Directorate Of Education ,GNCT Of Delhi
Practice Paper: Mid term
Class: XI (Session: 2022-23)
subject: Physics

Maximum Marks: 70 Marks Time Allowed: 3 hours

General Instructions:

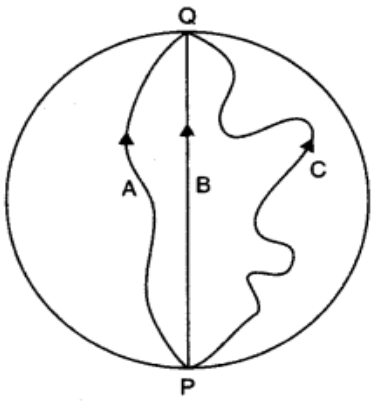
(1) All questions are compulsory. There are 35 questions in all.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) Section A contains 15 MCQ and 3 assertion reasoning MCQs of 1 mark each.
Section B contains 7 short answer questions of 2 marks each.
Section C has five short answer questions of 3 marks each .
Section D contains three long answer questions of 5 marks each.
Section E has two case based questions of 4 marks each.
(4) There is no overall choice. However internal choice is provided.
You have to attempt only one of the choices in such questions.

	Section – A **All questions are compulsory.**	
1	The number of significant figures in 0.06900 -- a. 2 b. 4 c. 6 d. 5	1
2	The dimension of light year is- a. T b. LT^{-1} c. L d. T^{-1}	1
3	Which one of the following pairs of quantities has the same dimensions? a. Force and work done b. Momentum and impulse c. Pressure and force d. Time period and frequency	1

4	At the upper most part of a projectile ,velocity and acceleration are at an angle of - a. 0 degree b. 30 degree c. 180 degree d. 90 degree	1
5	When the distance travelled by a body is proportional to the time taken. Its speed a. Remains unchanged b. Becomes zero c. Increases d. Decreases	1
6	The linear velocity of a body rotating at ω rad/s along a circular path of radius r is given by a. ωr b. ω/r c. 2ωr d. 3ω/r	1
7	Two vectors ,both equal in magnitude have their resultant equal in magnitude of either.The angle between these vectors will be a. 90 degree b. 0 degree c. 120 degree d. 180 degree	1
8	What is the ratio of the moment of inertia of two rings radii r and nr about an axis perpendicular to their plane and passing through their centres a. 1: 2n^2 b. 2n^2 :1 c. 1: n^2 d. n^2 :1	1
9	A boy standing on a rotating disc stretches out his hands ,the angular speed will a. Decrease b. Increase c. Will not change d. None of the above	1
10	A bullet of mass m moving with a speed v strikes a wooden block of mass M & gets embedded into the block.The final speed is a. $\frac{m}{m+M}$v	1

	b. $\frac{m}{2m+M}$v c. $\frac{m}{m+2M}$v d. $\frac{2m}{m+M}$v	
11	During inelastic collision between two bodies,Which of the following quantities always remain conserved. a. Total kinetic energy b. Total potential energy c. Total linear momentum d. None of the above	1
12	A particle is projected at an angle of 60 degree to the horizontal with a kinetic energy E.The K.E at the highest point is a. E/2 b. E/4 c. E/3 d. 2E	1
13	According to work-energy theorem,the work done by the net force on a particle is equal to the change in its a. linear acceleration b. Potential energy c. linear momentum d. Kinetic energy	1
14	Swimming is possible on account of a. Third law of motion b. First law of motion c. Second law of motion d. Force of Gravitation	1
15	A body whose momentum is constant must have constant a. velocity b. force c. acceleration d. none of the above	1
	Directions: These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following four responses. (a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion. (b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion. (c) If the Assertion is correct but Reason is incorrect.	

