Name _____Answer Key_____ Date _____

Honors Physics Kinematics WS #8H

Period _____ Mrs. Nadworny

Free Fall

Directions: Read textbook pages 60 – 64. Solve the following problems using the GUESS method. Show all work clearly.

1. A 4.0 kilogram rock and a 1.0 kilogram stone fall freely from rest from a height of 100 meters. After they fall for 2.0 seconds, what is the ratio of the rock's speed to the stone's speed?

   (A) 2:1 (B) 1:1 (C) 1:2 (D) 4:1

2. An object is dropped from rest and falls freely 20. meters to Earth. When is the speed of the object 9.8 meters per second?

   (A) after it has fallen 9.8 meters
   (B) during the entire first second of its fall
   (C) during its entire time of fall
   (D) at the end of its first second of fall

3. Andy Friese skydives out of a plane. We can assume his initial velocity is zero and neglect air resistance.
   a. How far has he traveled after 55 seconds?

$$d = v_i t + \tfrac{1}{2}at^2 = \tfrac{1}{2}(-9.81\,\tfrac{m}{s^2})(55s)^2 = 1.5\times10^4\ m$$

   b. What is his velocity 105 seconds after leaving the plane?

$$v_f = v_i + at = (-9.81\ \tfrac{m}{s^2})(105\ s) = 1030\ m/s\ down$$

4. Willie E. Coyote drops an anvil from rest off the top of a building in order to squash the roadrunner. If it takes 5.8 seconds for the anvil to make it to the ground, how tall is the building?

$$d = v_i t + \tfrac{1}{2}at^2 = \tfrac{1}{2}(-9.81\,\tfrac{m}{s^2})(5.8\ s)^2 = 170\ m$$

5. The Westin Stamfod Hotel is Detroit is 228 m tall. If a worker on the roof drops a sandwich, how long does it take the sandwich to hit the ground, assuming there is no air resistance? How would the air resistance affect the answer?

$$t = \sqrt{\frac{2d}{a}} = \sqrt{\frac{2(228\ m)}{(9.81\,\tfrac{m}{s^2})}} = 6.82\ s$$

If there were air resistance the time would be longer

6. A trained acrobat can safely land on the ground at speeds up to 15 m/s. What is the greatest height from which the acrobat can fall?

$$d = \frac{v_f^2 - v_i^2}{2a} = \frac{(15\,\tfrac{m}{s})^2 - (0\,\tfrac{m}{s})^2}{2(-9.81\,\tfrac{m}{s^2})} = 11\ m$$

Answers in size order: 6.82, 11, 170, 1030, 1.5×10^4