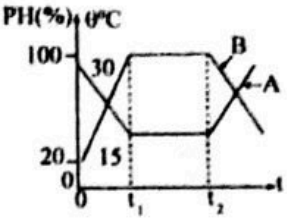
42. In the circuit shown R_1, R_2, and R_3 are of the order of a few kilo ohms.
An appreciable currents can be found
(1) only through R_1 and R_3
(2) only through R_2 and R_3
(3) only through R_1 and R_2
(4) through all R_1, R_2 and R_3
(5) through none of the resistors.

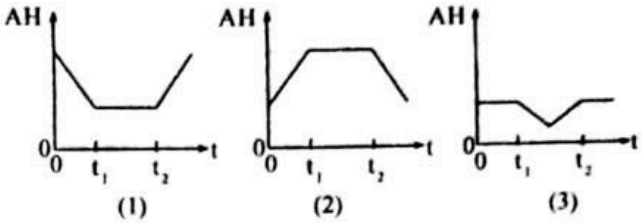


43. 

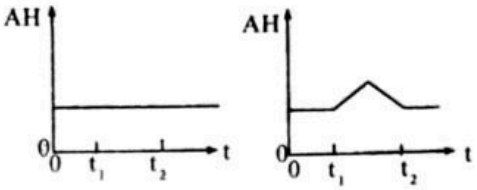
Water droplets drip at a constant rate from a tap as shown in the figure. The centre of gravity of the system of drops in the air is most likely to be found at
(1) P
(2) Q
(3) R
(4) S
(5) T

44. When the temperature (θ) of air inside a closed room is varied with time (t) according to the curve A shown in figure, its relative humidity (RH) is found to vary with time according to the curve (B). The corresponding variation of the absolute humidity (AH) of air inside the room with time (t) is correctly represented by



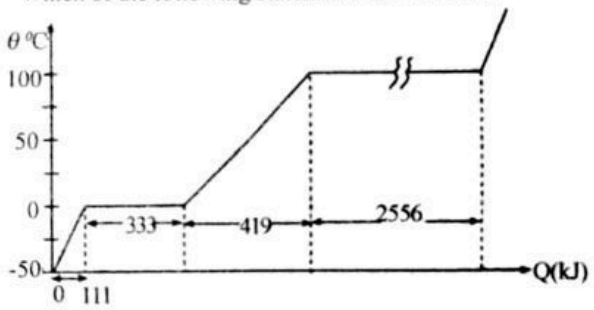


(1) (2) (3)



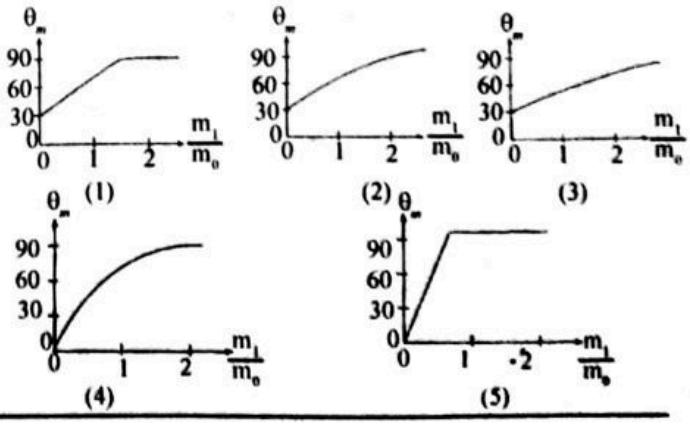
(4) (5)

45. The figure shows the amounts of heat, Q, (in kJ) absorbed by 1kg of ice under each of the states when it is heated from temperature - 50°C to 100°C.
Which of the following statements is **incorrect?**



(1) Specific latent heat of fusion of ice is $333 \times 10^3 Jkg^{-1}$.
(2) Specific latent heat of vaporization of water is $2256 \times 10^3 J\ kg^{-1}$
(3) Specific heat capacity of ice is $1110J\ kg^{-1}\ °C^{-1}$
(4) Specific heat capacity of ice is less than that of water
(5) Specific heat capacity of water is $4190J\ kg^{-1}\ °C^{-1}$

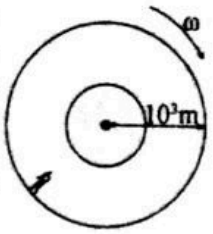
46. A vessel of negligible heat capacity contains water of mass m_0 at the room temperature of 30°C. when a mass m_1 of water at 100 °C is added to the vessel, the maximum temperature of the mixture becomes θ_m (neglect heat losses). The variation of θ_m with $\frac{m_1}{m_0}$ is best represented by



(1) (2) (3)

