CBSE EXAMINATION PAPER-2018

NEET-PHYSICS

(Solved)

Time allowed : 3 hours | Maximum Marks : 68

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **17 questions.** All questions are **compulsory.**

ii. This question paper is divided into **1 sections.**

iii. **Section A** – questions number **1 to 17** are multiple choice questions

iv. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.

v. Use of calculator is NOT allowed.

Section A

Question 1.

A student measured the diameter of a small steel ball using a screw gauge of least count 0.001 cm. The main scale reading is 5 mm and zero of circular scale division coincides with 25 divisions above the reference level. If screw gauge has a zero error of –0.004 cm, the diameter of ball is

[4 Marks]

(A) 0.529 cm

(B) 0.053 cm

(C) 0.525 cm

(D) 0.521 cm

Explanation:

Diameter of the ball
= MSR + CSR × (least count) − zero error
= 0.5 cm + 25 × 0.001 − (−0.004)
= 0.5 + 0.025 + 0.004
= 0.529 cm

Question 2.

The moment of force on a force, $\vec{?} = 4\hat{i} + 5\hat{j} - 6\hat{k}$ at (2, 0, −3), about the point

(2, −2, −2), is given by

[4 Marks]

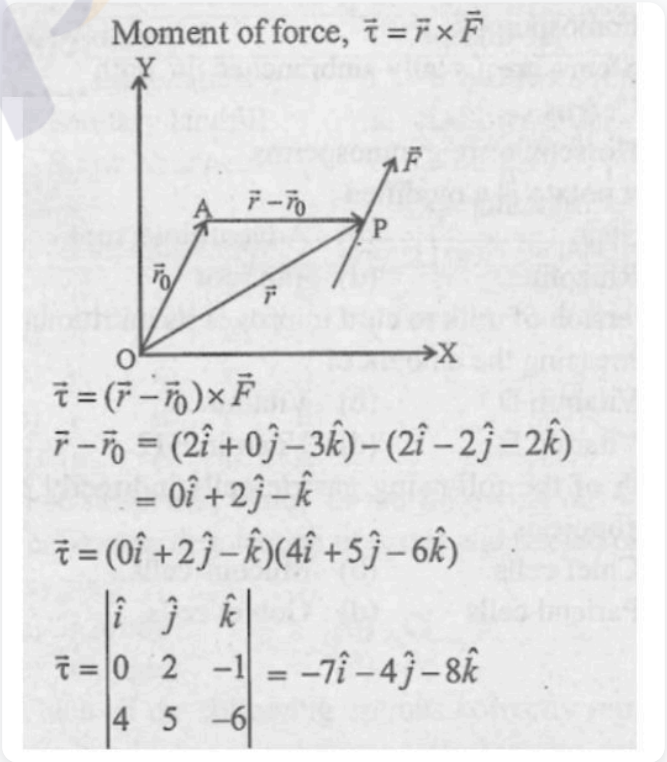
(A) $-8\hat{i} - 4\hat{j} - 7\hat{k}$

(B) $-7\hat{i} - 8\hat{j} - 4\hat{k}$

(C) $-7\hat{i} - 4\hat{j} - 8\hat{k}$

(D) $-4\hat{i} - \hat{j} - 8\hat{k}$

Explanation:

