UNIT 3

DYNAMICS

TEXTBOOK EXERCISE QUESTIONS

3.1   **Encircle the correct answer from the given choices.**

i.   **Newton's first law of motion is valid only in the absence of: (LHR 2014, GRW 2015)**
(a) Force
(b) net force
(c) friction
(d) momentum

ii.   **Inertia depends upon:**
(a) Force
(b) net force
(c) mass
(d) velocity

iii.   **A boy jumps out of a moving bus. There is a danger for him to fall:**
(a) Towards the moving bus
(b) Away from the bus
(c) In the direction of motion
(d) Opposite to the direction of motion

iv.   **A string is stretched by two equal and opposite forces of 10 N each. The tension in the string is:**
(a) Zero
(b) 5 N
(c) 10 N
(d) 20 N

v.   **The mass of a body**
(a) Decreases when accelerated
(b) Increases when accelerated
(c) Decreases when moving with high velocity
(d) None of the above

vi.   **Two bodies of masses m_1 and m_2 attached to the ends of an inextensible string passing over a frictionless pulling such that both move vertically. The acceleration of the bodies is:**

(a) $a = \dfrac{(m_1 - m_2)g}{m_1 + m_2}$

(b) $a = \dfrac{m_1 g}{m_1 + m_2}$

(c) $a = \dfrac{(m_1 + m_2)g}{m_1 - m_2}$

(d) $a = \dfrac{m_2 g}{m_1 + m_2}$

vii.   **Which of the following is the unit of momentum?**
(a) Nm
(b) $kgms^{-2}$
(c) Ns
(d) Ns^{-1}

viii.   **When horse pulls a cart, the action is on the:**
(a) Cart
(b) earth
(c) horse
(d) earth and cart

ix.   **Which of the following material lowers friction when pushed between metal plates?** **(LHR 2014, 2015)**
(a) Water
(b) fine marble powder
(c) air
(d) oil

3.2   **Define the following terms:**
i) Inertia   ii) Momentum   iii) Force
iv) Force of friction   v) Centripetal force

i. **Inertia**
Ans: See Q.no.3 short Question
ii. **Momentum**
Ans: See Q.no.4 short Question
iii. **Force**
Ans: See Q.no.2 short Question
iv. **Force of friction**
Ans: See Q. no.8 Long Question
v. **Centripetal force**
Ans: See Q. no. 22 short Question

3.3 What is the difference between?
i) **Mass and weight**
Differentiate between Mass and Weight.

Mass	Weight
• Mass of a body is the quantity of matter possessed by the body.	• The weight of the body is equal to the force with which earth attracts it.
• It is a scalar quantity.	• It is a vector quantity and is toward the center of the earth.
• It is measured by physical balance.	• It is measured by spring balance.
• It remains same everywhere. It does not change with change of place.	• It does not remains same at all places because the value of 'g' does remain same at all places.
• Unit of mass is kilogram (Kg).	• Unit of weight is Newton (N).
• It is a base quantity.	• It is a derived quantity.
• It can be calculated by using the formula F = ma.	• It can be calculated by using the formula w = mg.

ii) **Action and reaction**
When two bodies come in contact with each other, the force exerted by first body on second body is known as action.
When two bodies come in contact with each other, the force exerted by second body on first body is known as reaction.

iii) **Sliding friction and rolling friction** **(GRW 2015)**

Sliding Friction	Rolling Friction
Frictional force experienced by the body when a body slides over the other body.	Frictional force experienced by the body when a body rolls over the other body.
It is greater than rolling friction	It is less than sliding friction

3.4 What is the law of inertia?
Ans: Since Newton's first law of motion deals with the inertial property of matter, therefore, Newton's first law of motion is also known as law of inertia.

3.5 Why is it dangerous to travel on the roof of a bus?
Ans: It is dangerous to travel on the roof of a bus because when brakes are applied suddenly, the lower part of body of passenger sitting on its roof comes to rest immediately but due to inertia upper part of his body continues its motion in a straight line and he may fall forward and gets injured if there is no support.

3.6 Why does a passenger moves outward when a bus takes a turn?
Ans: When the bus traveling in a straight line suddenly takes a turn, the passenger in the bus due to inertia tends to continue his motion in the straight line and falls in the forward direction.

3.7 How can you relate a force with the change of momentum of a body?
Ans: See Q.no.6 Long Question

3.8 What will be the tension in a rope that is pulled from its ends by two opposite forces 100 N each?
Ans: The tension in a rope that is pulled from its ends by two opposite forces 100 N each will be 100 N.

3.9 **Action and reaction are always equal and opposite then how does a body move?**

Ans: Action and reaction are equal in magnitude but opposite in direction. Action and reaction do not act on the same body. Action is applied on one body due to which an equal and opposite reaction is acting on another body. Both of these do not neutralize each other due to which the body will move.

3.10 **A horse pushes the cart. If the action and reaction are equal and opposite then how does the cart move?**

Ans: The horse apply action on the road by his feet, the reaction is given by the road on the horse, due to which horse moves. The cart which is tied with the horse will also move.

3.11 **What is the law of conservation of momentum?**

Ans: The momentum of an isolated system of two or more than two interacting bodies remains constant.

An isolated system is a group of interacting bodies on which no external force is acting. If no unbalanced or net force acts on a system then its momentum remains constant.

3.12 **Why is the law of conservation of momentum important?**

Ans: Law of conservation of momentum has vast applications and is applicable universally on bigger bodies as well as on atoms and molecules. A system of gun and bullet, rocket and jet engines etc. Work on the principle of law of conservation of momentum.

3.13 **When a gun is fired, it recoils. Why?**

Ans: Total momentum of the gun and the bullet is zero before the firing. When gun is fired, bullet moves in forward direction and gun recoils to conserve momentum.

3.14 **Describe two situations in which force of friction is needed?**

Ans:

(i) We cannot write if there would be no friction between paper and the pencil.

(ii) Friction enables us to walk on the ground. We cannot run on a slippery ground. A slippery ground offers very little friction.

3.15 **How does oiling the moving parts of a machine lower friction?**

Ans: As the friction of liquids is less than friction of solids. So oiling the moving parts of the machines lower the friction.

3.16 **Describe ways to reduce friction.** **(LHR 2014)**

Ans: The friction can be reduced by:

- Making the sliding friction smooth
- Making the fast moving a streamline shape (fish shape) such as car, aeroplanes, etc. this causes the smooth flow of air and thus minimizes air resistance at high speeds.
- Lubricating the sliding surfaces
- Using ball bearings or roller bearings. Because the rolling friction is lesser than the sliding friction.

3.17 **Why rolling friction is less than sliding friction?** **(LHR 2013, 2014)**

- We know that greater the points of contact between two surfaces, greater will be the friction and vice versa. Since the points of contact between surfaces in case of rolling are less than points of contact in case of sliding therefore rolling friction is less than sliding friction.
- There is no relative motion between rolling surfaces.