CLASS XI - PHYSICS

✣ 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 few questions. You have to attempt only one of the choices in such questions.

(5) Use of calculators is not allowed.

✣ SECTION A

1. What energy does a stretched spring in a clock possess?
   A) Potential energy B) Kinetic energy
   C) Gravitational energy D) Elastic potential energy
2. Which of the following is a one-dimensional motion
   A) Landing of an aircraft
   B) Earth revolving around the sun
   C) Motion of wheels of a moving train
   D) Train running on a straight track
3. Identify the pair whose dimensions are equal.
   A) Work and energy B) force and work
   C) Impulse and moment of Inertia D) force and energy
4. The centripetal component of acceleration arises when?
   A) The direction of motion is changed.
   B) The direction propagation is changed.
   C) The direction of gravity is changed.
   D) The direction of projectile is changed. 1
5. A body of mass M hits normally a rigid wall with velocity v and bounces back with the same velocity. The impulse experienced by the body is
   A) Zero B) Mv C) 1.5Mv D) 2Mv
6. The radius and mass of earth are increased by 1%. 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

7. A body of mass M moves with a uniform speed v in a circle of radius r. Acceleration of the mass is
   A) 0 B) mv^2/r C) r^2/v D) v^2/r
8. A projectile is thrown up with speed 20 m/s at an angle 60º with the ground. Its velocity at the topmost point is
   A) 0m/s B) 20m/s C) 10m/s D) 15m/s
9. A person is holding a bucket by applying a force of 20 Newton. He moves a horizontal distance of 10 m and then climbs up a vertical distance of 25 m. Find the total work done by him.
   A) 100 J B) 150 J C) 50 J B) 500 J
10. A bomb is released by a horizontal flying airplane. The trajectory of the bomb is:
    A) parabola B) a straight-line
    C) a circle D) a hyperbola
11. One man takes 1 minute to raise a box to a height of 1 meter and another man takes (1/2) minute to do so. The energy of the two is:
    A) Different B) Same
    C) energy of the first is more
    D) energy of the second is more. 1
12. In motion of an object under the gravitational influence of another object. Which of the following quantities is not conserved?
    A) Angular momentum
    B) Mass of an object
    C) Total mechanical energy
    D) Linear momentum.
13. If the mass of bob of simple pendulum is increased by 50%, the time period of the pendulum:
    A) does not change B) increases
    C) decreases D) none of these
14. The young's modulus of a wire of length L. and radius r is Y. If the length and radius are halved, then what will be its young's modulus?
    A) Y/2 B) Y C) 2Y D) 4Y
15. Moment of inertia depends on
    A) Distribution of particles
    B) Mass

C) Position of axis of rotation
D) All of these

✣ SECTION B

For question 16, 17 and 18, two statements are given one labelled assertion A and the other labelled reason R. Select the correct answer to these questions from the codes a,b,c and d as given below.

a) both A and R are true and R is the correct explanation of A
b) both A and R are true but R is not the correct explanation of A
c) A is true but R is false
d) A is false and R is also false

16. Assertion (A): Bullet fired from a pistol not the projectile.
Reason: (R): In projectile motion body contains both horizontal and vertical acceleration

17. Assertion (A): Newton's third law is conservation of linear momentum.
Reason (R): Newton's second law also indicates conservation of linear momentum

18. Assertion(A): In simple harmonic motion, the velocity is maximum when the displacement is minimum.
Reason (R): Displacement and velocity of S.H.M. differ in phase by $\pi/2$

✣ SECTION C

19. A truck of mass 1000 kg moving with a speed of 72 km/hr collides with a stationary truck of the same mass. After the collision, the trucks get stick together and move. Calculate their common speed after collision.

OR

A simple harmonic motion is represented by $Y=15\sin(10t+0.4)$ cm
Find (i) Frequency (ii) Angular frequency (iii) Time period
(iv) Initial phase.

20. A body of mass 10Kg revolves in a circle of diameter 0.4m, making 1000rpm.Calculate. (i) Its linear velocity. (ii) Centripetal acceleration.

OR

Sate the law of conservation of linear momentum. What is the necessary condition to conserve it?

21. Discuss the variation of acceleration due to gravity with depth below the earth's surface.
22. A body of mass 0.25 Kg moving with velocity 12 m/s is stopped by applying a force of 0.6 N. Calculate the time taken to stop the body. Also calculate the impulse of this force.
23. Write an expression for the centre of mass of two particle system. What will be the location of centre of mass if the two particles have equal masses?
24. State and prove the equation of continuity.
25. Show that the motion of a simple pendulum is for small oscillation is simple harmonic in nature.