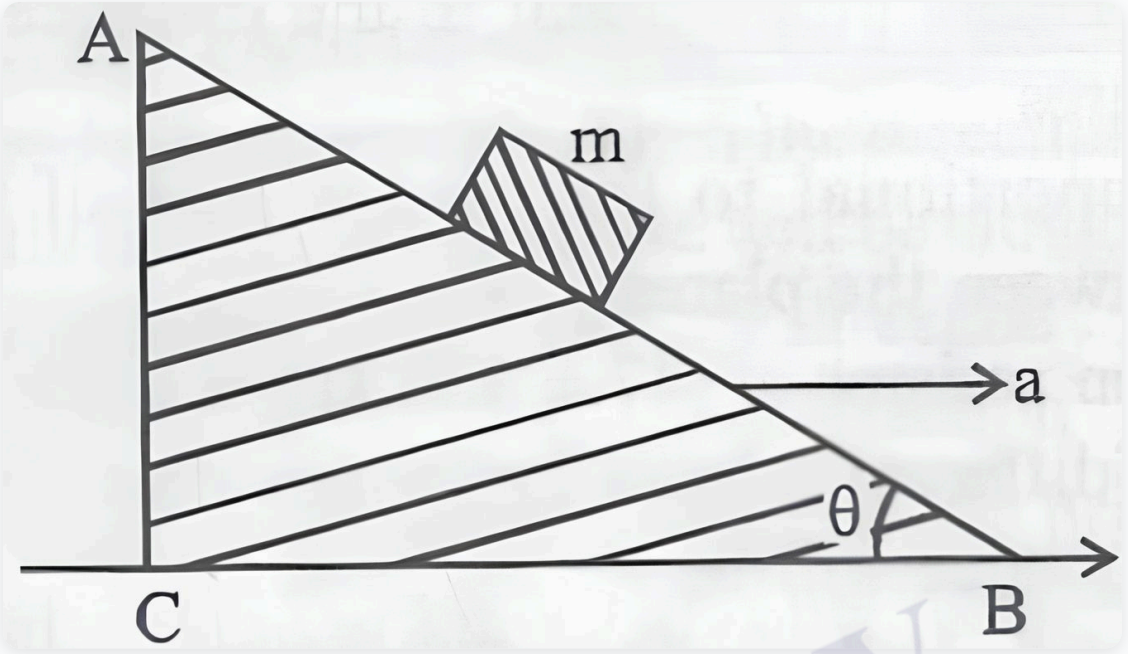


Question 3.

A block of mass m is placed on a smooth inclined wedge ABC of inclination θ as shown in the figure. The wedge is given an acceleration a towards the right. The relation between a

and θ for the block to remain stationary on the wedge is

[4 Marks]



(A) a = g tan θ

(B) a = g /cosec θ

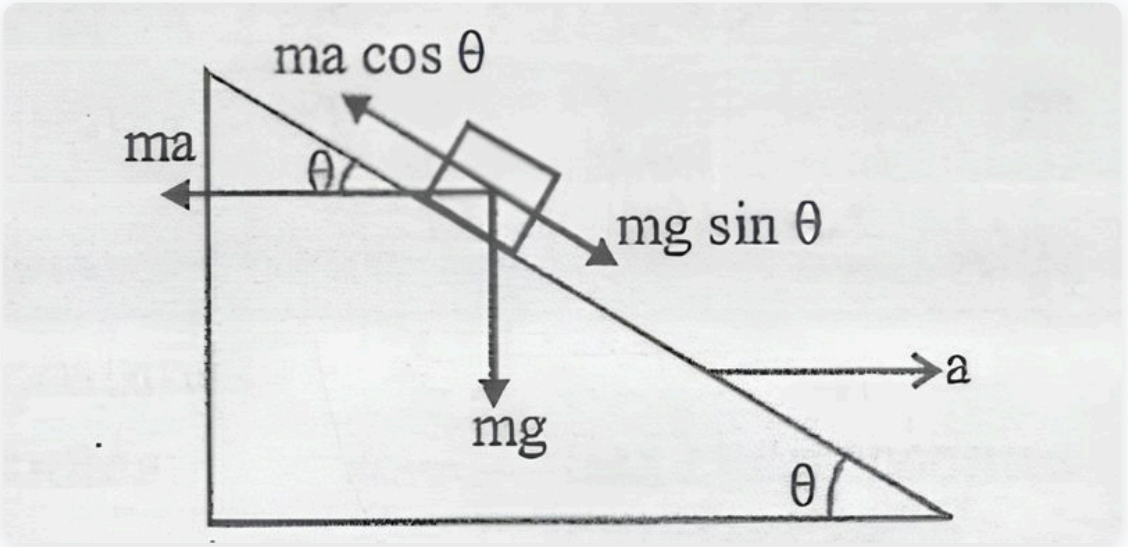
(C) a = g cos θ

(D) a = g/ sin θ

Explanation:

Let the mass of block is m . It will remain stationary if forces acting on it are in equilibrium, i.e. ma cos θ = mg sin θ ⇒ a = g tan θ.

Here ma = Pseudo force on block, mg = weight.



Question 4.

