



VISHWA BHARTI PUBLIC SCHOOL- DWARKA
Term I Examination – 2024-25

Class: XI
 Subject: **Physics**

Date: 09/09/2024

Time: 3hr
 MM: 70

General Instructions:

- (1) There are 33 questions in all. All questions are compulsory.
- (2) All the sections are compulsory.
- (3) 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.
- (4) 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.

SECTION-A

1. If the energy (E), velocity (v) and force (F) be taken as fundamental quantity, then the dimensions of mass will be
 (a) Fv^2 (b) Fv^{-1} (c) Ev^2 (d) Ev^{-2}
2. The force is given in terms of time t and displacement x by the equation $F = A \cos Bx + C \sin Dt$. The dimension formula of $\frac{AD}{B}$ is
 (a) $[M^0LT^{-1}]$ (b) $[ML^2T^{-3}]$ (c) $[M^1L^{-1}T^{-2}]$ (d) $[M^2L^2T^{-3}]$
3. If $t = \sqrt{x} + 4$, then $\left(\frac{dx}{dt}\right)_{t=4}$ is
 (a) 4 (b) zero (c) 8 (d) 16
4. A body drop from a height h, reaches the ground with a velocity of 3 km/h. Another body of the same mass dropped from the same the height h with an initial speed 4 km/h will reach the ground with a velocity of
 (a) 3 km/h (b) 4km/h (c) 5km/h (d) 12km/h
5. The horizontal range and the maximum height of a projectile are equal. The angle of projection of the projectiles is
 (a) $\theta = \tan^{-1}\left(\frac{1}{4}\right)$ (b) $\theta = \tan^{-1}(4)$ (c) $\theta = \tan^{-1}(2)$ (d) $\theta = 45^\circ$
6. The value of p so that the vector $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} + 2\hat{j} - 3\hat{k}$ and $3\hat{i} + p\hat{j} + 5\hat{k}$ are coplanar
 (a) 16 (b) -4 (c) 4 (d) -8
7. A truck and a car are moving with equal velocity. On applying brakes, both will stop after certain distance, then
 (a) Truck will cover less distance before stopping
 (b) Car will cover less distance before stopping
 (c) Both will cover equal distance
 (d) None of these
8. An object is moving on a plane surface with uniform velocity 10ms^{-1} in presence of a force 10N. The frictional force between the object and the surface is.
 (a) 1N (b) -10 N (c) 10N (d) 100N
9. A force $F = (2 + x)$ N acts on a particle in the x-direction. The work done by this force during a displacement from $x = 1.0\text{m}$ to $x = 2.0\text{m}$ is
 (a) 2.1J (b) 2.5J (c) 3.5J (d) 4.5J
10. In an inelastic collision, what is conserved?
 (a) Kinetic energy (b) Momentum (c) Both (a) and (b) (d) Neither (a) nor (b)
11. Two identical particles move towards each other with velocity $2v$ and v respectively. The velocity of their center of mass is

- (a) 0 (b) v (c) $\frac{v}{2}$ (d) $\frac{v}{3}$

12. A solid sphere of mass M and radius R is rotating about an axis passing through its center making 600 rev min^{-1} . Its rotational kinetic energy is
 (a) $80\pi R$ (b) $80\pi^2 MR^2$ (c) $\frac{2}{5}\pi^2 MR$ (d) $\frac{2}{5}\pi M^2 R^2$

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.

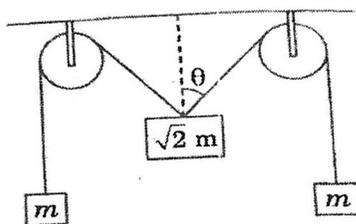
- a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.
 b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
 c) If Assertion is true but Reason is false.
 d) If both Assertion and Reason are false.
13. Assertion (A): In javelin throw, the athlete throws the projectile at an angle slightly more than 45° .
 Reason (R): The maximum range does not depend upon angle of projection.
14. Assertion (A) : During turning a cyclist leans toward the center of the curve, while a man sitting in a car leans outward of the curve.
 Reason (R) : An acceleration is acting toward the center of the curve.
15. Assertion (A): A rigid body is that which has a definite shape and size.
 Reason (R): Distances between different pairs of particles of such a body do not change on applying any force on it.
16. Assertion (A): When a body moves along a circular path, no work is done by the centripetal force.
 Reason (R) : The centripetal force is used in moving the body along the circular path and hence no work is done.

