

Laws of motion

Basics - 01

Objective : To assess your basis understanding of the content in the chapter. This assessment is essential before you attempt any higher order problems (like JEE, NEET, EAPCET etc.)

Fill in the Blanks

Note : The number of blanks are to give you a hint of the number of words required to fill up the blank

1. An object continues in its state of rest or uniform motion in a straight line unless compelled to change by an _____.
2. The property by which objects tend to resist any change in their state of rest or of uniform motion in a straight line is called _____.
3. Newton's second law can be mathematically written as $F =$ _____.
4. The SI unit of force is _____.
5. Action and reaction are two _____ having equal _____, opposite _____ and act on _____ bodies.
6. The product of mass and velocity is known as _____.
7. _____ is the measure of inertia and its SI unit is _____.
8. The net force on a body in equilibrium is _____.
9. Impulse imparted to a body equals the change in _____.
10. Frictional force always acts _____ to the two surfaces of the bodies in contact.
11. Frictional force tends to oppose the _____ motion between the bodies in contact.
12. Static friction is always _____ than or equal to kinetic friction.
13. _____ frictional force is self adjusting in nature.
14. For a car taking a turn on a flat road, the centripetal force is provided by _____.
15. Contact force arises due to contact between two surfaces. The component of contact force perpendicular to the surfaces is called _____ force and the component of contact force parallel to the surfaces is called _____ force.

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Short Answer / Conceptual (15)

16. State Newton's first law of motion and give an example.
17. When a moving bus suddenly stops, passengers lurch forward. Explain why.
18. What is the direction of frictional force acting on a block being pushed across a rough surface?
19. Differentiate between static and kinetic friction with examples.
20. A coin placed on a rotating turntable flies off tangentially when it slips. Explain why.
21. What is meant by "conservation of linear momentum"? Provide a real-life example.
22. Describe one situation where increased friction is desirable and one where it should be reduced.
23. Why is it easier to walk on rough surfaces than on slippery ones?
24. What is meant by a free-body diagram? Why is it helpful in solving problems?
25. Briefly describe Newton's third law with an example using any one of the objects around you.
26. How does banking of a road help vehicles take turns safely?
27. If a body is at rest on a table, state and explain all the forces acting on it using the first law.
28. Distinguish between mass and weight.
29. Why does a heavier object require more force to achieve the same acceleration as a lighter object?

Numerical/Application (10)

31. A ball of mass 0.2 kg is thrown upwards with a velocity of 20 ms^{-1} . What is its momentum at the moment of release?
32. Calculate the force required to give a 2 kg object an acceleration of 4 ms^{-2} .
33. A 0.05 kg pebble is dropped from a height. What is the magnitude and direction of the net force on the pebble during free fall? (Ignore air resistance.)
34. A force of 10 N acts on a body for 0.5 seconds. What is the impulse?
35. A car of mass 1000 kg moving at 36 kmph is brought to rest in 10 seconds by applying brakes. Calculate the average retarding force. (Why is *average* used in the question?)

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36. If the coefficient of static friction between a block and the floor is 0.2, what is the maximum force that can be applied before the 5 kg block starts moving? ($g = 10\text{ms}^{-2}$)
37. A 30 kg block is at rest on a horizontal surface. What is the normal reaction exerted by the surface?
38. Two balls with equal mass collide head-on and rebound with the same speed. What is the impulse experienced by each ball if their mass is 0.2 kg and speed is 5 ms^{-1} ?
39. A cyclist takes a turn of radius 5 m on a flat road at 5 ms^{-1} . Will the cyclist slip if the coefficient of static friction is 0.3? ($g = 10\text{ ms}^{-2}$)
40. A bullet of mass 0.01 kg is fired from a gun with a velocity of 400 ms^{-1} . If the gun's mass is 2 kg, what is its recoil velocity?