A moving block having mass m_1 collides with another stationary block having mass 4m. The lighter block comes to rest after collision. When the initial velocity of lighter block is v, then the value of coefficient of restitution (e) will be

[4 Marks]

(A) 0.25

(B) 0.8

(C) 0.5

(D) 0.4

Explanation:

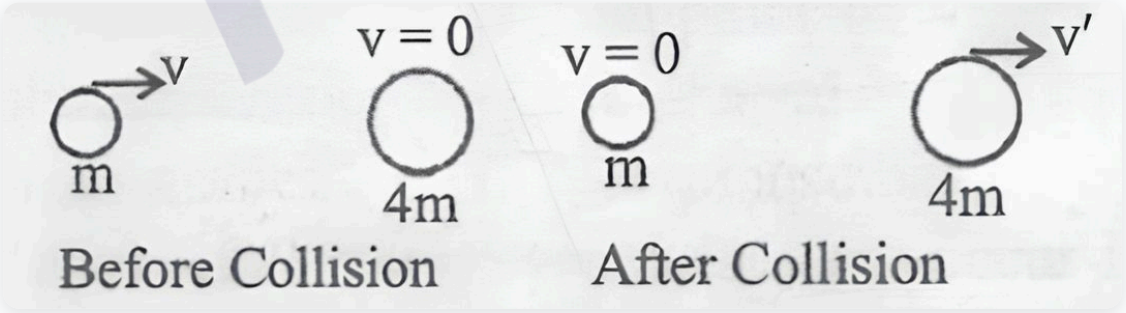
According to law of conservation of linear momentum,

$mv+4m \times 0 = 4mv' + 0 \Rightarrow V' = v/4$

Coefficient of restitution,

e = Relative velocity of separation / Relative velocity of approach v/4/v

or, e = 1/4 = 0.25



Question 5.

A solid sphere is rotating freely about its symmetry axis in free space. The radius of the sphere is increased keeping its mass same. Which of the following physical quantities would remain constant for the sphere?

[4 Marks]

(A) Rotational kinetic energy

(B) Angular momentum

(C) Angular velocity

(D) Moment of inertia

Explanation:

Angular momentum, remains conserved until the torque acting on sphere remains zero. ? $_{ex}$ = 0

So, dL/dt = 0

i.e, angular momentum L = constant.

Question 6.

A solid sphere is in rolling motion. In rolling motion a body possesses translational kinetic energy (K_t) as well as rotational kinetic energy (K_r) simultaneously. The ratio $K_t : (K_t + K_r)$) for the sphere is

[4 Marks]

(A) 5:7

(B) 10:7

(C) 7:10

(D) 2:5

Explanation:

In rolling motion, rotational kinetic energy,

$K_t = 1/2\ Iv^2$

And, $K_t + K_r = 1/2\ mv^2 + 1 / 2\ I\omega^2$

$= 1/2\ mv^2 + 1/2\ (2/5\ mr^2)(v/r^2) = 7 / 10\ mv^2$

$\therefore K_t/(K_t + K_r) = (1/2\ mv^2)/(7/10\ mv^2) = 5/7$

Question 7.

Three objects A (a solid sphere), B (a thin circular disk) and C (a circular ring), each have the same mass M and radius R. They all spin with the same angular speed ω about their own symmetry axes. The amount of work (W) required to bring them to rest, would satisfy the relation

[4 Marks]

(A) W_A > W_B > W_C

(B) $W_C > W_B > W_A$

(C) $W_A > W_C > W_B$

(D) $W_B > W_A > W_C$

Explanation:

Work done required to bring them to rest $\Delta W = \Delta KE$ (work-energy theorem)

$\Delta W = 1/2\ I\omega^2$ ($\Delta KE_{rot} = 1/2\ I\omega^2$)

or, $\Delta W \propto I$ (for same ω)

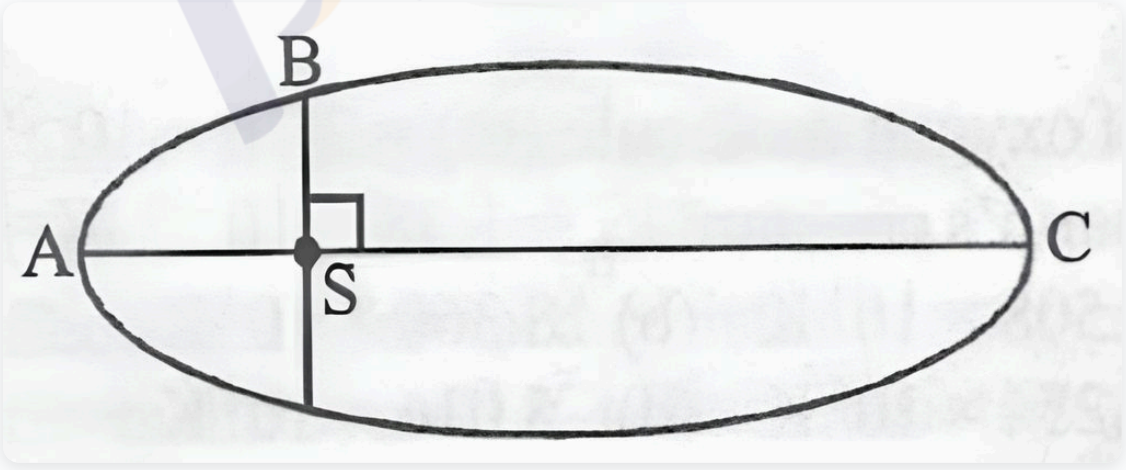
$I_{Solid\ sphere} = 2/5\ MR^2$, $I_{disk} = 1/2\ MR^2$