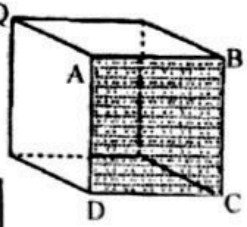
(4) (5)

47. Figure shows a space colony of radiue 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

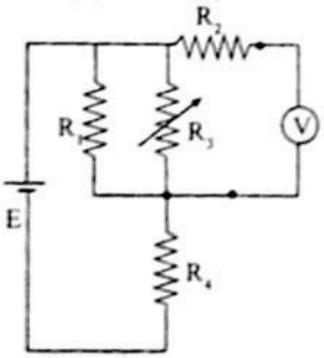


(1) $Q\left[\text{or } \frac{Q}{\varepsilon_0}\right]$ (2) $\frac{Q}{4}\left[\text{or } \frac{Q}{4\varepsilon_0}\right]$
(3) $\frac{Q}{6}\left[\text{or } \frac{Q}{6\varepsilon_0}\right]$ (4) $\frac{Q}{24}\left[\text{or } \frac{Q}{24\varepsilon_0}\right]$ (5) $\frac{Q}{36}\left[\text{or } \frac{Q}{36\varepsilon_0}\right]$

49. A radio is powered by six 1.5V 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 270Ω 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.

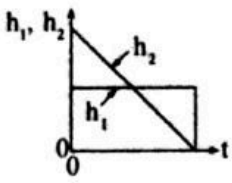
50. In the circuit shown E represents the e.m.f of a cell of negligible internal resistance. R_1, R_2 and R_4 are finite resistances. V is an ideal voltmeter connected across a variable resistance R_3. If the value of R_3 varies from zero to infinity, which of the following terms correctly predicts the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



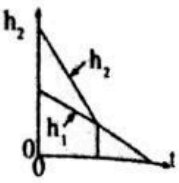
	When $R_3 = 0$	When $R_3 \to \infty$
(1)	0	$\left[R_4 + \frac{R_1 R_2}{R_1 R_2}\right]E$
(2)	$\left[\frac{R_1}{R_1+R_4}\right]E$	$\left[\frac{R_4}{R_1+R_4}\right]E$
(3)	0	$\left[\frac{R_1}{R_1+R_4}\right]E$
(4)	$\left[\frac{R_1+R_2}{R_1+R_4}\right]E$	$\left[\frac{R_1}{R_1+R_4}\right]E$
(5)	0	$\left[R_1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

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?

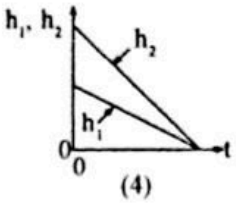
(1)



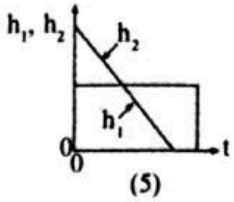
(2)



(3)

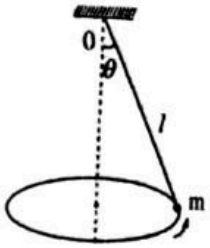


(4)



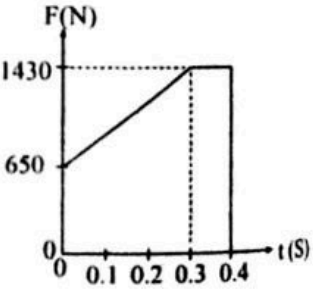
(5)

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 650N to 1430 N in 0.3s, stays constant for 0.1s, and then drops to zero as the feet lose contact with the floor. At what speed did the person leave the floor?



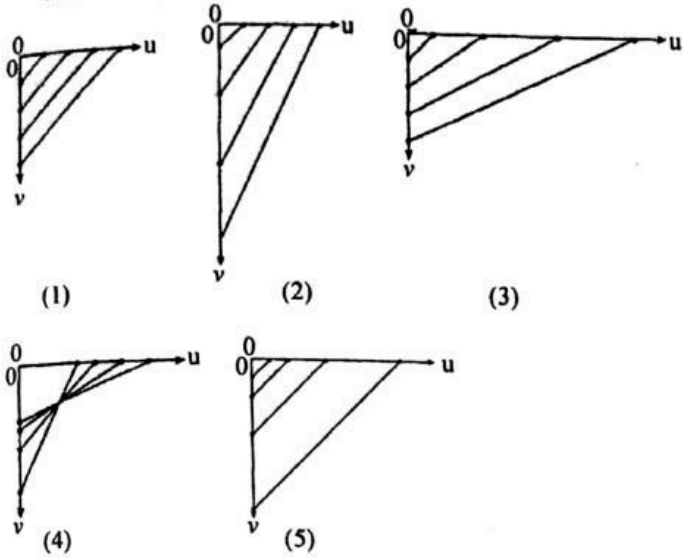
(1) 1ms^{-1} (2) 1.5ms^{-1} (3) 2ms^{-1}
(4) 3ms^{-1} (5) 10ms^{-1}

