**Kinetic Energy and The Work-Energy Theorem**

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<th>Learning Target</th>
<th>Description</th>
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<td>10.1</td>
<td>I can define, analyze, and calculate the amount of work done by a force in a closed system.</td>
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<tr>
<td>10.2</td>
<td>I can define, analyze, and solve problems involving kinetic energy.</td>
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**Work**

- **W = F d cos θ**
- Vector or Scalar: Vector
- Units: 1 N m = 1 J (Joule)
- Relationship: Directly Proportional

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**Interpret the Graph**

\[ W = F \cdot d = 30 \text{ J} \]

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**Compare and Contrast**

Positive Work
- Speeds up
- Work = \( W = \text{mg}d \)

Negative Work
- Speeds down
- Work = \( W = -\text{mg}d \)

\( 0 < \theta < 90 \)  
\( 90 < \theta < 180 \)

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**What About This One?**

\[ W = \text{area} = \frac{1}{2}bh \]

\[ = \frac{1}{2} \times (1.5 \text{ m}) \times (20 \text{ N}) \]

\[ W = 15 \text{ J} \]
10.2 WORK AND ENERGY

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**Work Done By A Variable Force**
Work can be obtained graphically by finding the area under a force-displacement graph.

**Work Done By a Spring**

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I'd love to continue talking about work, but I just don't have the energy.

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**Energy**
The ability to do work and cause change.

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**Forms of Energy**

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**Kinetic Energy**

Kinetic Energy is the energy of motion.

\[ KE = \frac{1}{2}mv^2 \]

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**Vector or Scalar**

Units  Relationship

\[ \text{Joules} \quad \text{m} \rightarrow \text{Direct prop.} \quad \text{v} \rightarrow \text{Direct Quad.} \]
KE = \frac{1}{2} mv^2

3) What is the range of possible values for kinetic energy?

IN CLASS EXAMPLES
3. A snowboarder is sliding across a flat section of snow and eventually comes to a rest. In this situation, does the kinetic friction force do positive, negative, or zero work. Explain.

4. The graph in Figure 10-22 shows the force and displacement of an object being pulled. Calculate the work done to pull the object 7.0 m.

5. How much work is done to stretch a spring of force constant 1.0 \times 10^4 \text{ N/m}, a distance of 0.15 m.

6. A 0.14 kg pinecone falls 16 m to the ground, where it lands with a speed of 13 m/s. How much kinetic energy does the pinecone have when it hits the ground?
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KEEP CALM AND LET'S PRACTICE

PRACTICE PROBLEMS (9-15)