$I_{(ring)} = MR^2 \therefore W_C > W_B > W_A$

Question 8.

The kinetic energies of a planet in an elliptical orbit about the Sun, at positions A, B and C are K_A, K_B, and K_C respectively. AC is the major axis and SB is perpendicular to AC at the position of the Sun S as shown in the figure. Then

[4 Marks]



(A) $K_A < K_B < K_C$

(B) $K_A > K_B > K_C$

(C) $K_B > K_A > K_C$

(D) $K_B < K_A < K_C$

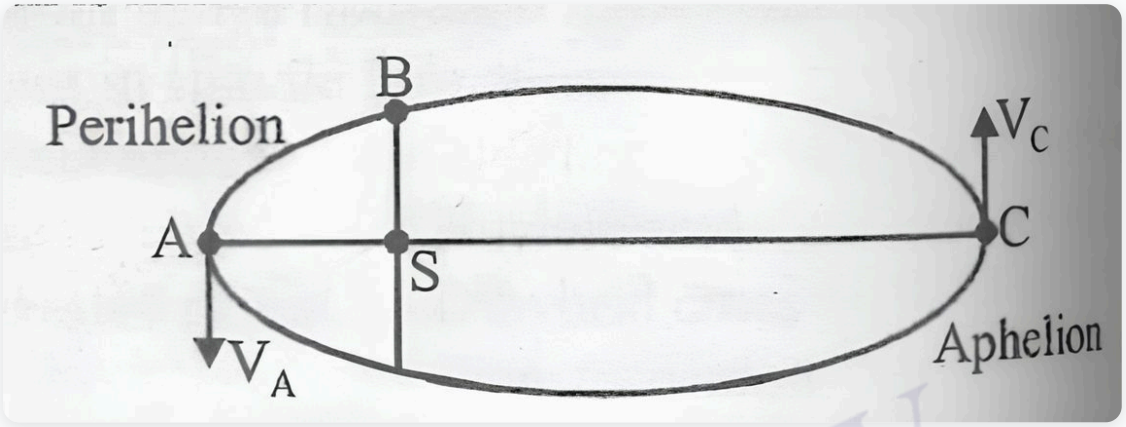
Explanation:

Speed of the planet will be maximum when its distance from the sun is minimum as mvr =constant.

Point A is perihelion and C is aphelion.

Clearly, V_A > V_B > V_C

So, K_A > K_B > K_C



Question 9.

Two wires are made of the same material and have the same volume. The first wire has cross-sectional area A and the second wire has cross-sectional area 3A. If the length of the first wire is increased by Δl on applying a force F, how much force is needed to stretch the second 'wire by the same amount?

[4 Marks]

