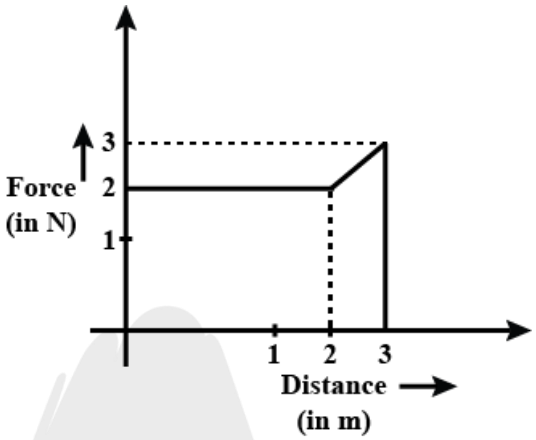
DPP – 2

Q.1 A particle moves in one dimension from rest under the influence of a force that varies with the distance travelled by the particle as shown in the figure. The kinetic energy of the particle after it has travelled 3 m is 3.25 K value of K



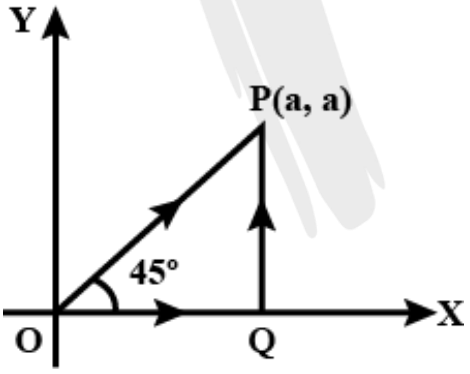
Q.2 A spring of force constant 800 N/m has an extension of 5 cm. The work done in extending it from 5 cm to 15 cm is 2 N, then N = _____.

Q.3 The potential energy (in joules) function of a particle in a region of space is given as:

$U = (2x^2 + 3y^3 + 2z)$

Here x, y and z are in metres. The magnitude of x component of force (in newton) acting on the particle at point P(1 m, 2 m, 3 m). is 0.5K value of K is ___.

Q.4 A particle is moved from (0,0) to (a, a) under a force $\vec{F} = (3\hat{i} + 4\hat{j})$ from two paths. Path 1 is OP and path 2 is OQP. Let W_1 and W_2 be the work done by this force in these two paths. Then :



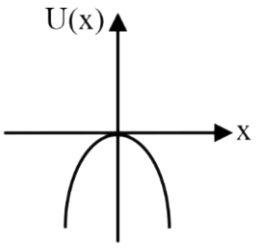
(A) $W_1 = W_2$

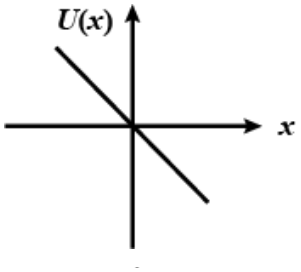
(B) $W_1 = 2\ W_2$

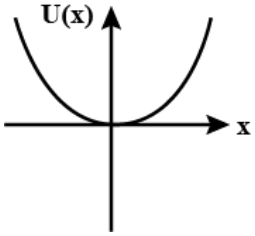
(C) $W_2 = 2\ W_1$

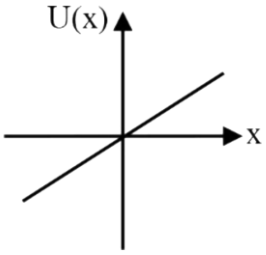
(D) $W_2 = 4\ W_1$

Q.5 A particle is placed at the origin and a force F = kx is acting on it (where k is a positive constant). If U(0) = 0, the graph of U(x) versus x will be (where U is the potential energy function)

(A) 

(B) 

(C) 

(D) 

Q.6 When a conservative force does positive work on a body

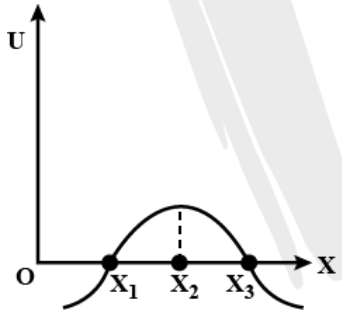
(A) the potential energy increases

(B) the potential energy decreases

(C) total energy increases

(D) total energy decreases

Q.7 In the figure shown the potential energy (U) of a particle is plotted against its position ' x ' from origin. Then which of the following statement is correct. A particle at:



(A) x_1 is in stable equilibrium

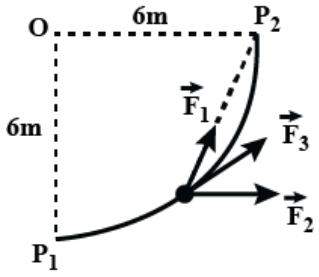
(B) x_2 is in stable equilibrium

(C) x_3 is in stable equilibrium

(D) None of these

Q.8 A smooth track in the form of a quarter circle of radius 6 m lies in the vertical plane. A particle moves from P_1 to P_2 under the action of forces $\vec{F}_1, \vec{F}_2$ and $\vec{F}_3$. Force $\vec{F}_1$ is always toward P_2 and is always 20 N in magnitude. Force $\vec{F}_2$ always acts horizontally and is always 30 N in magnitude.

