



Royal College - Colombo 07

Grade 13

First Term test - April 2023

Physics I

01 E I

Time : 2 hours

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

Answer all questions.

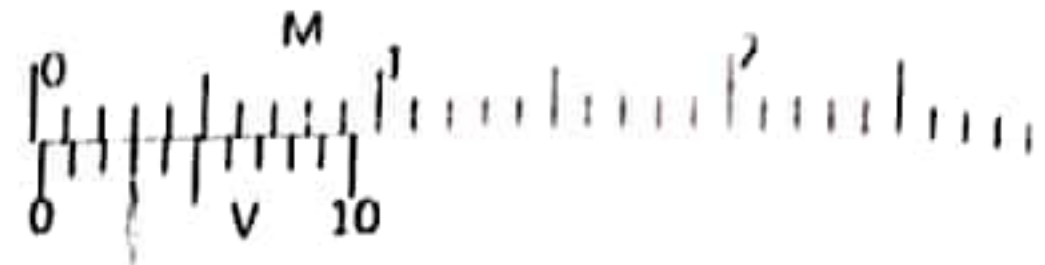
- (1) The unit of area expansivity is,  
 1)  $\text{K}^{-1}$       2)  $\text{K}^{-1} \text{m}^{-1}$       3)  $\text{K}^{-1} \text{m}^{-2}$       4)  $\text{K m}^{-1}$       5)  $\text{K m}^{-2}$
- (2) The dimensionally correct equation is given by  
 1)  $\frac{\text{Pressure}}{\text{Force}} = \text{Area}$       2)  $\frac{\text{Power}}{\text{Volume}} = \text{pressure}$   
 3)  $\frac{\text{Impulse}}{\text{Time}} = \text{momentum}$       4)  $\frac{\text{centripetal acceleration}}{\text{Force}} = \text{mass}$   
 5)  $\frac{\text{Electrical energy}}{\text{Impulse}} = \text{velocity}$
- (3) The variation of displacement (x) of an object of 100 g with time (t) is given by following equation.  

$$x = 6 \sin \left( 100t + \frac{\pi}{2} \right)$$
 displacement is measured in centi-meters.  
 The maximum kinetic energy is given by  
 1) 0.6 J      2) 1.8 J      3) 2.4 J      4) 3.6 J      5) 4.2 J
- (4) An object is dropped at 20 m height from the ground. It is exploded in to two identical parts at 15 m above from the ground and they reached to the ground at same time. The velocity of one part after the explosion is  $12.5 \text{ ms}^{-1}$ . The distance between two particles on the ground.  
 1) 5 m      2) 10 m      3) 15 m      4) 20 m      5) 25 m
- (5) The physical quantities which are not existed dimensions are  
 a. Relative density      b. Relative velocity  
 c. Angular displacement      d. co-efficient of friction  
 1) a and b only      2) a, b and c only      3) a, c and b only  
 4) a and d only      5) all a, b, c and d

22 A/L අයි [papers grp]



- (6) Following diagram shows the scale positions of a given Vernier caliper, when its external jaws are touched together. Least count of the caliper is 0.1 mm. The internal diameter of a hollow cylinder is measured by this caliper as 2.72 cm. The corrected reading is given by,

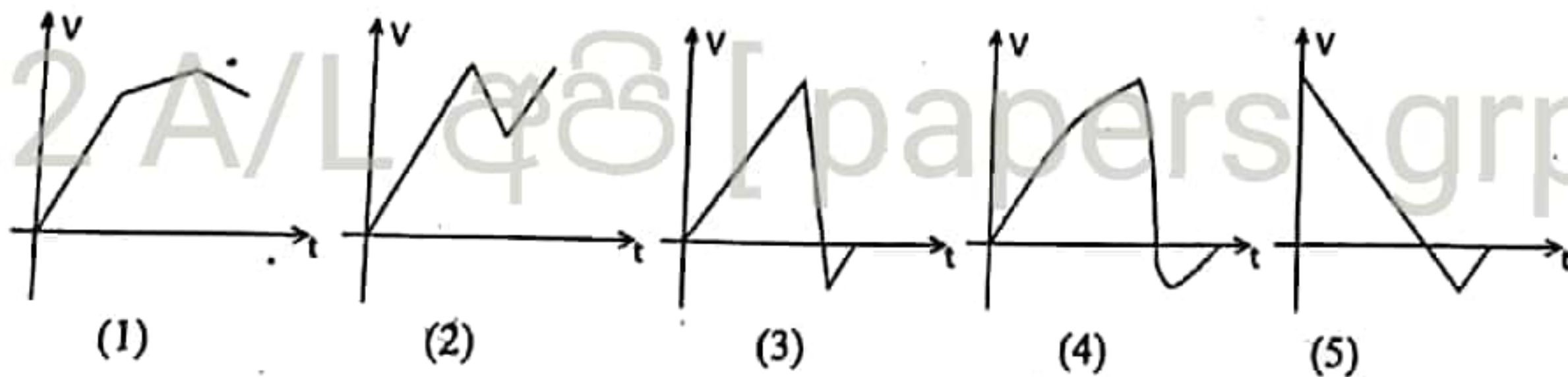


- 1) 2.69 cm      2) 2.75 cm      3) 2.79 cm  
4) 2.72 cm      5) cannot be determined

- (7) An object is moving along a linear path towards a given direction. In first  $\frac{3}{4}$  seconds it moves under  $u$  velocity and the next  $\frac{1}{4}$  seconds it moves under  $v$  velocity. The mean velocity of the object is,

- 1)  $\frac{uv}{u+v}$       2)  $\frac{u+v}{2}$       3)  $\frac{4uv}{v+3u}$       4)  $\frac{4uv}{3v+u}$       5)  $\frac{3uv}{4v+u}$

- (8) A coconut is dropped in to a water and it moved in to the water for a certain depth and then it floated in the water. If viscous forces are negligible, the variation of the velocity of the coconut with time is given by



- (9) A vehicle which is starting at rest and moving along a linear path with  $\alpha$  uniform acceleration and then  $\beta$  deceleration and become to the rest. The total time taken to the motion is  $T$ . The maximum velocity taken by the vehicle is,

- 1)  $\frac{\alpha\beta T}{2\alpha+\beta}$       2)  $\frac{\alpha\beta T}{\alpha+\beta}$       3)  $\frac{2\alpha\beta T}{\alpha+\beta}$       4)  $\left(\frac{\alpha+\beta}{\alpha\beta}\right)T$       5)  $\frac{\alpha}{\beta}T$

- (10) A bullet which emits from an artillery gun is followed a symmetrical projectile. The maximum horizontal displacement is 1 km. The period of the motion and the vertical height is respectively given by,

