B.K. BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
A CBSE DAY-CUM-BOYS' RESIDENTIAL SCHOOL

TERM-1 EXAMINATION (2025-26)

PHYSICS (042)

Class: XI **Time: 3hrs**
Date: 10.09.25 **Max Marks: 70**
Admission no: **Roll no:**

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 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 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 one question in Section B, one question in Section C, one question in each CBQ in Section D 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

1. The dimensional formula of pressure is:
(a) $[ML^{-1}T^{-2}]$ (b) $[MLT^{-2}]$ (c) $[ML^{2}T^{-2}]$ (d) $[M^{0}L^{0}T^{0}]$

2. Which of the following is a correct pair of fundamental quantities?
(a) Length and Mass (b) Force and Time (c) Pressure and Temperature (d) Work and Energy

3. Which of the following is a scalar quantity?
(a) Velocity (b) Acceleration (c) Displacement (d) Speed

4. A body is thrown vertically upward. The velocity at the highest point is:
(a) Maximum (b) Zero (c) Equal to initial velocity (d) None of these

5. In projectile motion, which quantity remains constant throughout the flight?
(a) Vertical velocity (b) Acceleration (c) Horizontal velocity (d) Height

6. The angle of projection for maximum range in projectile motion is:
(a) 30° (b) 45° (c) 60° (d) 90°

7. Newton's First Law is also known as:
(a) Law of Inertia (b) Law of Force (c) Law of Action-Reaction (d) Law of Momentum

8. Which of the following is not a unit of energy?
(a) Joule (b) Calorie (c) Watt (d) kWh

9. The work done by centripetal force is:
(a) Positive (b) Negative (c) Zero (d) Infinite

10. A body in rotational motion possesses rotational kinetic energy given by …..
(a) KE= 1/2 ωI^2 (b) KE= 1/2 $I\omega^2$ (c) KE= 2 ωI^2 (d) KE= $I\omega$

11. Acceleration due to gravity decreases with:
(a) Increase in mass (b) Increase in height from Earth's surface
(c) Decrease in radius (d) Increase in density

12. Gravitational potential energy is:
(a) Always positive (b) Always negative (c) Zero (d) Can be positive or negative

For Questions 13 and 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) If both Assertion and Reason are true and Reason is correct explanation of Assertion.
(b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
(c) If Assertion is true but Reason is false.
(d) If Assertion is false but Reason is true.

13. **Assertion**: In projectile motion, the horizontal velocity remains constant.
Reason: There is no acceleration in the horizontal direction.

14. **Assertion:** If the net external force on a body is zero, then its acceleration will be zero.
Reason: Acceleration does not depend upon the force.

15. **Assertion:** The change in kinetic energy of a particle is equal to the work done on it by the net force.
Reason: Change in kinetic energy of particle is equal to work done only in case of a system of one particle.

16. **Assertion**: Rotational kinetic energy depends on moment of inertia.
Reason: Moment of inertia is analogous to mass in linear motion.

SECTION-B

17. What are derived units? Write two examples. 2

18. A projectile is thrown with velocity 20 m/s at an angle of 60°. Calculate the time of flight. 2

Or

The ceiling of a long hall is 25 m high. What is the maximum horizontal distance that a ball thrown with a speed of 40 m s^{-1} can go without hitting the ceiling of the hall?

19. State and prove work-energy theorem for constant force. 2

20. Find the centre of mass of three particles at the vertices of an equilateral triangle. The masses of the particles are 100g, 150g, and 200g respectively. Each side of the equilateral triangle is 0.5m long. 2

21. State and explain Newton's universal law of gravitation. How does the gravitational force differ from electrostatic force? 2

Or

What is gravitational potential energy? Why is it considered negative near Earth's surface?

SECTION-C

22. What are the limitations of dimensional analysis? Give two examples where it fails. 3

OR

Kinetic energy 'K' of a body is given by the equation $K = \frac{1}{2} mv^2$, where m is mass and v is velocity. Use dimensional analysis to find the dimensional formula of kinetic energy.

23. A car moves with uniform acceleration of 2 m/s^2. If its initial velocity is 5 m/s, find the distance covered in 10 seconds. 3

24. Derive the three equations of the motion, using graphical method. 3

25. Derive the expression of magnitude and direction of resultant vector **R**, addition of two vectors **P** and **Q** using parallelogram method. The angle between **P** and **Q** is ɵ. 3

26. Prove that there will be always a loss in energy in an inelastic collision. 3

27. A solid cylinder of mass 20kg rotates about its axis with angular speed 100 rad/sec. The radius of the cylinder is 0.25m. What is the kinetic energy associated with the rotation of the cylinder? What is the magnitude of angular momentum of the cylinder about its axis? 3

28. State and explain Kepler's laws of planetary motion in detail. 3

SECTION-D (Case Study Based Questions)

29. A car starts from rest and accelerates uniformly at 2 m/s^2. (1 + 1 + 1 + 1)
    (i) What is its velocity after 5 seconds?
    (ii) What distance does it cover in 5 seconds?
    (iii) What is the acceleration at t = 5 s?
    (iv) What type of motion is this?

30. A body of mass 10 kg is lifted to a height of 5 m. (2 + 1 + 1)
    (i) Calculate the potential energy stored.
    (ii) If dropped, what will be its velocity just before hitting the ground?
    (iii) What is the work done by gravity during the fall?

SECTION-E

31. Derive the expression for range, time of flight, and maximum height in projectile motion.(5)

Or

Define uniform circular motion. Find the expression of centripetal acceleration for uniform circular motion.

32. (a) Why are circular roads banked? Deduce an expression of maximum turning speed for the banked road.

(b) A 1000 kg car rounds a curve on a flat road of radius 50 m at a speed of 50 km/hr. Will the car make the turn or will it skid if the coefficient of friction is 0.60? Justify. (5)

Or

(a)Explain the terms: friction and limiting friction.
(b)Give some methods for reducing friction.
(c)Write applications of ball bearing in rotating devices

33. Derive the expression for escape velocity from Earth's surface. Then calculate the escape velocity for a body on Earth using the values: Radius of Earth $R=6.4\times10^6$ m., $g=9.8$ m/s^2. (5)

Or

Find the expression of gravitational acceleration at the Earth's surface, hence find the expression for gravitational acceleration (i) above (ii) below the Earth's surface.

---------- **ALL THE BEST** ----------