



VISHWA BHARATI PUBLIC SCHOOL, DWARKA

Annual Examination- (2023-24)

CLASS: XI

TIME: 3Hr

SUBJECT: Physics

Date: 01-01-24

MM: 70

GENERAL INSTRUCTIONS:

1. There are 35 questions in all. All questions are compulsory.
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.
3. Section A contains eighteen MCQ of 1 mark each, Section B contains seven questions of two marks each, Section C contains five questions of three marks each, section D contains three long questions of five marks each and Section E contains two case study based questions of 4 marks each.
4. There is no overall choice. However, an internal choice has been provided in section B, C, D and E. You have to attempt only one of the choices in such questions.
5. Use of calculators is not allowed.

SECTION-A

1. A string has a mass of 100gm & is under a tension of 10N. What should be its length if the speed of transverse waves is to be 10m/s on the string.
a) 1.8m
b) 10m
c) 1m
d) 2m
2. Electromagnetic waves are considered to be which of the following types?
a) Transverse
b) Longitudinal
c) Both Transverse & Longitudinal
d) Neither longitudinal nor transverse
3. The radius and mass of earth are increased by 0.5%. Which of the following statements are true at the surface of the earth?
a) g will increase
b) g will decrease
c) Potential energy will remain unchanged
d) Escape velocity will remain unchanged

- 4 Which of the following variables has zero value at the extreme position in SHM?
- Acceleration
 - Speed
 - Displacement
 - Angular frequency
- 5 A particle is undergoing SHM with amplitude 10cm. The maximum speed it achieves is 1m/s. Find the time it takes to reach from the mean position to half the amplitude.
- $\pi/60$ s
 - $\pi/30$ s
 - $\pi/15$ s
 - $\pi/40$ s
- 6 If 315cal of heat is given to the system, and the system does 20cal of work, find the change in internal energy.
- 295cal
 - 335cal
 - 0 cal
 - 335J
- 7 First law of thermodynamics is based on?
- Conservation of energy
 - Conservation of mass
 - Conservation of momentum
 - Conservation of work
- 8 Consider a tank of height 20m filled with liquid of density 100kg/m^3 . The area of tank is 10m^2 . If the tank has a hole of area 2m^2 at the bottom, find the speed of the liquid flowing out through the hole when the height of liquid in the tank is 10m. Assume speed of liquid descending at top of tank is 5m/s.
- 20m/s
 - 14.14m/s
 - 15m/s
 - 20.615m/s
- 9 Stress in a solid body is defined as _____ per unit area.
- external force applied
 - strain
 - pressure
 - internal forces developed due to externally applied forces
- 10 The total mechanical energy of a system is conserved if the forces doing work in it are ____
- Not conservative
 - Conservative
 - Both a and b

- d) None
- 11 The time rate at which work is done or energy is transferred is called as
- Force
 - Work
 - Heat energy
 - Power
- 12 The acceleration due to gravity on the surface of the earth is _____
- greater towards the equator and lesser towards the poles
 - lesser towards the equator and greater towards the poles
 - same at all points on the surface of the earth
 - same everywhere except at the poles
- 13 Two cylinders have the same mass and radius. One is hollow and the other is solid. Which one will have the greater moment of inertia about the central axis?
- Hollow cylinder
 - Solid cylinder
 - Same for both
 - Depends on length of cylinder
- 14 The direction of zero or null vector is
- Specified
 - Not specified
 - Both a and b
 - Not confirm
- 15 The resultant acceleration of an object in circular motion is towards the centre only if
- Speed is constant
 - Speed is not constant
 - Both a and b
 - None

Directions : Each of these questions contain two statements, Assertion and Reason. Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

- Assertion is correct, reason is correct; reason is a correct explanation for assertion.
- Assertion is correct, reason is correct; reason is not a correct explanation for assertion
- Assertion is correct, reason is incorrect
- Assertion is incorrect, reason is correct.

- 16 Assertion : On a rainy day, it is difficult to drive a car or bus at high speed.
Reason : The value of coefficient of friction is lowered due to wetting of the surface.
- 17 Assertion : An object can move with constant velocity if no net force acts on it.
Reason : No net force is needed to move an object with constant velocity.
- 18 Assertion : Impulse of force and momentum are same physical quantities.
Reason : Both quantities have same unit.

SECTION – B

19. A string of mass 2.50 kg is under a tension of 200 N. The length of the stretched string is 20.0 m. If the transverse jerk is struck at one end of the string, how long does the disturbance take to reach the other end?
20. A spring balance has a scale that reads from 0 to 50 kg. The length of the scale is 20 cm. A body suspended from this balance, when displaced and released, oscillates with a period of 0.6 s. What is the weight of the body?
21. A geyser heats water flowing at the rate of 3.0 litres per minute from 27°C to 77°C . If the geyser operates on a gas burner, what is the rate of consumption of the fuel if its heat of combustion is $4.0 \times 10^4 \text{ J/g}$?
22. A hole is drilled in a copper sheet. The diameter of the hole is 4.24 cm at 27.0°C . What is the change in the diameter of the hole when the sheet is heated to 227°C ? Coefficient of linear expansion of copper = $1.70 \times 10^{-5} \text{ K}^{-1}$.
23. Read each statement below carefully and state with reasons and examples, if it is true or false;
A particle in one-dimensional motion
(a) with zero speed at an instant may have non-zero acceleration at that instant.
(b) with, zero speed may have non-zero velocity.