- 1)  $10\sqrt{2}$  s, 250 m      2) 10 s, 257 m      3)  $10\sqrt{2}$  s, 500 m  
4) 10 s, 500 m      5)  $5\sqrt{2}$  s, 250 m

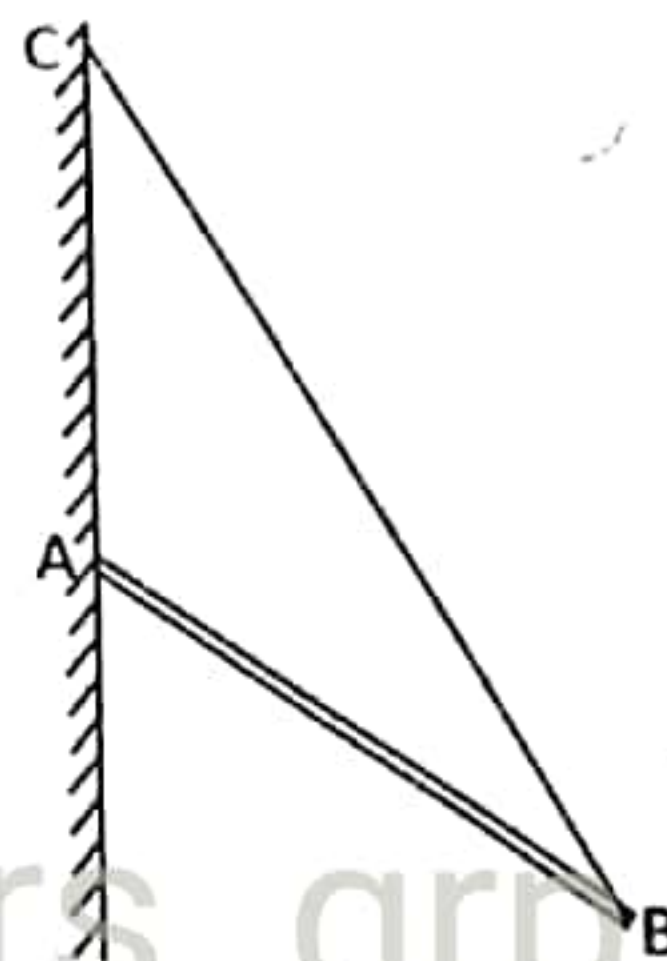
- (11) 99% of sound which emits from a machine is absorbed by a protective layer. The sound intensity level which reduces by the protective layer is,

- 1) 1 dB      2) 10 dB      3) 20 dB      4) 99 dB      5) 100 dB



- (12) A uniform rod of weight  $w$  is hinged at point A and it is under equilibrium with the string connected to the end B of the rod as shown in the figure.  $AB = AC$ . The rod is  $60^\circ$  inclined to the wall. The tension of the string is given.

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

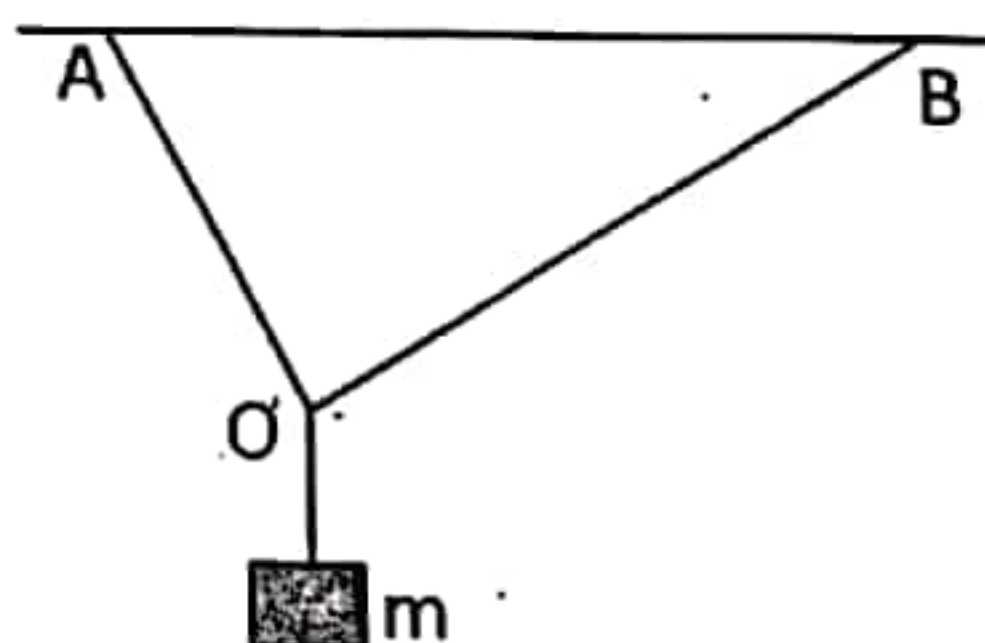


- (13) The statement which cannot be explained by the Bernoulli Theorem is,,

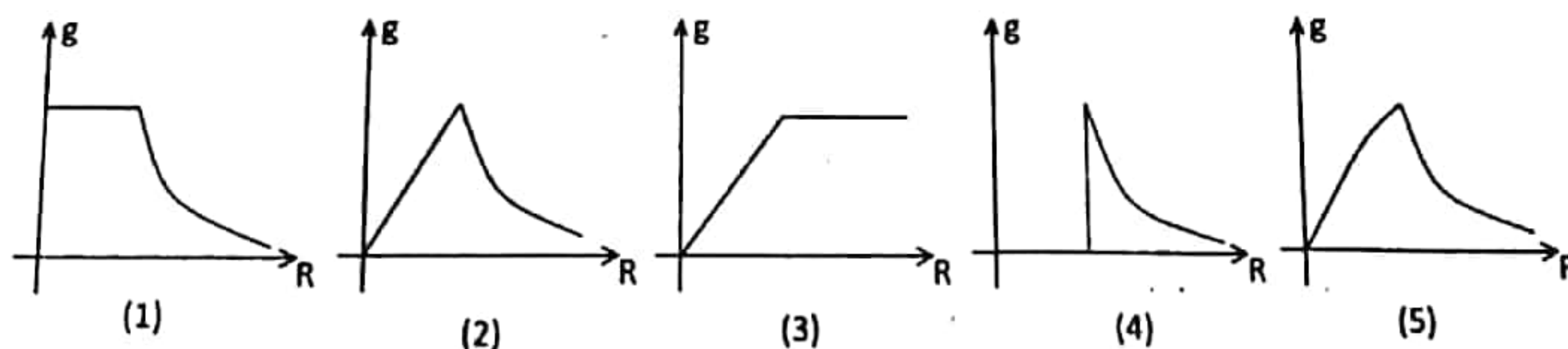
- 1) Flying a bird.  
 2) Emitting smoke from a high tube.  
 3) The motion of a sailing ship  
 4) Breaking a roof from the wind.  
 5) The motion of a rocket.

