2: One-Dimensional Motion Problems

Name: Key **Score:** _____

1. Can an object's velocity change direction when its acceleration is constant?
   a) No, this is not possible because it is always speeding up.
   b) No, this is not possible because it is always speeding up or always slowing down, but it can never turn around.
   c) Yes, this is possible, and a rock thrown straight up is an example.
   d) Yes, this is possible, and a car that starts from rest, speeds up, slows to a stop, and then backs up is an example.

2. An object is dropped from rest from the top of a 400 m cliff on Earth. If air resistance is negligible, what is the distance the object travels during the first 6 seconds of its fall?
   a) 30 m
   b) 60 m
   c) 120 m
   d) 180 m
   e) 360 m

$d = \frac{1}{2}at^2 = 5t^2 = 5(36) = 180$

3. Suppose that an object is moving with constant acceleration. Which of the following is an accurate statement concerning its motion?
   a) In equal times its speed increases by equal amounts.
   b) In equal times its velocity changes by equal amounts.
   c) In equal times it moves equal distances.
   d) None of the above is true.

4. Ball A is dropped from the top of a building. One second later, ball B is dropped from the same building. As time progresses, the distance between them
   a) Increases.
   b) Remains constant.
   c) Decreases.
   d) Cannot be determined from the information given.

Ball A is always faster than ball B

5. Ball A is dropped from the top of a building. One second later, ball B is dropped from the same building. As time progresses, the difference in their speeds
   a) Increases.
   b) Remains constant.
   c) Decreases.
   d) Cannot be determined from the information given.

Both accelerate at the same rate

6. A jumbo jet taking off from rest needs to reach a velocity of 100 m/s on a runway in order to takeoff. The runway is 1800 m long and the plane has a constant acceleration. Find: (10 points)

   a. The time it takes to reach takeoff velocity. (4 points)

   b. The acceleration of the plane. (4 points)

$x_i = 0$
$x_f = 1800\ m$
$v_i = 0$
$v_f = 100\ m/s$
a
t

$$v_f^2 = v_i^2 + 2a(x_f - x_i)$$
$$100^2 = 0 + 2a(1800 - 0)$$
$$\boxed{a = 2.78\ m/s^2}$$

$$v_f = v_i + at$$
$$100 = 0 + 2.78t$$
$$\boxed{t = 36\ s}$$

   c. Some propeller driven military planes use solid fuel rockets to assist in taking off on very short runways. Why do the rockets allow the same plane to take off from a shorter runway? (2 points)

$a \uparrow$, time $\downarrow$ $\quad t = \frac{\Delta v}{a}$