

Physics (New Book) - 9th Class Physics Chapter 3 Long Question Preparation

Q1. Write the advantages and disadvantages of friction, also give methods to reduce friction

Ans 1: Advantage; sometimes friction is most desirable we cannot write if there is no friction between paper and pencil friction enables us to walk on road. We cannot run on a slippery ground because a slippery ground offers very little friction birds cannot fly if there is no air resistance

Ans 2: Disadvantages: friction has advantages as well as disadvantages friction is undesirable when moving at high speeds because it opposes the motion and limits the speed of moving object most of our useful energy lost as heat and sound due to friction between various moving parts of machines in machines friction causes wear and tear of their moving parts

Ans 3: Method to reduce friction: friction can be reduced by making sliding surfaces smooth making fast moving objects a streamline shape (fist shape). Such as cars, aero planes etc, this causes the smooth flow of air and thus minimizes the resistance at high speeds. lubricating the sliding surfaces using ball bearing or rollers bearing. Because rolling friction is lesser than sliding friction

Q2. how much centripetal force is needed to make a body of mass 0.5 kg to move to a circle of radius 50cm with a speed 3 ms^{-1}

Ans 1:

$$m = 0.5 \text{ kg}$$

$$r = 50 \text{ cm} = 0.5 \text{ m}$$

$$v = 3 \text{ ms}^{-1}$$

$$F_c = ?$$

As we know that

$$F_c = mv^2/r$$

$$F_c = 0.5 \times (3)^2 / 0.5$$

$$F_c = 4 \text{ N}$$

Q3. State the Newton's first law of motion & Second law of motion.

Ans 1: Newton first law:

A body continues in its state of rest or of uniform motion in a straight line provided no net force acts on it.

Explanation for rest:

Similarly Newton's first law of motion deals with bodies which are either at rest or moving with uniform speed in straight line. According to first law of motion, a body at rest remains at rest provided no net force on it. This part of the law is true as we observe that objects do not move by themselves unless some moves it.

Explanation for motion:

Similarly a moving object does not stop moving by itself. A ball rolled on a rough ground stops earlier than that rolled on smooth ground. It is because rough surface offers greater friction. If there would be no force to oppose the motion of the body would never stop.

Newton's Second Law of Motion:

When a net force acts upon a body, it produces an acceleration in the body in the direction of force and the magnitude of acceleration is directly proportional to the net force and is inversely proportional to the mass of the body.

Mathematical Form:

If the force F is acting on the body of mass m then we can write this in the mathematical form as

$$F = ma \quad (1)$$

$$a = F/m \quad (2)$$

From (1) and (2) we have

$a \propto F/m$

$a = \text{Constant} \propto F/m$

$a = k \propto F/m$

In the above equation according to the international system units if $m = 1\text{kg}$

$a = 1\text{m s}^{-2}$, $F = 1\text{N}$ then the value of k will be 1. So the equation can be written as

$a = 1 \times F/m$

$F = ma$

Q4. Explain gun and bullet system using law of conservation of momentum

Ans 1: consider a gun and bullet system before firing the gun, both gun and bullet are at rest so the total momentum of system is zero. As the gun is fired bullet shoots out of the gun and acquires momentum. To conserve momentum of system the gun recoils. According to law of conservation of momentum, the total momentum of gun and bullet will also be zero after gun is fired. Let m be the mass of bullet and v be its velocity on firing the gun. M be the mass of gun and V be the velocity of gun with which it recoils. Total momentum of the gun and the bullet after the gun is fired = $MV + mv$ according to law of conservation of momentum. Total momentum of gun and bullet after fire = Total momentum of gun and bullet before fire. $MV + mv = 0$ $MV = -mv$

Ans 2: Note: negative sign indicates that velocity of gun is opposite to velocity of bullet, gun recoils. since mass of gun is much larger than the bullet therefore, the recoil is much smaller than the velocity of bullet

Q5. Explain braking and skidding

Ans 1: The wheels of moving vehicles have two velocity components: motion of wheels along the road and rotation of wheels about their axles. To move a vehicle on the road as well as to stop a moving vehicle requires friction between its tyres and the road. For example, if the road is slippery or the tyres are worn out then the tyres instead of rolling, slip over the road. The vehicle will not move if the wheels start slipping at the same point on the slippery road. Thus for the wheels to roll, the force of friction (gripping force) F between the tyres and the road must be enough to prevent them from slipping. If we want to stop a car quickly, a large force of friction between the tyres and the road is needed. But there is a limit to this force of friction that tyres can provide. If the breaks are applied too strongly, the wheels of the car will lock up (stop turning) and the car will skid due to its large momentum. If we want to reduce the skidding, it is necessary not to apply breaks too hard that lock up their rolling motion. It is unsafe to drive a vehicle with worn out tyres.

