

ARYAN INSTITUTE

CLASS-11TH
SUBJECT-PHYSICS
SAMPLE PAPER -03

Time Allowed :3 Hr

Max. Marks :70

General Instructions:

1. All questions are compulsory. There are 37 questions in all.
2. This question paper has four sections: Section A, Section B, Section C and Section D.
3. Section **A contains** twenty questions of one mark each, Section **B contains** seven questions of two marks each, Section **C contains** seven questions of three marks each, and Section **D contains** three questions of five marks each.
4. There is no overall choice. However, internal choices have been provided in two questions of one mark each, two questions of two marks, one question of three marks and three questions of five marks weightage. You have to attempt only one of the choices in such questions.
5. Use of Calculation is not permitted. However, you may use log tables if necessary.
6. You may use the following values of physical constants wherever necessary:

$$\text{Boltzmann's constant } K = 1.381 \times 10^{-23} \text{ J K}^{-1}$$

$$\text{Avogadro's number } N_A = 6.022 \times 10^{23} / \text{mol}$$

$$\text{Radius of Earth} = 6400 \text{ km}$$

$$1 \text{ atmospheric pressure} = 1.013 \times 10^5 \text{ Pa}$$

$$g = 9.8 \text{ m/s}^2$$

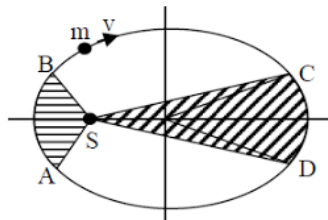
$$R = 8.3 \text{ J mol}^{-1} \text{ K}^{-1}$$

SECTION-A

- Q1.** A ball is thrown vertically upwards. It has a speed of 10 m s^{-1} when it has reached one-half of its maximum height. How high does the ball rise? Take $g = 10 \text{ m s}^{-2}$. **1**
- (a) 10 m (b) 5 m (c) 15 m (d) 30 m
- Q2.** If $\vec{A} \cdot \vec{B} = |\vec{A} \times \vec{B}|$, then the angle between \vec{A} and \vec{B} is **1**
- (a) $\frac{\pi}{2}$ (b) π
(c) $\frac{\pi}{4}$ (d) $\frac{\pi}{3}$
- Q3.** If the linear momentum is increased by 50%, the kinetic energy will increase by **1**
- (a) 50% (b) 100% (c) 125% (d) 25%

Q4. Two particles, which are initially at rest, move towards each other under the action of their internal attraction. If their speeds are v and $2v$ at any instant, then the speed of centre of mass of the system will be- **1**
 (a) $1.5v$ (b) v (c) $2v$ (d) zero

Q5. The figure shows elliptical orbit of a planet m about the Sun S . The shaded area SCD is twice the shaded area SAB . If t_1 is the time for the planet to move from C to D and t_2 is the time to move from A and B , then **1**



(a) $t_1 > t_2$ (b) $t_1 = 4t_2$ (c) $t_1 = 2t_2$ (d) $t_1 = t_2$

Q6. A mass m attached to a spring has an oscillation period 2 s. If the mass is increased by 2 kg, the oscillation period increases by 1 s. The initial mass m is- **1**
 (a) 1.6 kg (b) 3.9 kg (c) 9.6 kg (d) 12.6 kg

Q7. Tube A has both ends open while tube B has one end closed, otherwise they are identical. The ratio of fundamental frequency of tube A and B is **1**
 (a) 1:2 (b) 1:4 (c) 2:1 (d) 4:1

Q8. If the temperature of the sun were to be increased from T to $2T$ and its radius from R to $2R$, then the ratio of the radiant energy received on the earth to what it was previously will be - **1**
 (a) 4 (b) 16 (c) 32 (d) 64

Q9. SI unit of solid angle is- **1**
 (a) Radian (b) Steradian (c) Degree (d) Paralleltic second

Q10. A particle moves in a straight line with a constant acceleration. It changes its velocity from 10 m s^{-1} to 20 m s^{-1} while passing through a distance 135 m in t seconds. The value of t is **1**
 (a) 1.8 (b) 12 (c) 9 (d) 10

Q11. The length of a simple pendulum is increased by 1%. Its time period willby..... **1**

Q12. A ball is thrown upwards with a velocity of 5 m s^{-1} . The ball will back on the ground after a time.....(Take $g = 10 \text{ m s}^{-2}$)

Q13. Theorem of perpendicular axes is valid only for..... **1**

Q14. A string is subjected to a tension of 40 N. If one meter length of string weights 1 gram, the velocity of transverse waves set up in the string is..... **1**

Q15. A frame of reference which is either at rest or moving with a uniform velocity is called an **1**

OR

A car moving in uniform circular motion is an example offrame of reference.

- Q16.** What do you mean by rms speed of molecules of a gas? Is rms speed same as the average speed at given temperature? **1**
- Q17.** A simple harmonic motion is described by $a = -16x$, where a is acceleration and x is displacement in metre. What is the time-period? **1**
- Q18.** Write the name of weakest fundamental force in nature. **1**
- Q19.** Define moment of inertia and give its SI unit. **1**
- Q20.** A body is being raised to a height h from the surface of earth. What is the sign of work done by (a) applied force, (b) gravitational force? **1**

OR

Under what condition is the work done by a force maximum?

