

Chapter	2 Force and Motion	Class	1 st Year	Subject	Physics
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Give Short Answers of the Following Questions

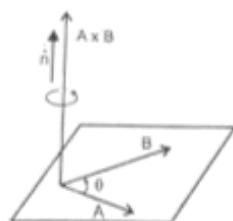
1. State right hand rule for two vectors w.r.t. vector product.

Ans. Direction of Vector Product:

The direction of vector product $\vec{A} \times \vec{B}$ can be found by right hand rule.

Right hand Rule:

Join the tails of the two vectors to define a plane of vectors. Rotate vector $\vec{A}$ into $\vec{B}$ through smaller of the two possible angles. Curl the fingers of the right hand in the direction of rotation. Erect thumb represents the direction of $\vec{A} \times \vec{B}$.



2. Define impulse and show how it is related to momentum.

Ans. Impulse:

When a large force acts on a moving body for a short interval of time then the product of force and time is called impulse.

Relation:

The impulse is equal to the instantaneous **change in momentum** of the body.

$$\vec{I} = \vec{F} \times t$$

As force is the time rate of change of momentum so

$$\vec{F} = \frac{m\vec{v}_f - m\vec{v}_i}{t}$$

Or $\vec{F} \times t = m\vec{v}_f - m\vec{v}_i$

$$\vec{I} = m\vec{v}_f - m\vec{v}_i \quad (\vec{I} = \vec{F} \times t)$$

3. Differentiate between an elastic and an inelastic collision.

Ans. In case of elastic collision the K.E of the system is conserved while in case of inelastic collision the K.E is not conserved. But the total linear momentum and the total energy of the system remains constant in both types of collision.

Behavior of Bouncing Ball:

- When a hard ball is dropped on a marble floor, it rebounds to very nearly the initial height. It loses negligible amount of energy in collision with the floor. Then such collision is approximately an elastic collision.

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- But if the ball is bounced from a sandy floor then it is not able to reach the initial height then there is a loss of kinetic energy and such collision is called inelastic collision.

4. Show that rate of change in momentum is equal to force applied. Also state Newton's second law of motion in terms of momentum.

Ans. Second Law in Terms of Momentum:

The time **rate of change of momentum** of body is equal to the applied force.

Let m = mass of the body $\vec{v}_i$ = initial velocity F = applied force

v_f = final velocity t = time interval

Then
$$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{\Delta t}$$

According to Newton's second law of motion,

$$\vec{F} = m \vec{a}$$

$$\vec{a} = \frac{\vec{F}}{m}$$

Comparing equations (1) and (2) we get

$$\frac{\vec{F}}{m} = \frac{\vec{v}_f - \vec{v}_i}{\Delta t}$$

$$\vec{F} = \frac{m\vec{v}_f - m\vec{v}_i}{\Delta t}$$

When $m\vec{v}_i$ represents the initial momentum while $m\vec{v}_f$ represents final momentum.

5. State law of conservation of linear momentum. Also state condition under which it holds.

Ans. Law of Conservation of Momentum:

Total linear momentum of an isolated system always remains constant.

Condition for application:

Law of conservation of momentum holds only for isolated systems otherwise it is not valid.

6. Show that range of projectile is maximum at an angle of 45°.

Ans. As range of the projectile can be expressed as:

$$R = \frac{v_i^2 \sin 2\theta}{g}$$

The range of the projectile is maximum when the value of $\sin 2\theta$ has maximum value. The maximum value of sine function is one. Thus

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$$\sin 2\theta = 1$$

$$\theta = \sin^{-1}(1)$$

$$2\theta = 90^\circ$$

$$\theta = \frac{90^\circ}{2}$$

$$\theta = 45^\circ$$

So

$$R_{\max} = \frac{v_i^2 \sin 2(45^\circ)}{g}$$

$$R_{\max} = \frac{v_i^2 \sin 90^\circ}{g}$$

$$R_{\max} = \frac{v_i^2}{g}$$

7. Find the time of flight of a projectile to reach the maximum height.

Ans. From first equation of motion

$$v_f = v_i + at$$

To find maximum height of the projectile,

$$v_f = v_{fy} = 0, \quad v_i = v_{iy} = v_i \sin \theta, \quad a = a_y = -g$$

So, $v_{fy} = v_{iy} + a_y t$

$$0 = v_i \sin \theta - gt$$

$$gt = v_i \sin \theta$$

$$t = \frac{v_i \sin \theta}{g}$$

8. The maximum horizontal range of a projectile is 800 m. find the value of height attained by the projectile at $\theta 60^\circ$.

Ans. For projectile, maximum horizontal range is

$$R_{\max} = \frac{v_i^2}{g} = 800\text{m}$$

And $H = \frac{v_i^2 \sin^2 \theta}{2g}$

$$H = \frac{v_i^2}{g} \frac{\sin^2 60^\circ}{2}$$

$$H = R_{\max} \frac{\sin^2 60^\circ}{2}$$

$$H = \frac{800 \times (0.866)^2}{2}$$

$$H = 400 \times (0.866)^2$$

$$H = 300\text{m}$$



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1st Year Solved Exercise Short Questions Notes



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