[SESSION-2025-26]

BASAVA INTERNATIONAL SCHOOL
TERM I EXAMINATION
SUBJECT: PHYSICS (042)

DATE: 8/09/2025 M.M: 70

CLASS: XI TIME: 3 Hours

General Instructions:

(i) All questions are compulsory.

(ii) The question paper has five sections and 33 questions.

(iii) Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.

(iv) There is no overall choice. However, internal choices have been provided in some questions.

SECTION A

1 In the relation y =a cos (ω t- k x), the dimensional formula for k is [1]

a) $[M^0 L^{-1} T^{-1}]$ b) $[M^0 L T^{-1}]$ c) $[M^0 L^{-1} T^0]$ d) $[M^0 L T]$

2 The speed of a projectile at its maximum height is half of its initial speed. The angle of projection is [1]

a) 60^0 b) 15^0 c) 30^0 d) 45^0

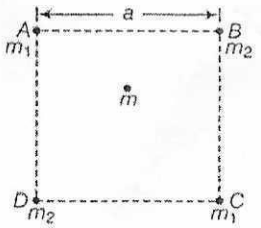
3 Under a constant torque, the angular momentum of a body changes from A to 4A in 4 sec. The torque on the body will be [1]

a) (3/4) A b) (1/4) A c) (4/3) A d) 4A

4 The mass of a lift is 2000 kg. When the tension in the cable is 28000 N, then its acceleration is [1]

a) 30 m s^{-2}downwards b) 4 m s^{-2}downwards c) 4 m s^{-2}upwards d) 14 m s^{-2} upward

5 A point mass m is placed at the centre of the square ABCD of side a units as shown below. [1]

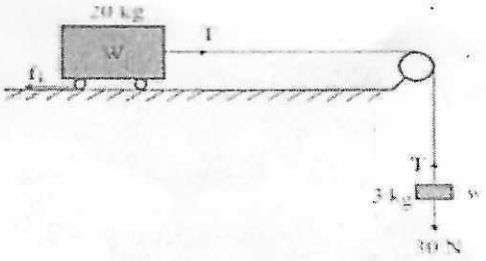


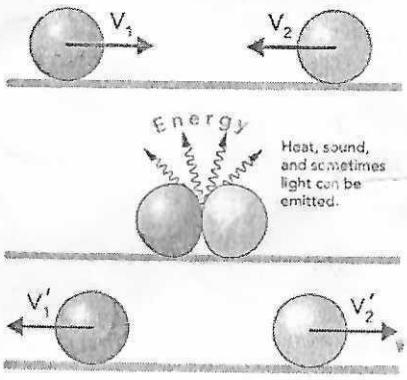
The resultant gravitational force on mass m due to masses m_1 and m_2 placed on the vertices of square is

a) $G m_1 m_2 / (a\sqrt{2})^2$ b) zero c) $2 G m_1 m_2 / a^2$ d) $Gm (m_1 + m_2) / (a\sqrt{2})^2$

6	The launching mechanism of a toy gun consists of a spring of unknown spring constant. When the spring is compressed 0.120 m, the gun, when fired vertically, is able to launch a 35.0-g projectile to a maximum height of20.0 m above the position of the projectile before firing. Neglecting all resistive forces, determine the spring constant. a) 873 N/m b) 993 N/m c) 903 N/m d) 953 N/m	1
7	A golf ball is released from rest from the top of a very tall building. Calculate the position in m of the ball after 2 seconds. a) 32.1 b) 19.6 c) 22.2 d) 20.9	1
8	Which of the following pairs of physical quantities does not have same dimensional formula? A) Angular momentum and Planck's constant b) Work and torque c) Tension and surface tension d) Impulse and linear momentum	1
9	A particle performs uniform circular motion with an angular momentum L. If the frequency of particle's motion is doubled and its K.E. is halved, the angular momentum becomes: a) 4L b) L/4 c) 2L d) none	1
10	If M is the mass of the earth and R its radius, the ratio of the gravitational acceleration and the gravitational constant is: a) MR b) MR^2 c) M/R^2 d) M^2R	1
11	The motion of planets in the solar system is an example of the conservation of a) mass b) linear momentum c) angular momentum d) energy	1
12	A body of mass M moving with velocity V explodes into two equal parts. If one comes to rest and the other body moves with velocity v, what would be the value of v? a) 2 V b) V c) $v/\sqrt{2}$ d) 4v	1
13	**Assertion (A):** Dimension of coefficient of viscosity is $[ML^{-1}T^{-1}]$ **Reason (R):** The coefficient of viscosity is the force acting per unit area per unit velocity gradient. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	1
14	**Assertion (A):** In circular motion, work done by centripetal force is zero. **Reason (R):** In circular motion, centripetal force is perpendicular to the displacement	1