(A) 6F

(B) 9F

(C) 4F

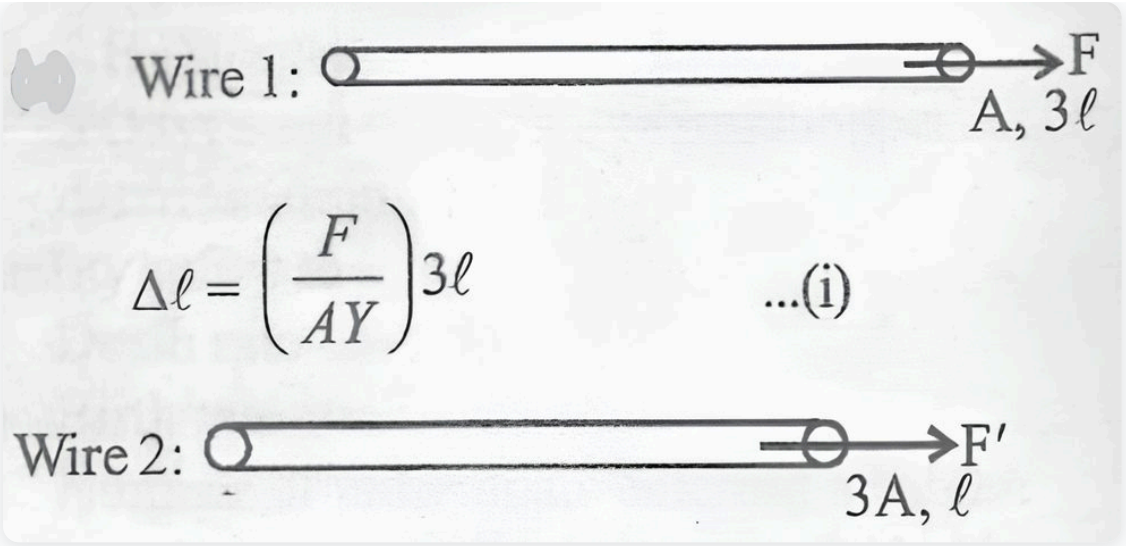
(D) F

Explanation:

Δl = (F'/3AY)l ....(ii)

From equation (i) & (ii),

Δl =(F/AY)3l = (F' /3AY)l or, F'=9F



Question 10.

A small sphere of radius 'r' falls from rest in a viscous liquid. As a result, heat is produced due to viscous force. The rate of production of heat when the sphere attains its terminal velocity, is proportional to

[4 Marks]

(A) r^4

(B) r^2

(C) r^5

(D) r^3

Explanation:

Power = rate of production of heat F.V

$= 6\pi\eta r V_T \cdot V_T = 6\pi\eta r V_T^2$

($\because F = 6\pi\eta r V_T$ r Stoke's formula)

$V_T \propto r^2$

$\because V_T = 2/9 \left(r^2(\rho - \sigma) / \eta(g)\right)$

$\therefore$ Power $\propto r^5$

Question 11.

The power radiated by a black body is P and it radiates maximum energy at wavelength,λ_0 If the temperature of the black body is now changed so that it radiates maximum energy at wavelength 3/4 λ_0 ,the power radiated by it becomes nP. The value of n is

[4 Marks]

(A) 3/4

(B) 4/3

(C) 256/81

(D) 81/256

Explanation:

From Wien's law

λ_{max} T = constant

i.e., $\lambda_{max1}T_1 = \lambda_{max2}T_2$

$\Rightarrow \lambda_0 T = 3\lambda_0/4\ T$

$\Rightarrow T' = 4/3\ T$

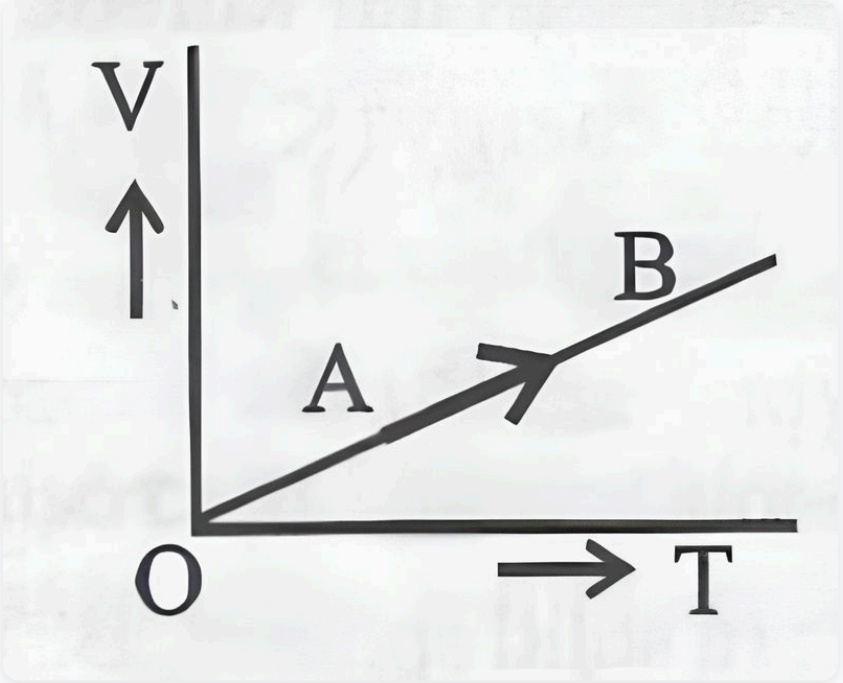
Power radiated $P \propto T^4$

So, $P_2/P_1 = n = (T'/T)^4 = (4/3)^4 = 256/81$

Question 12.