SECTION-B

- Q21.** The period of oscillation of a simple pendulum is $T = 2\pi \sqrt{\frac{L}{g}}$. Measured value of L is 20 cm known to 1 mm accuracy and time for 100 oscillations of the pendulum is found to be 90 s using a wrist watch of 1 s resolution. What is the accuracy in the determination of g ? **2**

OR

The length, breadth and thickness of a rectangular sheet of metal are 4.234 m, 1.005 m and 2.01 cm respectively. Find the area and volume of the sheet to correct significant figures.

- Q22.** Galileo, in his book Two New Sciences, stated that “for elevations which exceed or fall short of 45° by equal amounts, the ranges are equal.” Prove this statement. **2**

OR

An aircraft executes a horizontal loop of radius 1.00 km with a speed of 900 km/h. Compare its centripetal acceleration with the acceleration due to gravity (g).

- Q23.** A cyclist speeding at 18 km/h on a level road takes a sharp circular turn of radius 3 m without reducing the speed. The co-efficient of static friction between the tyres and road is 0.1. Will the cyclist slip while taking the turn? Explain. **2**
- Q24.** Why does a gun recoil on firing? What is recoil velocity? Find the expression for it. **2**
- Q25.** State Hook’s law. Calculate the fractional compression, $\frac{\Delta V}{V}$ of water at the bottom of the ocean having depth 3000 m. **2**

- Q26.** What is the mean free path of a gas molecule? On which factors does the mean free path depend? **2**
- Q27.** State the theorem of parallel axes and perpendicular axes. **2**

SECTION-C

- Q28.** Show that there are two values of time for a projectile when it is at same height. Also show that the sum of these two times is equal to the time of flight. **3**

OR

Prove the following relations by calculus method:

- (i) $s = ut + \frac{1}{2}at^2$
 (ii) $v^2 - u^2 = 2as$
 (iii) $u = u + at$

- Q29.** What is meant by parallax? How can we find the distance of a planet by parallax method? **3**
- Q30.** What is a couple? What effect does it have on a body? Show that moment of couple is same irrespective of the point of rotation of the body. **3**
- Q31.** Calculate the heat required to convert 3 kg of ice at -12°C kept in a calorimeter to steam at 100°C at atmospheric pressure. Given specific heat capacity of ice = $2100 \text{ J kg}^{-1} \text{ K}^{-1}$, specific heat capacity of water = $4186 \text{ J kg}^{-1} \text{ K}^{-1}$, latent heat of fusion of ice = $3.35 \times 10^5 \text{ J kg}^{-1}$ and latent heat of steam = $2.256 \times 10^6 \text{ J kg}^{-1}$. (No heat is absorbed by the calorimeter). **3**
- Q32.** Define escape speed and derive the expression for escape velocity on earth's surface. **3**
- Q33.** Calculate the change in energy of a 500 kg satellite when it falls from altitude of 200 km to 199 km. If this change takes place during one orbit, calculate the retarding force on the satellite. (Given: mass of earth = $6 \times 10^{24} \text{ kg}$ and radius of earth = 6400 km) **3**
- Q34.** An air bubble of volume 1.0 cm^3 rises from the bottom of a lake 40 m deep at a temperature of 12°C . To what volume does it grow when it reaches the surface which is at a temperature of 35°C ? **3**

SECTION-D

- Q35.** (i) Derive an expression for the excess pressure inside a soap bubble. **5**
 (ii) State and prove Bernoulli's theorem.

OR

- (i) Show that the pressure exerted by a liquid column is proportional to its height.
 (ii) State Pascal's law and its application.
- Q36.** (i) State the laws of limiting friction. **5**
 (ii) Calculate the acceleration of body sliding down a rough inclined

plane.

OR

- (i) Why does a horse pull a cart harder during the first few steps of its motion?
- (ii) Sudden motion on a blanket removes the dust particles from blanket. Why?
- (iii) A batsman deflects a ball by an angle 45° without changing its initial speed which is equal to 54 km/h. What is the impulse imparted to the ball? Mass of the ball is 0.15 kg.

Q37.

- (i) Define SHM. What are its characteristics? At what distance from the mean position in SHM of amplitude 'r' the energy is half kinetic and half potential? **5**
- (ii) A body oscillates with SHM according to the equation (in SI unit)

$$x = 5 \cos \left[2\pi t + \frac{\pi}{4} \right]$$

At $t = 1.5$ seconds, calculate (i) displacement, (ii) speed.

OR

- (i) What is the nature of sound waves in air? How is the speed of sound waves in atmosphere affected by the (a) humidity, (b) temperature?
- (ii) Derive an expression for nth mode of vibration in case of a closed end organ pipe. Hence, give the value of $v_1 : v_3 : v_5$.