- (14) An object of mass  $m$  is hung by two light inextensible strings at point A and B as shown in the figure.  $AB = 50$  cm. The lengths of two strings OA and OB are 30 cm and 40 cm respectively. The tensions of the strings are correctly represented by,

	OA	OB
1)	$\frac{mg}{5}$	$\frac{mg}{5}$
2)	$\frac{mg}{5}$	$\frac{3mg}{5}$
3)	$\frac{4mg}{15}$	$\frac{mg}{5}$
4)	$\frac{mg}{5}$	$\frac{4mg}{15}$
5)	$\frac{3mg}{15}$	$\frac{4mg}{15}$

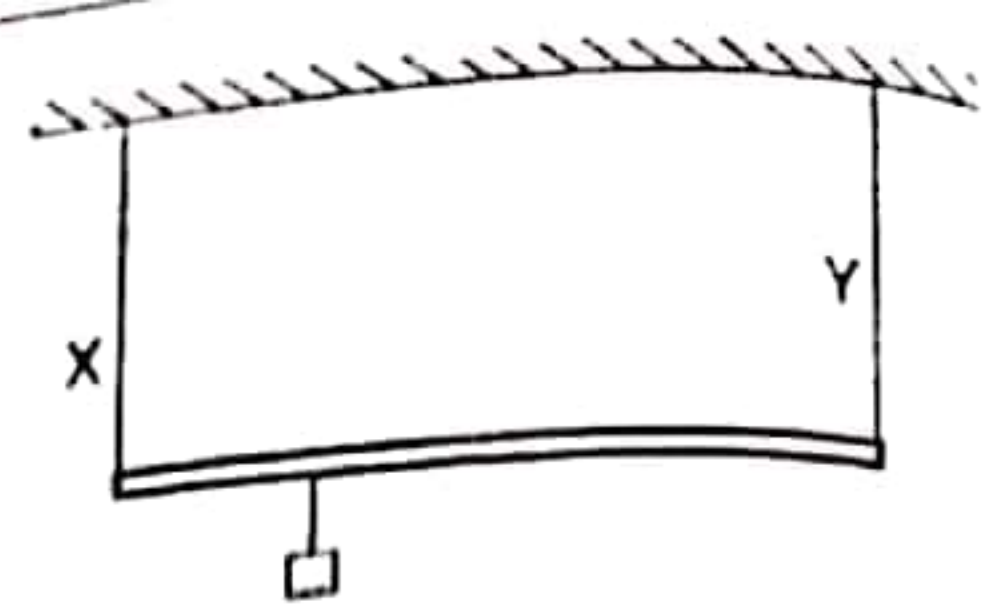


- (15) The variation of gravitational field intensity with the distance measured from the centre of the earth is best represented by, (The density of earth is uniform)



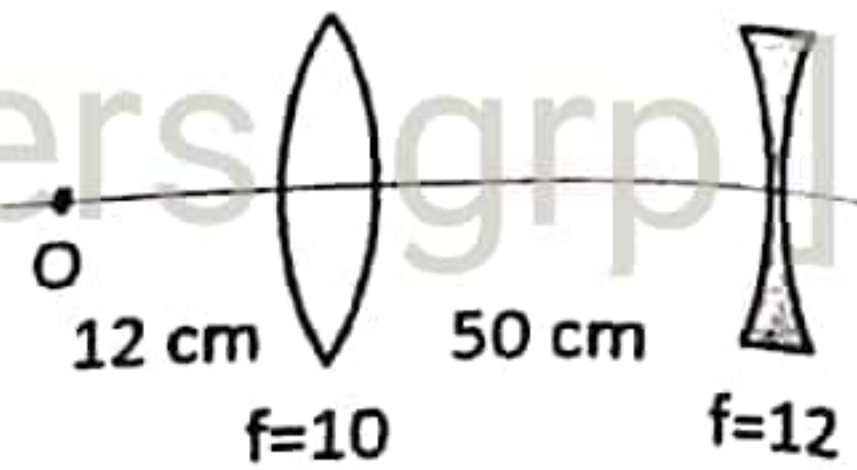


- (16) The light rod AB of length  $L$  is hung horizontally by two identical wires X and Y by hanging a mass  $m$ , at a point of the rod as shown in the figure. The wire X is resonated with the first overtone and the wire Y is resonated with the second overtone with a same tuning fork. The length to the point of hanging mass  $m$  from the wire X is



- 1)  $\frac{L}{15}$       2)  $\frac{L}{13}$       3)  $\frac{4L}{13}$       4)  $\frac{5L}{4}$       5)  $\frac{13L}{4}$

- (17) Consider the following statements regarding the final image of the object O formed by the above lens combination.

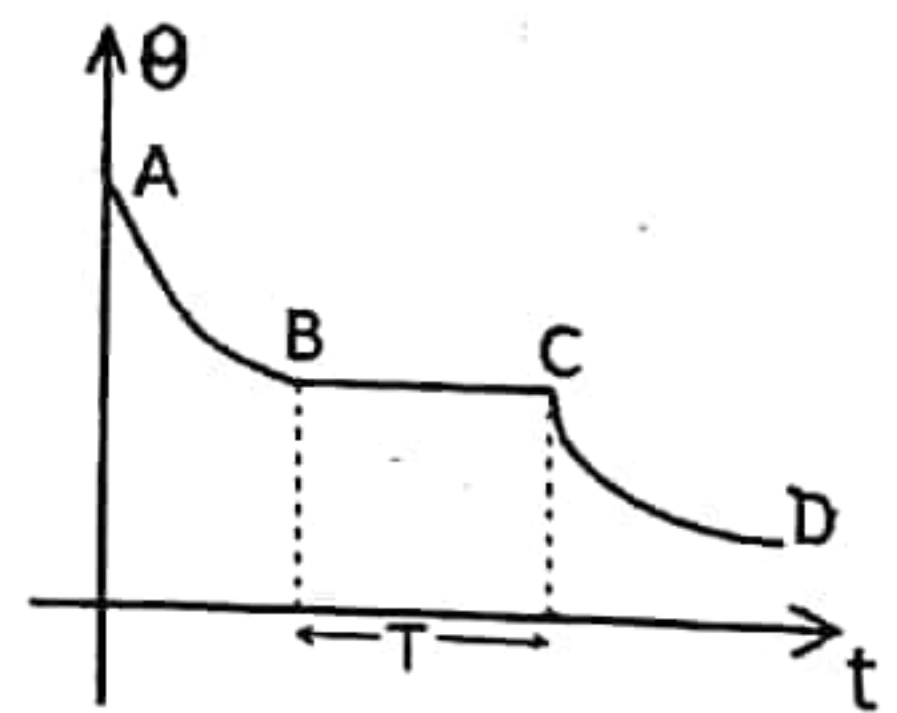


- A. A virtual image is formed by the concave lens.  
 B. The final image is formed at 60cm distance away to the right side from the concave lens.  
 C. A virtual image is formed by the convex lens at the left side of the convex lens.

