THE INDIAN SCHOOL

HALF YEARLY EXAMINATION (2017-2018)

SUBJECT: PHYSICS

CLASS- XI   **NO.OF PAGES:4**

TIME: 3Hrs   **M.M:70**

General Instructions:

i. All questions are compulsory.

ii. There are 26 questions in total. Question no. 1 to 5 are 1 mark each, Question no. 6 to 10 carry 2 marks each, Question no. 11 to 22 carry 3 marks each, Question no. 23 is value based question carrying 4 marks and Question no. 24 to 26 carry 5 marks each.

iii. There is no overall choice. However an internal choice has been provided in 1 question of 2 marks, 1 question of 3 marks and all 3 questions of 5 marks each.

iv. Use of calculators is not permitted.

1. Can a particle with zero acceleration speed up?

2. Define coherent system of units.

3. Name the process in which (i) momentum is conserved but K.E. is not conserved and (ii) momentum changes but K.E. does not change.

4. Can a couple acting on a rigid body produce translatory motion?

5. Why does frictional force get increased when a surface is polished beyond a certain limit?

6. Springs A and B are identical except that A is stiffer than B, i.e. force constant $K_A > K_B$. In which spring is more work expended if they are stretched by the same amount?

7. Define random errors and systematic errors.

   OR

   Differentiate between accuracy and precision.

8. A bob hung from the ceiling of a room by a string is performing simple harmonic oscillations. What will be the trajectory of the bob, if the string is cut, when the bob is (i) at one of its extreme positions, (ii) at its mean position?

9. A block slides down a smooth inclined plane when released from the top while another falls from the same point. Which one of them will strike the ground earlier?

10. State in the following cases, whether the motion is one, two or three dimensional motion:

(i) a kite flying in the sky

(ii) a speeding car on a long straight high way.

11. A projectile can have the same range R for two angles of projection. If T_1 and T_2 be the time of flight in the two cases, then prove that

$T_1 T_2 = 2R/g$.

12. An object is in uniform motion along a straight line. What will be the position- time graph for the motion of the object if (i) $x_0 = +ve$, $v = +ve$ (ii) $x_0 = +ve$, $v = -ve$ (iii) both x_0 and v are $-ve$.

13. The acceleration experienced by a boat after the engine is cut off, is given by $dv/dt = -kv^3$, where k is a constant. If v_0 is the magnitude of the velocity at the cut off, find the magnitude of the velocity at time t after the cut off.

14. A stone of 0.25 kg tied to the end of a string is whirled in a circle of radius 1.5 m with a speed of 40 rev/min in a horizontal plane. What is the tension in the string? What is the maximum speed with which the stone can be whirled around if the string can withstand a maximum tension of 200 N?

15. A metal bar 70 cm in length and 4 kg in mass is supported on two knife edges placed 10 cm from each end. A 6 kg weight is suspended at 30 cm from one end. Find the reactions at the knife-edges (Assume the bar to be of uniform cross-section and homogeneous).

16. Consider the case of two bodies of mass m_1 and m_2 connected by a string and placed on a smooth horizontal surface as shown. Calculate the acceleration of the system, and tension in the string when the force F is applied on m_2.

17. What are conservative forces? Show that gravitational force is a conservative force.

18. Give the geometrical meaning of angular momentum of a rigid body rotating at an angular speed of w and hence derive Kepler's second law of planetary motion.

19. In a harbour, wind is blowing at the speed of 72 km/hr and the flag on the mast of a boat anchored in the harbor flutters along the N-E direction. If the boat starts moving at a speed of 51 km/hr to the north, what is the direction of the flag on the mast of the boat?

20. If $\vec{a} = i - 2j - 3k$, $\vec{b} = 2i + j - k$ and $\vec{c} = i + 3j - 2k$, the find $\vec{a} \times (\vec{b} \times \vec{c})$.

21. A ball is dropped from a height of 90 m from a floor. At each collision with the floor it loses one-tenth of its speed. Plot the speed- time graph of its motion between t = 0 to 12 s.

OR

A batsman deflects a ball by an angle of 45^0 without changing its initial speed which is equal to 54 Km/hr. What is the impulse imparted to the ball? Mass of the ball is 0.15 Kg.

22. The number of particles given by $n= -D(n_2-n_1/ x_2-x_1)$ are crossing a unit area perpendicular to x-axis in unit time. n_1,n_2 are number of particles per unit volume, for values of x meant to be x_1 and x_2. What is the dimensional formula of diffusion constant D?

23. Alok wants to hit a target. He does not know in what direction should he point the rifle. He asked the same from his friend Rakesh who was senior to him. Rakesh explained the whole phenomenon to him.
    (i)   What would be the answer of Rakesh?
    (ii)   Why does a projectile fired along the horizontal not follow a straight line path?
    (iii)   What are the values displayed by Rakesh?
    (iv)   A projectile is projected so that it has maximum range R. What is the maximum height reached during the flight?

24. (i) Define centripetal acceleration. Derive an expression for the centripetal acceleration of the body moving with uniform speed v along a circular path of radius r.
    (ii) An insect trapped in a circular groove of radius 12 cm moves along the groove steadily and completes 7 revolutions in 10 s. What is the angular speed and linear speed of the motion? What is its linear displacement?

OR

(i) State the parallelogram law of vector addition and find the magnitude and direction of resultant of two vectors $\vec{P}$ and $\vec{Q}$ inclined at an angle Θ with each other.
(ii) The sum and difference of two vectors are perpendicular to each other. Prove that the vectors are equal in magnitude.

25. (i) Define elastic collision and discuss it for two bodies in one dimension. Calculate the velocities of the two bodies after collision.
    (ii) The spring constant of the spring shown in fig. is 250 N/m. Find the maximum compression of the spring.
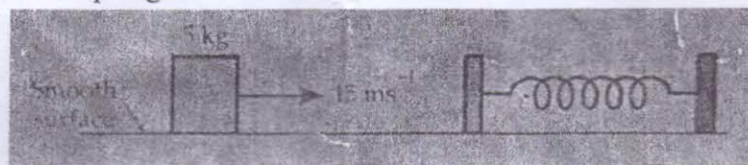
OR
(a) Two bodies have masses m_1 and m_2 have same linear momentum. What is the ratio of their kinetic energies?
(b) Draw a plot of force versus displacement x. Hence find an expression for the P.E. of an elastic stretched spring.

26. (a) What is meant by banking of roads? What is the need for banking a road? Obtain an expression for the maximum speed with which a vehicle can safely negotiate a curved road banked at an angle Θ. The coefficient of friction between the wheels and the road is μ.

(b) Explain, why a cricketer lowers his hands while holding a catch?

OR

(a) A 1000 kg car rounds a curve on a flat road at a speed of 50 Km/hr. Will the car make the turn or will it skid if the coefficient of friction is 0.6? Justify.

(b) Draw the graph between friction and applied force.

(c) Explain, why is it easier to pull a lawn mower than to push it.