Physics Practice

"Setting Up Problems"

Problem 1:

A person standing next to a 10m deep well throws a rock upward at 5 m/s. It travels up for a while, comes back down, then falls in the well.

- Draw a cartoon of the problem, making clear your coordinate system and origin.

- Write expressions for $x(t)$ and $v(t)$, putting in variables that you know (what is a?)

- Write sentences in terms of your algebraic variables that allow you to answer the following:

    1. How long does it take the rock to hit the bottom of the well?

    2. How high does the rock go?

    3. How fast is the rock going when it hits the ground?

Problem 2:

A person standing on top of a cliff of height 10m throws a rock horizontally at 5 m/s.

- Draw a cartoon of the problem, making clear your coordinate system and origin, and labelling interesting things.

- Write expressions for $x(t)$, $y(t)$, $v_x(t)$, and $v_y(t)$, putting in variables that you know.

- Write sentences in terms of your algebraic variables that allow you to answer the following:

    1. How long does it take the rock to hit the bottom of the cliff?

    2. Where does the rock strike the ground?

    3. What is the rock's speed when it strikes the ground?

Problem 3:

A person standing on top of a cliff of height 10m throws a rock upward at an angle 20° at 5 m/s.

- Draw a cartoon of the problem, making clear your coordinate system and origin, and labelling interesting things.

- Write expressions for $x(t)$, $y(t)$, $v_x(t)$, and $v_y(t)$, putting in variables that you know.

- Write sentences in terms of your algebraic variables that allow you to answer the following:

    1. How long does it take the rock to hit the bottom of the cliff?

    2. Where does the rock strike the ground?

    3. How high does the rock go?

    4. What is the rock's speed when it strikes the ground?

Problem 4:

An archer stands a distance d away from a building of height h. She shoots an arrow at a velocity v_0 at an angle θ below the vertical toward the building.

- Draw a cartoon of the problem, making clear your coordinate system and origin, and labelling interesting things.

- Write expressions for $x(t)$, $y(t)$, $v_x(t)$, and $v_y(t)$, putting in variables that you know.

- Write sentences in terms of your algebraic variables that allow you to answer the following:

    1. What is the minimum speed she must shoot the arrow with so that it hits the building?

    2. What is the minimum speed she must shoot the arrow with so that it lands on the roof of the building?

    3. Where on top of the building does the arrow land?

    4. What direction is the arrow traveling when it lands on the roof?

- For each of these questions, look back at the sentences you wrote on the preceding page, then describe what algebraic steps you would take to calculate the thing you want to calculate.

    1. What is the minimum speed she must shoot the arrow with so that it hits the building?

    2. What is the minimum speed she must shoot the arrow with so that it lands on the roof of the building?

    3. Where on top of the building does the arrow land?

    4. What direction is the arrow traveling when it lands on the roof?

Problem 5:

A hiker stands on top of a hill that makes an angle of 45° with the horizontal. She kicks a rock horizontally at speed v_0.

- Draw a cartoon of the problem, making clear your coordinate system and origin, and labelling interesting things.

- Write expressions for $x(t)$, $y(t)$, $v_x(t)$, and $v_y(t)$, putting in variables that you know.

- Write sentences in terms of your algebraic variables that allow you to answer the following:

    1. How long is the rock in the air?

    2. How far down the hill does the rock land?