Indian School Al Wadi Al Kabir

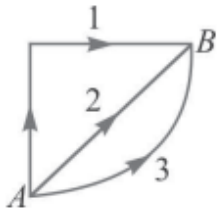
Assessment – 2 (2025-2026)

Class: XI | Subject: PHYSICS (042) | Max. marks: 70
Date: 23/11/2025 | Set - II | Time: 3 Hours

General Instructions:

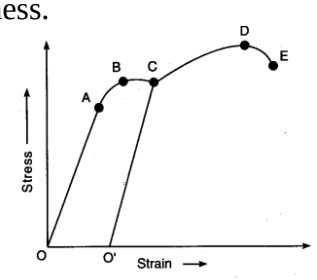
(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D, and Section E.
(3) All the sections are compulsory.
(4) **Section A** contains **sixteen questions, twelve MCQ and four assertion reasoning based on 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 four marks each,** and **Section E** contains **three long answer questions of five marks each**.
(5) There is no overall choice. However, an internal choice has been provided in two questions in Section B, one question in Section C, and all three questions in Section E. You have to attempt only one of the choices in such questions.
(6) Use of calculators is not allowed.

SECTION A		
Q. No.	**Question**	**Marks**
1.	If momentum (P), area (A), and time (T) are taken to be fundamental quantities, then energy has the dimensional formula (A) $[P^1 A^{-1} T^1]$ (B) $[P^2 A^1 T^1]$ (C) $[P^1 A^{-1/2} T^1]$ (D) $[P^1 A^{1/2} T^{-1}]$	1
2.	A pair of physical quantities having the same dimensional formula is (A) force and torque (B) work and energy (C) force and impulse (D) linear momentum and angular momentum	1
3.	A boy standing at the top of a tower of 20 m high, drops a stone. Assuming, $g = -10\ ms^{-2}$, the velocity with which it hits the ground is: (A) $20\ ms^{-1}$ (B) $40\ ms^{-1}$ (C) $5\ ms^{-1}$ (D) $10\ ms^{-1}$	1

4.	A missile is fired for maximum range with an initial velocity of 20 m/s. If g=10 ms^{-2}, the range of the missile is (A) 50 m (B) 60 m (C) 40 m (D) 10 m	1
5.	Two vectors have non-zero magnitudes. Their resultant is zero. What must be true? (A) Their magnitudes are unequal (B) They are anti-parallel and equal in magnitude (C) Their angle must be 45° (D) They are perpendicular	1
6.	The force exerted by the lift on the foot of a person is more than his weight; the lift is: (A) going up and slowing down (B) going up and speeding up (C) going down and slowing down (D) going down and speeding up	1
7.	If W_1, W_2 and W_3 represent the work done in moving a particle from A to B along three different paths 1, 2, 3, respectively (as shown) in the gravitational field of a point mass m, find the correct relation between W_1, W_2 and W_3:  (A) $W_1=W_2=W_3$ (B) $W_1>W_2>W_3$ (C) $W_1<W_2<W_3$ (D) $W_1>W_2<W_3$	1
8.	A man stands at the centre of a turn table and the turn table is rotating about its centre. If a man walks away from the axis of rotation, then which of the following are true? 1)Moment of inertia of the system increases. 2)Angular momentum of the system increases. 3)Angular velocity of the system decreases. 4)Kinetic energy of the system increases. (A) Option 1 only (B) Option 1 and 3 (C) Option 2 and 4 (D) All of the above	1

