AP Free Fall Acceleration Problems

Use a separate piece of paper to answer these question. Show all your work.
> List all your <u>knowns</u> and <u>unknown</u> information
> Show the equation you are using
> Substitute values and solve
> Box answer and check units

1. A stone is thrown straight upward and it rises to a height of 20 m. With what speed was it thrown?

   Ans. 19.8 m/s

2. A stone it thrown upward with a speed of 20 m/s. It is caught on its way down at a point 5.0 m above where it was thrown.

   a) What was its maximum height?   **Ans. 20.4 m**
   b) How fast was it going when it was caught? **Ans. -17.4 m/s**
   c) How long did the trip take   **Ans. 3.8 s**

3. The greatest height reported for a jump into an airbag is 99.4 m by stuntman Dan Koko. In 1948 he jumped from rest from the top of the Vegas World Hotel and Casino. He struck the airbag at a speed of 39 m/s (88mi/hr). To asses the effects of air resistance, determine how fast he would have been traveling on impact had air resistance been absent.

   Ans. 44.1 m/s

4. A hot air balloon is rising upward with a constant speed of 2.5 m/s. When the balloon is 3.00 m above the ground, the balloonist accidentally drops a compass over the side of the balloon. How much time elapses before the compass hits the ground?

   Ans. 1.08 s

5. A ball is thrown straight upward and rises to a maximum height of 16 m above its launch point. At what height above its launch point has the speed of the ball decreased to one half of its initial value?

   Ans. 12 m

6. A woman on a bridge 90.0 m high sees a raft floating at a constant speed on the river below. She drops a stone from rest in an attempt to hit the raft. The stone is released when the raft has 6.0 m more to move before passing under the bridge. The stone hits the water 2.00 m in front of the raft. Find the speed of the raft.

   Ans. .932 m

7. Two identical pellet guns are fixed simultaneously from the edge of the cliff. These guns impart an initial speed of 30 m/s to each pellet. Gun A is fired straight upward, with the pellet going straight up and then falling back down, eventually hitting the ground beneath the cliff. Gun B us fired straight downward. In the absence of air resistance, how long after pellet B hits the ground does pellet A hit the ground?

Ans. 6.12 s
Note: This answer is independent of the height of the cliff.

8. A spelunker(cave explorer) drops a stone from rest into a hole. The speed of sound is 343 m/s in air, and the sound of the stone striking the bottom is heard 1.5 s after the stone is dropped. How deep is the hole?

Ans. 10.6 m

9. A hot air balloon is ascending straight up at a constant speed of 7.0 m/s. When the balloon is 12.0 m above the ground, a gun fires a pellet straight up from ground level with an initial speed of 30 m/s. Along the paths of the balloon and the pellet, there are two places where each of them has the same altitude at the same time. How far above ground level are these places?

Ans. 41 m and 16 m