The correct statement(s) from above is/are given by

- 1) A only      2) B only      3) C only      4) A and B only      5) A and C only

- (18) A cooling curve is drawn for a liquid wax at  $100^{\circ}\text{C}$  in a vessel as shown in the figure. The mass of wax is  $m$ , the specific latent heat of fusion of wax is  $L$ . The gradients drawn to the points B and C are  $H_1$  and  $H_2$  respectively.



Consider the following statements.

- A.  $H_1 = H_2$   
 B. When  $m$  is increasing  $T$  is increasing.  
 C. The rate of heat loss at point A is greater than that of point C.

The correct statement (s) is (are) given by

- 1) A only      2) B only      3) C only  
 4) All A, B, C are true      5) All A, B, C are false

- (19) Consider the following statements regarding the Geostationary Satellites.

- A. The periodic time of the satellite is equal to the rotational periodic time of the earth.  
 B. The satellites of higher masses should be orbitalized at higher orbits than the satellites of less masses.  
 C. The satellites can be orbitalized even right above the Sri Lanka.

The true statement(s) is/are given by

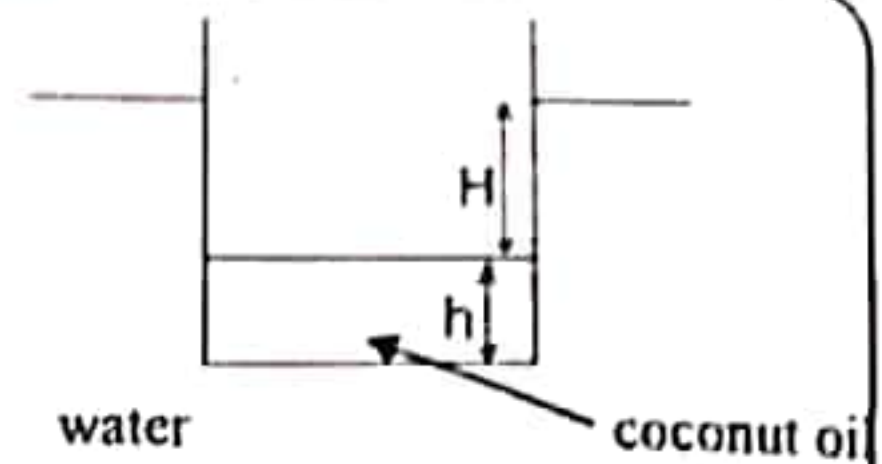
- 1) A only      2) B only      3) A and B only  
 4) B and C only      5) All A, B, C



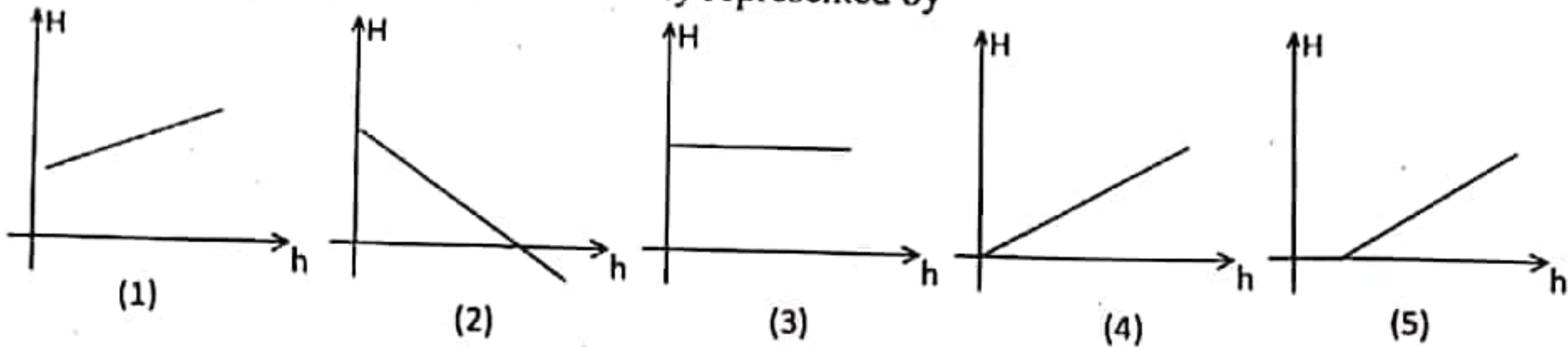
- (20) A cylindrical vessel with coconut oil is floating in the water.

$h$  – height of the coconut oil

$H$  – height to the outer water level from the coconut oil level.

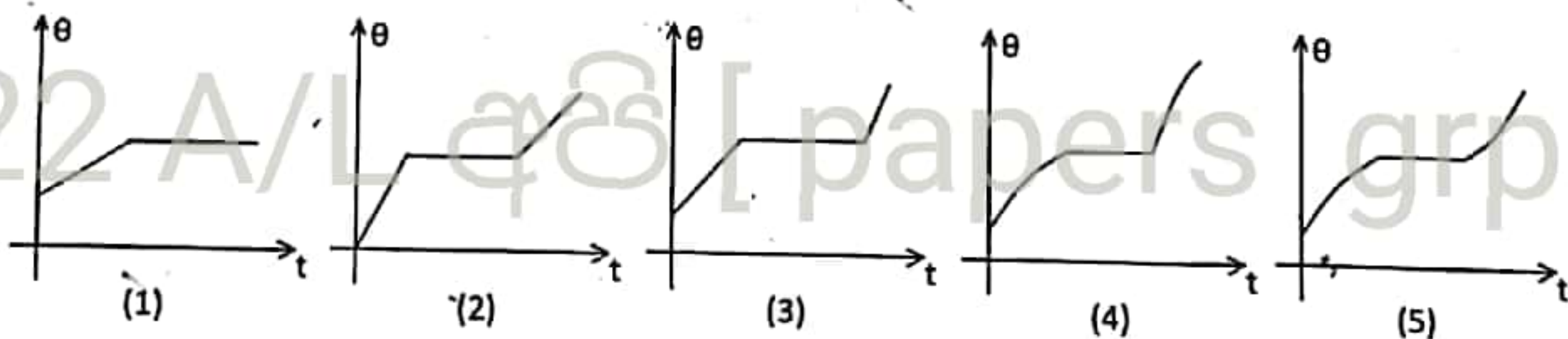


The variation of  $H$  with  $h$  is correctly represented by



- (21) A stone is dropped in to a well of having water at 20 m depth from the ground level. The sound is received after 2.05 s from the moment of dropping the stone. The velocity of sound is  
 1)  $300 \text{ ms}^{-1}$     2)  $330 \text{ ms}^{-1}$     3)  $334 \text{ ms}^{-1}$     4)  $350 \text{ ms}^{-1}$     5)  $400 \text{ ms}^{-1}$