The volume (V) of a monatomic gas varies with its temperature (T), as shown in the graph. The ratio of work done by the gas, to the heat absorbed by it, when it undergoes a change from state A to state B, is

[4 Marks]



(A) 1/3

(B) 2/3

(C) 2/7

(D) 2/5

Explanation:

Gas is monatomic, so $C_p = 5/2\ R$

Given process isobaric

$\therefore dQ = nC_p\ dT$

$\Rightarrow dQ = (5/2\ R)\ dT$

$dW = PdV = nRdT$

$\therefore$ Required ratio $= dW/dQ = nRdT / n(5/2\ R)dT = 2/5$

Question 13.

The efficiency of an ideal heat engine working between the freezing point and boiling point of water, is

[4 Marks]

(A) 12.5%

(B) 26.8%

(C) 6.25%

(D) 20%

Explanation:

Efficiency of ideal heat engine, $\eta = (1 - T_2/T_1)$

Sink temperature, $T_2 = 100^oC = 100 + 273 = 373$ K

Source temperature, $T_1 = 0^oC + 0^o + 273 = 273$ K

Percentage efficiency, $\% \eta = (1 - T_2/T_1) \times 100$

$=(1- 273/373)x100 = (100/373) \times 100 = 26.8\%$

Question 14.

At what temperature will the rms speed of oxygen molecules become just sufficient for escaping from the Earth's atmosphere?

(Given:

Mass of oxygen molecule (m)$=2.76 \times 10^{-26}$kg

Boltzmann's constant $k_B = 1.38 \times 10^{-23}$ JK^{-1})

[4 Marks]

(A) $1.254x10^4$K

(B) $5.016x\ 10^4$K

(C) $2.508x10^4$K

(D) $8.360x\ 10^4$ K

Explanation:

Let at temperature T rms speed of oxygen molecules become just sufficient for escaping from the Earth's atmosphere.

$V_{escape} =11200$m/s

Also, $V_{rms} = V_{escape} = \sqrt{(3k_BT/m_{O2})} = 11200$ m/s

Putting value of k_B and mO_2, we get,

$T = 8.360 \times 10^4$ K

Question 15.

A pendulum is hung from the roof of a sufficiently high building and is moving freely to and fro like a simple harmonic oscillator. The acceleration of the bob of the pendulum is 20 m/s^2 at a distance of 5 m from the mean position. The time period of oscillation is

[4 Marks]

(A) 1s

(B) 2s

(C) πs

(D) 2πs

Explanation:

From equation, acceleration, a = 20 m/s^2, and displacement, y = 5m $|a| = \omega^2 y$

$\Rightarrow 20 = \omega^2(5)$

$\Rightarrow \omega = 2$ rad / s

Time period of pendulum,

$T = 2\pi/\omega = 2\pi/2 = \pi s$

Question 16.

A tuning fork is used to produce resonance in a glass tube. The length of the air column in this tube can be adjusted by a variable piston. At room temperature of 27°C two successive resonances are produced at 20 cm and 73 cm of column length. If the frequency of the tuning fork 320 Hz, the velocity of sound in air at 27°C is

[4 Marks]

(A) 350 m/s

(B) 300 m/s

(C) 330 m/s

(D) 339 m/s

Explanation:

Two successive resonance are produced at 20 cm and 73 cm of column length

$\therefore \lambda/2 = (73 - 20) \times 10^{-2}$ m

$\Rightarrow \lambda = 2 \times (73 - 20) \times 10^{-2}$

Velocity of sound, $v = n\lambda$

$= 2 \times 320\ [73 - 20] \times 10^{-2} = 339.2\ m/s^{-1}$

Question 17.

The fundamental frequency in an open organ pipe is equal to the third harmonic of a closed organ pipe. If the length of the closed organ pipe is 20 cm, the length of the open organ pipe is

[4 Marks]

(A) 12.5 cm

(B) 16 cm

(C) 13.2 cm

(D) 8 cm

Explanation:

For closed organ pipe, third harmonic

$n = (2N - 1)V / 4l = 3V/4l\ (\because N = 2)$

For open organ pipe, fundamental frequency

$n = NV / 2l' = V/2l\ (\because N = 1)$

According to question, $3V/4l = V/2l'$

$\Rightarrow l = 4l'/3 \times 2 = 2l/3 = 2 \times 20 / 3 = 13.33cm$