	a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c) A is true but R is false. d) A is false but R is true.	
15	**Assertion:** The acceleration due to gravity near the: earth surface differs slightly from the GM/R^2 **Reason:** The earth is not a uniform sphere and earth rotates about its axis. a) Assertion and reason both are correct statements and reason is correct explanation for assertion. b) Assertion is correct statement but reason is wrong statement. c)Assertion and reason both are correct statements but reason is not correct explanation for assertion. d) Assertion is wrong statement but reason is correct statement.	1
16	**Assertion (A):** If the sum of the two unit vectors is also a unit vector, then magnitude of their difference is root of three. **Reason (R):** To find resultant of two vectors, we use square law. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A. c)A is true but R is false. d) A is false but R is true.	1
	SECTION B	
17	The escape speed of a projectile on the earth's surface is 11.2 km/s. A body is projected out with thrice this speed. What is the speed of the body far away from the earth? Ignore the presence of the sun and other planets.	2
18	Write parallel and perpendicular axis theorem regarding moment of inertia.	2
19	A body of mass 0.5 kg travels on straight line path with velocity $v= (3x^2+ 4)$ m/s. Calculate net work done by the force during its displacement from x= 0 to x= 2 m.	2
20	Two identical particles move towards each other with velocities 2V and V respectively. What is the velocity of the centre of mass?	2
21	Assuming earth to be a uniform sphere find an expression for density of earth in terms of g and G? OR A satellite is orbiting the earth with speed v_0. To make the satellite escape, what should be the minimum percentage increase in its velocity	2
	SECTION C	
22	Define Orbital and escape velocity of earth and derive an expression for escape velocity	3

	of a body from the surface of earth.	
23	An artificial satellite revolves around the earth at a height of 1000 km. The radius of the earth is 6.38×10^3 km. Mass of the earth is 6×10^{24} kg and G = 6.67×10^{-11} Nm^2/Kg^2. Find its orbital velocity and period of revolution.	3
24	From the top of a multi-storeyed building, 39.2 m tall, a boy projects a stone vertically upwards with an initial velocity of 9.8 m s^{-1} such that it finally drops to the ground, I. When will the stone reach the ground? II. When will it pass through the point of projection? III. What will be its velocity before striking the ground? Take g = 9.8 m s^{-2}.	3
25	What is the acceleration of the block and the trolley system shown in figure. If the coefficient of kinetic friction between the trolley and the surface is 0.04? What is the tension in the string? Take g= 10 m/s^2. Neglect the mass of the string. 	3
26	Define angular momentum. Derive the relation between angular momentum and torque.	3
27	What do you mean by banking of a curved road? Determine the angle of banking so as to minimise the wear and tear of the tyres of a car negotiating a banked curved.	3
28	State and prove work energy theorem. If the kinetic energy of a body increases by 300 %, by what percent will the linear momentum of the body increase? OR Which one is easier pulling or pushing of a body? Explain with diagram and equations.	3
	SECTION D	
29	**Read the text carefully and answer the questions:** An **elastic collision** is a **collision** in which there is no net loss in kinetic energy in the system as a result of the **collision**. Both momentum and kinetic energy are conserved quantities in **elastic collisions**.	4



(I) In which motion, momentum changes but K.E does not?

a) linear motion b) straight-line motion c) circular motion d) parabolic motion

(II) The coefficient of restitution for elastic collision is:

a) 1 b) -1 c) infinite d) 0

(III) Two balls at the same temperature collide. What is conserved?

