# PROBLEM-SOLVING TACTICS

**(a)** One should always isolate the known and unknown quantities and write equations and solve them.

**(b)** The next step would be to find out a way from unknown to known quantities and write equations and solve them.

**(c)** One should always be very careful in doing so to avoid silly mistakes such as unit change of parameter.

**(d)** Energy is scalar in nature. However, get a clear idea of what is being gained or lost by which entity.

**(e)** Physical visualization of any problem will always help in increaseaing confidence in solving equations pertaining to the same.

**(f)** Further, problems involving integration would be easy to understand if you go event by event and then solve.

**(g)** Special cases and boundary conditions of circular motion are definitely recommended to be mastered because many problems break down to these special cases just after few manipulations.

# FORMULAE SHEET

| S. NO. | DESCRIPTION | FORMULA |
|---|---|---|
| 1 | Kinetic energy of the particle | $K(v) = \frac{1}{2}mv^2 = \frac{1}{2}m\vec{v}.\vec{v}$ |
| 2 | Work done by force F | $W = \vec{F}.\vec{r}$ (here $\vec{r}$ is total displacement) |
| 3 | Work done by variable force | $w = \int \vec{F}.d\vec{r}$ |
| 4 | Power generated by force F acting on body | $P = \frac{dW}{dt} = \vec{F}.\frac{d\vec{r}}{dt} = \vec{F}.\vec{v}$ |
| 5 | Increase in Kinetic Energy = Decrease in Potential Energy | $KE = -\Delta U$ |
| 6 | Energy conservation principle | $\Delta K + \Delta U = 0; \frac{1}{2}mv^2 = mgh$ or, $v = \sqrt{2gh}$ |
| 7 | For a Spring work done W | $W = \int_{x_1}^{x_2} -kx\,dx = \frac{1}{2}k\left(x_1^2 - x_2^2\right)$ |
| 8 | Work-Energy principle | $W_{net} = \Delta KE = K_f - K_i$ |
| 9 | Work done by variable forces in short range | For $\vec{F} = \vec{F}_1 + \vec{F}_2 + .......$<br>$W = \int \vec{F}.d\vec{r} = \int \left(\vec{F}_1 + \vec{F}_2 + .....\right).d\vec{r}$ |
| 10 | For conservative forces, change in potential energy | $U_f - U_i = -\int_{r_i}^{r_f} \vec{F}.d\vec{r}$ |
| 11 | Elastic Potential Energy | $U = \frac{1}{2}kx^2$ |