Worksheet answers

The following questions relate to the presentation, *Measuring distance*. Questions start at slide 3:

1. [slide 3] What makes us think that a particular object is closer to us?

   open question

2. [slide 5] How was this scale diagram produced in the first place?

   open question

3. [slide 6] What is different between the two images?

   Background stars are in different positions.

4. [slide 7] What is different between the two images?

   Nothing, background stars are in the same position.

5. [slide 8] What do the changes in the background tell us about how far away we are from an object?

   open question

6. [slide 10] What do you notice about the position of the soccer ball against its background as the view is alternated between the left and right players? Describe the effect (of parallax).

   The soccer ball changes its position against the background wall when alternating between the left and right player.

7. [slide 11] What do you notice about the effect (of parallax) when the soccer ball is moved further away from the observer?

   The parallax effect seems to be less when the soccer ball is further away from the observer, and greater when the soccer ball is closer to the observer.

8. [slide 12] What is the effect of moving the observers further apart?

   The further apart the players, the greater the effect.

9. How can parallax be used to measure how far away an object is?

   The magnitude of the parallax effect is related to how close the object is, as demonstrated by the slides and practical activity.

10. [slide 14] How does the distance between observer and object affect parallax?

    The further away an object is, the smaller the apparent movement against the background.

11. [slide 15] Why does Mars appear in the same position to both observers?

    Mars is further away than the Moon.

12. [slide 16] How can we increase the parallax for very distant objects, such as stars?

    Find a way to move observation positions further apart.

13. [slide 16] How can the measurement of distant stars be further improved?

    There is a limit to how far apart the observation points can be placed, although satellites have been used to extend the distance. However, for objects at further distances the apparent movement or parallax angle becomes too small to be easily measured.

14. [slide 19] Why might stars be of different brightness?

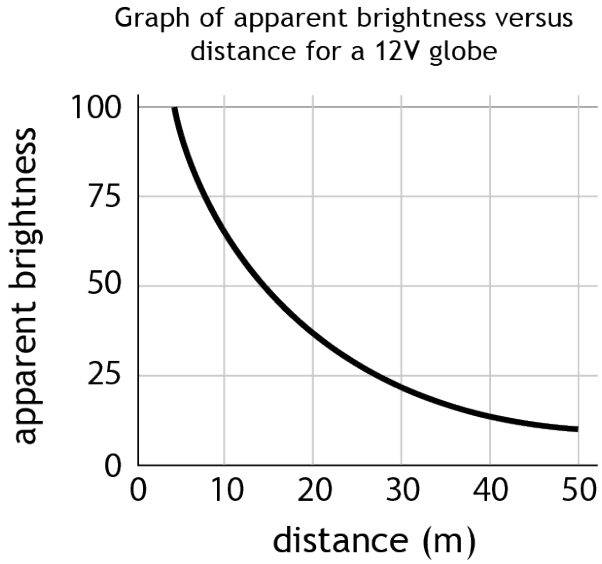
    open question

15. [slide 20] What happens to the brightness of the globe as it is moved further away?

    As the globe recedes it seems less bright, but the amount of light it gives out stays the same! There is a difference between absolute brightness and apparent brightness.

16. Write down what is meant by absolute brightness and apparent brightness.

    Absolute brightness is the brightness of a star seen from an unchanging standard distance (by convention this is 10 parsecs), while apparent brightness changes as you get further away, or as seen from Earth.



17. Using the graph above, calculate:

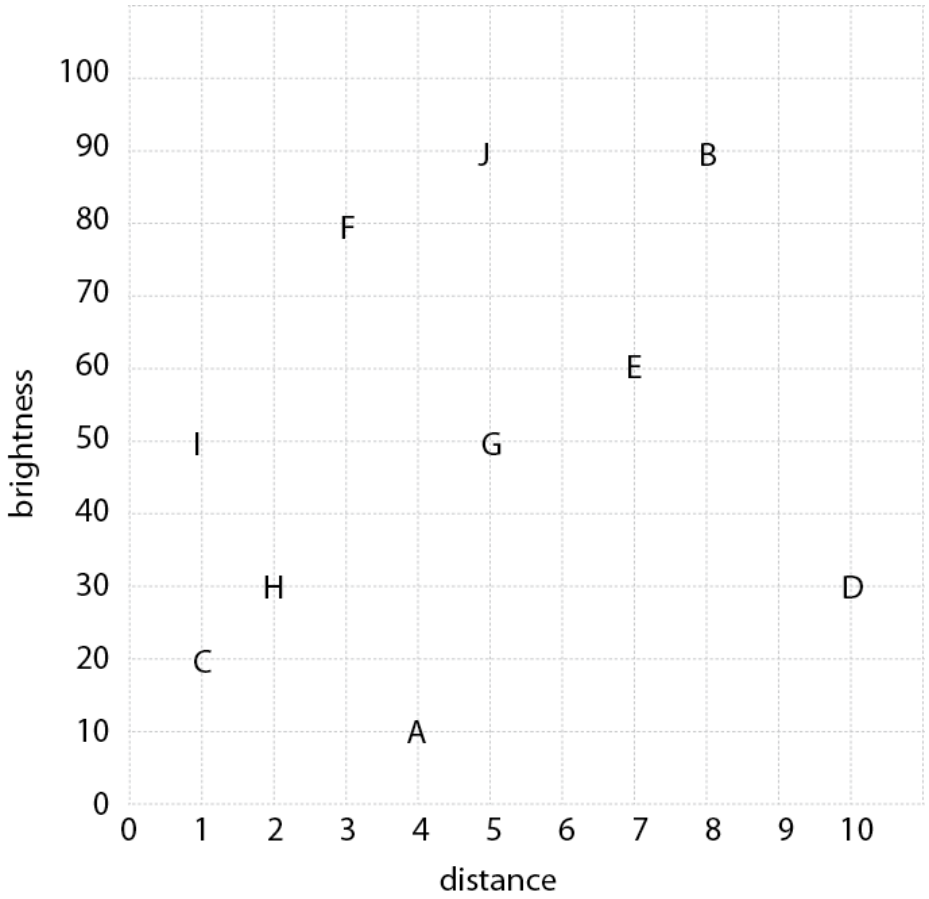
    the brightness of a globe 30 m from an observer *about 20* .....

    the distance to a globe of observed (or apparent) brightness 40 *about 18 m* .....

18. [slide 21] What must we do to compare the absolute brightness of different globes?

    We need to know the distance to each globe and its apparent brightness.

19. [slide 23] Plot values for brightness and distance on the grid below.



20. [slide 23] Is there a simple pattern connecting the brightness of stars to distance from us?

    no

21. What affects the apparent brightness of a star? (Hint: Think about the globe, and think about the same experiment using different globes.)

    The absolute brightness (eg 100 W globe or 40 W globe), and distance from the observer.

22. If we knew the absolute brightness could we work out the distance from our observations of the apparent brightness?

    Yes. The apparent brightness can be compared to the absolute brightness to work out how far away the star is.

23. How might astronomers determine the absolute brightness of distant objects (open question)?

    open question

24. [slide 26] How does this help to measure how far away a Cepheid variable is?

    The absolute brightness can be calculated from the pulse rate. Apparent brightness is measured and compared to absolute brightness to work out the distance.

25. [slide 27] Which of the two stars is closer? How did you work it out?

    The star with greater apparent brightness is closer since they pulse at the same rate and so must have the same absolute brightness.

26. [slide 29] Why are standard candles so important to astronomers?

    Astronomers use standard candles to determine absolute brightness of objects. By comparing this with apparent brightness, as observed from Earth, they begin to measure distances across the Universe.

27. [slide 30] Can you guess why this system of measurement is called the 'cosmic distance ladder'?

    Each step in measurement proceeds from the one before.