

D 13610

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Name.....

Reg. No.....

**FIRST SEMESTER (CBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2021**

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. What is meant by falsification ?
2. Give two examples for Pseudoscience.
3. What is fictitious force ?
4. Define law of conservation of momentum.
5. Define terminal velocity.
6. What is Bola ?
7. State and explain ideal gas law.
8. Give the geometrical interpretation of angular momentum.
9. State Hook's law.
10. What is rigidity modulus.
11. State work - energy theorem.
12. Explain bending of a beam.

(Ceiling—20)

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 Scientific method.
14. Compare different unit systems.

Turn over

15. Calculate the work done in twisting a steel wire of diameter 2 mm. and length 0.25 m. through an angle 45° . Given rigidity modulus for steel is $8 \times 10^{10} \text{N/m}^2$.
16. Derive the M.I. of Stick.
17. Define Torque. Derive its relation with angular momentum
18. Determination of Y by bending of a beam.
19. A wire of radius 1mm and length 2 m. is stretched through 0.1 mm. on the application of a force of 10 N, Find the stress and strain

(Ceiling - 30)

Section C (Essay Type)

*(Essays - Answer in about **two pages**, any **one** question. Answer question carries 10 marks).*

20. Explain centre of mass. Write on Drum Major's Baton.
21. What is cantilever ? Calculate the bending moment of a cantilever loaded at free end.

(10 marks)

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(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)

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Name.....

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FIRST SEMESTER B.A./B.Sc. DEGREE EXAMINATION, NOVEMBER 2019

(CBCSS—UG)

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. What is science ?
2. What is meant by contact forces ? Give two examples.
3. Work done during uniform circular motion is zero. Justify.
4. Space rockets are usually launched from west to east ? Why ?
5. Draw the energy diagram of an attractive two atom system and mark the bounded region.
6. State work-energy theorem.
7. Define angular momentum of a particle. Give its S I Unit.
8. Define central force. Show that angular momentum is conserved in central force motion.
9. Two lenses-one convex and the other concave-of same mass and same radius are given. Which one will have greater moment of inertia,when rotating about an axis perpendicular to the plane and passing through the centre ? Justify your answer.
10. Give the relationship between linear velocity and angular velocity. Identify a pair of perpendicular vectors in the relation.
11. State Hooke's law of elasticity.
12. Write down the relationship between various elastic constants.

(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. Distinguish between science and pseudoscience with examples.
14. Discuss the criteria for ascertaining the relevance of a hypothesis for a research project.
15. A spring gun with a piston of mass m attached to a spring of constant k uses a marble of mass M as the shot. The marble and the piston are pulled back a distance L from the equilibrium position and suddenly released. Calculate the speed of the marble as it loses contact with the piston. Neglect friction.
16. A man weighing 100 kg stands on a scale (measuring newtons) in a moving elevator. Find the reading on the scale when the lift : (i) remains stationary ; (ii) accelerates upwards at the rate of 4 m/s^2 ; (iii) accelerates downwards at the rate of 2 m/s^2 ; (iv) falls freely under gravity ; and (v) moves with uniform velocity.
17. A uniform drum of radius R and mass M rolls without slipping down a plane inclined at an angle θ . Find its acceleration along the plane. Moment of inertia of the drum about its axis is $I_0 = MR^2/2$.
18. Derive an expression for the time period of a physical pendulum and hence show that a simple pendulum corresponds to a special case of it.
19. Derive an expression for the period of oscillation of a torsion pendulum.

(Ceiling - 30)

Section C (Essay Type)

Answer in about two pages, any one question.

Answer carries 10 marks

20. State Newton's laws of motion. Apply these laws to find (a) the force on each car of mass M in a string of three freight cars pulled with force F by a locomotive ; and (b) the tension on a string of length R used to whirl a mass m in a vertical plane in the gravitational field of the earth.
21. Distinguish between conservative and non conservative forces with examples. Derive the relation between potential energy and force for a conservative system and discuss how this relation is used in stability analysis.

(1 × 10 = 10 marks)

Part D (Essay Type)

Answer any two questions.

34. Find the volume of the solid generated by revolving the regions bounded by the curve $x = \sqrt{5}y^2$, $x = 0$, $y = -1$, $y = 1$ about x -axis.

35. Let $f(x) = \begin{cases} 3-x, & x < 2; \\ \frac{x}{2} + 1, & x > 2. \end{cases}$

- a) Find $\lim_{x \rightarrow 2^+} f(x)$ and $\lim_{x \rightarrow 2^-} f(x)$.
- b) Does $\lim_{x \rightarrow 2} f(x)$ exist? If so, what is it? If not, why not?
- c) Find $\lim_{x \rightarrow 4^+} f(x)$ and $\lim_{x \rightarrow 4^-} f(x)$.
- d) Does $\lim_{x \rightarrow 4} f(x)$ exist? If so, what is it? If not, why not?
36. Find the center of mass of a thin plate of constant density δ covering the region bounded above by parabola $y = 4 - x^2$ and below by x -axis.

(2 × 10 = 20 marks)