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 ms^{-1} and V_0 = 20 ms^{-1} then $f' > f_0$
(2) If V_s = 20 ms^{-1} and V_0 = 60 ms^{-1} then $f' < f_0$
(3) If V_s = -20 ms^{-1} and V_0 = -60ms^{-1} then $f' > f_0$
(4) If V_s = -60 ms^{-1} and V_0 = -20 ms^{-1} then $f' > f_0$
(5) If V_s = 60 ms^{-1} and V_0 = -20 ms^{-1} then $f' > f_0$

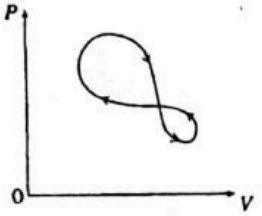
55. For real images produced by a convex lens, values of object distance (u) and image distance (v) are marked on the u-axis and v

- axis respectively. Which of the following best represents the correct pattern when the corresponding u and v points are connected by straight lines?

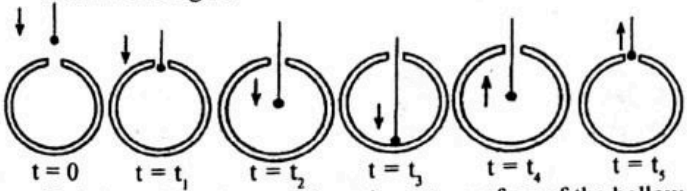


(1) (2) (3) (4) (5)

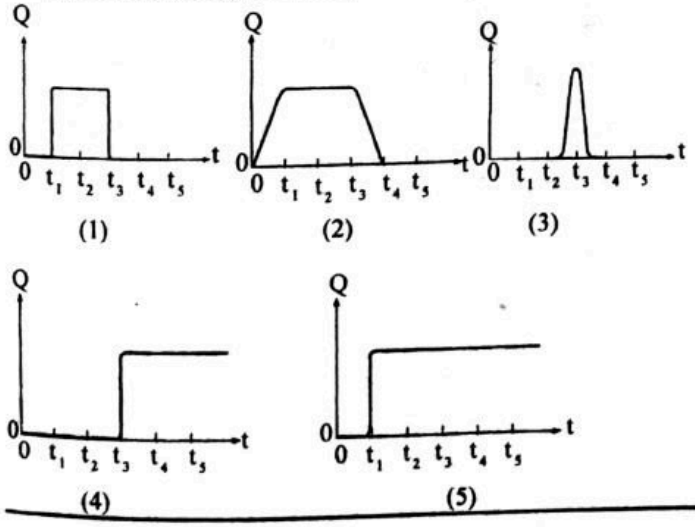
56. An ideal gas undergoes a cyclic process as shown in the figure. Consider the following statements.
(A) Over a complete cycle a net work is done by the gas.
(B) Over a complete cycle a net heat goes out of the gas.
(C) The temperature of the gas remains unchanged throughout the cycle.
Of the above 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 in is removed in the same manner. Positions of the metal ball different times t = 0, t_1, t_2, t_3, t_4 and t_5 are shown in the figure.

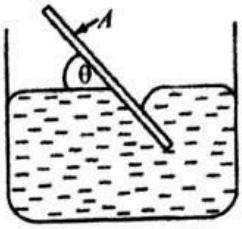


Variation of the charge (Q) on the outer surface of the hollow sphere with time (t) is best represented by

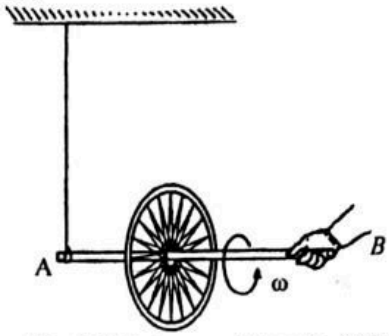


(1) (2) (3) (4) (5)

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) $90^0 - \theta$
(4) $180^0 - \theta$
(5) $90^0 + \theta$

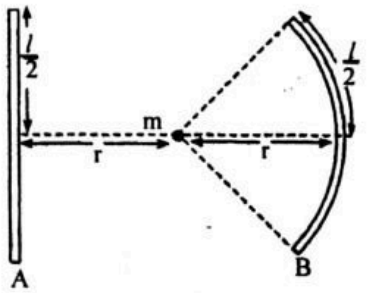


59. The figure shows a bicycle wheel, which is rotating with large angular velocity ω about the axle AB, hung from a string connected to the end A and holding from end B. If it is released from end B,



(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 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) $F_B < F_A < \frac{GMm}{r^2}$