Acceleration

Objectives:

- Given the materials distributed by your teacher, design an investigation to identify how acceleration, time, and velocity are related. Once you have your procedure outlined, check with your teacher to get approval.
- Describe how to calculate the acceleration of an object.
- Explain how positive and negative acceleration affect motion.

1. Define **Acceleration:**

_____

_____

Example:

ACCELERATION EQUATION:

$$\textit{acceleration} = \frac{\textit{final velocity} - \textit{initial velocity}}{\textit{final time} - \textit{initial time}} \qquad a = \frac{(v_f - v_i)}{(t_f - t_i)} \qquad a = \Delta v/t$$

SI Units: meters per second squared m/s^2

Describe a Velocity-Time Graph (Speed-Time Graph)

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2. A flowerpot falls off a second-story windowsill. The flowerpot starts from rest and hits the sidewalk 1.5 seconds later, with a velocity of 14.7 m/s. Find the average acceleration of the flowerpot.

Known: $t = 1.5$ s *initial* $v = 0$ m/s down *final* $v = 14.7$ m/s down

Unknown: $a =$ _____ m/s^2

Formula: $a = \frac{\textit{final } v - \textit{initial } v}{t}$

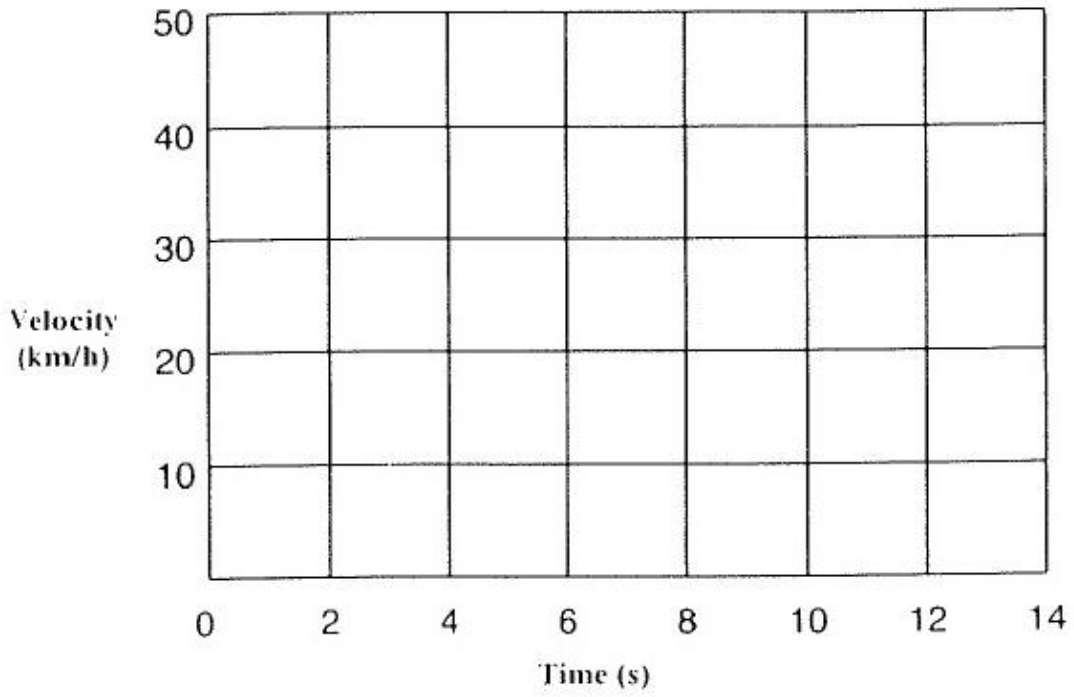
3. Calculating positive acceleration:
   a) Suppose a jetliner starts at rest down the runway in a single direction. After accelerating for 20s, it reaches a speed of 80 m/s. Because it started at rest, its initial speed was zero. What is the average acceleration?

4. Calculating negative acceleration:
   a) Imagine a skateboarder is moving in a straight line at a constant speed of 3 m/s and comes to a stop in 2 s. The final speed is zero, and the initial speed was 3 m/s.

Graphing Velocity vs. Time

Plot the following data on the graph, and answer the questions below.

Velocity (km/h)	Velocity (m/s)	Time (s)
0.0		0
10.0		2
20.0		4
30.0		6
40.0		8
50.0		10



1. As time increases, what happens to the velocity?

2. What is the velocity at 5 s (in m/s)?

3. Assuming constant acceleration, what would the velocity be at 14 s?

   _____km/h _____m/s

4. At what time does the object reach a velocity of 45 km/h?

5. What is the object's acceleration?

   Formula:

   Substitution:

   Answer:_____

6. Calculate the slope of the graph. Slope=_____

7. What is the relationship between the slope of the graph and acceleration?

8. What would the shape of the graph be if a velocity of 13.89 m/s is maintained from 10 s to 20 s?

9. Calculate the acceleration described in question 8.

   Formula:

   Substitution:

   Answer: _____