Quiz.

1. According to Kepler's laws of planetary motion,
   a) planets travel in perfect circles around the sun.
   b) the amount of time it takes a planet to complete an orbit around the sun depends on its average distance to the sun.
   c) planets travel around the sun at constant speeds.

2. What causes a projectile to follow a path below the straight-line path it should follow in the absence of a net, external force?
   a) inertia
   b) the force due to Earth's gravity
   c) air resistance

3. A satellite is a type of projectile that
   a) orbits above Earth's gravity.
   b) is continually falling around the earth.
   c) has no inertia

4. An example of an open orbit would be in the shape of a(n)
   a) circle
   b) ellipse
   c) hyperbola

5. Why are black holes "black?"
   a) They contain no light.
   b) They are so dense that their escape speed is greater than the speed of light.
   c) They are so far away that the light coming from them hasn't had time to reach us.

6. What is conserved in a planetary orbit around the sun?
   a) mechanical energy only
   b) angular momentum only
   c) both mechanical energy and angular momentum

7. A satellite in an elliptical orbit around Earth will travel
   a) the fastest when it is closest to Earth
   b) the fastest when it is farthest from Earth
   c) at the same speed at every point in its orbit

8. After a rock thrown straight up reaches the top of its path and then falls a short distance, its acceleration is (neglect air resistance)
   a) greater than when it was at the top of its path.
   b) less than when it was at the top of its path.
   c) the same as it was at the top of its path.

9. If a satellite's radial velocity is zero at all times, its orbit must be
    a) parabolic
    b) elliptical
    c) circular

Answer Key.
1. b)

Kepler's laws of planetary motion tell us that the orbits of the planets are elliptical, not circular; that the speed changes depending on our distance to the sun; and that the period-to-average-distance-from-the-sun ratio for a planet is $T^2 \sim r^3$.

2. b)

In the absence of gravity, a projectile would follow a straight-line path. In the absence of air resistance, a projectile would still follow a path below this straight line. Earth's gravity causes the projectile to fall into a curve, rather than remaining straight.

3. b)

Satellites can never escape Earth's gravity, and as long as they have mass they will have inertia. Objects in orbit are actually in sustained free-fall, and the reason they do not land is that the influence of their inertia is enough to keep them in orbit.

4. c)

Circles and ellipses are both examples of closed orbits. However, a parabola never closes.

5. b)

As you will learn soon, everything radiates. Black holes "contain" light, but the escape velocity of a black hole is so great that it exceeds the speed of light. Some light sources are too far for us to see them, but that has nothing to do with the fact that all black holes are "black."

6. c)

When a planet is farthest away from the sun, it has the most potential energy, and when the planet is closest to the sun it has the most kinetic energy, so energy must be conserved. Also, when the planet is farthest away its velocity is a minimum, and when the planet is closest its velocity is a maximum, so angular momentum must be conserved.

7. a)

Both the conservation of mechanical energy and conservation of angular momentum can be used to answer this question.

8. c)

Don't forget, the acceleration due to gravity, g, can be considered constant at or near the surface of the earth.

9. c)

If the radial velocity is zero, then that means all of the velocity is tangential. That means the radius of the orbit can never change, and the orbit is circular.