Name _____

Make a prediction: If we drop a hammer and a piece of paper, which one will hit the ground first? Why?
A: Hammer, **B**: Paper, **C**: Both will hit at same time

If we do the same experiment on the moon, which one will hit the ground first? Why?
A: Hammer, **B**: Paper, **C**: Both will hit at same time

Will the acceleration of the hammer be the same as on Earth?
A: Yes, **B**: No, it will be greater, **C**: No, it will be less

Does the speed of a falling object depend on the mass of the object, i.e. will a heavier object fall faster than a lighter one or vice versa?

If we drop an object and ignore air resistance, and approximate $g \sim 10m/s^2$ how fast (in m/s) will it be moving...
After 1s?   After 2s?   After 3s?

Kinematics equations for y direction:

$$y = y_0 + v_{0y}t + \frac{1}{2}a_y t^2 \tag{1}$$

$$v_y = v_{0y} + a_y t \tag{2}$$

$$v_y^2 = v_{0y}^2 + 2a_y(y - y_0) \tag{3}$$

$g = 9.8m/s^2$ (g is always positive) For falling objects, if down is negative, what is $a_y =$
If down is positive, what is $a_y =$

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1. Let's choose up to be positive and down to be negative. Let's also choose our reference point, $y_0 = 0$ to be the place where the ball is released (above the ground). For the following cases, determine the signs of y, v_{0y}, v, and a_y throughout the motion and sketch position vs. time, velocity vs. time and acceleration vs time plots for each situation.

   (a) A ball is dropped from rest.
       Sign of y: Sign of v_{0y}:   Sign of v_y: Sign of a_y:
       Sketches:

   (b) A ball is thrown downwards with initial speed v_{0y}.
       Sign of y: Sign of v_{0y}:   Sign of v_y: Sign of a_y:
       Sketches:

(c) A ball is thrown upwards with initial speed v_{0y}.

While moving upwards: Sign of y: Sign of v_{0y}:   Sign of v_y: Sign of a_y:

While at the highest point: Sign of y: Sign of v_y: Sign of a_y:

While moving from highest point back to starting point: Sign of y: Sign of v_y: Sign of a_y:

While moving from starting point down to ground: Sign of y: Sign of v_y: Sign of a_y:

Sketches:

2. Suppose you are standing on the roof of a building and want to drop water balloons on the pavement to scare some innocent pedestrians below. The water balloons are pretty sturdy and need to be going fast when they hit the ground in order for them to break. Ignoring air resistance, would it be better to:

A. Throw the balloons upward with a speed v_0,

B. Drop the balloons from rest

C. Throw the balloons downward with a speed v_0

D. A. or C.

3. A basketball is thrown straight up at 2.5m/s by a referee, releasing the ball 1m above the ground.

(a) What is the maximum height of the ball, relative to the release point?

(b) How long does it take to reach the maximum height?

(c) What is the ball's speed when it returns to the release point (i.e. 1m above the ground)? Hint: No calculation needed!

(d) What is the ball's impact speed as it hits the ground?

(e) How long does it take for the ball to hit the ground?