9.	The radii of two planets are respectively R_1 and R_2 and their densities are respectively ρ_1 and ρ_2. The ratio of the accelerations due to gravity at their surfaces is: (A) $g_1:g_2 = R_1 / \rho_1 : R_2 / \rho_2$ (B) $g_1:g_2 = R_1\rho_1 : R_2\rho_2$ (C) $g_1:g_2 = \rho_1 / R_1 : \rho_2 / R_2$ (D) $g_1:g_2 = \rho_1 / R_1^2 : \rho_2 / R_2^2$	1
10.	Two bodies are rotating about an axis, their angular momentum being the same. Moment of inertia of body − 1 is I_1 and that of body − 2 is I_2. Their respective rotational kinetic energies are K_1 and K_2. If $I_1 > I_2$, then (A) $K_1 > K_2$ (B) $K_1 < K_2$ (C) $K_1 = K_2$ (D) the data is insufficient to predict the relation.	1
11.	If stress is numerically equal to Young's modulus, the elongation will be (A) 1/4 the original length (B) equal to the original length (C) 1/2 the original length (D) twice the original length	1
12.	The pressure at the bottom of a tank containing a liquid does not depend on (A) acceleration due to gravity (B) height of the liquid column (C) area of the bottom surface (D) nature of the liquid	1
	For Questions 13 to 16, two statements are given one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below. (A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion. (B) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion. (C) Assertion is true but Reason is false. (D) Both Assertion and Reason are false.	
13.	**Assertion (A):** A body becomes massless at the centre of Earth. **Reason (R):** Acceleration due to gravity increases as we go below the surface of the Earth.	1
14.	**Assertion (A):** A long wire stretches more than a short wire of the same material and cross-section under the same load. **Reason (R):** Extension produced in a wire is directly proportional to its length.	1
15.	**Assertion (A):** A ball thrown vertically upward can have the same speed at two different heights during its motion. **Reason (R):** Acceleration is constant throughout the motion.	1

16.	**Assertion (A):** A thinner column of liquid shows the same pressure at a given depth as a wider column of the same liquid. **Reason(R):** Pressure depends only on depth, density, and on the shape of the container.	1
	SECTION B	
17.	State the law of conservation of angular momentum and illustrate with an example.	2
18.	(a) State Hooke's law. (b) Define modulus of elasticity and write its dimensional formula.	2
19.	State Newton's universal law of gravitation and hence derive the expression for the same.	2
20(I)	A pump on the ground floor of a building can pump up water of mass 30000 kg in 15 min. If the tank is 40 m above the ground, and the efficiency of the pump is 30%, how much electric power is consumed by the pump? **OR**	2
20(II)	A shot travelling at the rate of 100 ms^{-1} is just able to pierce a plank 4 cm thick. What velocity is required to just pierce a plank 9 mm thick?	2
21(I)	A geostationary satellite orbits the earth at a height of nearly 36,000 km from the surface of the Earth. What is the potential due to earth's gravity at the site of this satellite? (Take the potential energy at infinity to be zero.) Mass of the Earth = 6×10^{24} kg, radius = 6400 km. **OR**	2
21(II)	If the distance between the sun and the earth is increased by three times, then calculate the percentage decrease in attraction between the two.	2
	SECTION C	
22.	Assuming that mass 'M' of the largest stone that can be moved by a flowing river depends on, 'v' the velocity of the river, 'ρ' the density of water and 'g' the acceleration due to gravity, find the expression for mass 'M' using dimensional analysis.	3
23.	Masses of 50 g and 40 g are connected by a string, passing over a smooth pulley. If the system travels 2.18 m in the first two seconds, find the value of g.	3
24.	a) State Pascal's law. b) Explain one application of Pascal's law with the help of a neat diagram.	3
25.	A 2 kg body and a 3 kg body are moving along x-axis. At a particular instant, the 2 kg body is 1 m from the origin and has a velocity of 3 m/s and the 3 kg body is 2 m away from the origin has a velocity of -1 m/s. Find the position and velocity of the centre of mass and also find the total momentum.	3
26.	With the help of a neat diagram, derive an expression for acceleration due to gravity above the surface of the Earth.	3

