KENDRIYA VIDYALAYA SANGATHAN, LUCKNOW REGION
HALF YEARLY EXAMINATION : 2024-25
CLASS – XI
SUBJECT – PHYSICS (THEORY) Set - 1

Time: 3 hour **Max.Marks: 70**

General Instructions:

(i) There are 33 questions in all. All questions are compulsory.

(ii) This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.

(iii) 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 4 marks each and Section E contains three long answer questions of five marks each

(iv) There is no overall choice. However, an internal choice has been provided in one question of section B, one question of section C, one question in each CBQ of section D and in all three questions of section E. You have to attempt only one of the choices in such questions.

(v) ***Use of calculator is not allowed.***

SECTION – A: OBJECTIVE TYPE QUESTIONS (16 Ques. × 01 Mark each = 16 Marks)		
1	The dimensional formula of torque is - (a) $[M L^2 T^{-3}]$ (c) $[M L^2 T^{-4}]$ (b) $[M L^2 T^{-2}]$ (d) $[M L^{-2} T^{-3}]$	**1**
2	The SI unit of universal gravitational constant is - (a) Kg m s^{-1} (c) N m^{-1} s (b) N m^2 kg^{-2} (d) Kg m s	**1**
3	A person is sitting in a lift accelerating upwards. Measured weight of person will be - (a) Less than the actual weight (c) More than actual weight (b) Equal to actual weight (d) Zero	**1**
4	The area under velocity –time graph is equal to - (a) Acceleration (c) Force (b) Displacement (d) Linear Momentum	**1**
5	A bullet of mass 10 g is fired from a gun of mass 1 kg. If the recoil velocity is 5 m/s , the velocity of the muzzle is - (a) 0.05 m/s (c) 50 m/s (b) 5 m/s (d) 500 m/s	**1**
6	In an inelastic collision, what is conserved ? (a) Kinetic energy (c) Both (a) & (b) (b) Momentum (d) Neither (a) nor (b)	**1**
7	Two bodies of masses m and 4m are moving with equal kinetic energies. The ratio of their linear momenta is - (a) 1 : 2 (c) 4 : 1 (b) 1 : 4 (d) 1 : 1	**1**
8	A man is sitting on a rotating stool with his arms outstretched. Suddenly he folds his arms. The angular velocity - (a) decreases (c) becomes zero (b) increases (d) remains constant	**1**
9	The body of mass 50 kg is at rest. The work done to accelerate it by 20 m/s in 10 seconds (a) 10^3 J (c) 2×10^3 J	**1**

	(b) 10^4 J (d) 4×10^4 J	
10	When a body is taken from poles to equator on the earth, its weight – (a) Increases (c) Remains the same (b) Decreases (d) Increases at south pole and decreases at north pole	**1**
11	Two satellites of mass M_1 and M_2 are revolving around the earth in circular orbits of radii r_1 and r_2 respectively. The ratio of their orbital speeds v_1/v_2 = (a) r_1/r_2 (c) r_2/r_1 (b) $\sqrt{\frac{r_1}{r_2}}$ (d) $\sqrt{\frac{r_2}{r_1}}$	**1**
12	If longitudinal strain for a wire is 0.03 and its Poisson ratio is 0.5, then its lateral strain is - (a) 0.003 (b) 0.0075 (c) 0.015 (d) 0.035	**1**
13	**Assertion:** Displacement of a body may be zero, when distance travelled by it is not zero. **Reason:** The displacement is the longest distance between initial and final positions. (a) If both assertion and reason are true and the reason is the correct explanation of the assertion. (b) If both assertion and reason are true but reason is not the correct explanation of the assertion. (c) If assertion is true but reason is false. (d) If the assertion and reason both are false.	**1**
14	**Assertion:** It is difficult to move a cycle along the road with its brakes on. **Reason:** Sliding friction is greater than a rolling friction. (a) If both assertion and reason are true and the reason is the correct explanation of the assertion. (b) If both assertion and reason are true but reason is not the correct explanation of the assertion. (c) If assertion is true but reason is false. (d) If the assertion and reason both are false.	**1**
15	**Assertion:** A planet moves faster when it is closer to the sun in its orbit and vice - versa. **Reason:** Orbital velocity in orbit of planet is constant. (a) If both assertion and reason are true and the reason is the correct explanation of the assertion. (b) If both assertion and reason are true but reason is not the correct explanation of the assertion. (c) If assertion is true but reason is false. (d) If the assertion and reason both are false.	**1**
16	**Assertion:** Stress is the internal restoring force per unit area of a body. **Reason:** Steel is more elastic than rubber. (a) If both assertion and reason are true and the reason is the correct explanation of the assertion. (b) If both assertion and reason are true but reason is not the correct explanation of the assertion. (c) If assertion is true but reason is false. (d) If the assertion and reason both are false.	**1**
SECTION – B: SHORT ANSWER TYPE-I (05 Ques. × 02 Marks each = 10 Marks)		