	(d) If both the Assertion and Reason are incorrect.	
16	**Assertion:** Horizontal range is same for angle of projection θ and (90 – θ). **Reason :** Horizontal range is independent of angle of projection	1
17	**Assertion:** A physical quantity cannot be called as a vector if it has zero magnitude. **Reason:** A scalar has both magnitude and direction.	1
18	**Assertion:** Two balls of different masses are thrown vertically upward with the same speed. They will pass through their point of projection in the downward direction with the same speed. **Reason :** The maximum height and downward velocity attained at the point of projection are independent of the mass of the ball.	1
	Section – B **All questions are compulsory.In case of internal choice,attempt any one.**	
19	A woman starts from her home at 9.00 am, walks at a speed of 5 km/h on a straight road up to her office 2.5 km away, stays at the office until 5.00 pm, and returns home by auto with a speed of 25 km/h. Choose suitable scales and plot the x-t graph of her motion.	2
20	a) What is the angle between **A**x**B** and **BxA?** b) Can the resultant of two vectors of different magnitudes be zero?Justify.	2

21	Three girls skating on a circular ice ground of radius 200 m start from a point P on the edge of the ground and reach a point Q diametrically opposite to P following different paths as shown in Fig. What is the magnitude of the displacement vector for each?For which girl is this equal to the actual length of path skate ?  **OR** A motorboat is racing towards north at 25 km/h and the water current in that region is 10 km/h in the direction of 60°east of south. Find the resultant velocity of the boat.	2
22	Determine the maximum acceleration of the train in which a box lying on its floor will remain stationary, given that the coefficient of static friction between the box and the train's floor is 0.15.	2
23	Two bodies A and B having masses m_A and m_B respectively have equal K.E. If p_A and p_B are their respective momentum, then prove that the ratio of momentum is equal to the square root of the ratio of respective masses.	2
24	Show that in the absence of an external force the velocity of the C.M. of a system remains constant. **OR** Using the expression for power and K.E. of rotational motion, derive the relation $\tau = I\alpha$.	2
25	Choose the correct alternative: (a) If the zero of potential energy is at infinity, the total energy of an orbiting satellite is negative of its **kinetic/potential energy.** (b) The energy required to launch an orbiting satellite out of Earth's gravitational influence is **more/less** than the energy required to project a stationary object at the same height (as the satellite) out of Earth's influence.	2

	Section – C **All questions are compulsory.In case of internal choice,attempt any one.**	
26	The position of an object is given by X = 2 t^2 + 3t .find out that its motion is uniform or non uniform. **OR** The data regarding the motion of two different objects P and Q is given in the following table. Examine them carefully and state whether the motion of the objects is uniform or non-uniform. **Time** | **Distance travelled by object P in (m)** | **Distance travelled by object Q(in m)** 9:30am | 10 | 12 9:45am | 20 | 19 10:00am | 30 | 23 10:15am | 40 | 35 10:30am | 50 | 37 10:45am | 60 | 41 11:00am | 70 | 44	3
27	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 momentum of the object? **OR** A projectile is fired at an angle θ .Find expression for- a) Maximum height b) Total time of flight c) Horizontal range	3

28	a)When an air bubble rises in water,What happens to its potential energy-increases or decreases? Give a reason. b)Can a body have energy without momentum?Justify. c) Will water at the foot of the fall be at a different temperature from that at the top? explain.	3
29	State the work energy theorem. Prove work energy theorem for a variable force.	3
30	In the HCl molecule, the separation between the nuclei of the two atoms is about 1.5 Å (1 Å = 10^–10 m). Find the approximate location of the CM of the molecule, given that a chlorine atom is about 35.5 times as massive as a hydrogen atom and nearly all the mass of an atom is concentrated in its nucleus.	3
	Section – D **All questions are compulsory.In case of internal choice,attempt any one.**	
31	a) Explain observation clearly with reason : If you look out of the window of a fast moving train, the nearby trees, houses etc. seem to move rapidly in a direction opposite to the train's motion, but the distant objects (hill tops, the Moon, the stars etc.) seem to be stationary. (In fact, since you are aware that you are moving, these distant objects seem to move with you). b) The Sun is a hot plasma (ionised matter) with its inner core at a temperature exceeding 107 K, and its outer surface at a temperature of about 6000 K.At these high temperatures, no substance remains in a solid or liquid phase. In what range do you expect the mass density of the Sun to be,in the range of densities of solids and liquids or gases ? Check if your guess is correct from the following data : mass of the Sun = 2.0 × 10^30 kg, radius of the Sun = 7.0 × 10^8 m. **OR** a) Let us consider an equation 1/2 m v^2 =m g h where m is the mass of the body,v its velocity, g is the acceleration due to gravity and h is the height. Check whether this equation is dimensionally correct.	5