Force $\vec{F}_3$ always acts tangentially to the track and is of magnitude 15 N. Select the correct alternative(s)



(A) work done by $\vec{F}_1$ is 120 J (B) work done by $\vec{F}_2$ is 180 J

(C) work done by $\vec{F}_3$ is 45π (D) $\vec{F}_1$ is conservative in nature

Q.9 Which of the following is/are conservative force(s)?

(A) $\vec{F} = 2r^3\hat{r}$ (B) $\vec{F} = -\frac{5}{r}\hat{r}$

(C) $\vec{F} = \frac{3(xi+yj)}{(x^2+y^2)^{3/2}}$ (D) $\vec{F} = \frac{3(yi+xj)}{(x^2+y^2)^{3/2}}$

Q.10 If one of the forces acting on a particle is conservative then:

(A) Work done by this force is zero when the particle moves exactly once around any closed path.

(B) Work done by this force equals the change in the kinetic energy of the particle.

(C) It obeys Newton's second law.

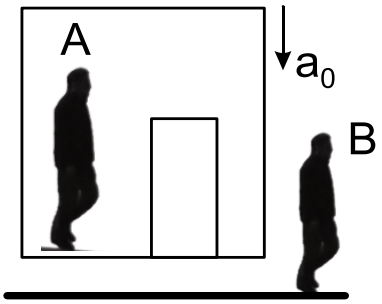
(D) Work done by this force depends on the end points of the motion, not on the path in between.

Q.11 A particle of mass m = 1 kg lying on x-axis experiences a force given by law $F = x(3x - 2)$ Newton, where x is the x-coordinate of the particle in meters. The points on x-axis where the particle is in equilibrium are:

(A) $x = 0$ (B) $x = 1/3$ (C) $x = 2/3$ (D) $x = 1$

Comprehension for Question no. 12 to 13

A block of mass m is kept in an elevator which starts moving downward with an acceleration a_0 as shown in figure. The block is observed by two observers A and B for a time interval t_0.



Q.12 The observer B finds that the work done by gravity is

(A) $\frac{1}{2}mg^2t_0^2$ (B) $-\frac{1}{2}mg^2t_0^2$ (C) $\frac{1}{2}mga_0t_0^2$ (D) $-\frac{1}{2}mga_0t_0{}^2$

Q.13 The observer B finds that work done by normal reaction N is :-

(A) zero (B) $-Na_0t_0{}^2$ (C) $\frac{Na_0t^2}{2}$ (D) None of these

Q.14 The potential energy function for the force between two atoms in a diatomic molecule is approximately given by $U(x) = \frac{a}{x^{12}} - \frac{b}{x^6}$, where a and b are constant and x is the distance between the atoms. if the dissociation energy of the molecule is $D = \left[U(x = \infty) - U_{\text{at equilibrium}}\right]$, D is:

(A) $\frac{b^2}{6a}$ (B) $\frac{b^2}{2a}$ (C) $\frac{b^2}{12a}$ (D) $\frac{b^2}{4a}$

Q.15 The work done on a particle of mass m by a force, $K\left[\frac{x}{(x^2+y^2)^{3/2}}\hat{i} + \frac{y}{(x^2+y^2)^{3/2}}\hat{j}\right]$ (K being a constant of appropriate dimensions), when the particle is taken from the point $(a, 0)$ to the point $(0, a)$ along a circular path of radius a about the origin in the $x - y$ plane is :-

(A) $\frac{2\,K\pi}{a}$ (B) $\frac{K\pi}{a}$ (C) $\frac{K\pi}{2a}$ (D) 0

ANSWER KEY

1.	(2)	**2.**	(4)	**3.**	(8)	**4.**	(A)	**5.**	(C)	**6.**	(B)	**7.**	(D)
8.	(B,C,D)	**9**	(A,B,C)	**10.**	(A,C,D)	**11.**	(A,C)	**12.**	(C)	**13.**	(D)	**14.**	(D)
15.	(D)												