**Astronomy Assessment and TPS Questions:**

**Kepler’s Second Law**

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1. In the drawing at right, the motion of a planet traveling around a star is shown. We have shaded in a triangular area that was swept out during the motion of the planet while moving from position **A** to **B**. Which two other planet positions (provided below) would sweep out another triangular area for the motion of the planet that would obey Kepler’s Second Law?

**A**

**B**

**C**

**D**

**E**

**F**

**G**

* 1. **C** to **D**
  2. **E** to **F**
  3. **F** to **G**

1. The planet shown in the drawing at right obeys Kepler’s Second Law. Each lettered position represents the location for the planet during a particular day in a year. During which day (at which lettered position) would the planet move the farthest?

**A**

**B**

**C**

**E**

**D**

1. Kepler proposed that the orbits of the planets have what shape?
   1. circular
   2. focal-planer
   3. elliptical
   4. equal-triangular
2. Kepler’s Laws of planetary motion are based on detailed observations made by which astronomer?
   1. Isaac Newton
   2. Tycho Brahe
   3. Galileo Galilei
   4. Nicholas Copernicus

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For the next two questions, consider the information in the table and the student comment both provided below.

|  |  |  |
| --- | --- | --- |
| **Planet** | **Distance from the Sun**  **(in Astronomical Units - AU)** | **Planet mass**  **(in terms of Earth’s mass)** |
| **Mercury** | 0.38 | 0.06 |
| **Venus** | 0.72 | 0.82 |
| **Earth** | 1.0 | 1.0 |
| **Mars** | 1.52 | 0.11 |
| **Jupiter** | 5.20 | 318 |

A student in your class makes the following comment about the relationship between the location of planets in our solar system and their orbital period and mass:

“As we look at planets farther away from the Sun than Mercury we see that their distance gets bigger and that the mass of the planets is also getting larger. So I think that the farther away a planet is the longer it takes to go around the sun and the more massive the planet will be too.”

1. Which planet listed in the table illustrates the fact that the student is incorrect in their reasoning
   1. Mercury
   2. Venus
   3. Earth
   4. Mars
   5. Jupiter
2. Which of the following Laws would you use to explain to this student that their reasoning is incorrect?
   1. Newton’s 3rd
   2. Kepler’s 2nd
   3. Newton’s Law of Gravity
   4. Kepler’s 3rd
   5. Newton’s 2nd

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1. Kepler’s second law says “a line joining a planet and the Sun sweeps out equal areas in equal amounts of time.” Which of the following statements means nearly the same thing?
   1. Planets move farther in each unit of time when they are closer to the Sun.
   2. Planets move equal distances throughout their orbit of the Sun.
   3. Planets move the same speed at all points during their orbit of the Sun.
   4. Planets move slowest when they are moving away from the Sun.
   5. Planets move fastest when they are moving toward the Sun.
2. According to Kepler’s Second Law of Planetary Motion, a planet with an orbit like Earth’s would
   1. move faster when further from the Sun.
   2. move slower when closer to the Sun.
   3. experience a dramatic change in orbital speed from month to month.
   4. experience very little change in orbital speed over the course of the year.
   5. none of the above.

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The planet in the orbit shown in the drawing at right obeys Kepler’s Laws. Use this drawing to answer the next four questions.

**D**

**A**

**B**

**C**

1

1

1

1

2

2

2

2

1. During which portion of the planets orbit “**B**”, “**C**”, or “**D**”, would the planet take the same amount of time as it took for the portion of the orbit identified with letter “A”? Answer “E” if you think the planet took the same amount of time to travel through ALL of the portions of the motion (**A**, **B**, **C**, and **D**).
2. During which part of the planet’s orbit (**A**, **B**, **C**, or **D**) would the planet move with the greatest speed? Answer “**E**” if you think the planet travels with the same speed during ALL of the portions of the motion (**A**, **B**, **C**, and **D**).
3. During how many portions of the planet’s orbit (**A**, **B**, **C** and **D**) would the planet be speeding up the entire time?
4. Only during one of the portions shown.
5. During two of the portions shown.
6. During three of the portions shown.
7. During four of the portions shown.
8. None of the above.
9. During how many segments of the planet’s orbit (**A**, **B**, **C** and **D**) would the planet be slowing down the entire time?
   1. Only during one of the portions shown.
   2. During two of the portions shown.
   3. During three of the portions shown.
   4. During four of the portions shown.
   5. None of the above.
10. During which of the portions of the planet’s orbit would the planet experience an increase in speed for at least a moment?
11. Only during one of the portions shown.
12. During two of the portions shown.
13. During three of the portions shown.
14. During four of the portions shown.
15. None of the above.

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A

B

C

The planet in the orbit shown in the drawing at right obeys Kepler’s Laws. Use this drawing to answer the next two questions.

1. Which of the planets shown would experience the greatest change in speed?
2. Which of the planet orbits is least like the Earth’s orbit around the Sun?