- (22) A vessel of having thick walls with small amount of water at  $30^\circ\text{C}$  is heated by a gas cooker with uniform heat supply for a long time. The correct variation of the temperature inside the vessel with time is given by,



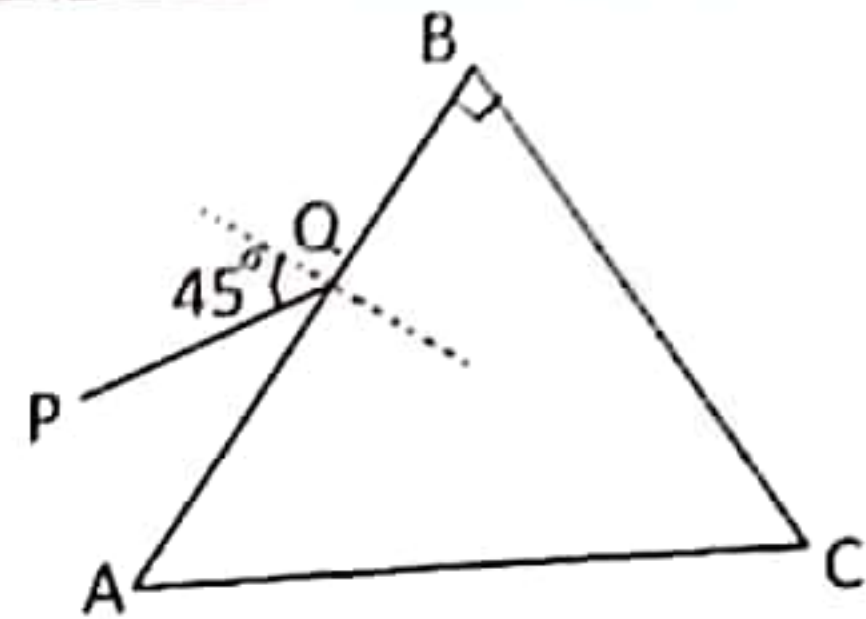
- (23) The radius of the earth is  $R$  and the gravitational field intensity on the surface is  $g$ . The gravitational field intensity at a point of height having two times of the radius is,  
 1)  $\frac{g}{9}$     2)  $\frac{g}{4}$     3)  $\frac{g}{3}$     4)  $\frac{g}{2}$     5)  $2g$

- (24) The wave length of a light emitted by a star is 5% higher than the wave length of that light when measured from the earth. The velocity of light is  $3 \times 10^8 \text{ ms}^{-1}$ . The star is

- 1) moving towards the earth with  $3 \times 10^7 \text{ ms}^{-1}$  velocity.
- 2) moving outwards the earth with  $3 \times 10^7 \text{ ms}^{-1}$  velocity
- 3) moving towards the earth with  $1.5 \times 10^7 \text{ ms}^{-1}$  velocity.
- 4) moving outwards the earth with  $1.5 \times 10^7 \text{ ms}^{-1}$  velocity.
- 5) moving outwards the earth with  $1.7 \times 10^7 \text{ ms}^{-1}$  velocity.



- (25) The figure shows a prism of having  $90^\circ$  refracting angle and 1.5 refracting index. A light ray PQ is incident on AB, surface. The most correct statement is,



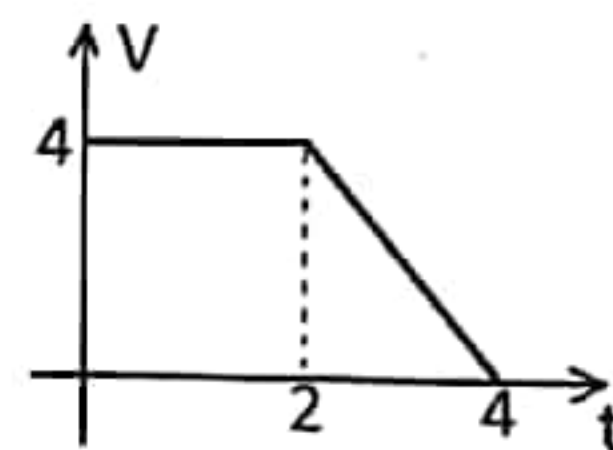
- 1) The ray undergoes minimum deviation.
- 2) The minimum deviation can be obtained by decreasing or increasing the incident angle.
- 3) The ray is never emerged from the BC surface for every incident angles.
- 4) Even the ray is emerged from the BC surface the minimum deviation can be obtained by varying the angle of incident.
- 5) The ray is emerged from the BC surface when the angle of incident is zero.

- (26) A gas mixture is consisted with  $H_2$  and  $O_2$ . The ratio of masses of  $H_2$  and  $O_2$  is 1: 8. The kinetic energy of  $H_2$  gas molecules is E. The kinetic energy of  $O_2$  gas molecules is given by,

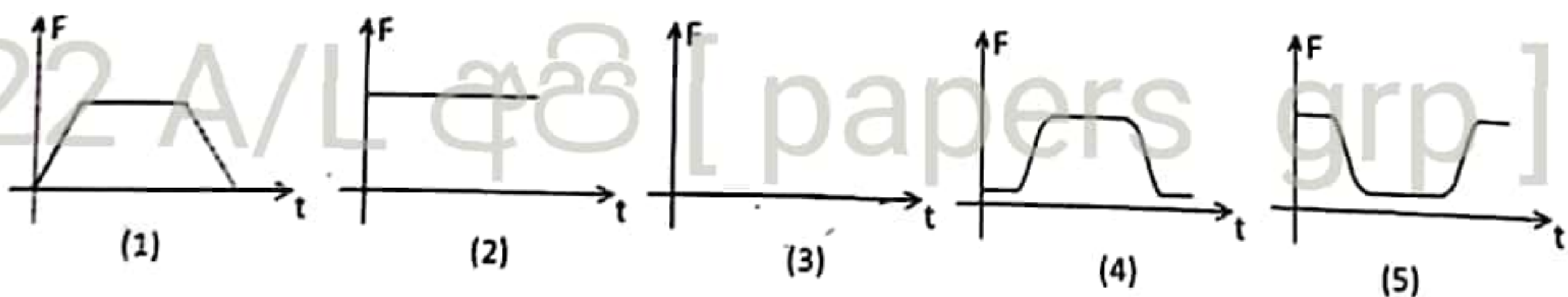
- 1)  $\frac{E}{2}$
- 2) E
- 3) 2E
- 4) 8E
- 5) 16E

