



General Instructions:

1. All parts are compulsory.
2. Answers without relevant diagram/figure/circuit wherever necessary will not carry any marks.
3. Direct answers to numerical problems without detailed solutions will not carry marks.

Part A

I. Answer all the following questions.

10x1=10

1. Express 1KWh in joules.
2. Draw p-t graph for uniform velocity.
3. Define free fall of a body.
4. Which law of motion is used to explain rocket propulsion?
5. Write the distance of geostationary satellite from center of earth.
6. What is the significance of zeroth law of thermodynamics?
7. State Hooke's law.
8. Define second's pendulum.
9. Define black body radiation.
10. What is the distance between node and adjacent antinode?

Part B

II. Answer any five of the following questions.

5x2=10

11. Mention any two limitations of dimensional analysis.
12. Distinguish between distance and displacement.
13. A person can throw a stone to maximum height H. What is maximum horizontal distance he can throw?
14. Friction is a necessary evil. Justify?
15. State 2nd law of thermodynamics.
16. Write any two applications of thermal expansion.
17. Define free and forced oscillations.
18. Define streamline and turbulent flow of liquid.

Part C

III. Answer any five of the following questions.

5x3=15

19. Write three equations of rotational motion.
20. If A and B are two vectors whose dot product is equal to cross product, find the angle between them.
21. Check the correctness of equation $T = 2\pi\sqrt{l/g}$
22. Define power and show that $\vec{P} = \vec{F} \cdot \vec{v}$
23. Write any 3 differences between progressive and stationary wave.
24. Explain land breeze and sea breeze.
25. What is capillarity and mention any two of its application.

26. Gravitational force between two bodies is 1N. If the distance between them is doubled, what will be the force?

Part D

- IV. Answer any two of the following questions. 2x5=10
27. State and explain parallel and perpendicular axis theorem.
28. State and prove work energy theorem for a constant force.
29. Derive the expression for time of flight and maximum range for a projectile.

Part E

- V. Answer any two of the following questions. 2x5=10
30. Derive the expression for the variation of the acceleration due to gravity with altitude.
31. Derive an expression for work done during isothermal process.
32. Discuss the modes of vibration in open pipe.

- VI. Answer any three of the following questions. 3x5=15
33. A jet airplane traveling at the speed of 500km/h ejects its products of combustion at the speed of 1500km/h relative to the jet plane. What is the speed of ejection with respect to an observer on the ground?
34. A shell of mass 0.02kg is fired by a gun of mass 100kg. If the muzzle speed of the shell is 80m/s, what is the recoil speed of the gun?
35. A pump on the ground floor of a building can pump up water to fill a tank of volume 30m^3 in 15 min. If the tank is 40m above the ground and the efficiency of the pump is 30%. How much electric power is consumed by the pump?
36. A steam engine delivers 5.4×10^8 J of work per minute and serves 3.6×10^9 J of heat per minute from its boiler. What is the efficiency of the engine? How much heat is wasted per minute?
37. Progressive wave is represented by equation $Y = 5\sin(80\pi t - 0.5\pi x)$, where x, y are in meters and t is in seconds. Find a) amplitude b) wavelength c) wave frequency d) wave velocity
