Answer keys to "Kepler's Second Law"

1. **Yes**
2. **[Staying the same]** Since the planet is moving the same distance in the same time it must be traveling at the same speed the entire time.
3. ...
4. ...
5. **[Equal to]** The lettered positions identified in Answer 4 were chosen because the area swept out between them would be about the same as the area swept out between A and B. And since we are told that the planet obeys Kepler's second law—equal areas in equal times—the time interval must be equal.
6. **[Question 4]**
7. **[Question 4]** Since the planet traveled a greater distance for the motion identified in Question 4 than it did in Question 3, and both motions took place in the same amount of time, the planet had to be moving faster during the interval identified in Question 4.
8. **[No]**
9. **[Fastest: G; Slowest: A]** Since the time intervals between the lettered positions are the same, and the distance traveled in that time interval is greatest at Position G and smallest at Position A, it must be moving fastest at Position G and slowest at Position A.
10. skipped
11. **The closer a planet is to its companion star the faster it moves, and the farther away it is the slower it moves.**
12. **[A]** Orbit A is a circle, and Earth's eccentricity is nearly zero, and since orbits with an eccentricity of zero are "perfectly circular," Orbit A must be the one that most closely matches Earth's orbits. Orbits B and C are not circles.
13. **[Largest: Pluto; Smallest: Venus]**

Answer keys to "Kepler's Third Law"

1. **[The closer (Jupiter-sized) planet called Esus will have the shorter orbital period.]**

2. **[Yes, the Earth-like planet called Sulis would now have the shorter orbital period.]**
3. **[Stay the same.]**
4. **[They would both orbit around their central star in the same amount of time.]** Since the orbital period depends only on how far away the planet is from its central star, and not on the mass of the planet, they will move around their star in the same amount of time because they are at the same distance away from the star.
5. **[Increase]**
6. **[1 AU]**
7. **[about 2.8 years]**
8. **[d]**
9. **[Earth]**
10. **[d]**
11. **[Mars]** The Student incorrectly thinks that the planets keep getting more massive the farther away they are from the Sun. This is true until Mars, which is less massive than Earth, the next closest planet to the Sun than Mars. The Student is correct, though, that the farther the planets are away from the Sun, the longer they take to go around the Sun.