

**FIRST SEMESTER (CBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2020**

Physics/Applied Physics

PHY 1B 01/APH 1B 01—METHODOLOGY OF SCIENCE AND BASIC MECHANICS

(2019 Admissions)

Time : Two Hours

Maximum : 60 Marks

The symbols used in this question paper have their usual meanings.

Section A (Short Answer Type)

*Answer **all** questions in two **or** three sentences.*

Each correct answer carries a maximum of 2 marks.

1. Define Hypothesis.
2. Obtain an expression for fractional change in acceleration due to gravity with altitude.
3. State Work-energy theorem.
4. How do you infer the nature of stability of a system from its potential energy ?
5. Check whether the force $F = A (3i + zj + yk)$, where A is a constant, is conservative or not.
6. Draw the energy diagram for a particle moving under a repulsive inverse square force.
7. Define Torque. Deduce the relation connecting torque and angular momentum.
8. State the theorem of parallel axes. Express it mathematically.
9. A metallic disc is melted and recast into a thin walled cylinder of same radius. Which one will have a greater moment of inertia ? Justify your answer.
10. Show that motion under a central force will be planar.
11. What is Poisson's ratio ?
12. Find out the expression for the work done in twisting a rod.

(Ceiling 20)

Turn over

Section B (Paragraph/Problem Type)

Answer **all** questions in a paragraph of about **half a page** to one page.

Each correct answer carries a maximum of 5 marks.

13. Write a note on inductive and deductive reasoning.
14. Explain science as a social activity.
15. A block of mass m rests on a wedge of angle θ . Draw the force diagram. If μ is the coefficient of friction, find the value of θ at which the block starts to slide.
16. Define centre of mass of a rigid body. A drum major's baton consisting of two masses m_1 and m_2 separated by a thin rod of length l is thrown into air. Prove that the centre of mass of the baton follows a parabolic trajectory. Neglect friction.
17. Using Work-energy theorem, show that the escape velocity is independent of launch direction.
18. Define reduced mass of a system. Discuss the vibration of a diatomic molecule and obtain an expression for the angular frequency.
19. Show that the Young's modulus Y , modulus of rigidity η and Poisson's ratio σ are related by the equation $Y = 2\eta(1 + \sigma)$.

(Ceiling 30)

Section C (Essay Type)

Answer in about **two pages**, any **one** question.

The question carries 10 marks.

20. State Newton's laws of motion. Use the laws to discuss the motion of : (i) A block of mass whirling at the end of a string on a horizontal plane in the absence of gravity and friction ; and (ii) A conical pendulum rotating at a constant angular frequency. Find the tension in the string in both cases.
21. State and prove the law of conservation of angular momentum. Prove that the angular momentum of a rigid body is equal to the sum of the angular momentum about the center of mass and the angular momentum of the center of mass about the origin.

(1 × 10 = 10 marks)