Work Done by Variable Force

1. A particle moves under the effect of a force $F = Cx$ from $x = 0$ to $x = x_1$. The work done in the process is

(a) Cx_1^2 (b) $\frac{1}{2}Cx_1^2$

(c) Cx_1 (d) Zero

2. A cord is used to lower vertically a block of mass *M* by a distance *d* with constant downward acceleration $\frac{g}{4}$. Work done by the cord on the block is

(a) $Mg\frac{d}{4}$ (b) $3Mg\frac{d}{4}$

(c) $-3Mg\frac{d}{4}$ (d) *Mgd*

3. Two springs have their force constant as k_1 and $k_2 (k_1 > k_2)$. When they are stretched by the same force

(a) No work is done in case of both the springs

(b) Equal work is done in case of both the springs

(c) More work is done in case of second spring

(d) More work is done in case of first spring

4. A spring of force constant 10 *N/m* has an initial stretch 0.20 *m*. In changing the stretch to 0.25 *m*, the increase in potential energy is about

(a) 0.1 *joule* (b) 0.2 *joule*

(c) 0.3 *joule* (d) 0.5 *joule*

5. The potential energy of a certain spring when stretched through a distance '*S*' is 10 *joule*. The amount of work (in joule) that must be done on this spring to stretch it through an additional distance '*S*' will be

(a) 30 (b) 40

(c) 10 (d) 20

6. Two springs of spring constants 1500 *N/m* and 3000 *N/m* respectively are stretched with the same force. They will have potential energy in the ratio

(a) 4 : 1 (b) 1 : 4

(c) 2 : 1 (d) 1 : 2

7. A spring 40 *mm* long is stretched by the application of a force. If 10 *N* force required to stretch the spring through 1 *mm*, then work done in stretching the spring through 40 *mm* is

(a) 84 *J* (b) 68 *J*
(c) 23 *J* (d) 8 *J*

8. A position dependent force $F = 7 - 2x + 3x^2 newton$ acts on a small body of mass 2 *kg* and displaces it from $x = 0$ to $x = 5m$. The work done in *joules* is
(a) 70 (b) 270
(c) 35 (d) 135

9. A body of mass 3 *kg* is under a force, which causes a displacement in it is given by $S = \frac{t^3}{3}$ (in *m*). Find the work done by the force in first 2 seconds
(a) 2 *J* (b) 3.8 *J*
(c) 5.2 *J* (d) 24 *J*

10. The force constant of a wire is *k* and that of another wire is $2k$. When both the wires are stretched through same distance, then the work done
(a) $W_2 = 2W_1^2$ (b) $W_2 = 2W_1$
(c) $W_2 = W_1$ (d) $W_2 = 0.5W_1$

11. A body of mass 0.1 *kg* moving with a velocity of 10 *m/s* hits a spring (fixed at the other end) of force constant 1000 *N/m* and comes to rest after compressing the spring. The compression of the spring is
(a) $0.01m$ (b) $0.1m$
(c) $0.2m$ (d) $0.5m$

12. When a 1.0*kg* mass hangs attached to a spring of length 50 *cm*, the spring stretches by 2 *cm*. The mass is pulled down until the length of the spring becomes 60 *cm*. What is the amount of elastic energy stored in the spring in this condition, if *g* = 10 *m/s*^{2}
(a) 1.5 *Joule* (b) 2.0 *Joule*
(c) 2.5 *Joule* (d) 3.0 *Joule*

13. 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*

14. When a spring is stretched by 2 *cm*, it stores 100 *J* of energy. If it is stretched further by 2 *cm*, the stored energy will be increased by
(a) 100 *J* (b) 200 *J*

(c) 300 *J* (d) 400 *J*

15. A spring when stretched by 2 mm its potential energy becomes 4 J. If it is stretched by 10 mm, its potential energy is equal to

(a) 4 *J* (b) 54 *J*

(c) 415 *J* (d) None

16. A spring of spring constant 5 × 10^3 *N/m* is stretched initially by 5*cm* from the unstretched position. Then the work required to stretch it further by another $5cm$ is

(a) 6.25 *N-m* (b) 12.50 *N-m*

(c) 18.75 *N-m* (d) 25.00 *N-m*

17. A mass of 0.5*kg* moving with a speed of 1.5 *m/s* on a horizontal smooth surface, collides with a nearly weightless spring of force constant $k = 50 \rightleftarrows N/m$. The maximum compression of the spring would be

(a) 0.15 *m* (b) 0.12 *m*

(c) 1.5 *m* (d) 0.5 *m*

18. A particle moves in a straight line with retardation proportional to its displacement. Its loss of kinetic energy for any displacement *x* is proportional to

(a) x^2 (b) e^x

(c) *x* (d) $log_e x$

19. A spring with spring constant *k* when stretched through 1 *cm*, the potential energy is *U*. If it is stretched by 4 *cm*. The potential energy will be

(a) 4*U* (b) 8*U*

(c) 16 *U* (d) 2*U*

20. A spring with spring constant *k* is extended from $x = 0$ to $x = x_1$. The work done will be

(a) kx_1^2 (b) $\frac{1}{2}kx_1^2$

(c) $2kx_1^2$ (d) $2kx_1$

21. If a long spring is stretched by 0.02 *m*, its potential energy is *U*. If the spring is stretched by 0.1 *m*, then its potential energy will be

(a) $\frac{U}{5}$ (b) U

(c) 5*U* (d) 25*U*

22. Natural length of a spring is 60 *cm*, and its spring constant is 4000 *N/m*. A mass of 20 *kg* is hung from it. The extension produced in the spring is, (Take $g = 9.8\ m/s^2$)

(a) 4.9 *cm* (b) 0.49 *cm*
(c) 9.4 *cm* (d) 0.94 *cm*

23. The spring extends by *x* on loading, then energy stored by the spring is : (if *T* is the tension in spring and *k* is spring constant)

(a) $\frac{T^2}{2k}$ (b) $\frac{T^2}{2k^2}$
(c) $\frac{2k}{T^2}$ (d) $\frac{2T^2}{k}$

24. The potential energy of a body is given by, $U = A - Bx^2$ (Where *x* is the displacement). The magnitude of force acting on the particle is

(a) Constant
(b) Proportional to *x*
(c) Proportional to x^2
(d) Inversely proportional to *x*

25. The potential energy between two atoms in a molecule is given by $U(x) = \frac{a}{x^{12}} - \frac{b}{x^6}$; where *a* and *b* are positive constants and *x* is the distance between the atoms. The atom is in stable equilibrium when

(a) $x = \sqrt[6]{\frac{11a}{5b}}$ (b) $x = \sqrt[6]{\frac{a}{2b}}$
(c) $x = 0$ (d) $x = \sqrt[6]{\frac{2a}{b}}$

26. Which one of the following is not a conservative force

(a) Gravitational force
(b) Electrostatic force between two charges
(c) Magnetic force between two magnetic dipoles
(d) Frictional force