

Instructions:

- Show all your calculations clearly.
- Make sure to include units in your answers.
- For complex problems, use the quadratic formula where necessary:

$$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

- Check your answers for accuracy.
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1. Dropping Objects from Rest. (Basic level)

- a. A ball is dropped from a height of 5 meters. How long will it take to hit the ground?
(Use $g=9.8 \text{ m/s}^2$)

$$s = \frac{1}{2}gt^2$$

- b. A stone is dropped from a height of 10 meters. How long will it take to reach the ground?

2. Throwing Objects Upward (Intermediate level)

- a. If you throw a ball upwards with an initial velocity of 20 m/s, how long will it take to reach the highest point?

$$v = u - gt$$

- b. How high will the ball go?

$$s = ut - \frac{1}{2}gt^2$$

- c. What will be the final velocity of the ball when it comes back to the starting point?

$$v = -u$$

3. Complex Problems (Advanced level)

- a. A rock is thrown downwards from a height of 50 meters with an initial velocity of 10 m/s. How long will it take to hit the ground?

$$s = ut + \frac{1}{2}gt^2$$

- b. What will be the final velocity of the rock just before it hits the ground?

$$v = u + gt$$

- c. A helicopter is ascending at 15 m/s and releases a package from a height of 120 meters. How long will it take for the package to reach the ground?

$$s = ut + \frac{1}{2}gt^2 \quad \text{where} \quad u = -15 \text{ m/s}$$

- d. What will be the final velocity of the package just before it hits the ground?

$$v = u + gt$$

4. Mixed Problems (Mixed Difficulty)

- a. A feather and a hammer are dropped from the same height on the Moon where there is no air resistance. Which one will hit the ground first?

- b. A student throws a ball straight up with a velocity of 12 m/s. Calculate the time it takes for the ball to reach its highest point and its maximum height.

$$v = u - gt \quad \text{and} \quad s = ut - \frac{1}{2}gt^2$$

- c. An object is thrown downward with an initial velocity of 8 m/s from a height of 30 meters. How long will it take to reach the ground and what will be its final velocity?

$$s = ut + \frac{1}{2}gt^2 \quad \text{and} \quad v = u + gt$$

- d. A helicopter is moving upwards at 10 m/s and drops a package from a height of 80 meters. Calculate the time it takes for the package to reach the ground and its final velocity just before impact.

$$s = ut + \frac{1}{2}gt^2 \quad \text{where } u = -10 \text{ m/s}$$

Extra Challenge:

- Think about how air resistance might affect the results in real-life scenarios. Write a short paragraph explaining your thoughts.
