

Astronomy Review Package Answer Section

PROBLEM

1. $1 \text{ AU} = 150\,000\,000 \text{ km}$

$$\frac{222\,000\,000}{150\,000\,000}$$

$$= 1.52 \text{ AU}$$

The distance from Mars to the Sun is 1.52 AU.

2. $3 \times 10^5 \text{ km/s} \times 60 \text{ s/min} \times 15 \text{ min} = 2.7 \times 10^8 \text{ km}$

Light can travel $2.7 \times 10^8 \text{ km}$ in 15 minutes.

3. $4.85 \times 10^{13} \text{ km}$

4. $s = d \div t$

$$t = d \div s$$

$$t = 778\,000\,000 \text{ km} \div 300\,000 \text{ km/s}$$

$$t = 5187 \text{ s}$$

$$t = 5187 \text{ s} \div 60 \text{ s/min}$$

$$t = 86.4 \text{ min}$$

It would take approximately 86 minutes.

5. $s = d \div t$

$$t = d \div s$$

$$t = 150\,000\,000 \text{ km} \div 300\,000 \text{ km/s}$$

$$t = 500 \text{ s}$$

$$t = 500 \text{ s} \div 60 \text{ s/min}$$

$$t = 8.3 \text{ min}$$

It would take approximately 500 seconds or 8.3 minutes.

SHORT ANSWER

- Retrograde motion is the apparent slowing, reversal, and then looping of a planet in its path. It occurs because the Earth travels around the Sun faster than other planets such as Mars, Jupiter, and Saturn.
- The Earth orbits around the sun following an elliptical path (similar to a flattened circle). The sun is not the centre of the ellipse, but is one of two focal points. It takes approximately $365 \frac{1}{4}$ days to complete one revolution.

8. Spring tides are very high tides that are caused during new and full moon phases when the Sun, Moon and Earth are in a line and the gravitational pull is very strong.

Neap tides are weaker tides that occur during the first and third quarter phases of the moon, when the Sun and Moon are perpendicular to each other with respect to the Earth. These are weaker because the gravitational pull of the Sun somewhat counteracts the pull of the Moon on the oceans.

9. Copernicus devised a heliocentric, or sun-centred model of the universe. He likely did not publish his work because he feared that he would upset the Catholic Church, although he claimed the reason was that the model needed further study.
10. The Northern Hemisphere is tilted towards the Sun in July and away from the Sun in January.
11. Mercury is close to the Sun, giving it very hot daytime temperatures. Because of the lack of atmosphere, no heat is trapped and the nightside is exposed to the extreme cold of space.
12. Rotation is the spinning of an object around an axis, whereas revolution is the circular or elliptical motion of an object usually around another object. The time for one rotation on Earth is about 24 hours or one day. It takes the Earth much longer to complete one revolution around the Sun. Specifically, the time for one revolution of the Earth is about 365 days or one year.
13. The density of Saturn is less than the density of water. This means, if you had enough water, Saturn would float in it.
14. Earth's atmosphere is unique because it contains mostly nitrogen, oxygen, and water vapour. The Earth also has an ozone layer which acts to filter some of the harmful radiation from the Sun. The atmosphere keeps the Earth's temperatures relatively constant. These conditions are ideally suited to promote the origin of life.
15. Precession is the changing direction of the Earth's axis. The axis traces a circle every 26 000 years. One effect of precession is the changing of the North Celestial Pole; the pole is currently close to Polaris, but in another 12 000 years, it will be very close to Vega.
16. The stars at the end of the bowl located farthest from the handle point north towards Polaris.
17. The zodiac is a group of constellations that is mostly named after animals. As observed from Earth, the planets move through the constellations of the zodiac.
18. Kepler explained planetary motion without mathematical errors. He believed in a heliocentric model of the solar system. Kepler's laws of planetary motion include:
 1. The planets travel in elliptical orbits around an off centre Sun, with the Sun as one of the focal points.
 2. The speed of a planet's orbit depends on its distance from the Sun. When a planet is close to the Sun it moves faster.
 3. The farther a planet is from the Sun, the longer its orbit.
19. The bright skies of the city allow only the brightest stars; thus, it is easier to find the general outlines of the constellations.
20. When measuring the Moon and Sun's diameter from Earth, only the apparent diameter is measured. The two objects have the same apparent diameter, but their actual diameter is very different. The Sun is much larger but appears to have the same diameter as the Moon because it is much farther away.
21. Alpha Centauri is 4.3 light years away from Earth. Thus, it takes light from this star over 4 years to travel to Earth. We would not know until 4.3 years later that it had disappeared because light from the star would still continue to travel towards the Earth.
22. Star clusters can be categorized as either globular or open. Globular clusters are spherically shaped, tight groups of thousands of very old stars. Open clusters usually contain only a few hundred young stars and are nearly always found in spiral arms.

23. Possible answers may include
 - radar
 - parallax
 - triangulation
 - cephalid variables (standard candles)
 - red shifts
24. They are launched such that their paths are influenced by the gravitational pull of the planets along their route.
25. Proxima Centauri is 4.2 light years away. travelling at the speed of a space probe (about 60 000 km/h), it would take 80 000 years, which is far greater than a human lifespan. Additionally, scientists believe that there is not enough mass in the universe to provide sufficient rocket fuel, and even if there was, we would not have tanks large enough to carry it. Also, when we reached Proxima Centauri, we would likely have no way of stopping and/or returning home.
26. the tilt of the earth towards the sun affects the seasons. the more direct the sunlight is hitting a hemisphere, the warmer it will be in that hemisphere.
27. In summer, the northern regions are always in sunlight, as the northern part of the earth is tilted towards the sun.
28. see notes
29. see notes. A lunar eclipse is the earth's shadow on the moon, while a new moon is the shadow of the moon itself.