## Projectile Motion Problems

1) Two stones, A and B, are thrown horizontally from the top of a cliff. Stone $A$ has an initial speed of 15 meters per second and stone B has an initial speed of 30 meters per second. Compared to the time it takes stone A to reach the ground, the time it takes stone $B$ to reach the ground is $\qquad$
2) The diagram below represents the path of an object after it was thrown. What happens to the object's acceleration as it travels from A to B?

3) The diagram below represents the path of a stunt car that is driven off a cliff, neglecting friction. Compared to the horizontal component of the car's velocity at point A , the horizontal component of the car's velocity at point $B$ is $\qquad$

4) As shown in the diagram below, a student standing on the roof of a 50 -meter-high building kicks a stone at a horizontal speed of 4 meters per second. How far did the stone land from the building? [Neglect friction.]

5) A kicked soccer ball has an initial velocity of 25 meters per second at an angle of $40^{\circ}$ above the horizontal, level ground. [Neglect friction.]
(a) Calculate the magnitude of the horizontal component of the ball's initial velocity.
(b) Calculate the magnitude of the vertical component of the ball's initial velocity.
6) An outfielder throws a baseball to second base at a speed of $20 \mathrm{~m} / \mathrm{s}$ and an angle of $30^{\circ}$ above the horizontal.
(a) Calculate the magnitude of the horizontal component of the ball's initial velocity.
(b) Calculate the magnitude of the vertical component of the ball's initial velocity.
7) A child kicks a ball with an initial velocity at an angle. The ball has an initial vertical velocity of 20 meters per second. [Neglect air resistance.]
(a) How much time did it take the ball to reach its highest point?
(b)How high did the ball go in the air?
(c) What was the total time the ball was in the air?
8) A plane flying horizontally above Earth's surface at 100 meters per second drops a crate. The crate strikes the ground 30 seconds later. [Neglect air resistance]
(a) What is the magnitude of the horizontal component of the crate's velocity just before it strikes the ground?
(b) What height was the crate dropped from?
9) A golf ball is given an initial speed of 20 meters per second and returns to level ground. Which launch angle above level ground results in the ball traveling the greatest horizontal distance? [Neglect friction.]
10) A soccer player kicks a ball with an initial velocity of 10 meters per second at an angle of $30^{\circ}$ above the horizontal. The horizontal velocity of the ball is $8.7 \mathrm{~m} / \mathrm{s}$. The vertical velocity of the ball is $5 \mathrm{~m} / \mathrm{s}$.
(a) What time did it take the ball to reach its highest point?
(b) What maximum height did the ball travel?
(c) What total time was the ball in the air?
(d) How far horizontally did the ball travel?
