

Name: _____

Score: _____

Program, Year & Section: _____

Date: _____

Worksheet 5c Free Fall

Study the following problems and solve for what is asked.

1. A stone is released from the railing of a bridge and strikes the water below the bridge in 1.50 s. How high is the bridge above water? **(Express all answers to 3 s.f.)**

Given:

$$v_i = \text{_____ m/s}$$

$$t = \text{_____ s}$$

Find: d

Solution:

$$d = v_i t + \frac{gt^2}{2}$$

$$d = \left(\frac{\text{m}}{\text{s}} \right) (\text{_____ s}) + \frac{\left(\frac{\text{m}}{\text{s}^2} \right) (\text{_____ s})^2}{2} = \text{_____ m}$$

2. A ball is thrown vertically upward with a speed of 15.0 m/s from the roof of a tall building. The ball leaves the thrower's hand at a point even with the roof railing. On its way back down, it just misses the railing. What are (a) the position and (b) velocity of the ball 1.00 s and 4.00 s after it leaves the thrower's hand? **(Express all answers to 3 s.f.)**

Given:

$$v_i = \text{_____ m/s}$$

$$t_1 = \text{_____ s}$$

$$t_2 = \text{_____ s}$$

Find: (a) **d** of the ball at $t = 1.00$ s and $t = 4.00$ s

(b) **v** of the ball at $t = 1.00$ s and $t = 4.00$ s

Solution:

(a) At $t = 1.00$ s

$$d = v_i t + \frac{gt^2}{2}$$

$$d = \left(\frac{\text{m}}{\text{s}} \right) (\text{_____ s}) + \frac{\left(\frac{\text{m}}{\text{s}^2} \right) (\text{_____ s})^2}{2} = \text{_____ m}$$

$$v_f = gt + v_i$$

$$v_f = \left(\frac{m}{s^2} \right) (\quad s) + \left(\frac{m}{s} \right) = \frac{m}{s}$$

(b) At $t = 4.00 \text{ s}$

$$d = v_i t + \frac{gt^2}{2}$$

$$d = \left(\frac{m}{s} \right) (\quad s) + \frac{\left(\frac{m}{s^2} \right) (\quad s)^2}{2} = \quad m$$

$$v_f = gt + v_i$$

$$v_f = \left(\frac{m}{s^2} \right) (\quad s) + \left(\frac{m}{s} \right) = \frac{m}{s}$$

3. A ball is thrown directly downward, with an initial speed of 10.0 m/s , from a height of 50.0 m . After what time interval does the ball strike the ground?
(Express all answers to 3 s.f.)

Given:

$$v_i = \quad \text{m/s}$$

$$d = \quad \text{m}$$

Find: t when the ball strikes the ground

Solution:

$$d = v_i t + \frac{gt^2}{2}$$

$$m = \left(\frac{m}{s} \right) (t) + \frac{\left(\frac{m}{s^2} \right) t^2}{2}$$

This follows a quadratic trinomial: $ax^2 + bx + c = 0$.

The value of the variable can be computed using the quadratic formula.

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

$$t = \frac{(- \quad) \pm \sqrt{(\quad)^2 - 4(\quad)(\quad)}}{2(\quad)}$$

This will yield two roots (answers) for t .

$$t = \quad s \qquad t = \quad s$$