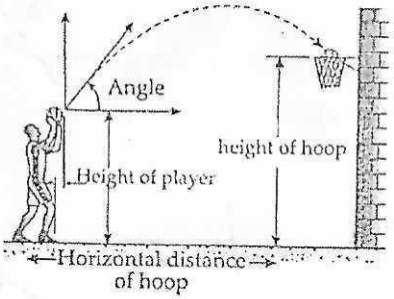
a) Force b) kinetic energy c) velocity d) momentum

(IV) The momentum of two objects moving with the same speed but in opposite directions upon collision is

a) Fall b) increased c) decreased d) zero

30 **Read the text carefully and answer the questions:** 4

Using the laws of physics, it is possible to make a successful jump shot in basketball every time. The trajectory of a basketball is always a parabola. It is a projectile when it is launched up into the air, and this is due to the effects of gravity as well as the force put on the ball by the player that properly follows the properties of a projectile.



The velocity of the ball changes as it moves through the air, but the velocity of the first half of the path matches with the last half of the path. It may deviate from its path if the ball collides with either the backboard or another player interfering with its path.

From the information of the height of the player, the horizontal distance and height of the hoop, the player can easily calculate the speed to be imparted to the ball and the angle for a sure success. If player's height is 1.27 meters standing at a distance of 2

	meters from the hoop which is at a height of 3.05 meters, he needs an angle of 55^{o} and velocity of the ball 7 m/s to be imparted to make his shot a success. (If he uses a smaller angle he has to shoot with a greater velocity.) To improve chances of an accurate shot, often a player includes a backspin on the ball as he launches it for a shot. The backspin ensures that the ball enters the hoop, especially if the shot is a "soft shot." Soft shot is when the ball is shot at a low angle and low velocity, the player adds a backspin because if the ball winds up hitting the rim, the spin will help it to enter the hoop. The backspin changes the velocity direction (once it hits the rim) to the opposite direction of the rim rather than bouncing it out. (a) What is the trajectory of a basketball? What happen to the velocity of ball during its motion? (b) When the basketball deviates from its parabolic path? (c) What information is required to calculate the speed to be imparted to the ball and the angle for an accurate shot? (d) Why backspin is applied on basketball while launching it for a shot?	
	SECTION E	
31	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. Hence derive expressions for the velocities of the two bodies in terms of their initial velocities before collisions. Discuss the special cases also. OR (i) Derive an expression for the potential energy of an elastic stretched spring. (ii) Two springs have force constants k_1 and k_2 ($k_1 > k_2$). On which spring is more work done, if (a) they are stretched by the same force and (b) they are stretched by the same amount.	5
32	Define centripetal acceleration. Derive an expression for the centripetal acceleration of a particle moving with uniform speed v along a circular path of radius r. Discuss the direction of this acceleration. OR (i) Show that for two complementary angles of projection of a projectile thrown with the same velocity, the horizontal ranges are equal. (ii) For what angle of projection of a projectile, is the range maximum? (iii) For what angle of projection of a projectile, are the horizontal range and maximum height attained by the projectile equal?	5
33	(i) Define gravitational potential energy and drive an expression for it. (ii) Find gravitational potential energy of system of four particles each of mass m, placed	5

	at the vertices of a square of side l. Or, (I) A circular plate of uniform thickness has a diameter 56 cm . A circular portion of diameter 42 cm is removed from one edge of the plate. Find CM of the remaining portion. (ii) Derive the rotational equation:- $\omega^2 - \omega_0^2 = 2\alpha\theta$	