**Physics**

**Free Fall Practice Problems for A2.4**

Ignore air friction and use the convention that **down is negative.** g = 9.8 m/s/s

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| 1. **a-b: A baseball is popped straight up in the air at a velocity of 42.0 m/s**a. What is the greatest height it reaches? (90.0 m)b. What time does it spend in the air before reaching the same elevation from which it was popped up? (8.57 s)**c-d: A rock is dropped from rest from the top of a cliff and strikes the ground after 2.10 seconds.**c. What is its velocity of impact with the ground? (-20.6 m/s)d. What is the height of the cliff? (21.6 m)**e. An air rocket is launched from the ground straight up, and on the way down is strikes a light tower that is 16.0 m tall with a downward velocity of 12.0 m/s**. What was its initial upward velocity? (+21.4 m/s) |
| 2. **a-b: A soccer ball is kicked straight up from the ground, and reaches a height of 23.0 m before coming back down.**a. What time does it spend in the air (total)? (4.33 s)b. What was its initial upward velocity leaving the ground? (+21.2 m/s)**c-d: A golf ball is dropped from a cliff and strikes the ground with a downward velocity of 34.0 m/s.**c. How high is the cliff? (59.0 m)d. What time did it take the ball to strike the ground? (3.47 s)**e. An air rocket is launched straight up at 36.0 m/s.**  What time elapses between the launch, and the point on the way down where it has a downward velocity of 21.0 m/s? (5.82 s) |
| 3. **a-b: A steel marble is launched straight up from the ground at some velocity, and stays in the air for a total time of 8.20 s before striking the ground again.**a. What was its initial launch velocity? (+40.2 m/s)b. To what height does the marble rise before going back down again? (82.4 m)**c-d: A hot pocket is dropped from the top of a 52.0 m tall building in Manhattan.**c. What time does it take to reach the sidewalk below? (3.26 s)d. What is the velocity of impact with the sidewalk? (-31.9 m/s)**e. An air rocket is launched straight upwards at 27.0 m/s.** What is its velocity at a time of 4.80 s? (-20.0 m/s) |
| 4. **a-b: A giant lizard jumps straight upwards from the ground at 4.30 m/s.** a. To what height does the lizard rise before going back down again? (0.943 m)b. What total time does the lizard spend in the air? (0.878 s)**c-d: A frozen blueberry falls from a counter top and strikes the floor with a downward velocity of 4.50 m/s.**c. What is the height of the counter top? (1.03 m)d. What time does it take the blueberry to strike the ground? (0.459 s)**e. An air rocket is launched straight up with a speed of 31.0 m/s and strikes a 12.0 m tall light tower on the way down.** What is the velocity of impact with the light tower? (-26.9 m/s) |
| 5. **a-b: A bowling ball is launched using black powder from a well casing and goes straight up 320. m before coming back down again.** a. For what time does the bowling ball stay in the air? (16.2 s)b. What was its initial upward velocity of launch? (+79.2 m/s)**c-d: A person falls from a bridge that is 18.0 m above the water.**c. What time does it take them to reach the water? (1.92 s)d. What is the velocity of impact with the water? (-18.8 m/s)**e. An air rocket is launched straight up and lands on the roof of a building 3.80 s later with a downward velocity of 8.60 m/s.** What was its initial velocity of launch from the ground? (+28.6 m/s) |