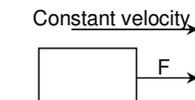
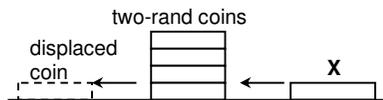


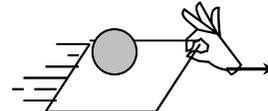
Newton's First Law of Motion

- **Newton's First Law of Motion:** An object continues in a **state of rest** or **uniform velocity** unless it is acted upon by an unbalanced (or net or resultant) force. In other words, an object at rest tends to remain at rest and an object moving tends to continue moving at that constant velocity when the **resultant force is zero** (no unbalanced forces or resultant or net force acting on it) OR an object at rest remains at rest and a moving object continues moving at a constant velocity **unless an unbalanced force** acts upon it.
- Applicable to **all** cases where $F_{\text{net}} = 0$.
- Therefore, whenever a body is **at rest** or **moving at a constant velocity, the resultant force is zero**, i.e. all the forces in the X-direction and all the forces in the Y-direction must add up to zero. Also keep this in mind when you draw a force diagram or a free-body diagram.
- **Inertia** of a body is its tendency to resist any change in its motion.
- The inertia of an object is determined by its **mass**. (NB: Inertia is **not** a force – it is a **property!**)
- Make sure whether you have to explain your answer using Newton's First **Law** or the **property**, inertia.

Exercise 8:

- 1 Give ONE word/term for
- 1.1 the resistance of an object to changing its position. (1)
- 2 Siphso, a five year old boy, stands in the coach of a passenger train while the train is moving at a high constant speed on the straight section of a line between two suburban stations. He jumps straight upward and lands on his feet again. The position where he lands will probably be from where he jumped.
- A the same position B slightly forward
C slightly backward D a noticeable distance backward (2)
- 3 A workman, standing on a scaffold, lowers an object of weight 300 N by means of a rope, at constant speed. If the weight of the rope is negligible, the force that the man exerts, is
- A equal to 300 N B constant and less than 300 N
C greater than 300 N D less than 300 N and decreasing. (2)
- 4 According to Newton's First Law
- A the acceleration of a body is directly proportional to the force causing the acceleration.
B the velocity of a body remains constant unless an unbalanced force acts upon it.
C the impulse on a body is the product of the mass and the change in velocity.
D the sum of the gravitational potential energy and the kinetic energy of a body is constant. (2)
- 5 Ziyanda places 4 two-rand coins, one above the other, on a horizontal table. Friction is negligible. She shoots another two-rand coin (X) which strikes the lowest coin horizontally. Coin X displaces and replaces the lowest coin, while all the other coins remain at the same place on the table. Which ONE of the following laws explains why the top three coins are not displaced?
- A Newton's First Law of Motion
B Newton's Third Law of Motion.
C Law of Conservation of Momentum
D Law of Conservation of Energy. (2)
- 6 A body slides along a frictionless, horizontal surface at constant velocity. For which ONE of the following pairs are the magnitudes of both physical quantities zero?
- A Displacement and momentum B Acceleration and momentum
C Displacement and resultant force D Acceleration and resultant force (2)
- 7 An object is moving to the right at constant velocity whilst a force F is acting on it. The magnitude of the frictional force acting on the object is



- A zero. B equal to F.
C smaller than F. D larger than F. (2)
- 8 If an object is at rest, it can be concluded that
- A no external forces act on it.
B the net force on the object is zero.
C the object is prevented from moving by friction.
D the object experiences a net force greater than zero. (2)
- 9 A driver of a motor places a book on the level dashboard of his car in front of him. He observes that the book slides towards the windscreen when the brakes are applied. Which of Newton's laws best explains the motion of the book?
- A First Law B Second Law
C Third Law D Law of Universal Gravitation (2)
- 10 While driving very fast along a slippery road, the driver of a car is dismayed to find that the car does not respond when he attempts to turn a corner.
- 10.1 Name and state a law of motion which can be used to explain why the car does not respond to the steering. (4)
10.2 From the law you have quoted above, state what is necessary in order to turn the car. (3)
- 11 The driver of an empty delivery van which is travelling at $18 \text{ m}\cdot\text{s}^{-1}$ has to make an emergency stop. He applies the brakes. What property of matter is illustrated by the fact that a loose object in the van carries on moving after the van has stopped? (2)
- 12 The sketch shows a sheet of paper with a metal sphere at rest on it, lying on the smooth surface of a table. The sheet of paper is carefully pulled at constant velocity towards the right without the sphere moving relative to the paper. The moment that the force acting on the paper stops, the sphere starts to roll towards the right.
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- 12.1 Which property of matter is illustrated by the sphere after the paper stops? (3)
12.2 **Name** and **formulate** the law that pertains to the behaviour of the ball after the paper stops. (4)
12.3 Explain why the wearing of safety belts by the occupants of a car, can save their lives during a collision. (6)
- 13 A car of mass 800 kg is being towed by a truck, using a tow rope. When the car is being towed along a level road at constant speed, the force exerted on the rope is 100 N. Explain why a force is needed to tow the car at a constant speed. (2)
- 14 Name and state the Physics law which applies to the following real life situation:
A bottle is placed on a sheet of paper. When the paper is jerked in a horizontal direction, the bottle remains in the same position. (3)
- 15 A lifebuoy is dropped from a hovering rescue helicopter to a man in difficulties off the Clifton beachfront. He is hoisted up together with the buoy at a constant speed. Ignore air friction and answer the following question: What is the magnitude of the upward force in the cable while the man is out of the water and being hoisted upwards? (3)
- 16 A flatbed truck carrying a concrete block near the back of its flat bed, as shown, is travelling due west along a straight level road. The truck collides head on with a concrete bridge support and stops. The concrete block slides into the back of the driver's cab, and bends the cab inwards before stopping. Assume friction between the floor of the truck and the block to be negligible. Considering the stages of motion of the block on the truck, namely **sliding along the bed of the truck** and **colliding with the back of the cab**, explain briefly how **Newton's First Law of motion** is illustrated during the motion of the block. (2)
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