KENDRIYA VIDYALAYA SANGATHAN, MUMBAI REGION

HALF YEARLY EXAMINATION

2022-2023

SUBJECT: Physics (Theory) Max. Marks:70

CLASS: XI Time: 3:00 Hrs

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 (1+1+2) 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 body is moving in a straight line along X- axis. Its distance x in metres from the origin is given by $x = 8t + 3t^2$ The time t is in seconds, the instantaneous velocity at t = 2 s is

   (a) 60 ms^{-1} (b) 20 ms^{-1} (c) 40 ms^{-1} (d) 12 ms^{-1}

2. Which of the following is Fundamental quantity?

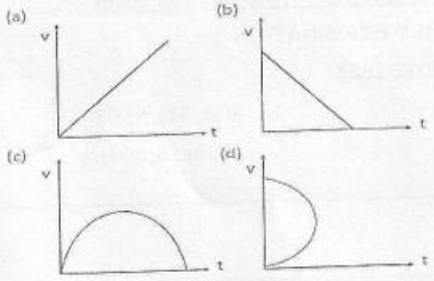
   (a) Work

   (b) Length

   (c) Force

   (d) Electric field

3. Which of the following fig. cannot be speed – time graph



4. Which of the following pairs has the same dimensions?
   (a) Pressure and power
   (b) Impulse and velocity
   (c) Surface tension and force
   (d) work and torque
5. Moment of inertia depends on
   (a) Distribution of particles
   (b) Mass
   (c) Position of axis of rotation
   (d) All of these
6. At the top of the trajectory of a projectile, the acceleration is
   (a) Maximum
   (b) Minimum
   (c) g
   (d) Zero
7. If force (F), work (W) and velocity (v) are taken as fundamental quantities. What is the dimensional formula of time (T)?
   (a) [WFv]
   (b) $[WF^{-1}v^{-1}]$
   (c) $[W^{-1}F^{-1}v]$
   (d) $[WFv^{-1}]$
8. A ball is thrown vertically upward. It has a speed of 10 m/s. When it reaches one half of its maximum height. How high does the ball rise? (take g = 10m/s2)
   (a) 10 m
   (b) 5 m
   (c) 15 m

(d) 20 m

9. In elastic collision,
   (a) Momentum conserved
   (b) K E conserved
   (c) a & b both
   (d) None of the above
10. Total energy at every point on vertical circular motion is
   (a) $\frac{7}{2} mgr$
   (b) $\frac{1}{2} mgr$
   (c) $\frac{5}{2} mgr$
   (d) $\frac{3}{2} mgr$
11. A constant force acting on a body of mass 3 kg changes its speed from 2 ms^{-1} to 3.5ms^{-1} in 25 s. The direction of the motion of the body remains unchanged, the magnitude of force
   (a) 0.25N
   (b) 0.18N
   (c) 0.11N
   (d) 0.33N
12. The maximum velocity of vehicle on banked road is independent of
   (a) Normal reaction
   (b) Mass of vehicle
   (c) Radius of curved road
   (d) None of the above
13. The total flight requires a time that is?
   (a) Four times the time necessary to reach the maximum height.
   (b) Thrice the time necessary to reach the maximum height
   (c) Equal to the time necessary to reach the maximum height.
   (d) Twice the time necessary to reach the maximum height
14. A shell in its flight explodes into four unequal parts. Which of the following is conserved?
   (a) Momentum
   (b) Kinetic energy

(c) Potential energy

(d) Charge

15. A force which pushes the object in the x direction is given by $F = (3x + 2)$ N the work done by this force as it pushes the object from $x = 0$ to $x = 4m$.

(a) 14J

(b) 32 J

(c) 64J

(d) 30J

16. 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 and 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

Assertion: Work done by the conservative force is path independent.

Reason: Frictional force is non conservative force.

17. 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 and 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

Assertion: An ice-skater stretches out arms-legs during performance.

Reason: Stretching out arms-legs helps the performer to balance his or her body so that he or she does not fall.

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 and 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

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.

SECTION B

19. State Kepler's orbital and Areal laws of planetary motion.

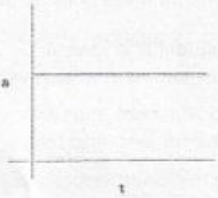
20. Define (a) centre of mass (b) radius of gyration.

21. The Pressure depends on distance as $P = \frac{\alpha}{\beta}\exp(\frac{-\alpha z}{k\theta})$, where α and β are constant z is distance, k is Boltzmann's constant and θ is temperature. Find the dimension of α and β. *(The dimensions of the Boltzmann's constant are $[M^1 L^2 T^{-2} K^{-1}]$)*

22. A car moving along a straight highway with speed of 126 km/hr is brought to stop within a distance of 200 m. What is the retardation of the car and how long does it take for the car to stop.

OR

Acceleration-time graph of a moving object is shown in figure. Draw the velocity-time graph and displacement-time graph corresponding to this type of motion.