SECTION B

17. Draw the following graphs for an object projected upward with a velocity v_0 , which comes back to the same point after some time:
 (i) Acceleration versus time graph
 (ii) Speed versus time graph
18. Assuming that the mass M of the longest stone that can be moved by a flowing river depend upon 'v' the velocity, ' ρ ' the density of water and on 'g' the acceleration due to gravity. Show that M varies with the sixth power of the velocity of flow.
19. A man runs across the roof – top of a tall building and jumps horizontally with the hope of landing on the roof of the next building which is of a lower height than the first. If his speed is 9 m/s , the (horizontal) distance between the two building is 10 m and the height difference is 9 m , will he be able to land on the next building? (take $g = 10 \text{ m/s}^2$)
20. A body rolled on ice with a velocity of 8 ms^{-1} comes to rest after travelling 4 m . Compute the coefficient of friction. Given $g = 9.8 \text{ ms}^{-2}$
21. (a) Show that for two complementary angles of projection of a projectile throw with the same velocity, the horizontal ranges are equal
 (b) For what angle of projection of a projectile, horizontal range becomes equal to maximum height?
- OR
- (b) Find the area of a parallelogram whose diagonals are $\vec{A} = 2\hat{i} + \hat{j} + \hat{k}$ and $\vec{B} = \hat{i} - \hat{j} + 2\hat{k}$

SECTION C

22. (a) Explain briefly about tension.



- (b) The pulleys and string shown in figure are smooth and of negligible mass. For the system to remain in equilibrium, what should be the angle θ ?
23. Explain, which is easier to pull or push a pitch roller.
24. A woman pushes a trunk on railway platform which has a rough surface. She supplies a force of

100N over a distance of 10m. Thereafter she gets progressively tired and her applied force reduces linearly with distance to 50N. The total distance by which the trunk has been moved is 20m. Plot the force applied by the woman and the frictional force, which is 50N. Calculate the work done by the two forces over 20m.

25. A bomb at rest explodes into two fragments of masses 2.0 kg and 1.0 kg. The total energy of the fragment is found to be 4×10^4 J. Calculate the momentum of the smaller fragment.
26. (a) Explain the reason why a diver performs somersaults by jumping from a high diving board keeping his legs and arms out stretched first and then curling his body.

(b) A child stands at the center of a turn table with his two arms outstretched. The turn table is set rotating with angular speed of 40 rpm. How much is the angular speed of the child, if he folds his hands back reducing the moment of inertia to $\frac{2}{5}$ time the initial value? Assume that the turn table rotates without friction. Show that the child's new K.E of rotation is more than the initial K.E of rotation. How do you account for this increase in K.E?

27. (a) If earth was to shrink suddenly with the mass remaining constant, what would happen to the length of the day?
- (b) A flywheel of mass 25 kg has a radius of 0.2 m. It is making 240 rpm. What is the torque necessary to bring it to rest in 20 s? If the torque is due to a force applied tangentially on the rim of the wheel, what is the magnitude of the force? Assume that mass of flywheel is concentrated at its rim.

28. State the parallelogram law of vector addition and find the magnitude and direction of the two vectors \vec{P} and \vec{Q} include at an angle θ with each other. What happens, when $\theta = 0^\circ$ and $\theta = 90^\circ$.

