Work, Energy and Power

Worksheet -1

1. A spring is cut into two equal halves. How is the spring constant of each half affected? 1

Ans. Spring constant of each half becomes twice the spring constant of the original spring.

2. The momentum of an object is doubled. How does it's. K.E. change? 1

Ans.

$$K = \frac{p^2}{2m}$$

$$p' = 2p$$

$$K' = \frac{(p')^2}{2m} = \frac{(2p)^2}{2m} = 4\frac{p^2}{2m} = 4K$$

3. In which motion momentum changes but K.E. does not? 1

Ans. Uniform circular motion

4. A light body and a heavy body have same linear momentum. Which one has greater K.E.? 1

Ans.

$$K = \frac{p^2}{2m}$$

$$As\ p\ is\ \text{constant} \quad K\alpha\ \frac{1}{m}$$

As the mass of the lighter body is less so it will have more kinetic energy

5. A shot fired from cannon explodes in air. What will be the changes in the momentum and the kinetic energy? 2

Ans. The linear momentum will be conserved, because explosion occurs from within.
KE will increase due to (chemical) potential energy of the explosives.

6. Can a body have momentum without energy? 1

Ans. Yes. When E = K + U = 0, either both are zero or K = -U. Thus K.E. may or may not be zero.
If p =0, K = 0
If p ≠0, K = -U

7. Obtain an expression for K.E. of a body moving uniformly? 3

Ans.

8 What is meant by a positive work, negative work and zero work? Illustrate your answer with example? 3

Ans.

9. A body of mass 2kg initially at rest moves under the action of an applied force of 7N on a table with coefficient of kinetic friction = 0.1. Calculate the 3
(1) Work done by the applied force in 10s
(2) Work done by the friction in 10s
(3) Work done by the net force on the body in 10s.

Ans. $Given: \; m = 2kg, \quad F = 7N, \; u = 0$

$\mu = 0.1, \quad t = 10s$

$Sol^n:$

$F = ma_1$

$7 = 2a_1$

$a_1 = 3.5ms^{-2}$

$f = \mu R = \mu mg = 0.1 \times 2 \times 9.8 = 1.96N$

$Also, f = -ma_2$

$1.96 = -2a_2$

$a_2 = -0.98ms^{-2}$

$\therefore a = a_1 + a_2 = 3.5 - 0.98 = 2.52ms^{-2}$

$Now, s = ut + \frac{1}{2}at^2 = 0 \times 10 + \frac{1}{2} \times 2.52 \times 100 = 126m$

$(a) W = Fs = 7 \times 126 = 882J$

$(b) W = fs = -1.92 \times 126 = -246.9J$

$(c) W = (F - f)s = (7 - 1.92) \times 126 = 5.04 \times 126 = 635J$

10. Derive the expression for the potential energy stored in a spring? 3

Ans.