D.A.V. BR PUBLIC SCHOOL BINA
Practice Paper Session 2023-24
Class XI   Subject Physics

Time Allowed 3 Hrs   **MM:70**

General Instructions:

i. There are 33 questions in all. All questions are compulsory.

ii. This question paper has five sections: Section A, Section B, Section C, Section D   and Section E.

iii. All the sections are compulsory.

iv. Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study based questions of four marks each and Section E contains three long answer questions of five marks each.

v. There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.

vi. Use of calculators is not allowed.

Section A

1. Plants get water through roots because of   **1**

    a) Elasticity   b) Viscosity c) Capillarity d) Gravity

2. The x and y coordinates of a particle at any time t is given by $x = 7t+4t^2$ and $y = 5t$,   **1**
    where x and y are in metre and t in seconds. The acceleration of particle at t = 5s is

    a) $41m/s^2$ b) $25m/s^2$ c) $17 m/s^2$ d) $8m/s^2$

3. The temperature of a wire is doubled. Young's modulus of elasticity   **1**

    a) will become four times   b) will also double

    c) will remain the same   d) will decrease

4. The maximum load a wire can withstand without breaking when its length is reduced to   **1**
    half of its original length, will be-

    a) Unchanged b) four times c) Two times   d) half

5. The angle of contact for pure water and clean glass will be-   **1**

    a) 90 degree b) 0 degree c) 8 degree d) 110 degree

6. Two masses m and 4m are moving with equal kinetic energies. The ratio of the magnitude of their linear momenta is   **1**

    a) 1:3 b) 1:4 c) 1:2 d) 1:6

7. In the equation PV=RT, V refers to the volume of-   **1**

    a) 1 kg of gas b) 1g of gas c) 1 mole of gas d) Any amount of gas

8. Total internal energy of a mole of monatomic gas at temperature T is   **1**

    a) $\frac{1}{2}RT$ b) $\frac{5}{2}RT$ c) $\frac{7}{2}RT$ d) $\frac{3}{2}RT$

9. In an elastic collision, what is conserved?   **1**

    a) Kinetic energy b) Momentum

    c) Kinetic energy and momentum d)Neither kinetic energy nor momentum

10. A ball is travelling with uniform translatory motion. This means that   **1**

    a) It is at rest.

    b) The path can be a straight line or circular and the ball travels with uniform speed.

    c) All parts of the ball have the same velocity magnitude and direction and the velocity is constant.

    d) The centre of the ball moves with constant velocity and the ball spins about its centre uniformly.

11. A mass of 5 kg is moving along a circular path of radius 1 m. If the mass moves with 300 revolutions per minute, its kinetic energy would be   **1**

    a) $250\ \pi^2$ b) $100\ \pi^2$ c) $5\pi^2$ d) 0

12. Beats are produced by two waves $Y_1 = a \sin (2000\ \pi t)$ and $Y_2 = a \sin (2008\ \pi t)$ **1**

    The number of beats heard per second is

    (a) zero (b) one (c) four (d) eight

For Questions 13 to 16, two statements are given –one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below

    a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.

    b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

    c) If Assertion is true but Reason is false.

    d) If both Assertion and Reason are false.

13. **Assertion(A):** In a one dimensional perfectly elastic collision between two moving bodies of equal masses, the bodies merely exchange their velocities after collision.   **1**

Reason (R): lf a lighter body at rest suffers perfectly elastic collision with a very heavy body moving with a certain velocity, then after collision both travel with same velocity.

14. **Assertion (A):** When a body completes its 'round trip', the net work done against gravitational force is zero.   **1**

    Reason (R) : Gravitational force is conservative in nature.

15. **Assertion (A):** If the sum of the two unit vectors is also a unit vector, then magnitude of their difference is root of three.   **1**

    Reason (R): To find resultant of two vectors, we use square law.

16. **Assertion (A):** The maximum horizontal range of the projectile is proportional to square of velocity.   **1**

    Reason (R) : The maximum horizontal range of the projectile is always equal to maximum height attained by projectile.

Section B

17. Compute the fractional change in volume of a glass slab, when subjected to a hydraulic pressure of 10 atm. Bulk modulus of glass B $= 37{\times}10^9 \ \text{Nm}^{-2}$ **2**

18. a) Why does the temperature of a gas rise when the gas is suddenly compressed? Explain on the basis of the kinetic theory of gases.   **2**

    b) Why do molecules of air in a room not fall and settle on the ground under the action of gravity?

OR

    a) When volume of a given mass of a gas is reduced at constant temperature, the gas pressure increases. How will you explain this fact on the basis of the kinetic theory of gases?

    b) A certain mass of gas is enclosed in a container. When the temperature of the gas is raised, its pressure rises. How will you explain this on the basis of the kinetic theory of gases?

19. State and prove work energy theorem.   **2**

20. Linear momentum is a scalar or a vector? Write its unit and dimensional formula.   **2**

OR

State Newton's second law of motion. Give an example.

21. Oil is sprinkled on sea waves to calm them. Why?   **2**

22. Define (i) Specific heat capacity (ii) Molar specific heat capacity at Constant pressure   **2**

23. a) If a body has infinite heat capacity, what does it mean?   **2**

b) Define triple point of water?