27(I)	Using v-t graph, derive $s=ut+1/2\ at^2$, where all the terms have their usual meanings. **OR**	3
27(II)	Using v-t graph, derive $v^2 - u^2 = 2as$, where all the terms have their usual meanings.	3
28.	a) State the law of conservation of mechanical energy. b) State and prove work energy theorem for a constant force.	3
	SECTION D	
29	The **stress–strain curve** of a material provides important insights into its mechanical behaviour under applied forces. It shows how a material deforms (strain) in response to applied stress. On a typical curve for a metal (Fig.), different points represent key mechanical properties: • Point D corresponds to the ultimate tensile strength, which is the maximum stress that the material can withstand before it begins to weaken. Beyond this point, the material starts to experience necking, where its cross-sectional area decreases locally. • Point E represents the fracture point, where the material finally breaks or fails completely. The distance between points D and E differs for various materials. For ductile materials, this distance is relatively large, indicating significant deformation after reaching the ultimate tensile strength. For brittle materials, this distance is small, meaning they fracture almost immediately after reaching the maximum stress. Thus, the stress–strain curve not only identifies the strength of a material but also indicates its ductility or brittleness.  (I) The slope of the initial linear portion of the stress–strain curve represents: (A) Toughness (B) Yield strength (C) Young's modulus (D) Ductility (II) Which of the following is true for the plastic region of a stress–strain curve? (A) The slope gives Young's modulus (B) The material returns to its original shape after unloading (C) Permanent deformation occurs (D) No elongation occurs (III) The ratio stress to strain remains constant for a small deformation of a material. When the deformation is made larger, this ratio:	1 Mark each

	(A) Increases (B) Decreases (C) Remains constant (D) Becomes zero (IV) A wire suspended vertically from one of the ends is stretched by attaching a weight of 200 N to the lower end. If the weight stretches the wire by 1 mm, the elastic energy stored in the wire is: (A) 20 J (B) 10 J (C) 0.2 J (D) 0.1 J	
30.	An artillery cannon launches a projectile with an initial speed, making an angle theta θ with the horizontal (x-axis). To study its motion, we make the ideal assumption that air resistance is completely absent. Under this assumption, no horizontal forces act on the projectile after it leaves the cannon. The only force acting on the projectile during its flight is gravity, which provides a constant downward acceleration of g. As a result, the horizontal motion remains uniform (constant velocity), while the vertical motion is uniformly accelerated due to gravity. This combination of motions creates the characteristic curved, parabolic path of the projectile.	
	(I) The path of the projectile is a parabola. How is this derived from the equations of motion for x and y coordinates (With the help of a neat graph, write the equations for x and y components)?	2
	(II) What is a projectile?	1
	(III) What is the acceleration of the projectile in the horizontal (a_x) and vertical (a_y) directions after it is launched?	1
	SECTION E	
31(I)	(A) State Newton's second law of motion and hence derive F=ma. (B) State and prove the law of conservation of linear momentum. (C) Two billiard balls each of mass 0.05 kg and moving in opposite directions with speed of 6 ms^{-1} collide and rebound with the same speed. What is the impulse imparted to each ball due to the other? **OR**	3+2
31 (II)	(A) Derive an expression for maximum velocity of a car moving on a banked circular road having coefficient of friction μ. (B) A car of mass 1500 kg is moving with a speed of 12.5 m/s on a circular path of radius 20 m on a level road. What should be the frictional force between the car and the road so that the car does not slip?	3+2

32(I)	(A) Define Orbital velocity. Hence, derive an expression for the orbital velocity of a satellite. (B) A body weighs 90 kg on the surface of the Earth. How much will it weigh on the surface of Mars, whose mass is 1/9 and radius is ½ of that of the Earth? **OR**	3+2

32(II)	(A) Define escape speed. Derive an expression for the escape speed of an object. (B) At what height above the earth's surface, the value of 'g' is the same as in a mine 80 km deep?	3+2
33(I)	(A) Derive the expressions for final velocities of two bodies undergoing one dimensional elastic collision. (B) The length of a steel wire increases by 0.5 cm, when it is loaded with a weight of 5 kg. Calculate the force constant of the wire and the work done in stretching the wire. **OR**	3+2
33(II)	(A) What is elastic collision? Prove that bodies of identical masses exchange their velocities after head-on elastic collision. (B) A railway carriage of mass 10,000 kg moving with a speed of 54 km/h strikes a stationary carriage of same mass. After the collision, the carriages get coupled and move together. What is their common speed after collision?	3+2