

Physics

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(Chapter 5) (Work Energy and Power) (Exercises) (Class 11)

Therefore, for the positivity of the kinetic energy, the total energy of the particle must be greater than $-V_1$. So, the minimum total energy the particle must have is $-V_1$.

$$-\frac{b}{2} < x < \frac{a}{2}; \frac{a}{2} < x < \frac{b}{2}; -V_1$$

In the given case, the potential energy (V_0) of the particle becomes greater than the total energy (E)

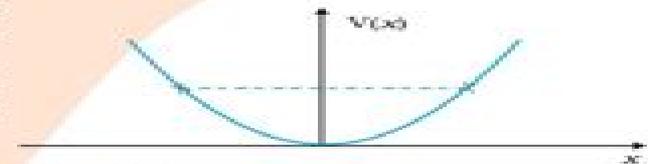
$$\text{for } -\frac{b}{2} < x < \frac{a}{2} \text{ and } -\frac{a}{2} < x < \frac{b}{2}$$

Therefore, the particle will not exist in these regions.

The minimum potential energy in this case is $-V_1$. Therefore, $\text{K.E.} = E - (-V_1) = E + V_1$. Therefore, for the positivity of the kinetic energy, the total energy of the particle must be greater than $-V_1$. So, the minimum total energy the particle must have is $-V_1$.

Question 5.4:

The potential energy function for a particle executing linear simple harmonic motion is given by $V(x) = kx^2/2$, where k is the force constant of the oscillator. For $k = 0.5 \text{ N m}^{-1}$, the graph of $V(x)$ versus x is shown in Fig. 6.12. Show that a particle of total energy 1 J moving under this potential must 'turn back' when it reaches $x = \pm 2 \text{ m}$.



Answer 5.4:

Total energy of the particle, $E = 1 \text{ J}$ and Force constant, $k = 0.5 \text{ N m}^{-1}$

$$\text{Kinetic energy of the particle, } K = \frac{1}{2}mv^2$$

According to the conservation law: $E = V + K$

$$1 = \frac{1}{2}kx^2 + \frac{1}{2}mv^2$$

At the moment of 'turn back', velocity (and hence K) becomes zero.

$$\therefore 1 = \frac{1}{2}kx^2 \Rightarrow \frac{1}{2} \times 0.5x^2 = 1 \Rightarrow x^2 = 4 \Rightarrow x = \pm 2$$

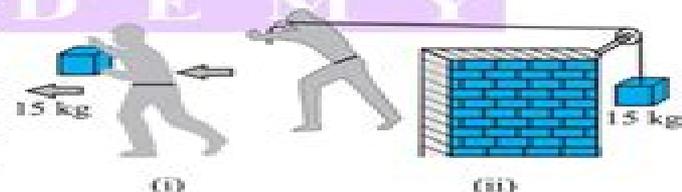
Hence, the particle turns back when it reaches $x = \pm 2 \text{ m}$.

Question 5.5:

Answer the following:

- The casing of a rocket in flight burns up due to friction. At whose expense is the heat energy required for burning obtained? The rocket or the atmosphere?
- Comets move around the sun in highly elliptical orbits. The gravitational force on the comet due to the sun is not normal to the comet's velocity in general. Yet the work done by the gravitational force over every complete orbit of the comet is zero. Why?
- An artificial satellite orbiting the earth in very thin atmosphere loses its energy gradually due to dissipation against atmospheric resistance, however small. Why then does its speed increase progressively as it comes closer and closer to the earth?

- In Figure (i), the man walks 2 m carrying a mass of 15 kg on his hands. In Figure (ii), he walks the same distance pulling the rope behind him. The rope goes over a pulley, and a mass of 15 kg hangs at its other end. In which case is the work done greater?



Physics Chapter 5 Review Answers

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