23. State the significant figures of (a) 0.006m (b) 6.320J
(c) 0.00006032 kg (d) 2.64×10^5m.

24. If a vector $2\mathbf{i} + 4\mathbf{j} + 5\mathbf{k}$ is perpendicular to the vector $4\mathbf{i} - 7\mathbf{j} + n\mathbf{k}$. Find the value of n.

25. Write dimension of (a) work (b) gravitational constant
(c) Momentum (d) Coefficient of friction.

OR

What is dimension? Write the two physical quantities which having same dimensions.

SECTION C

26. State and prove work- energy theorem.

27. An aircraft executes a horizontal loop of radius 1.00 km with a steady speed of 900km/h. Compare its centripetal acceleration with the acceleration due to gravity.

28. State and prove law of conservation of linear momentum.

OR

Force of 100N is exerted at an angle of 30° on the box kept on the floor with the coefficient of static friction of 0.2. Find the frictional force.

29. Derive an expression for position–time relation with the help of graph.

30. The frequency n of vibration of a stretched string is a function of its tension T, the length *l* and mass per unit length m, derive the relation between n, T, *l* and m by dimensional method.

SECTION D

31. (a) Derive an expression for potential energy of spring.

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

OR

(a) Derive an expression for the minimum velocity at the highest and lowest points in vertical circular motion.

(b) A bucket containing water is tied to one end of a rope 1.25m long and rotate about the other end in a vertical circle. What should be the minimum velocity at the highest and lowest points so that water in the bucket may not spill?

32. (a) What is banking of road?

(b) Define angle of banking

(c) Derive an expression for maximum velocity of car on banked road.

OR

(a) Show that maximum velocity of car on curved road is equal to $\sqrt{\mu r g}$

(b) A curve on a highway forms an arc of radius 100m. If the road is 10m wide and its outer edge is 1m higher than the inner edge, for what speed the road is banked?

33. (a)Show that path of a projectile is parabolic .

(b) Neeraj Chopra thrown javelin with an angle 45^0 to achieve gold medal in Olympic, the javelin hit the ground at 89.94m away from starting point. Find the velocity of javelin.

OR

What is projectile? Derive an expression for (a) horizontal range (b)Time of flight.

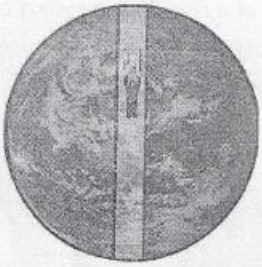
SECTION E

34. **Case Study**

Read the following paragraph and answer the following questions.

Journey through the centre of earth

Suppose you could dig a tunnel from one surface to the opposite through the centre of the Earth. How will be journey through the tunnel? Let us assume that the Earth to be of uniform density, there is no air friction and temperature is normal. At the starting point the initial acceleration will be equal to 9.8 m /s^2.The acceleration gradually reduces as one approaches the centre $g_{effective} = g \times r_{effective}/R_{earth}$. The gravity at any radius r effective is less than R earth and is linearly proportional to the distance from the centre So, the weight will go on reducing as the centre is approached.



It will again go on increasing as one moves from away from the centre. The traveller will pop up on the opposite side of the Earth within 42 minutes approximately. But unless the traveller grabs something to hold on, he or she will fall back for a return journey and continue to oscillate with a round trip time.The time period will be $2\pi\sqrt{R_{earth}/g}$

(i) How the acceleration due to gravity varies inside the tunnel?

(ii) What is acceleration due gravity at the centre of earth?

OR

In the above figure, where is value of g maximum?

(iii) Calculate the time period of oscillation inside the tunnel as shown in the above fig. ($g = 10\ ms^{-2}$, $R_{earth} = 6400km$).

35. **Case Study**

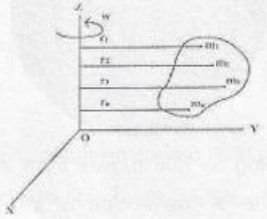
Read the following paragraph and answer the following questions.

Moment of Inertia

The mass of a body resists a change in its state of linear motion, it is a measure of inertia in linear motion. Similarly, the moment of inertia of a body about an axis of rotation resists a change in its rotational motion. The greater the moment of inertia of a body, the greater is the torque required to change its state of rotation. It is a measure of rotational inertia of a body. The moment of inertia of rigid body about a fixed axis is defined as the sum of the products of the masses of the particles constituting the body and the squares of their respective distances from the axis of rotation.

$$I = m_1 r_1^2 + m_2 r_2^2 + \ldots\ldots\ldots + m_n r_n^2 = \sum_{i=1}^{n} m_i r_i^2$$

Thus, the moment of inertia of a rigid body depends on the mass of the body, its shape and size, distribution of mass about the axis of rotation, and the position and orientation of the axis of rotation.



(i)What is the S I unit of moment of inertia?

(ii) If a person sitting on a rotating stool with his hands out stretched, suddenly lowers his hands, then what is effect on moment of inertia?

(iii)On which quantity moment of inertia depend?

OR

Is momentum of inertia is fixed quantity? Justify.

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