- (27) The velocity time graph of an object moving along a linear path is given in the figure. The average velocity of the object is,

- 1)  $2.0 \text{ ms}^{-1}$
- 2)  $3.0 \text{ ms}^{-1}$
- 3)  $3.5 \text{ ms}^{-1}$
- 4)  $4.0 \text{ ms}^{-1}$
- 5)  $4.5 \text{ ms}^{-1}$



- (28) A motor vehicle is moving along a linear path with a constant velocity and then it is taking a bend and again it is moving along a linear path. The variation of the frictional force (F) between the wheels and the road is given by,



- (29) A mercury column of  $l_0$  length is existed in a capillary tube. The linear expansivity of the material of the capillary tube is  $\alpha$ . The volume expansivity of mercury is  $\gamma$ . The length of the mercury column when it's temperature is increased in  $\theta$  is

- 1)  $l_0 (1 + \gamma\theta)$
- 2)  $\frac{l_0(1 + \gamma\theta)}{(1 + \alpha\theta)}$
- 3)  $\frac{l_0(1 + \gamma\theta)}{1 + 2\alpha\theta}$
- 4)  $\frac{l_0(1 + \gamma\theta)}{1 + 3\alpha\theta}$
- 5)  $\frac{l_0(1 + 3\gamma\theta)}{1 + 2\alpha\theta}$



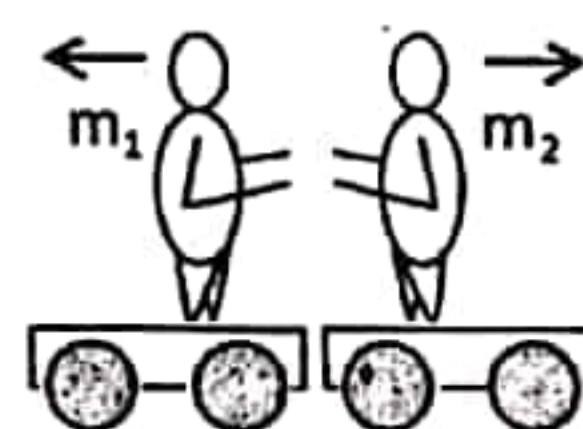
(30) When two ice blocks are compressed together, they are combined each other. Consider the following statements regarding this phenomenon.

- A. There is an attraction force between two ice blocks.
- B. When pressure is increased, melting point of ice is decreasing.
- C. Ice cubes are combined together as the gravitational force created due to compressing is greater than the intermolecular bonds.

The true statement (s) is/are

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

(31) Two children on two trollies of mass  $m_1$  and  $m_2$  are pushed each other. The coefficient of friction between wheels of the trollies and the floor is  $\mu$ . when they are stopped, the distance travelled by  $m_1$  and  $m_2$  are  $x_1$  and  $x_2$  respectively. The  $\frac{x_1}{x_2}$  is given by,



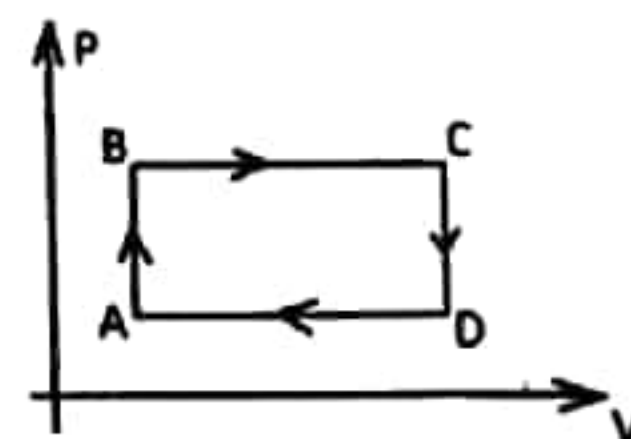
- 1)  $\frac{m_2}{m_1}$
- 2)  $\frac{m_1}{m_2}$
- 3)  $\left(\frac{m_2}{m_1}\right)^2$
- 4)  $\left(\frac{m_1}{m_2}\right)^2$
- 5)  $\frac{m_1 m_2}{m_1 + m_2}$

(32) A steel bullet at  $30^\circ\text{C}$  is just melted after colliding at a target. The 50% of heat generated by the collision is absorbed by the bullet. The specific heat capacity of steel  $150 \text{ J kg}^{-1} \text{ K}^{-1}$ , The specific latent heat of steel  $25 \times 10^3 \text{ J kg}^{-1}$ . The melting point of steel is  $330^\circ\text{C}$ . The velocity of the bullet collided at the target is

- 1)  $100 \text{ ms}^{-1}$
- 2)  $100\sqrt{2} \text{ ms}^{-1}$
- 3)  $100\sqrt{5} \text{ ms}^{-1}$
- 4)  $100\sqrt{10} \text{ ms}^{-1}$
- 5)  $100\sqrt{15} \text{ ms}^{-1}$

(33) Consider the following statements regarding the cyclic process represented by the given figure.

- A. The temperature of C is greater than that of B.
- B. The heat is released during the CD process.
- C. The difference of internal energy during the whole process is zero.

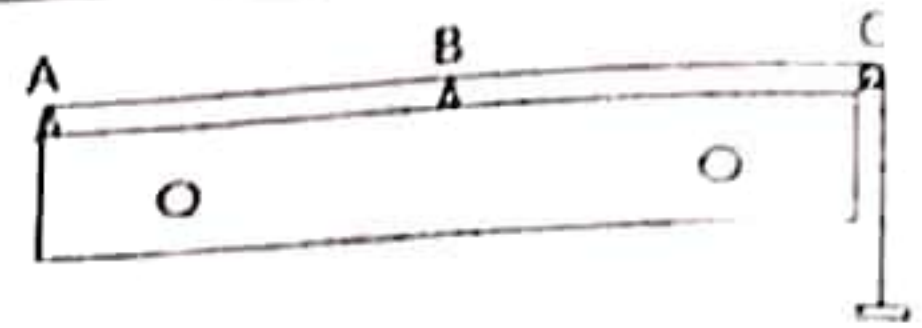


The correct statement(s) from following is/are,

- 1) A and B only
- 2) A, and C only
- 3) B and C only
- 4) All A, B and C are false
- 5) All A, B and C are correct



- (34) The wire segment AB is resonated with the tuning fork of frequency  $f_1$  and the wire segment BC is resonated with the tuning fork of frequency  $f_2$  in the fundamental mode. If the bridge B is removed, the frequency of the fundamental mode of the wire AC is given by

