Work, Energy and Power

Worksheet -3

1. If two bodies stick together after collision will the collision be elastic or inelastic? 1

Ans. Inelastic

2. When an air bubble rises in water, what happens to its potential energy? 1

Ans. Decreases as work is done by upthrust on the bubble.

3. A spring is kept compressed by pressing its ends together lightly. It is then placed in a strong acid, and released. What happens to its stored potential energy? 1

Ans. It converts to the kinetic energy of the molecules of the acid.

4. A body is moving along Z – axis of a co – ordinate system is subjected to a constant force F given by $\vec{F} = \left(-\hat{i} + 2j + 3k\right)N$. What is the work done by this force in moving the body a distance of 4m along the Z – axis? 2

Ans. $\vec{F} = \left(-\hat{i} + 2j + 3k\right)N$

$\vec{s} = 4k$

$W = \vec{F}.\vec{s} = \left(-\hat{i} + 2j + 3k\right).4k = 12J$

5. A ball is dropped from the height h_1 and if rebounces to a height h_2. Find the value of coefficient of restitution? 2

Ans. $v_1 = \sqrt{2gh_1}$

$v_2 = \sqrt{2gh_2}$

$e = \frac{v_2}{v_1} = \frac{\sqrt{2gh_2}}{\sqrt{2gh_1}} = \sqrt{\frac{h_2}{h_1}}$

6. State and prove work energy theorem analytically? 2

Ans.

7. An object of mass 0.4kg moving with a velocity of 4m/s collides with another object of mass 0.6kg moving in same direction with a velocity of 2m/s. If the collision is perfectly inelastic, what is the loss of K.E. due to impact? 3

Ans. Kinetic energy before collision

$$K = \frac{1}{2}m_1u_1^2 + \frac{1}{2}m_2u_2^2 = \frac{1}{2}\times 0.4\times 4^2 + \frac{1}{2}\times 0.6\times 2^2 = 4.4J$$

As the collision is perfectly inelastic, $v = \frac{m_1u_1 + m_2u_2}{m_1 + m_2} = \frac{0.4\times 4 + 0.6\times 2}{0.4 + 0.6} = 2.8ms^{-1}$

Kinetic energy after collision

$$K' = \frac{1}{2}\left(m_1 + m_2\right)v^2 = \frac{1}{2}\times\left(0.4 + 0.6\right)\times 2.8^2 = 3.92J$$

Loss in K.E, $K' - K = 4.4 - 3.92 = 0.48J$

8 Prove that in an elastic collision in one dimension the relative velocity of approach before impact is equal to the relative velocity of separation after impact? 3

Ans. (i)

9. (a) Define potential energy. Give examples. 3
(b) Draw a graph showing variation of potential energy, kinetic energy and the total energy of a body freely falling on earth from a height h?

Ans.