



**DELHI PUBLIC SCHOOL NEWTOWN**  
**SESSION 2023-2024**  
**HALF YEARLY EXAMINATION**

**CLASS: IX**  
**SUBJECT: PHYSICS [SET A]**

**FULL MARKS: 80**  
**TIME: 2 HOURS**

*Candidates are allowed additional 15 minutes for only reading the paper.  
They must NOT start writing during this time.  
The intended marks for questions or parts of questions are given in brackets [ ]  
Section A is compulsory. Attempt any four questions from Section B  
This paper consists of six printed pages*

**SECTION A**

**Question 1**

**[15 × 1 = 15]**

**Choose the correct answers to the questions from the given options:**

**(i) Parsec is the unit of:**

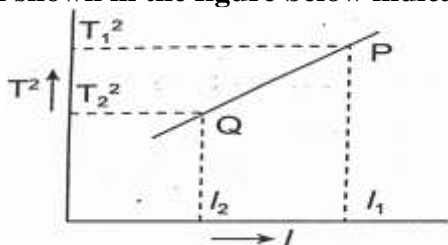
- (a) time                      (b) distance                      (c) frequency                      (d) linear momentum

**(ii) Assertion (A): The average and instantaneous velocities have same value in a uniform motion.**

**Reason (R) : In uniform motion, the velocity of an object increases uniformly.**

- (a) both assertion and reason are true.  
(b) both assertion and reason are false.  
(c) assertion is false but reason is true.  
(d) assertion is true reason is false.

**(iii) The graph shown in the figure below indicates:**



- (a)  $lT^2$  is constant    (b)  $l/T^2$  is constant    (c)  $(T^2 + l)$  is constant    (d) none of these

**(iv) The effective length of pendulum is the length**

- (a) from point of suspension to half the length of string  
(b) from point of suspension up to bob  
(c) it is the distance of the point of oscillation (i.e the centre of gravity of the bob) from the point of suspension  
(d) none of the above

(v) Which of the following is not a vector

- (a) linear momentum      (b) gravitational force      (c) kinetic energy      (d) acceleration

(vi) Mark the incorrect statement regarding the distance.

- (a) it is a scalar quantity  
(b) it depends on the path followed by the object  
(c) it can be positive or negative  
(d) it may not be zero even if displacement is zero

(vii) In an activity for physics lesson, a student was instructed by his teacher to run due north for a distance of 12 m before moving towards east to another 16 m. The time taken was 20 seconds. The average speed of the student is:

- (a)  $2.4 \text{ ms}^{-1}$       (b)  $1.4 \text{ ms}^{-1}$       (c)  $3.4 \text{ ms}^{-1}$       (d)  $1.0 \text{ ms}^{-1}$

(viii) The pressure at a certain depth in river water is  $P_1$  and at the same depth in sea water is  $P_2$  then

- (a)  $P_1 > P_2$       (b)  $P_2 > P_1$       (c)  $P_1 = P_2$       (d)  $P_1 - P_2 = \text{atmospheric pressure}$

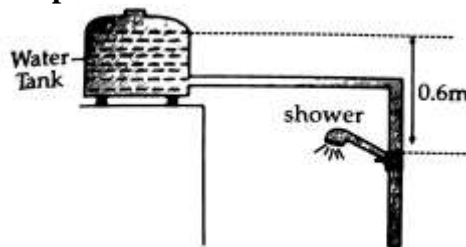
(ix) If the distance of separation between two bodies of different masses is doubled, the force of attraction becomes

- (a) half      (b) twice the initial value      (c) four times      (d) one fourth

(x) A particle is moving in a circular path of radius  $r$ . The displacement after travelling quarter of a circle would be

- (a)  $2r$       (b)  $r/2$       (c)  $\sqrt{2}r$       (d)  $\pi r$

(xi) A plumber noticed that the bath in Ravi's home was not functioning satisfactorily as the water pressure at the shower head was too low



The water pressure at the shower head

- (a) 4000 Pa      (b) 600 Pa      (c) 6000 Pa      (d) 60000 Pa

(xii) Mark the incorrect statement

- (a) The upward force exerted on a body by the fluid in which it is submerged, is called the upthrust or buoyant force.  
(b) If we push the empty can into water, we feel a downward force.  
(c) Gases also exhibit buoyancy.  
(d) If a piece of cork is placed on the surface of water in a tub, it floats partially inside water.

