FREEDOM INTERNATIONAL SCHOOL

WORKSHEET- MCQ (SOLUTIONS)

PHYSICS

CLASS XI

WORK, ENERGY AND POWER

1. A force $\vec{F}= (3\,\hat{\imath} + c\hat{\jmath} + 2\,\hat{k})$ acting on a particle causes a displacement $\vec{s}= (-4\,\hat{\imath} + 2\,\hat{\jmath} + 3\,\hat{k})$ in its own direction. If the work done is 6 J, then the value of 'c' is

   (a) 0 (b) 6 (c) 1 (d) 12

   Ans: (b) 6

   w= $\vec{F}.\vec{s}$= -12+2c+6= 6

   c= 6

2. When a body moves with a constant speed in a circular path, then

   (a) work done will be zero (b) acceleration will be zero

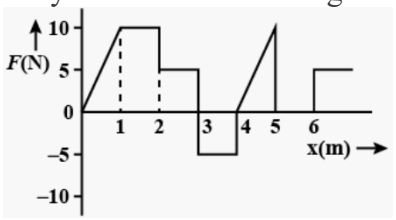
   (c) no force acts on the body (d) its velocity remains constant

   Ans: (a) work done will be zero

3. The relationship between the force F and position x of a body is as shown in the figure. The work done in displacing the body from x= 1m to x= 5 m will be

   (a) 30 J (b) 15 J

   (c) 25 J (d) 20 J



   Ans: (b) 15 J

   W= Area under F-x graph

   = 10(2-1)+ 5(3-2)+(-5)(4-3)+1/2(5-4)10

   = 10+5-5+5= 15 J

4. Two bodies of masses m and 4 m have equal kinetic energy. What is the ratio of their momentum?

   (a) 1: 4 (b) 1: 2 (c) 1:1 (d) 2:1

   Ans: (b) 1: 2

   p=$\sqrt{2mk}$

   $p_1/p_2 = \sqrt{\frac{m_1}{m_2}} = 1/2$

5. A body of mass 10 kg initially at rest acquires velocity of 10 m/s. What is the work done?

   (a) -500 J (b) 500 J (c) 50 J (d) -50 J

   Ans: (b) 500 J

   K_i= 0

   W= $\Delta K = K_f - K_i = 1/2\ mv^2$

   = ½ x 10 x 100 = 500 J

6. The potential energy of a particle of mass 5 kg moving in the X-Y plane is given by U= (-7x + 24y) J, x and y being in metre. If the particle starts from rest from origin, then speed of the particle at t= 2s is

(a) 5 m/s (b) 14 m/s (c) 17.5 m/s (d) 10 m/s

Ans: (d) 10 m/s

$$\vec{F} = \frac{-du}{dx}\hat{\imath} - \frac{du}{dy}\hat{\jmath} = 7\,\hat{\imath} - 24\hat{\jmath}$$

a_x= 7/5 m/s^2 a_y= -24/5 m/s^2 [a= F/m]

$v_x = a_x t$ v_x= 14/5 m/s

$v_y = a_y t$ v_y= -48/5 m/s

$v=\sqrt{v_x^2 + v_y^2}$= 10 m/s

7. A 300 J of work is done in sliding a 2 kg block up an inclined plane of height 10 m. Taking g= 10 m/s^2, the work done against friction is

(a) 200 J (b) 100 J (c) zero (d) 1000 J

Ans: (b) 100 J

Total work done= Work done against friction+ Increase in P.E

300 J= W+ mgh

W= 300 – (2 x 10 x 10)

W= 100 J

8. A spring of force constant 800 N/m has an extension of 5 cm. The work done in extending it from 5 cm to 15 cm is

(a) 16 J (b) 8 J (c) 32 J (d) 24 J

Ans: (b) 8 J

W= ½ k (x_2^2-x_1^2)

= ½ (800)(225-25)10^{-4}

= 8 J

9. A particle moves with a velocity $(5\,\hat{\imath} - 3\hat{\jmath} + 6\,\hat{k})$ m/s under the influence of a constant force $\vec{F}$= $(10\,\hat{\imath} + 10\,\hat{\jmath} + 20\,\hat{k})$ N. The instantaneous power applied to the particle is

(a) 200 J/s (b) 40 J/s (c) 140 J/s (d) 170 J/s

Ans: (c) 140 J/s

P= $\vec{F} \cdot \vec{v}$

= 50-30+120 = 140 J/s

10. A body of mass 5 kg, moving with velocity 10 m/s collides with another body of mass 20 kg at rest and comes to rest. The velocity of the second body due to collision is

(a) 2.5 m/s (b) 7.5 m/s (c) 5 m/s (d) 10 m/s

Ans: (a) 2.5 m/s

$m_1u_1+m_2u_2= m_1v_1+m_2v_2$

5 x 10 + 0= 20 v_2

50= 20 v_2

For questions 11 to 15, two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the options as given below.

A. Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

B. Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. Assertion is true but Reason is false.

D. Both Assertion and Reason are false.

11. **Assertion:** in an elastic collision of two billiard balls, the total kinetic energy is conserved during the short time of collision of the balls (i.e., when they are in contact).
    Reason: Energy spent against friction does not follow the law of conservation of energy.
    Ans: D
    [During collision, there is deformity of shape of balls leading to increase in potential energy of the body, thus decreasing the kinetic energy momentarily.]
12. **Assertion:** Work done in moving a body over a closed loop is zero for every force in nature.
    Reason: Work done does not depend on nature of force.
    Ans: D
13. **Assertion:** A spring has potential energy, both when it is compressed or stretched.
    Reason: In compressing or stretching work is done on the spring against the restoring force.
    Ans: A
14. **Assertion:** Work done by friction on a body sliding down an inclined plane is positive.
    Reason: Work done is less than zero, if angle between force and displacement is acute or both are in same direction.
    Ans: D
15. **Assertion:** Water at the foot of the water fall is always at different temperature from that at the top.
    Reason: The potential energy of water at the top is converted into heat energy during falling.
    Ans: A