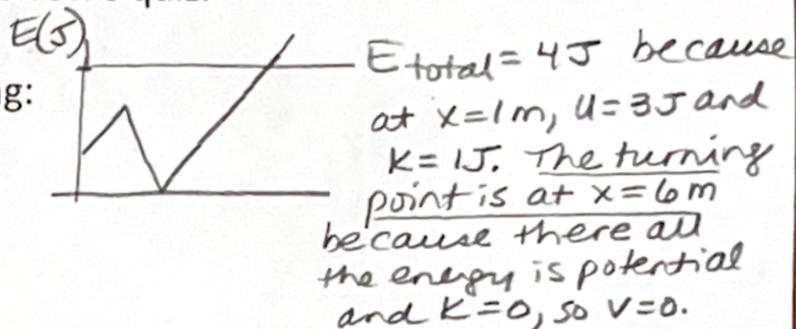


Energy Diagrams

Instructions: Provide mathematical support and/or verbal support for every answer.

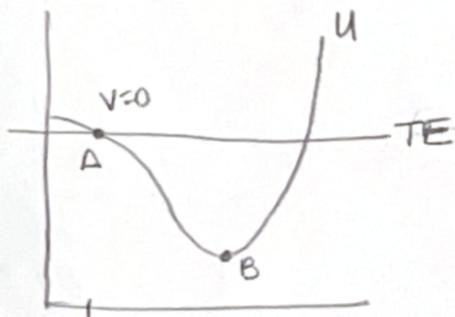
1. Carefully read, study, and understand Section **10.5 Energy Diagrams** (p.244-247), skipping Example 10.8. Be able to answer questions related to it on tomorrow's quiz.

2. Do the **Stop to Think 10.6** on p.247, explaining your reasoning:



3. p.257 #24

$m = 20g$
at $x = 1.0m$, $K = 0$



a) $F = -\text{slope of } U \text{ vs. } x \text{ curve}$, and the slope here is negative, so force is positive. It will move right.

b) Max speed occurs when $U(x)$ is a minimum, so at $x = 4m$.

Find V_{max} : $E_i + \Sigma \text{trans} = E_f$

$$U_A + 0 = U_B + K_B$$

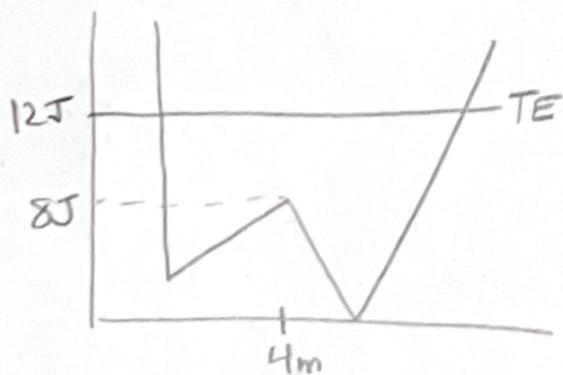
$$4J = 1J + \frac{1}{2}mV_{max}^2$$

$$3J = \frac{1}{2}(.020kg)V_{max}^2$$

$$17.3 m/s = V_{max}$$

c) The turning points are at $x = 1m$ and $x = 6m$, because these are the points where TE line crosses the U line.
 $K=0$ at the turning points, and $v=0$ at the turning points.

4. p. 257 #28



$m = .5kg$ Mechanical energy is potential + kinetic

$E = 12J$

a) Turning points are when the U curve crosses the TE line. This is at $x = 1m$ and $x = 8m$.

b) What is speed at $x = 4.0m$?

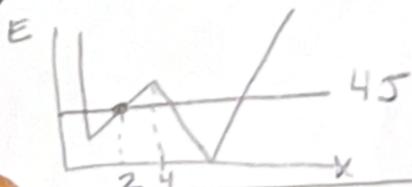
$$TE = \text{kinetic} + \text{potential}$$

$$12J = \frac{1}{2}mv^2 + 8J$$

$$4J = \frac{1}{2}(.5kg)v^2$$

$$4m/s = v$$

d) $TE = 4.0J$



- It can be at $x = 2m$, but it would have 0 speed.
- It can't be at $x = 4m$, because that would mean it has more potential energy than total energy!

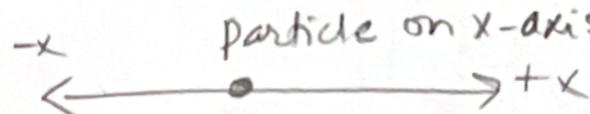
c) Max speed is when U is a minimum, so at $x = 6m$.

$$TE = K + U$$

$$12J = \frac{1}{2}mv^2 + 0J$$

$$12J = \frac{1}{2}(.5kg)v^2$$

$$6.9m/s = v$$

5. p.257 #33 

$$U(x) = \frac{10}{x}$$

Find F_x at $x = 2m, 5m, 8m$

$$\begin{aligned}
 F &= -\frac{dU}{dx} \\
 &= -\frac{d}{dx} \left(\frac{10}{x} \right) \\
 &= -\frac{d}{dx} (10x^{-1}) \\
 &= -10 \frac{d}{dx} (x^{-1}) \\
 &= -10 (-1x^{-2}) \\
 &= 10x^{-2} \\
 &= \frac{10}{x^2}
 \end{aligned}$$

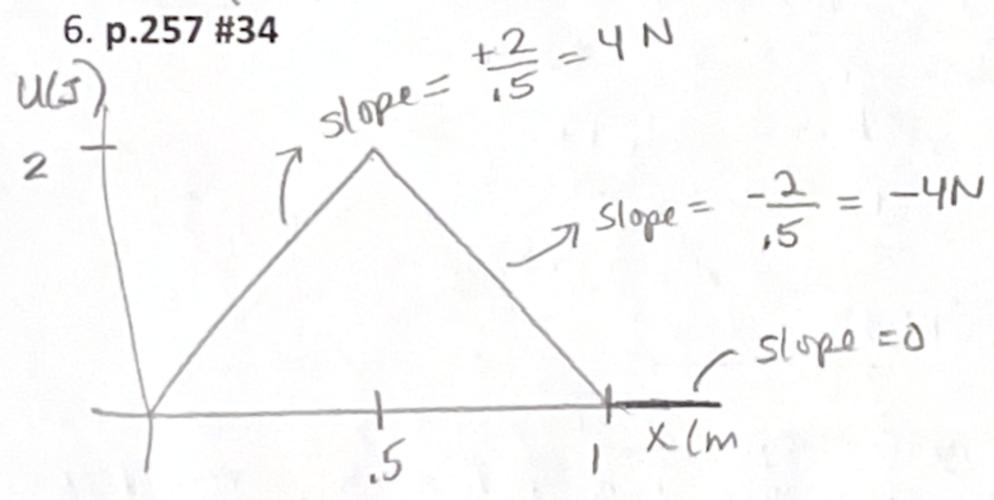
$$F = \frac{10}{x^2}$$

$$F(2m) = \frac{10}{(2m)^2} = 2.5N$$

$$F(5m) = \frac{10}{(5m)^2} = 0.40N$$

$$F(8m) = \frac{10}{(8m)^2} = 0.16N$$

6. p.257 #34



From $0 \rightarrow 0.5m$, $F = -4N$
 From $0.5m \rightarrow 1m$, $F = +4N$
 After $1m$, $F = 0N$

because F is negative slope of U vs x graph,
 or $-\frac{dU}{dx}$.

