DELHI PUBLIC SCHOOL

SAIL TOWNSHIP, RANCHI

ANNUAL EXAMINATION (2016-17)

Class:-XI **Subject:- Physics**

Time- 3 hrs. **M.M-70**

General Instructions:-

1. All questions are compulsory.

2. The question paper consists of 26 questions divided into five sections A,B, C, D and E.
Section – A comprises 5 questions of 1 mark each.
Section – B comprises 5 questions of 2 marks each.
Section- C comprises 12 questions of 3 marks each.
Section- D comprises 1 value –based question and
Section- E comprises 3 questions of 5 marks each.

3. There is no overall choice. However, internal choice is provided in some questions. You have to attempt only one of the alternatives in such questions.

Section- A

1. **Two bodies of masses m_1 and m_2 respectively ($m_1 > m_2$) have equal linear momentum. Which one will have greater kinetic energy and why? [1]**

2. **Write the S.I. units of**
(a) velocity gradient (b) Velocity head. [1]

3. **What is the value of the Bulk modulus for a perfectly rigid body. Why? [1]**

4. **The maximum acceleration of a simple harmonic oscillator is a_0 and its maximum velocity is V_0. What is it's amplitude in terms of a_0 and V_0? [1]**

5. **State Doppler's effect. [1]**

Section- B

6. **The depth (x) to which a bullet can penetrate a human body depends upon (i) coefficient of rigidity (η) and (ii) it's K.E. (E). By using dimensions, find an expression for x. [2]**

7. **A woman throws an object of mass 500 g with a speed of 25 m/s.**

(a) What is the impulse imparted to the object?

(b) If the object hits a wall and rebounds with half the original speed, what is the change in the momentum of the object? [2]

OR

A girl riding a bicycle along a straight road with a speed of 5m/sec throws a stone of mass 0.5 kg which has a speed of 15 m/s with respect to the ground along the direction of her motion. The mass of the girl and the bicycle is 50 kg. Does the speed of the bicycle change after the stone is thrown? If yes, what is the change in it's speed?

8. **What is meant by limiting friction? State two laws of limiting friction. [2]**
9. **State the theorems of**
   (i) parallel axes (ii) perpendicular axes [2]
10. **With the help of a labelled block diagram explain the action of a heat engine briefly. Write the expression for it's efficiency. [2]**

Section- C

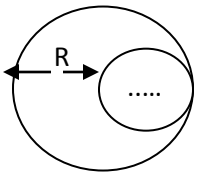
11. **Two resistors of resistance $R_1 = (100 \pm 3)\ \Omega$ and $R_2 = (200 \pm 4)\ \Omega$ are connected (i) in series (ii) in parallel. Find the equivalent resistances, in the two cases, specifying the error limits. [3]**
12. **Derive Stoke's formula dimensionally. [Use F for viscous drag, r for radius of the sphere, η for coefficient of viscosity of the fluid and v for the velocity of the spherical body] [3]**
13. **A balloon is ascending at the rate of 9.8 m/s at a height of 39.2 m above the ground when a food packet is dropped from the balloon. After how much time and with what velocity does it reach the ground? (Take g=9.8 m/s^2) [3]**
14. **Derive the given equation of motion for a uniformly accelerated body:-**
    $S = ut + \frac{1}{2} at^2$ [3]
15. **The position vector of a particle is $\vec{r} = 2t\,\hat{\imath} + t^2\,\hat{\jmath} + 3\,\hat{k}$, where t is in seconds and the coefficients have the proper units for r to be in metres. What will be the value of v and a for the particle and the magnitude and direction of v at t= 2 sec ? [3]**
16. **Derive expressions for the (a) Time of flight (b) Maximum height attained and**
    (c) Horizontal Range in case of a projectile [3]

OR

The maximum height attained by projectile is increased by 10% by increasing it's speed of projection, without changing the angle of projection. What will be the percentage increase in it's horizontal range?

17. **Derive an expression for the gravitational potential at a point in the gravitational field of the earth. How is the gravitational potential energy related to the gravitational potential? [3]**
18. **Derive expressions for the (a) orbital velocity and (b) the height from the surface of the earth of a geostationary satellite. [3]**

19. **From a uniform disc of radius R , a circular hole of radius R/2 is cut out. The centre of the hole is at R/2 from the centre of the original disc. Locate the centre of gravity of the resulting flat body.**



[3]

20. **Derive an expression for the excess pressure inside a liquid drop.** **[3]**

21. **Define simple harmonic motion. Prove that the motion of simple pendulum is simple harmonic in nature.** **[3]**

22. **Define coefficient of linear expansion ($\propto$). Derive it's relation with the coefficient of superficial expansion (β).** **[3]**

Section- D

23. **Palash went to Big Bazaar to purchase goods. There he saw an old lady struggling with her trolley. Immediately he showed her the lift and explained to her how it carries the load from one floor to the next. He then took her to the in the lift and showed her how to operate it. The old lady was very happy.**

(a) What values does Palash possess?

(b) An elevator can carry a maximum load of 1800 kg and its moving up with a constant speed of 2m/s. The frictional force opposing the motion is 4000 N. Compute the minimum power delivered by the motor to the elevator. **[4]**

Section- E

24. **Define elastic collision. Derive expressions for the final velocities of two bodies undergoing elastic collision in one dimension.**

Find their final velocities when a light body collides against a massive stationary body.

OR **[5]**

Derive the 'work –energy theorem'.

A body of mass 0.5 kg travels in a straight line with velocity $v = ax^{3/2}$, where $a = 5m^{-1/2}s^{-1}$. What is the work done by the net force during it's displacement from x=0 to x=2 m?

25. **Define terminal velocity. With the help of a labelled diagram, derive an expression for the terminal velocity of a spherical body falling through a viscous liquid. How will the terminal velocity change if the radius of the body is doubled?** **[5]**

OR

State and prove Bernoulli's theorem.

Water enters a horizontal pipe of non-uniform cross-section with a velocity of 0.6 m/s and leaves the other end with a velocity of 0.4 m/s. At the first end, the pressure of water is 1200 N/m^2. Calculate the pressure at the other end. Density of water is 1000 kg/m^3.

26. **Discuss the formation of stationary waves in stretched strings. Show that**

$$\nu : \nu : \nu : \ldots\ldots\ldots\ldots : \nu = 1 : 2 : 3 : \ldots\ldots\ldots\ldots : n.$$

Mention two differences between stationary waves and progressive waves. **[5]**

OR

What are beats? Explain the formation of beats analytically and hence calculate the beat frequency.

A tuning fork, marked 512 Hz produces 5 beats per sec. when sounded with another unmarked tuning fork B. If B is loaded with wax the number of beats is again 5 per sec. What is the frequency of fork B when not loaded?