B.K. BIRLA CENTRE FOR EDUCATION

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

TERM-1 EXAMINATION (2026-27)

PHYSICS (042)

Class: XI **SET-II** **Time: 3hrs**
Date: 02.09.2026 **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 SI unit of pressure is:
   (a) Newton (b) Pascal (c) Joule (d) Watt
2. The number of significant figures in the measurement 0.0450 m is:
   (a) 2 (b) 3 (c) 4 (d) 5
3. The dimensional formula of work (or energy) is:
   (a) $[MLT^{-1}]$ (b) $[ML^2T^{-2}]$ (c) $[ML^{-1}T^{-2}]$ (d) $[ML^2T^{-1}]$
4. A body moving with uniform velocity has acceleration equal to:
   (a) Zero (b) Constant, non-zero
   (c) Continuously increasing (d) Cannot be determined
5. The area under an acceleration-time graph gives:
   (a) Displacement (b) Change in velocity (c) Speed only (d) Jerk
6. The position of a particle moving along a straight line is given by $x = 2t^3 - 9t^2 + 12t$ (x in m, t in s). Its velocity at t = 1 s is:
   (a) −3 m/s (b) 3 m/s (c) 0 m/s (d) 6 m/s
7. Two vectors of equal magnitude are added such that the angle between them is 0°. The magnitude of the resultant is:

(a) Zero (b) Twice the magnitude of either vector
(c) Equal to either vector (d) 1.5 times either vector

8. The horizontal range of a projectile (fired with a given speed) is maximum when the angle of projection is:
(a) 30° (b) 45° (c) 60° (d) 90°
9. For a projectile, the horizontal range is equal to twice the maximum height attained. The angle of projection is:
(a) $\tan^{-1}(2)$ (b) $\tan^{-1}(4)$ (c) $\tan^{-1}(1)$ (d) $\tan^{-1}(1/4)$
10. Newton's first law of motion is also known as the law of:
(a) Inertia (b) Conservation of momentum
(c) Action and reaction (d) Gravitation
11. A body of mass 3 kg experiences a net force of 12 N. The acceleration produced in it is:
(a) 2 m/s^2 (b) 4 m/s^2 (c) 6 m/s^2 (d) 8 m/s^2
12. A rocket accelerates forward by ejecting exhaust gases backward. This is based on the conservation of:
(a) Energy (b) Mass (c) Linear momentum (d) Angular momentum

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 (A): The number of significant figures in the number 100 is ambiguous when the number is written without a decimal point.
Reason (R): Trailing zeros in a number without a decimal point may or may not be significant, depending on the precision of measurement.
14. Assertion (A): A body performing uniform circular motion has zero acceleration since its speed remains constant.
Reason (R): Acceleration in circular motion arises due to the continuous change in the direction of velocity, even though the speed remains constant.
15. Assertion (A): A cyclist leans towards the centre of the curve while taking a turn on a level circular road.
Reason (R): Leaning provides a component of the normal reaction directed towards the centre, which contributes to the centripetal force needed for the turn.
16. Assertion (A): A boatman rowing across a river takes the least time to cross it when he rows perpendicular to the bank, regardless of the speed of the river's current.
Reason (R): The time taken to cross the river depends only on the width of the river and the component of the boat's velocity perpendicular to the bank.

SECTION-B

17. Write the dimensional formulae of (a) the universal gravitational constant G, and (b) the coefficient of viscosity η. [2]
18. A car moving with a speed of 25 m/s is brought to rest by applying brakes uniformly in 4 s. Find (a) the acceleration of the car, and (b) the distance travelled before it stops. [2]
19. (a) State the triangle law of vector addition.

OR

(b) Two vectors A and B have magnitudes 5 units and 12 units respectively, and the angle between them is 90°. Find the magnitude of their resultant. [2]

20. Define time period and frequency of a particle moving in uniform circular motion. Derive the relation connecting them with the angular velocity ω. [2]
21. State Newton's third law of motion. Illustrate it with one suitable example. [2]

SECTION-C

22. State the principle of homogeneity of dimensions. Using it, check the dimensional correctness of the equation $v^2 = u^2 + 2as$, where symbols have their usual meanings. [3]
23. The time period T of oscillation of a block of mass m attached to a spring of force constant k depends on m and k. Using the method of dimensions, derive an expression for T (you need not find the value of the dimensionless constant). [3]
24. Derive the equation v = u + at for a body moving with uniform acceleration, using a velocity-time graph. [3]
25. A ball is thrown vertically upward with a velocity of 19.6 m/s from the ground. Calculate (a) the time taken to reach the maximum height, (b) the maximum height reached, and (c) the total time taken to return to the ground. [3]
26. (a) Derive an expression for the horizontal range of a projectile projected at an angle θ with the horizontal, with initial speed u.

OR

(b) Find the angle between two vectors of magnitude 8 N and 6 N such that the magnitude of their resultant is 10 N. [3]

27. What is uniform circular motion? Derive an expression for the centripetal force acting on a particle of mass m moving with uniform speed v in a circle of radius r. [3]
28. State Newton's second law of motion. Show how the equation F = ma can be derived from it.3

SECTION-D (Case Study Based Questions)

29. Read the following passage and answer the questions that follow:
A car starts from rest and accelerates uniformly at 3 m/s² for 8 s. It then moves with this constant velocity for the next 15 s, and finally decelerates uniformly, coming to rest in the next 4 s.
    (i) What is the velocity of the car at the end of the acceleration phase (i.e. at t = 8 s)? [1]
    (ii) What is the distance covered by the car during the acceleration phase? [1]
    (iii) What is the distance covered by the car during the constant-velocity phase? [1]
    (iv) What is the magnitude of deceleration of the car during the last phase of its motion? [1]

30. Read the following passage and answer the questions that follow:
A man of mass 70 kg stands on a weighing machine placed on the floor of a lift.
    (i) When the lift is stationary (or moving with uniform velocity), find the reading of the weighing machine. Also write the general expression for the normal reaction R on the man when the lift moves with an acceleration a (taking upward acceleration as positive). [2]
    (ii) If the lift accelerates downward at 2.5 m/s², what will the weighing machine read? [1]
    (iii) If the cable of the lift snaps and it falls freely under gravity, what will the weighing machine read? [1]

SECTION-E

31. (a) Derive the three equations of motion, v = u + at, s = ut + ½ at² and $v^2 = u^2 + 2as$, for a body moving with uniform acceleration, using the method of calculus.

OR

(b) A stone is dropped from the top of a tower 90 m high. At the same instant, another stone is thrown upward from the ground with a velocity of 30 m/s. Find when and where the two stones meet. (Take g =10 m/s²) [5]

32. (a) Derive expressions for the time of flight and the horizontal range of a projectile projected at an angle θ with the horizontal from the ground. Hence show that the range is maximum when θ = 45°.

OR

(b) State the parallelogram law of vector addition and derive expressions for the magnitude and direction of the resultant of two vectors. Hence find the magnitude and direction of the resultant of two forces of 10 N and 5 N acting at an angle of 60° to each other. [5]

33. (a) State the law of conservation of linear momentum and derive it from Newton's third law of motion. A bullet of mass 15 g moving with a velocity of 400 m/s gets embedded in a freely suspended wooden block of mass 3 kg. Find the velocity of the block (with the bullet embedded in it) immediately after the collision.

OR

(b) Explain the concept of friction. Define the angle of friction and the angle of repose, and show that the two are equal. A block of mass 10 kg lies on a horizontal surface for which the coefficient of friction is 0.4. Find the minimum horizontal force required to just move the block. (Take g = 10 m/s²) [5]

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