OR

Explain clearly, with examples, the distinction between:

- (a) Magnitude of displacement (sometimes called distance) over an interval of time, and the total length of path covered by a particle over the same interval;
(b) Magnitude of average velocity over an interval of time, and the average speed over the same interval.

24. State with reasons, whether the following algebraic operations with scalar and vector physical quantities are meaningful:

- (a) adding any two scalars, (b) adding a scalar to a vector of the same dimensions

OR

A body of mass 2 kg initially at rest moves under the action of an applied horizontal force of 7 N on a table with coefficient of kinetic friction = 0.1. Compute the

- (a) Work done by the applied force in 10 s
- (b) Work done by friction in 10 s

25. A body weighs 63 N on the surface of the Earth. What is the gravitational force on it due to the Earth at a height equal to half the radius of the Earth?

SECTION-C

26. 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 .

27. A cylinder with a movable piston contains 3 moles of hydrogen at standard temperature and pressure. The walls of the cylinder are made of a heat insulator, and the piston is insulated by having a pile of sand on it. By what factor does the pressure of the gas increase if the gas is compressed to half its original volume?

28. An electron and a proton are detected in a cosmic ray experiment, the first with kinetic energy 10 keV, and the second with 100 keV. Which is faster, the electron or the proton? Obtain the ratio of their speeds, (electron mass = $9.11 \times 10^{-31} \text{ kg}$, proton mass = $1.67 \times 10^{-27} \text{ kg}$, $1 \text{ eV} = 1.60 \times 10^{-19} \text{ J}$).

OR

A molecule in a gas container hits a horizontal wall with speed 200 ms⁻¹ and angle 30° with the normal, and rebounds with the same speed. Is momentum conserved in the collision? Is the collision elastic or inelastic?

29. The driver of a three-wheeler moving with a speed of 36 km/h sees a child standing in the middle of the road and brings his vehicle to rest in 4.0 s just in time to save the child. What is the average retarding force on the vehicle? The mass of the three-wheeler is 400 kg and the mass of the driver is 65 kg.

OR

A body of mass 0.40 kg moving initially with a constant speed of 10 ms^{-1} to the north is subject to a constant force of 8.0 N directed towards the south for 30 s. Take the instant the force is applied to be $t = 0$, the position of the body at that time to be $x = 0$, and predict its position at $t = -5 \text{ s}$, 25 s, 100 s.

30 Explain why

- (a) To keep a piece of paper horizontal, you should blow over, not under, it.
- (b) When we try to close a water tap with our fingers, fast jets of water gush through the openings between our fingers.
- (c) The size of a needle of a syringe controls flow rate better than the thumb pressure exerted by a doctor while administering an injection.

SECTION-D

34. State First law of Thermodynamics. What is an isothermal process. Derive an expression for work done by system for isothermal process.

OR

Derive an expression for work done by system during an adiabatic process. Show that slope in adiabatic process is γ times the slope in isothermal process?

32. What are standing waves? Derive an expression for the standing waves. Also define the terms node and anti node. .

OR

Discuss the formation of standing waves in string fixed at both ends and the different modes of vibrations.

33. Define coefficient of viscosity and give its SI unit. On what factors does the terminal velocity of a spherical ball falling through a viscous liquid depend? Derive the formula for terminal velocity.

OR

What is meant by streamline flow? State the equation of continuity. Write the properties of an ideal fluid. Establish Bernoulli equation as applied to an ideal fluid.

SECTION-E

34. The average velocity tells us how fast an object has been moving over a given time interval but does not tell us how fast it moves at different instants of time during that interval. For this, we define instantaneous velocity or simply velocity v at an instant t . The velocity at an instant is defined as the limit of the average velocity as the time interval Δt becomes infinitesimally small.

1) The area under velocity time graph gives

- a) Displacement over given time interval
- b) Acceleration
- c) Velocity
- d) None of these

- 2) Slope of velocity time graph gives
- Acceleration
 - Velocity
 - Distance
 - Displacement.
- 3) Write note on velocity time graph.
- 4) Write a note on position time graph

35. Projectile motion is a form of motion in which an object or particle is thrown with some initial velocity near the earth's surface and it moves along a curved path under the action of gravity alone. The path followed by a projectile is called its trajectory, which is shown below. When a projectile is projected obliquely, then its trajectory is as shown in the figure below.

Here velocity u is resolved into two components, we get (a) $u \cos\theta$ along OX and (b) $u \sin\theta$ along OY.

- The example of such type of motion is
 - motion of car on a banked road
 - motion of boat in sea
 - a javelin thrown by an athlete
 - motion of ball thrown vertically upward
- The acceleration of the object in horizontal direction is
 - constant
 - decreasing
 - increasing
 - zero
- The vertical component of velocity at point H is
 - maximum
 - zero
 - double to that at O
 - equal to horizontal component
- A cricket ball is thrown at a speed of 28 m/s in a direction 30° with the horizontal. The time taken by the ball to return to the same level will be
 - 2.0 s
 - 3.0 s
 - 4.0 s
 - 2.9 s