✣ SECTION C

26. Find the maximum and minimum velocity of a vehicle of mass m on a banked road of banking angle 0, if coefficient of static friction of the wheels of vehicle with the road is μ?3

OR

An aircraft executes a horizontal loop at a speed of 720 km/h with its wings banked at 15 degree. What is the radius of the loop? (tan 15 degree = 0.2679)

27. Draw a graph between force of friction and applied force and then show the friction graph which show the limiting friction.
28. Derive the Work-energy theorem for constant force.
29. Derive expression for escape velocity of a satellite at a height h from the surface of the earth
30. Four particles of mass 1 kg. Zig, 3 kg and 4 kg are placed at the four vertices A, B. C and D of a square of side 1m. Find the position of center of mass of the particle.

OR

(a) What is (i) positive week (ii) negative week (iii) zero work.
(b) Show that work done to conservative force does not depends on the path followed by the body.

✣ SECTION D

31. Define elastic collision and discuss it for ray bodies in one dimension. Calculate the velocities of bodies after collision. A lighter body collides with a match more massive body at rest. Prove that the direction of the lighter body is reversed and massive body remain at rest.

OR

(a) Derive the Ascent formula. (b) Water rises to a height of 20 mm in a glass capillary. To what height will water rise in a capillary with its radius half of that of the first one?

32. (a) State and prove the Bernoulli's theorem for an ideal fluid
(b) Give the expression for Bernoulli's theorem, when liquid flows in level pipe, what will be the expression when liquid flow stops?

OR

(a) Define (i) Critical velocity (ii) Stoke's law
(b) What do you mean by terminal velocity? Obtain the expression for body falling in any viscous medium.

33. An object of mass m is projected by making angle Q from the vertical with initial velocity. calculate (i) Time to reach maximum height (ii) Velocity of projectile at any point just crossing the maximum height after time t. (iii) Velocity when hits the ground.

OR

State the parallelogram law of vector addition. Derive an expression for magnitude and direction of resultant of the two vectors.

✣ SECTION E

Question 34 and 35 are case study-based question and are compulsory.

Q34. **CASE STUDY:**

The nature of a physical quantity is described by its dimensions. All the physical quantities represented by derived units can be expressed in terms of some combination of seven fundamental or base quantities. We shall call these base quantities as the seven dimensions of the physical world, which are denoted with square brackets [ ]. Thus, length has the dimension [L], mass [M], time [T], electric current [A], thermodynamic temperature [K], luminous intensity [cd], and amount of substance [mol]. The dimensions of a physical quantity are the powers (or exponents) to which the base quantities are raised to

represent that quantity. Note that using the square brackets [ ] round a quantity means that we are dealing with 'the dimensions of the quantity. In mechanics, all the physical quantities can be written in terms of the dimensions [L], [M] and [T]. For example, the volume occupied by an object is expressed as the product of length, breadth and height, or three lengths. Hence the dimensions of volume are

$[L] \times [L] \times [L] = [L^3]$.

i). Dimensions of impulse equals to the dimensions of _____

ii). The dimensions of torque is same as that of _____

iii). Write two quantities which are dimensionless.

OR

Write two applications of dimensional analysis.

Q35. CASE STUDY: MOTION UNDER GRAVITY:

An object released near the surface of the Earth is accelerated downward under the influence of the force of gravity. The magnitude of acceleration due to gravity is represented by g. If air resistance is neglected, the object is said to be in free fall. If the height through which the object falls is small compared to the earth's radius, g can be taken to be constant, equal to 9.8 m s-2. Free fall is thus a case of motion with uniform acceleration. We assume that the motion is in direction, more correctly in -y direction because we choose upward direction as positive. Since the acceleration due to gravity is always downward, it is in the negative direction and we have = $-g = -9.8\ m/sec^2$

i). A stone of mass 0.05kg is thrown vertically upwards. What is the direction and magnitude of net force on the stone during its upward motion?

ii). Three different objects of masses m1, m2, m3 are allowed to fall from rest and from the same point 'O' along three different frictionless paths. The speed of the three objects, on reaching the ground, will be in which ratio?

iii). A cricket ball is thrown up with a speed of 19.6 m/sec. Find the Maximum height it can reach.

OR

A ball is thrown up under gravity. Find its velocity after 1 sec at a height of 10 m.

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