

Name: \_\_\_\_\_

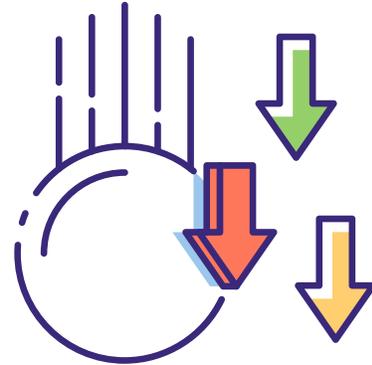
Date: \_\_\_\_\_

# Where am I?

## A Gravitational Exploration

### Introduction:

You wake up in an unknown location, and something feels a little *off* about the way objects move (including you). Determine your local value of gravity using simple materials and compare it to planetary data to figure out where you are.



### Free Fall Equation (one of them, anyway!)

This is *one* formula for an object's displacement when dropped from rest, experiencing a constant acceleration.

$$\Delta y = \frac{1}{2} at^2$$

Do you notice anything surprisingly missing from this equation?

Term	Symbol	Definition	SI Unit
Displacement	$\Delta y$	The change in an object's position (final position - initial position)	meter (m)
Acceleration	$a$	The rate of change of an object's velocity	meters per second <sup>2</sup> (m/s <sup>2</sup> )
Time	$t$	How long does the event in question take to happen?	second (s)

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### Your Mission:

1. Gather your materials: something sturdy that can be dropped (like a ball or toy), a meter stick (or better yet, multiple meter sticks attached together to form one epic multi-meter-stick of power), and a stopwatch or timer.
2. Designate who will drop the object, who will be the timer, and who will record the time.
3. Drop (do not impart an initial force) the object from the same height 8 times, recording the time for each drop from the moment of released to the moment it hits the ground.

#	Drop height (m)	Time (s)
1		
2		
3		
4		
5		
6		
7		
8		

4. Calculate the average time from all 8 of your trials and record it below:

5. Rearrange the displacement equation and solve for acceleration:

$$\Delta y = \frac{1}{2} at^2$$

6. Use your average time and drop height (displacement) to calculate the acceleration due to gravity:

7. Use the planetary gravity table to find the planet with your closest value. Are you, in fact, on Earth, or did you accidentally transport yourself somewhere else?

8. What are some possible sources of error in this experiment? How would you modify this experiment for greater accuracy?

9. In *Project Hail Mary*, Ryland Grace performs this same experiment with a drop height of 91 centimeters and arrives at an average time of 0.348 seconds. Is he on Earth? How do you know?