Free Fall and the Kinematic Equations
Lesson Notes

The BIG 4:

$$d = v_o \cdot t + \frac{1}{2} \cdot a \cdot t^2$$

$$v_f^2 = v_o^2 + 2 \cdot a \cdot d$$

$$d = (v_o + v_f) / 2 \cdot t$$

$$v_f = v_o + a \cdot t$$

d: displacement
a: acceleration
t: time
v_o: original velocity
v_f: final velocity

Problem-Solving Strategy
1. Identify **known values** of 3 variables. Write down; relate to the symbols.
2. Identify the **unknown**. Write in symbol form.
3. Find the kinematic equation. Write down.
4. Substitute known values into equation.
5. Solve for unknown.

Example 1
Rex Things dropped his mother's vase out the window of his fourth story apartment 18.2 m above the ground. Determine the time it took for it to reach the ground.

Known Variables: _____

Unknown Variable: _____

Equation: _____

Solution and Answer:

Example 2
Rex Things dropped his mother's vase out the window of his fourth story apartment 18.2 m above the ground. Determine its landing speed.

Known Variables: _____

Unknown Variable: _____

Equation: _____

Solution and Answer:

Example 3
Eva Baul throws a ball upward at 23.4 m/s. Determine the time it takes for the ball to reach its highest point (i.e., the peak).

Known Variables: _____

Unknown Variable: _____

Equation: _____

Solution and Answer:

Example 4
Eva Baul throws a ball upward at 23.4 m/s. Determine the distance of the ball above its initial position when it reaches the peak.

Known Variables: _____

Unknown Variable: _____

Equation: _____

Solution and Answer:

Example 5
Jason stands on a cliff 24 m above the ground and throws a ball upward at 16 m/s. Determine the speed of the ball when it hits the ground below the cliff.

Known Variables: _____

Unknown Variable: _____

Equation: _____

Solution and Answer: