

**Worksheet answers**

1. How does this model help you understand the size of the Solar System?

*Open question*

2. What problems are there with a simple model like this?

*Orbits of the planets are not circular so the distances quoted are averages. The planets do not all orbit in the same plane.*

3. Where should you send a class volunteer to represent the nearest star, Proxima Centauri?

*Sydney, Singapore ...*

4. Your first destination is Saturn, 9.539 AU from the Sun. How far is this in kilometres?

*$1.43 \times 10^9$  km*

5. What measurement technique can be used to establish distances to planets in the Solar System?

*parallax*

6. Our galaxy, the Milky Way, is 100 000 light-years across and the Sun is 25 000 light years from the centre. How long would it take you to travel from Earth to the outer rim of the Milky Way if you were travelling at the speed of light?

*25 000 years*

7. If you wanted to travel to a neighbouring star, which one would be quicker to get to, the brightest star in our galaxy, Sirius, which is 8.5 million light-years away, or Proxima Centauri, 1.29 parsecs away?

*The distance to Sirius is  $8.50 \times 10^{13}$  km and Proxima Centuri is  $3.99 \times 10^{13}$  km, so Proxima Centuri would be quicker to reach.*

8. The Large Magellanic Cloud is 163 000 light years from the Milky Way, and the Small Magellanic Cloud 12 007 580 277 AU. Which is closest to our own galaxy?

*Large Magellanic Cloud:  $1.63 \times 10^{18}$  km*

*Small Magellanic Cloud:  $1.80 \times 10^{18}$  km*

*The Large Magellanic Cloud is closer.*

9. Some scientists predict that spacecraft powered by fusion technology will be capable of reaching speeds of 10% of the speed of light. How many years would it take to reach the Alpha Centauri star system, 4.36 light-years away?

*43.6 years*

10. At 10% of the speed of light. How many years would it take to reach the Large Magellanic Cloud?

*16 300 years*

11. You have discovered a new galaxy, and want to work out if it is possible to travel to it. You note distinctive, regular pulsations in the brightness of certain stars in this galaxy. What type of stars are these, and how can they help establish distance to this galaxy?

*They are Cepheid variables. The pulse rate of these stars is related to absolute brightness, so observations of apparent brightness can be used to calculate how far away a Cepheid is.*

12. What is the name given to a celestial object with a known brightness, used to establish distances in astronomy?

*standard candle*

13. A new supernova event has been discovered and imaged by ground-based telescopes. Astronomers believe this event can be used to measure distance to the host galaxy. What type of supernova is this called?

*type 1a supernova*

14. What methods can astronomers use to establish distance to a galaxy where a supernova event occurs?

*Since type 1a supernovae all reach the same maximum brightness, the distance/brightness relationship can be used to work out how far away it is.*

15. Why is the study of supernovae remnants important to our understanding of the Universe?

*Heavy elements, that may be included in planetary objects, are produced in supernova explosions.*