OR

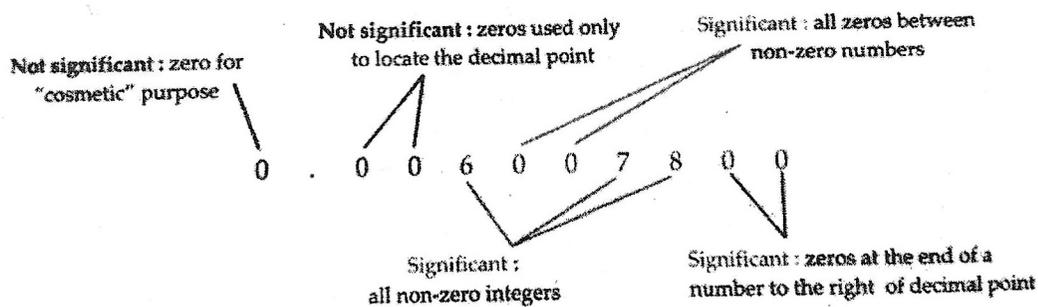
What is projectile? A projectile is fired with a velocity u at angle Θ with the horizontal. Show that the trajectory is a parabola.

SECTION D

Case Study Based Questions

29. Read the following paragraph and answer the questions that follow.

Every measurement involves errors. The result of a measurement should be reported in a way that indicates the precision of measurement. The reported result is a number that includes all the digits in the number which are known reliably plus the first digit that is uncertain. The reliable digits plus the first uncertain digit are known as significant figures. Significant figures indicate precision the precision of measurement which, in turn, depends on the least count of the measuring instrument. A choice of change of different units does not change the number of significant figures in a measurement. Only proper significant figures should be retained in reporting measured computed quantities. Rules for determining the number of significant figures, carrying out arithmetic operations with them, and 'rounding off' the uncertain digits must be followed.



- (i) The significant figures of the number 6.0023
 (a) 1 (b) 5 (c) 4 (d) 2
- (ii) If $L = 2.331$ cm, $B = 2.1$ cm, then $L + B = ?$
 (a) 4.431 cm (b) 4.43 cm (c) 4.4 cm (d) 4 cm
- (iii) The respective number of significant figures for the numbers 23.023, 0.0003 and 2.1×10^{-3} are
 (a) 4, 4, 2 (b) 5, 1, 2 (c) 5, 1, 5 (d) 5, 5, 2
- (iv) A student measured the length of a rod and wrote it as 3.50 cm. Which instrument did he use to measure it?
 (a) A metre scale
 (b) A vernier callipers where the 10 divisions in vernier scale match with 9 divisions in main

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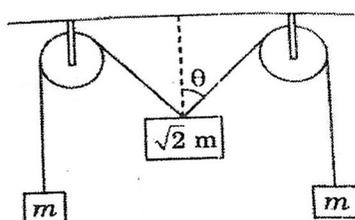
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in a distance of 50m.

32. What is perfect elastic collision? Obtain the expression for the final velocity for the two bodies undergoing elastic collision in one dimension. Also prove that if the masses are equal, the velocities get exchange after the collision.

OR

- (a) Discuss elastic collision between two bodies in ~~one~~ dimensions.
(b) A railway carriage of mass 9000kg moving with a speed of 36 kmh^{-1} collides with stationary carriage of the same mass. After the collision, the carriage get coupled and move together. What is their common speed after collision? What type of collision is this?
33. (a) Derive the following rotational kinematic equation
 $\omega^2 - \omega_0^2 = 2\alpha\theta$, where the symbols have their usual meaning.
(b) The motor of an engine is rotating about its axis with angular velocity of 100 rpm. It comes to rest in 15 s, after being switched off. Assuming constant angular deceleration, calculate the number of revolutions made by it before coming to rest.

OR

- (a) Define kinetic energy of rotation of a body. Derive the expression for the kinetic energy of rotation of a rigid body rotating in XY plane about Z-axis with a uniform angular velocity ω .
(b) An energy of 484 J is spent in increasing the speed of a flywheel from 60 rpm to 360 rpm. Calculate moment of inertia of flywheel.