Section C

24. Write the expression of variation in acceleration due to gravity with depth. **3**
    What depth below the surface of earth the weight of body decreases by 1/4 times of the value on the surface.

25. A hollow sphere is filled with water through a small hole in it. It is hung by a long thread **3**
    and as water slowly flows out of the hole at the bottom, one finds that the period of oscillations first increases and then decreases. Explain why?

26. Using kinetic theory of gases, prove that the pressure exerted on the wall of a container by **3**
    an ideal gas is directly proportional to the square of the root mean square speed of the molecules of the gas.

27. Derive the relation between the linear velocity, and the angular velocity, when a body is **3**
    moving along a circular track of radius r.

OR

Derive equations of motion.

28. Is the pressure on the two sides of a curved liquid surface equal? Obtain an expression for **3**
    the excess pressure inside a spherical liquid drop, in terms of its radius R and the surface tension (T) of the liquid.

Section D

29. Heat transfer is defined as the movement of heat across the border of the system due to a **4**
    difference in temperature between the system and its surroundings. The temperature difference exists between the two systems, heat will find a way to transfer from the higher to the lower temperature.

    (i) When heat is transferred by molecular collision, it is referred to as heat transfer by:

    a) convection   b) conduction   c) radiation   d) convection and radiation

    (ii) At what factor heat absorbed by radiation by the body depends on?

    a) distance between body   b) source of heat   c) its colour   d) all of the above

    (iii) The sea breeze caused by:

    a) conduction   b) convection   c) radiation   d) none of these

    (iv) Thermal conductivity of air with rise in temperature:

    a) increase   b) decrease   c) constant   d) none of these

OR

Mass transfer takes place in

a) conduction   b) convection   c) radiation d) Convection and radiation

30. Simple harmonic motion (SHM) is not any periodic motion but one in which displacement is a sinusoidal function of time.A particular type of periodic motion in which a particle moves to and fro repeatedly about a mean position under the influence of a restoring force is termed as simple harmonic motion (S.H.M).Oscillatory motion is said to be simple harmonic if the displacement x of the particle from the origin varies with time as

$$x(t) \; Acos(\omega t + \phi)$$

A body is undergoing simple harmonic motion if it has an acceleration which is directed towards a fixed point, and proportional to the displacement of the body from that point.

Acceleration $a \propto -x \Rightarrow a = -kx \; or \; \frac{d^2x}{dt^2} - kx$

(i) A particle of mass m oscillating under the influence of Hooke's law restoring force given by $F = -k \, x$ exhibits simple harmonic motion.The time period of simple harmonic motion depends upon

 a) amplitude   b) energy   c) phase constant   d) mass

(ii) Which of the following motions is not simple harmonic?

 a) Oscillations of a vertical spring-mass system   b) Motion of a simple pendulum

 c) Motion of planet around the Sun   d) Oscillation of liquid in a U-tube

(iii)Which of the following expressions does not represent simple harmonic motion?

 a) x = A cos ωt + B sinωt   b) x = A cos (ωt + a)

 c) x = B sin (ωt + b)   d) x = A sin ωt cos² ωt

(iv)The particle acceleration during SHM is given by

 a) $\frac{d^2x}{dt^2} = -\omega^2 x$ b) $\frac{d^2x}{dt^2} = -\omega^2 t$ c) $\frac{d^2x}{dt^2} = -\omega x$ d) $\frac{d^2x}{dt^2} = -\omega t$

OR

Which of the following is not a characteristic of simple harmonic motion?

a) The motion is periodic.

b) The motion is along a straight line about the mean position.

c) The oscillations are responsible for the energy conversion.

d) The acceleration of the particle is always directed towards the extreme position.

Section E

31. a) A spherical steel ball (density p) of radius r falls under gravity through a vertical column of a fluid (density o <p) of coefficient of viscosity n. Will the ball attain constant velocity? If yes, under what condition? Can this condition be used to find value of n? Justify giving

the necessary expressions.

b) What is capillary rise and what is the reason of capillary rise and draw the graph which shows relation between capillary rise ′h′ and capillary radius ′r′?

OR

a) State and prove Bernoulli's theorem.

b) Prove that the speed of efflux is the same as the speed a body would acquire in falling freely through a height h.

32. Draw a diagram showing the various forces acting on a vehicle moving on a banked road. Deduce a formula for the maximum velocity with which the vehicle can move along the banked road, when friction' is also present. **5**

OR

State Newton's second law of motion. From this law, obtain a vector expression for force, in terms of acceleration. Hence give the definition of the SI unit of force. Explain why second law of motion is the real law of motion

33. A particle is executing uniform horizontal circular motion with a speed v along a circular path of radius r. **5**

a) Why do we regard the particle as having an accelerated motion, even though its speed is constant?

b) Obtain the expression for this acceleration.

c) Write this expression in vector form.

d) Show that this acceleration is centripetal in nature.

OR

A body is projected with a speed 'u' at an angle of projection θ with the horizontal. Obtain the equation for the trajectory of its motion. States its nature. From the equation obtained deduce the expression for horizontal range R).

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