17	The distance covered by a particle in time t is given by $x = a + bt + ct^2 + dt^3$, find the dimensions of a, b, c and d. **OR** 5.74 g of a substance occupies 1.2 cm^3 . Express its density keeping significant figures in view.	**2**
18	Distinguish between position vector and displacement vector.	**2**
19	Three point masses of 1 kg, 2 kg and 3 kg lie at (1,2) , (0, -1) and (2, -3) respectively. Calculate the coordinates of the centre of mass of the system.	**2**
20	State and prove work energy theorem.	**2**
21	What is the relation between height h and depth d for the same change in g ?	**2**
	SECTION – C: SHORT ANSWER TYPE-II (07 Ques. × 03 Marks each = 21 Marks)	
22	The centripetal force F acting on a particle depends on its mass m which is moving with velocity v in a circle of radius r . Obtain dimensionally an expression for centripetal force F .	**3**
23	State impulse -momentum theorem. A batsman hits back a ball straight in the direction of the bowler without changing its initial speed of 12 m/s. If the mass of the ball is 0.15 kg, determine the impulse imparted to the ball. (Assume linear motion of the ball.)	**3**
24	Derive kinematic equations (i) velocity – time relation and (ii) displacement – time relation, by using v-t graph for uniformly accelerated motion of a particle.	**3**
25	Define angle of friction. Deduce its relation with coefficient of friction.	**3**
26	Define moment of inertia . On what factors does it depend ? Write moment of inertia of a uniform circular disc about an axis through its centre and perpendicular to its plane.	**3**
27	Prove that in an elastic one dimensional collision between two bodies, the relative velocity of approach before collision is equal to the relative velocity of separation after the collision.	**3**
28	Draw stress -strain curve for a loaded wire. On the graph mark: (a) Hooke's limit (b) Elastic limit (c) Yield point (d) Breaking point **OR** What is elastic potential energy ? Derive an expression for the elastic potential energy of a stretched wire. Prove that its elastic energy density is equal to ½ stress × strain .	**3**
	SECTION – D: CASE STUDY BASED (02 Ques. × 04 Marks each = 08 Marks)	
29	**Case Study :** **Read the following paragraph and answer the questions.** The spring force is an example of a variable force which is conservative. In an ideal spring, the spring force F_s is proportional to x, where x is the displacement of the block from the equilibrium position. The displacement could be either positive or negative. This force law for the spring is called Hooke's law and is mathematically stated as $F_s = - kx$. Here the constant k is called the spring constant. **Answer the following Questions:** i) The nature of spring force is : (a) non conservative (b) conservative (c) constant (d) frictional ii) The work done by the spring force in a cyclic process is : (a) positive (b) negative (c) zero (d) infinite iii) The S.I. unit of spring constant is : (a) N (b) Nm (c) Nm^2 (d) Nm^{-1} iv) If the extension is x then the work done by the spring force is equal to (a) kx /2 (b) - kx /2 (c) $- kx^2 /2$ (d) $kx^2 /2$ **OR**	**4**

	If the spring is stiff then the value of k will be (a) zero (b) large (c) small (d) infinite	
30	**Case Study :** **Read the following paragraph and answer the questions.** A rigid body is said to be in mechanical equilibrium, if both its linear momentum and angular momentum are not changing with time , or equivalently, the body has neither linear acceleration nor angular acceleration. **Answer the following Questions:** i) If the total force on the rigid body is zero then it is in : (a) mechanical equilibrium (c) translational equilibrium (b) rotational equilibrium (d) chemical equilibrium ii) If the total torque on the rigid body is zero then it is in : (a) mechanical equilibrium (c) translational equilibrium (b) rotational equilibrium (d) chemical equilibrium iii) A pair of equal and opposite forces with different lines of action is known as : (a) couple (b) torque (c) moment (d) angular momentum iv) A torque of 2.0×10^{-4} Nm is applied to produce an angular acceleration of 4 rad s^{-2} in a rotating body. what is the moment of inertia of the body ? (a) 8×10^{-4} kg m^2 (c) 0.5×10^{-4} kg m^2 (b)4×10^{-4} kg m^2 (d) 2×10^{-4} kg m^2 **OR** The angular momentum of a body is 31.4 Js and its rate of revolution is 10 cycles per second. Calculate the moment of inertia of the body about the axis of rotation. **(a)** 0.5 kg m^2 (b) 3.14 kg m^2 (c) 314 kg m^2 (d) 1.0 kg m^2	**4**
	SECTION – E: LONG ANSWER TYPE (03 Ques. × 05 Marks each = 15 Marks)	
31	Define the centripetal acceleration. Derive an expression for centripetal acceleration of a particle moving with uniform speed v along circular path of radius r explain how it acts along the radius towards the centre of circular path? **OR** What is meant by banking of roads? What is it necessary? Find the expression for the maximum speed of a vehicle of mass m on a banked road of banking angle θ, if coefficient of static friction of the wheels of vehicle with the road is μ?	**5**
32	Define projectile and projectile motion. A projectile is fired with a velocity u making an angle θ with the horizontal . Derive expressions for (i) time of flight (ii) maximum height and (iii) horizontal range **OR** Two vectors **A** and **B** are inclined to each other at an angle θ . Using parallelogram law of vector addition, find the magnitude and direction of their resultant. Discuss the special cases when (i) $\theta = 0°$ (ii) $\theta = 180°$ and (iii) $\theta = 90°$	**5**
33	What is escape speed ? Obtain an expression for the escape speed on earth. Show that escape speed from the surface of earth is 11.2 km/s . **OR** Define orbital speed. Derive an expression for the orbital speed of a satellite revolving around very close to the surface of the earth. Find the ratio of this orbital speed to escape speed.	**5**

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