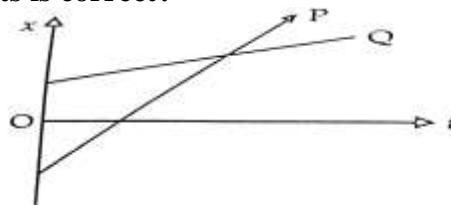
(xiii) Which of the following is a derived unit that can be expressed by three fundamental units?

- (a) Volume                      (b) Energy                      (c) Velocity                      (d) Density

(xiv) If the displacement of an object is proportional to square of time, then the object moves with

- (a) uniform velocity  
(b) uniform acceleration  
(c) increasing acceleration  
(d) decreasing acceleration

(xv) Figure shows the displacement- time curve of the particles P and Q. Which of the following statements is correct?



- (a) Both P and Q move with equal uniform speed  
(b) P is accelerated, Q is retarded  
(c) Both P and Q move with uniform speeds but speed of P is more than the speed of Q  
(d) both P and Q move with uniform speeds but speed of Q is more than the speed of p

### Question 2

- (i) (a) What is the frequency of a second's pendulum?  
(b) What will be the effect on the frequency of any simple pendulum if the mass of the bob is increased keeping the effective length same?  
(c) How are angstrom and centimetre related mathematically? [3]
- (ii) Write general characteristics of non-contact forces. [2]
- (iii) A ball is thrown up vertically, and returns back to the thrower in 6 s. Assuming there is no air friction, draw the acceleration-time graph representing the journey. [2]
- (iv) Two bodies of masses  $M_1$  and  $M_2$  have the same linear momentum. What is the ratio of their Kinetic energies? [2]
- (v) Pressure in case of solids is inversely proportional to area of cross section. Does this statement hold true for fluids? Justify your answer. [2]
- (vi) Write two uses of an aneroid barometer. [2]
- (vii) A body of density  $\rho$  is emerged in a liquid of density  $\rho_L$ . State the condition for  
(a) the body to float      (b) to sink in liquid. [2]

### Question 3

- (i) How can Newton's first law of motion be obtained from second law of motion? [2]
- (ii) How does the liquid pressure on a diver change if  
a) The diver moves to the greater depth and  
b) As diver moves horizontally. [2]
- (iii) Draw a graph showing the variation of acceleration with mass when force remains constant. [2]

- (iv) A body is suspended by a string from a rigid support. Draw a neat and labelled diagram showing the forces acting on it. [2]
- (v) A body is thrown vertically upward with an initial velocity  $u$ . Derive the expression for time taken to attain the maximum height. [2]

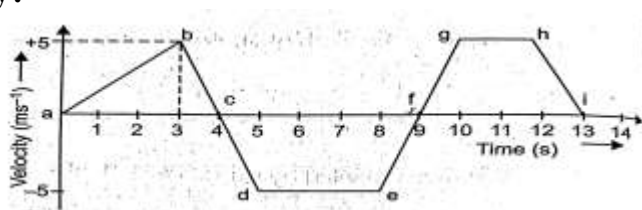
### SECTION B

(Attempt any four questions)

#### Question 4

[4+3+3]

- (i) (a) The time periods of two pendulums are 1.44 second and 0.36 second respectively. Compare their effective lengths.  
 (b) A boy is swinging on a swing. If another boy sits along with him without disturbing the motion how will the time period change? Give a reason.
- (ii) Derive the relationship between 'g' and 'G'. Hence justify the statement "Two objects of different masses, dropped from the same height in vacuum will reach the ground together"
- (iii) Consider the following velocity time graph of a body in motion as shown.  
 a) Find displacement and distance travelled by the body.  
 b) Mention the time interval when the object was moving with negative uniform velocity?