Q6. Write note on application of centripetal force

Ans 1: There are many applications of centripetal force but some are following

Ans 2: Banking of roads: when a car takes a turn, centripetal force is needed to keep it in its curved track. The friction between the tyres and the road provides the necessary centripetal force. The car would skid if the force of friction between the tyres and the road is not sufficient enough, particularly when the roads are wet. This problem is solved by banking of curved roads. Banking of road means that the outer edge of a road is raised. Imagine a vehicle on a curved road. Banking causes a component of vehicle's weight to provide the necessary centripetal force while taking a turn. Thus banking of roads prevents skidding of vehicle and thus the driving safe.

Ans 3: Washing machine dryer: the dryer of a washing machine is basket spinners. They have a perforated wall having large numbers of fine holes in the cylindrical rotor. The lid of the cylindrical container is closed after putting wet clothes in it. When it spins at high speed, the water from wet clothes is forced out through these holes due to lack of centripetal force.

Ans 4: Cream separator: most modern plants use a separator to control the fat contents of various products. A separator is a high-speed spinner. It acts on the same principle of centrifuge machines. The bowl spins at very high speed causing the heavier contents of milk move outward in the bowl pushing the lighter contents inward towards the spinning axis. Cream or butterfat is lighter than other components in milk. Therefore, skimmed milk, which is denser than cream, is collected at the outer wall of the bowl. The lighter part (cream) is pushed toward the center from where it is collected through a pipe.

Q7. define and explain friction

Ans 1: Friction: the force that opposes the motion of moving objects is called friction. Factors: in case of solid, forces of friction between two surfaces depends upon many factors such as: nature of two surfaces in contact, pressing force between them

Ans 2: Explanation: No surface is perfectly smooth. A surface that appears smooth has pits and bumps that can be seen under a microscope, the contact points between two surfaces form a sort of cold welds. These cold welds resist the surfaces from sliding over each other. Adding weight over the surface increases the pressing force that increases the resistance. Limiting friction: maximum value of friction is known as force of limiting friction

Ans 3: Mathematical form: Let a body be at rest if a force is applied to it and it remains at rest then the friction is equal to the applied force that tends to move a body at rest, it increases with the applied force. Friction can be increased to certain maximum value but it does not increase beyond this. This maximum value of friction is force of limiting friction. It depends on normal reaction (pressing force) between two surfaces in contact

Ans 4: Coefficient of friction: ratio between the force of limiting friction F_s and normal reaction R is constant. This constant is called the coefficient of friction. Coefficient of friction has no unit as it is a ratio between two same quantities.

Ans 5: Uses of friction: friction is needed to walk on the ground. It is risky to run on wet floor with shoes that have smooth soles. Athletes use special shoes that have extraordinary ground grip. Such shoes prevent them from slipping while running fast. To stop a bicycle we apply breaks the rubber pads pressed against the rims provide friction. It is the friction that stops the bicycle.

Q8. Derive relation for tension and acceleration when two bodies moving along vertically

Ans 1: Consider two bodies A and B of masses m_1 and m_2 respectively. Let m_1 is greater than m_2 . The bodies are attached to the opposite ends of an inextensible string. The string passes over a frictionless pulley. The body A being heavier must be moving downward with some acceleration. Let this acceleration be a . At the same time, the body B attached to the other end of the string moves up with the same acceleration a . As the pulley is frictionless, hence tension will be the same throughout the string. Let the tension in the string be T .

Q9. Define dynamics, also briefly explain force , inertia and momentum

Ans 1: Dynamics: the branch of mechanics that deals with the study of motion of an object and cause of its motion is called dynamics

Ans 2: Force: A force moves or tends to move, stops or tends to stop the motion of a body. The force can also change the direction of motion of a body. It is represented by F . Its SI unit is Newton, it is a vector quantity

Example: A door can be opened or closed by pushing or pulling it

Goal keeper need a force to stop a ball coming to him

A batsman changes the direction of moving ball by pushing it with bat

Note: A force can also change the shape or size of a body on which it acts

Ans 3: Inertia: inertia of a body is its property due to which it resists any change in its state of rest or motion

Explanation: Galileo observed that it is easy to move or to stop light objects than heavier ones. Newton concluded that everybody resists to change in its state of rest or uniform motion in straight line. This property of matter is inertia.

Example: Take a glass cover it with a piece of cardboard, place a coin on the cardboard. Now flick the card horizontally with a jerk of your finger. Card board will fly away but coin will not move with card board due to inertia and will fall into glass.

Cut a strip of paper, place it on a table, stack a few coins at its one end. Pull out the paper strip under coins with a jerk, coin remain stacked on pulling out the strip quickly due to inertia

Ans 4: Momentum: Momentum of a body is the quantity of motion it possesses due to its mass and velocity

OR

The product of mass and velocity is known as momentum

Mathematical form: its formula is $P=mv$

Momentum is a vector quantity. Its direction will be same in which body moves. Its S.I unit is Ns

Q10. A force of 20 N moves a body with an acceleration of 2ms^{-2} What is the mass.

Ans 1: $F = 20 \text{ N}$

$a = 2\text{ms}^{-2}$

$m = ?$

Solution:

$F=ma$

So $m = 20/2$

$m = 10 \text{ kg}$