ATOMIC ENERGY CENTRAL SCHOOL,ANUPURAM

CH-6 Work Power and Energy(module6/6)

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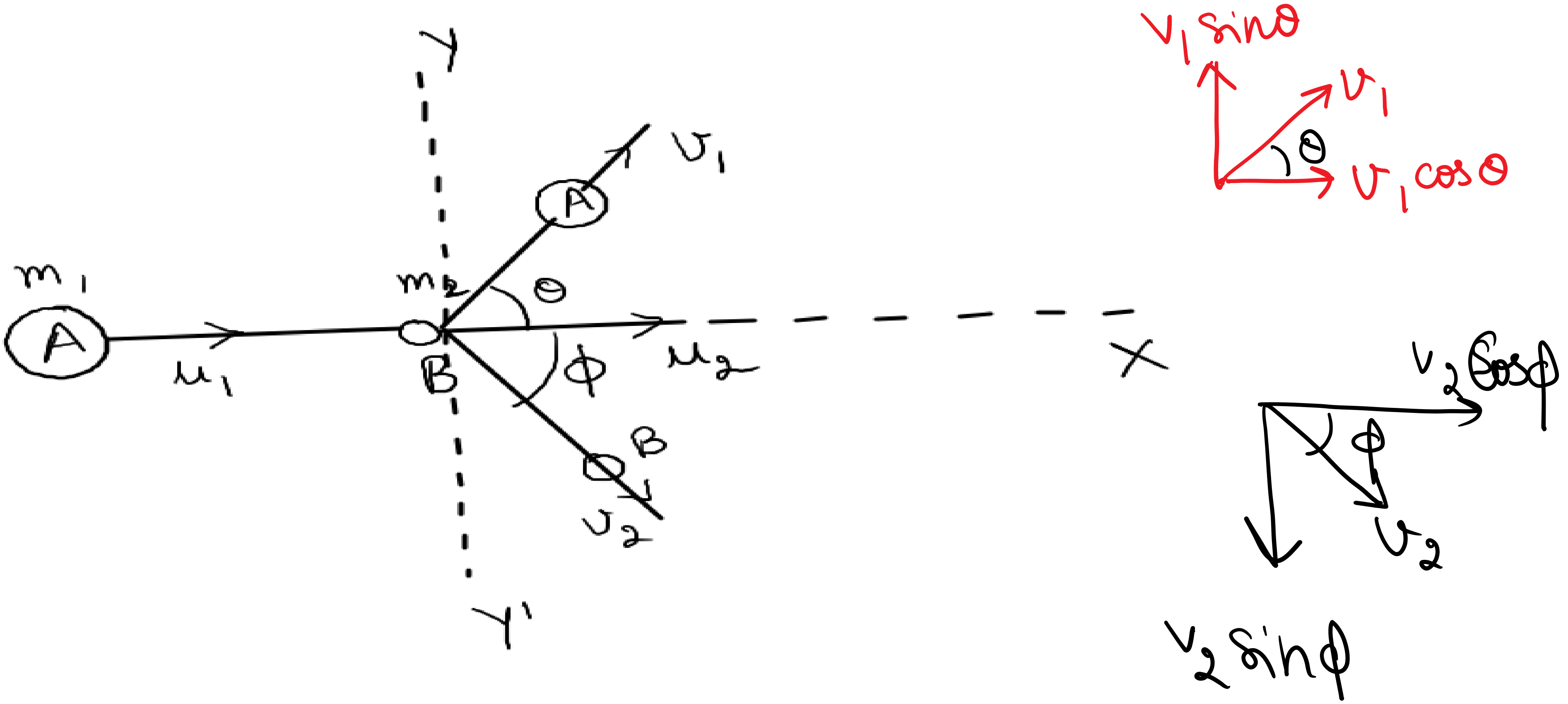
Elastic collison in two dimension

When two bodies travelling initially along the same straight line collide without loss of kinetic energy and move along different directions in a plane after collision , the collision is said to be in two dimension

Suppose m_1 and m_2 are the masses of two bodies A and B moving initially along X axis with velocities u_1 and u_2 respectively

When $u_1 > u_2$ the two bodies collide. After collision , let the body A move with velocity v1at an angle theta with x axis.

Let the body B move with a velocity v_1 at an angle Θ with x axis.let the body B move with a velocity v_2 at an angle Φ



Here Θ is known as angle of scattering and Φ is known as angle of recoil.As the collision is elastic ,kinetic energy is conserved

i.e

$$\frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2 = \frac{1}{2}m_1u_1^2 + \frac{1}{2}m_2u_2^2 \quad \text{--- (1)}$$

$$m_1v_1^2 + m_2v_2^2 = m_1u_1^2 + m_2u_2^2 \quad \text{--- (2)}$$

as linear momentum is conserved in elastic collision, therefore along x-axis, total linear momentum after collision = total linear momentum before collision

$$m_1v_1\cos\theta + m_2v_2\cos\phi = m_1u_1 + m_2u_2 \quad \text{--- (3)}$$

along Y axis $\quad m_1v_1\sin\theta - m_2v_2\sin\phi = 0 \quad (4)$

From equation 2,3 and 4 we have to calculate four variables v1,v2 , Θ and Φ,which is not possible. We have to measure experimentally any one parameter i.e final velocities v_1,v_2 of A,B or their directions Θ and Φ the rest of the parameters can then be calculated from the three equation 2,3 and 4

Inelastic collision in one dimension

Before collision after collision

Total momentum before collision = Total momentum after collision

$$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2 \quad \text{—— (5)}$$

If we know masses m1 and m2,initial velocity u1 and u2 and one of the final velocities, we can calculate the other final velocity

4.25. INELASTIC COLLISION IN TWO DIMENSIONS

When two bodies travelling initially along the same straight line collide involving some loss of kinetic energy, and move after collision, along different directions in a plane, the collision is said to be inelastic collision in two dimensions.

As the system is closed and isolated, the total linear momentum of the system remains constant, *i.e.,*

$$\vec{P}_f = \vec{P}_i$$

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Referring to Fig. ~~4.30~~ and equating final momentum $(\vec{P}_f)$ along X-axis to initial momentum $(\vec{P}_i)$ along the same axis, we get

$$m_1 v_1 \cos\theta + m_2 v_2 \cos\phi = m_1 u_1 + m_2 u_2 \quad ...(65)$$

As initial momentum of the two bodies along Y-axis is zero, therefore applying the law of conservation of linear momentum along Y-axis, we get

$$0 = m_1 v_1 \sin\theta - m_2 v_2 \sin\phi \quad ...(66)$$

Knowing m_1, m_2 ; u_1, u_2 ; θ and ϕ, we can calculate v_1 and v_2 from eqns. (65) and (66).

4.33