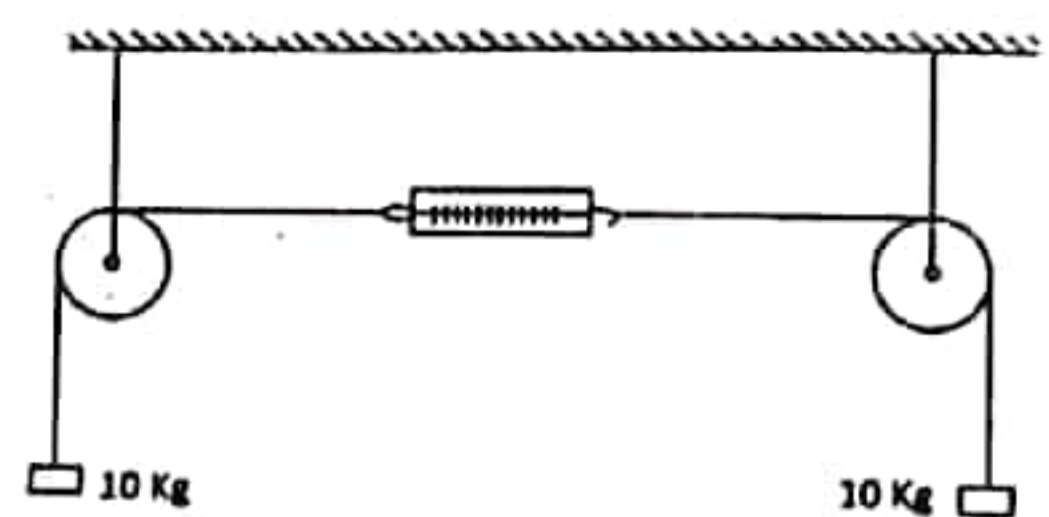


- 1)  $f_1 + f_2$     2)  $\frac{f_1 + f_2}{2}$     3)  $\frac{f_1 f_2}{f_1 + f_2}$     4)  $\sqrt{f_1 f_2}$     5)  $f_1 - f_2$

- (35) A metal flute is made to produce to correct notes at  $30^\circ\text{C}$ . When this flute is used in a lower temperature,

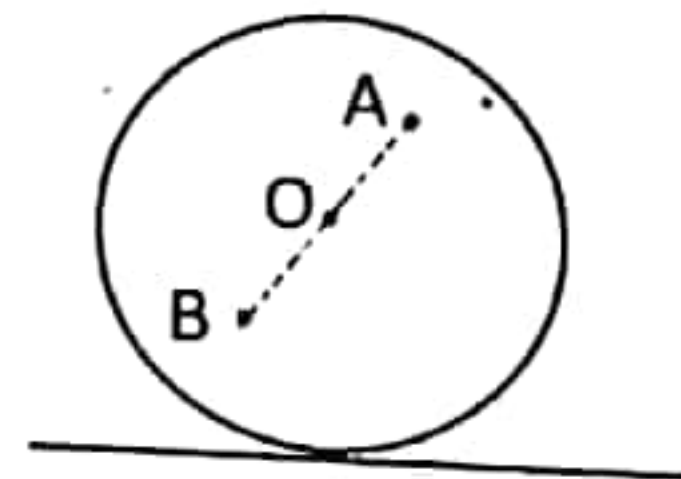
- 1) The frequency is increased due to the gaps between each and every holes are reduced.  
 2) The frequency is not changed as no change in gaps between each and every holes.  
 3) The frequency is decreasing due to the temperature of the air is decreased.  
 4) The frequency is not changed because the temperature is not affected to the frequency.  
 5) All statements are wrong

- (36) The figure shows that a spring balance is set with two smooth pulleys using a light inextensible string. The hanging masses are 10 kg. The reading of the spring balance is,



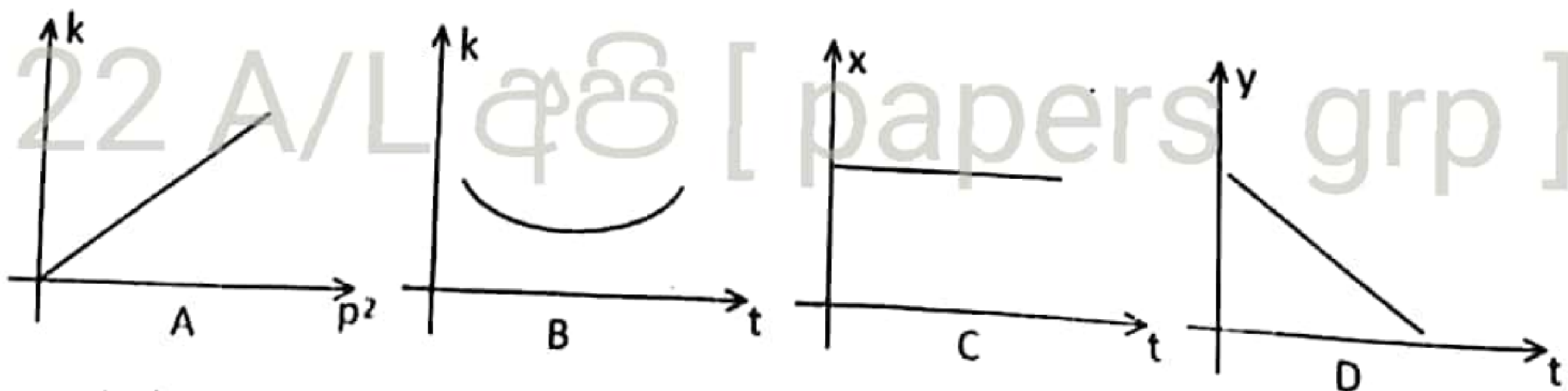
- 1) 0 N    2) 50 N    3) 100 N  
 4) 200 N    5) 250 N

- (37) A uniform disk is moving with  $V$  uniform velocity along a rough path. The velocities of points A, O and B are  $V_A$ ,  $V_O$ ,  $V_B$  respectively. The correct relationship is,



- 1)  $V_A = V_B = V_O$     2)  $V_A = V_B > V_O$   
 3)  $V_A = V_B < V_O$     4)  $V_A > V_O > V_B$   
 5)  $V_A < V_O < V_B$

- (38) A particle is projected to a direction of  $\theta$  degrees inclination from horizontal. After  $t$  time duration, the vertical displacement, the horizontal displacement, the linear momentum, the kinetic energy of the particle is  $y$ ,  $x$ ,  $p$  and  $k$  respectively. The correct relationship (s) is (are) given by,



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



(39) The radius and the mass of a role of fabric is  $R$  and  $M$  respectively. Now it is unrolled on a table until it's radius becomes  $R/2$ . The decrement of the potential energy of the fabric role is given by

- 1)  $\frac{1}{2} MgR$                       2)  $\frac{5}{8} MgR$                       3)  $\frac{3}{4} MgR$   
 4)  $\frac{7}{8} MgR$                       5)  $\frac{1}{8} MgR$

(40) The velocity of sound in a gas which is in a vessel of having a large volume is  $V_0$ . Now the volume is decreased up to half while keeping constant pressure. The velocity is sound is given by,

- 1)  $V_0$                       2)  $\sqrt{2} V_0$                       3)  $\sqrt{3} V_0$                       4)  $\frac{V_0}{\sqrt{2}}$                       5)  $\frac{V_0}{2}$

(41) The false statement from following statements regarding the evaporation is,

- 1) The rate of evaporation will be increased in a windy environment.
- 2) The rate of evaporation will be increased under high temperature.
- 3) The temperature will be increased when the rate of evaporation is increased.
- 4) Evaporation can take place at any temperature.
- 5) Evaporation is used when producing the salt.