#### Question 5

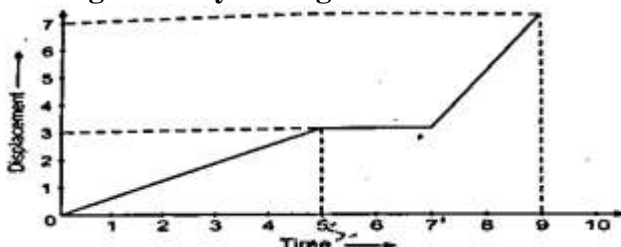
[4+3+3]

- (i) a) Derive an expression for the pressure at a point inside a liquid.  
 b) "Hydraulic machines act as force multipliers". Justify the statement.
- (ii) A cube of each side 15 cm is immersed in a tube containing water of density 1000 such that its top surface is 20 cm below the free surface of the water. Calculate  
 (a) The pressure at the top of cube.  
 (b) The pressure at the bottom of the cube.  
 (Atmospheric pressure =  $10^5$  Pa and  $g = 10 \text{ ms}^{-2}$ )
- (iii) a) Will a pendulum clock move slowly or quickly in the winter? Give reasons.  
 b) Define 1 Newton force.

#### Question 6

[4+3+3]

- (i) In the figure given below the displacement of a body is shown at different times:  
 a) Calculate the velocity of the body during the three different segments of time.  
 b) Find the average velocity during the time interval 5 s to 9 s.



- (ii) A hockey ball of mass 100 g at rest, is hit by a hockey stick, such that the force acts on the ball for 0.08 s. The ball covers a distance of 80 m in next 1.6 s. Find the magnitude of force applied.
- (iii) Draw a labelled diagram clearly indicating the positions of centre of gravity and centre of buoyancy along with the forces that act on a body partially submerged in a liquid.

#### Question 7

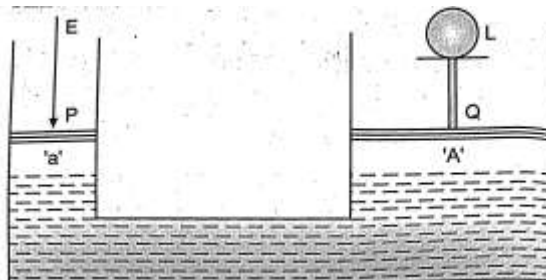
[4+3+3]

- (i) A train starts from rest and accelerates uniformly at a rate of  $2 \text{ ms}^{-2}$  for 10s. It then maintains a constant speed for 200s, the brakes are then applied and the train is uniformly retarded and comes to rest in 50 s. Find
  - (a) maximum velocity reached.
  - (b) the retardation in the last 50 second.
  - (c) the total distance travelled.
- (ii) a) Define 1 Pascal pressure.  
b) Why does a fountain pen leak at higher altitude?
- (iii) A metal plate of length 1.5 m and width 0.2 m is placed 40 cm below alcohol of density  $800 \text{ kgm}^{-3}$ . If the atmospheric pressure is  $10^5 \text{ Pa}$ , calculate total force experienced by the plate. (Density of mercury =  $13600 \text{ kgm}^{-3}$ )

#### Question 8

[4+3+3]

- (i) The figure given below is a simplified version of hydraulic press. Answer the following questions.



- a) What is the pressure exerted on the piston P?
- b) What is the pressure throughout the fluid?
- c) What is the pressure exerted by the fluid on piston Q?
- d) What is the thrust on the piston Q?
- (ii) a) Write any two laws of liquid pressure.  
b) Why is water not used as a barometric liquid?
- (iii) Why does the atmospheric pressure vary with altitude? Draw a graph to illustrate it.

#### Question 9

[4+3+3]

- (i) (a) Write two factors affecting upthrust.  
(b) Calculate the equivalent height of a water barometer, if the pressure recorded by mercury barometer is 60 cm of mercury. (Density of mercury is  $13600 \text{ kgm}^{-3}$  and density of water is  $1000 \text{ kgm}^{-3}$ ).
- (ii) Derive the equation  $v^2 = u^2 + 2as$  graphically for uniformly accelerated motion.

- (iii) Figure shows the same block of wood floating in three different liquids A, B, C of densities  $\rho_1$ ,  $\rho_2$ ,  $\rho_3$  respectively. Which of the liquids has highest density and which one has lowest density? Give reason for your answer.