	b) Consider a simple pendulum, having a bob attached to a string, that oscillates under the action of the force of gravity. Suppose that the period of oscillation of the simple pendulum depends on its length (l), mass of the bob (m) and acceleration due to gravity (g). Derive the expression for its time period using the method of dimensions .	
32	a) How does a ballet dancer or an acrobat take advantage of conservation of angular momentum? b) Will the spheres of equal masses one solid and the other hollow have equal moment of inertia? Justify. **OR** a) Show that in the absence of an external force the velocity of the C.M of a system remains constant. b) Equal torques are applied on a hollow cylinder and solid sphere, both having the same mass and radius.The cylinder rotates about its axis and the sphere rotates about its diameter.Which one will acquire greater speed and why?	5
33	a) State Newton's law of Gravitation. Give the vector form of it. Also derive the expression to find the acceleration due to gravity at the surface of the earth. b) The acceleration due to gravity at the Moon's surface is 1.67 ms^-2 . If the radius of the Moon is 1.74 X10^6m. Calculate the mass of the Moon. **OR** a) Define escape velocity. b) Derive the expression for finding the escape velocity of the body. c) Does it depend on the location (e.g differnt planets) from where it is projected?	5
	Case Study Section – E **All questions are compulsory.In case of internal choice,attempt any one.**	
34	**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.**	4

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 y-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 a = – g = – 9.8 m s^–2 The object is released from rest at y = 0.Therefore, v_0 = 0 and the equations of motion become

$$v = 0 - g t = -9.8\, t \quad \mathrm{m\ s^{-1}}$$
$$y = 0 - \tfrac{1}{2}\, g t^2 = -4.9\, t^2 \quad \mathrm{m}$$
$$v^2 = 0 - 2 g y = -19.6\, y \quad \mathrm{m^2\ s^{-2}}$$

These equations give the velocity and the distance travelled as a function of time and also the variation of velocity with distance.

1)Suppose you hold a book in one hand and a flat sheet of paper in another hand. You drop them both, and they fall to the ground.The falling book is a good example of free fall, but the paper is not because-

a) The book is significantly affected by the air.
b) The paper is relatively more affected by gravity.
c) Free fall is the motion of an object when gravity is the only significant force on it. The paper is significantly affected by the air, but the book is not.
d) None of the above

2) Suppose you throw a ball straight up into the air.One correct option is-

a) Velocity is reduced at a constant rate as the ball travels upward.
b) At its highest point, velocity is zero.
c) As the ball begins to drop, the velocity begins to increase in the negative direction.
d) All of the above

	3) A stone that starts at rest is in free fall for 8.0 s. The stone's velocity after 8.0 s will be a) 78.4 m/s downward b) 108 m/s downward c) 118 m/s downward d) 97 m/s downward **OR** A stone that starts at rest is in free fall for 8.0 s.The stone's displacement during this time will be- a) 510 m downward b) 800 m downward c) 100 m downward d) 310 m downward	
35	**The first law refers to the simple case when the net external force on a body is zero. The second law of motion refers to the general situation when there is a net external force acting on the body.** **It relates the net external force to the acceleration of the body.** **The following common experiences indicate the importance of momentum for considering the effect of force on motion.** ***Suppose a light-weight vehicle (say a small car) and a heavy weight vehicle (say a loaded truck) are parked on a horizontal road. We all know that a much greater force is needed to push the truck than the car to bring them to the same speed at the same time. Similarly, a greater opposing force is needed to stop a heavy body than a light body at the same time, if they are moving with the same speed.** ***Speed is another important parameter to consider. A bullet fired by a gun can easily pierce human tissue before it stops, resulting in casualty. The same bullet fired with moderate speed will not cause much damage. Thus for a given mass, the greater the speed, the greater is the opposing force needed to stop the body in a certain time.** **The greater the change in the momentum in a given time, the greater is the force that needs to be applied.** 1)Momentum of a body is defined to be the product of a) its mass and velocity square b) its mass and acceleration c) its mass and velocity d) its mass and applied force	4

	2)The rate of a change of a particle's momentum p is given by the force acting on the particle, refers to- a) Newton's first law of motion b) Newton's second law of motion c) Newton's third law of motion d) None of the above 3) A bullet of mass 0.04 kg moving with a speed of 90 m s^–1 enters a heavy wooden block and is stopped after a distance of 60 cm. The average resistive force exerted by the block on the bullet is- a) 270 N b) 450 N c) 375N d) 540 N **OR** The motion of a particle of mass m is described by y = ut + 1 /2gt^2 The force acting on the particle will be- a. mg/4 b. mg/2 c. mg d. 4mg	