(42) The gravitational acceleration on a surface of a planet of radius  $R$  is  $g$ . The gravitational acceleration on the surface of a planet having same density and radius  $2R$  is given by

- 1)  $\frac{g}{4}$                       2)  $\frac{g}{2}$                       3)  $2g$                       4)  $4g$                       5)  $8g$

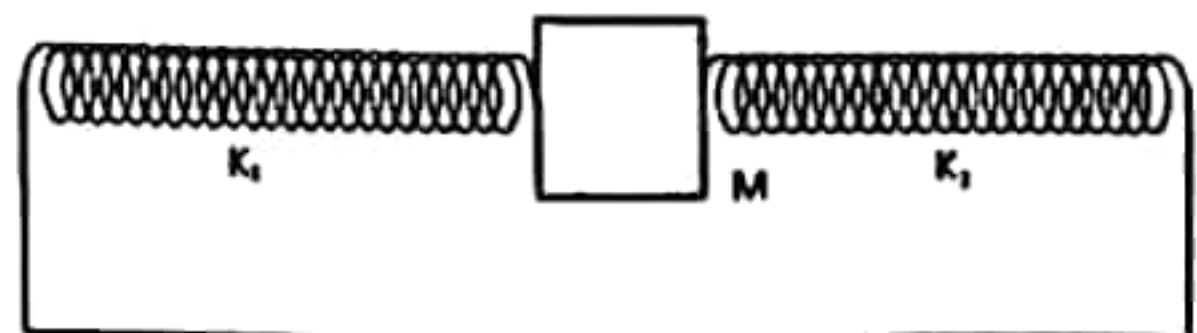
(43) The rate of heat loss of an object which is under convection only is depended on,

- A. The nature of the surface.
- B. The temperature of the surface.
- C. The area of the surface.
- D. The temperature of surrounding

The correct statement(s) is/are

- 1) A and B only                      2) B and C only
- 3) A and C only                      4) A, B and C only
- 5) All A, B, C and D

(44) A block of mass  $M$  is connected to two springs of having spring constants  $K_1$  and  $K_2$  as shown in the figure. The maximum acceleration of the block when it is pulled  $x$  distance towards left and released, is



- 1)  $\frac{(K_1 + K_2)}{M} x$                       2)  $\frac{2(K_1 - K_2)}{M} x$                       3)  $\frac{(K_1 - K_2)}{M} x$   
 4)  $\frac{(K_1^2 + K_2^2)}{M} x$                       5)  $\frac{2(K_1 - K_2)x^2}{M}$



(45) The wrong statement regarding the microscopes and telescopes is.

- 1) The maximum difference of magnifications under normal and special adjustment of simple microscope is 1.
- 2) In a compound microscope the focal length of eye piece is larger than the focal length of objective piece.
- 3) A compound microscope can be used as a telescope when observing through the objective lens.
- 4) The focal length of the objective lens is larger than that of eye piece in a telescope.
- 5) In telescopes the diameter of the objective lens is larger than that of eye piece

(46) A point light source is kept at a point of 1 m depth from the upper surface of a transparent liquid of refractive index  $n$ . The radius of the circular lighting area formed on the surface of the medium is,

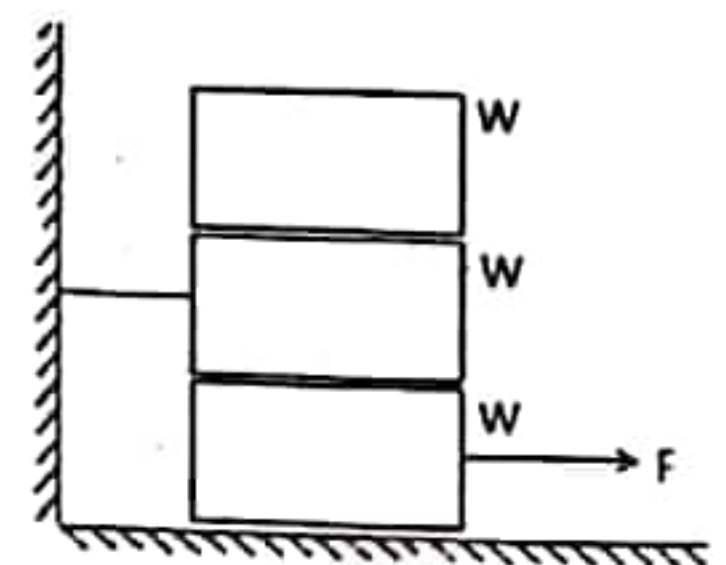
- 1)  $\frac{1}{n}$
- 2)  $\frac{2}{n}$
- 3)  $\sqrt{n^2 - 1}$
- 4)  $\frac{1}{\sqrt{n^2 - 1}}$
- 5)  $\frac{2}{\sqrt{n^2 - 1}}$

(47) The range of vision of a person of having a defective eye is 15 cm to 200 cm. The focal length and the type of the lens which is used to correct the defect is,

- 1) 15 cm, convex
- 2) 200 cm convex
- 3) 15 cm concave
- 4) 200 cm concave
- 5) 18.5 cm convex

(48) Three identical blocks of weight  $W$  are kept as shown in the figure. The co-efficient of friction between each and every surface is  $\mu$ . The minimum force required to move the lowest block is,

- 1)  $\mu W$
- 2)  $2 \mu W$
- 3)  $3 \mu W$
- 4)  $4 \mu W$
- 5)  $5 \mu W$



(49) At the practical of determination of prism angle using a spectrometer, two readings were taken as  $310^\circ 17'$  and  $70^\circ 17'$ . The prism angle would be,

- 1)  $59^\circ$
- 2)  $60^\circ$
- 3)  $61^\circ$
- 4)  $70^\circ 34'$
- 5)  $58^\circ 30'$

(50) The variation of the thickness ( $d$ ) of an ice block which is forming on the surface of water in an environment of temperature of  $-10^\circ\text{C}$  with time ( $t$ ) is correctly represented by,

