

Worksheet: Using Cepheid Variable Stars to Measure Distances to other Galaxies



Q1: *T* Crucis is a Cepheid variable star in the constellation Crux. It has a period of variation of 6.7 days. Calculate its mean absolute magnitude, giving your answer to 2 significant figures.

A -2.0

B -8.7

C -3.7

D -6.1

E -4.3

Q2: The mean absolute magnitude of a Cepheid variable star is related to its period of variation by the formula $M = a(\log_{10}(P) - 1) + b$, where M is the mean absolute magnitude of the star, P is its period, and a and b are constants that have to be determined experimentally.

The following table shows the mean absolute magnitude and period for two Cepheid variable stars.

Star	Period (Days)	Mean Absolute Magnitude
Star A	15.9	-4.54
Star B	28.9	-5.17

► Use the data in the table to find the value of a . Give your answer to 3 significant figures.

A -2.43

B -37.4

C 2.43

D 8.21

E 37.4

► Use the data in the table to find the value of b . Give your answer to 3 significant figures.

A -4.05

B 2.99

C -5.03

D -2.89

E -12.1

Q3: Which of the following statements describes the property of Cepheid variable stars that makes it possible to determine how far away they are when parallax cannot be used as a distance-measuring technique?

- A The mean absolute magnitude of Cepheid variable stars is related to their period of variation.
- B The absolute magnitude of Cepheid variable stars in the x-ray range is constant.
- C The peak absolute magnitude of Cepheid variable stars is related to their mass.
- D The mean absolute magnitude of Cepheid variable stars is related to their mean surface temperature.
- E The mean absolute magnitude of Cepheid variable stars is related to their mass.

Q4: *X Sagittarii* is a Cepheid variable star in the constellation Sagittarius. It has a period of 7.0 days.

► Calculate the mean absolute magnitude of the star. Give your answer to 2 significant figures.

- A -2.0
- B -6.1
- C -3.7
- D -8.8
- E -4.3

► The star has a mean apparent magnitude of 4.6. Calculate how far away the star is from Earth in parsecs. Give your answer to 2 significant figures.

A 23 pc

B 15 pc

C 460 pc

D 120 pc

E 7 pc

Q5: A Cepheid variable star is found to be at a distance of 33.2 kpc from Earth. It has a mean apparent magnitude of 12.4. What is the mean absolute magnitude of the star? Give your answer to 3 significant figures.

A 3.60

B 30.0

C 9.79

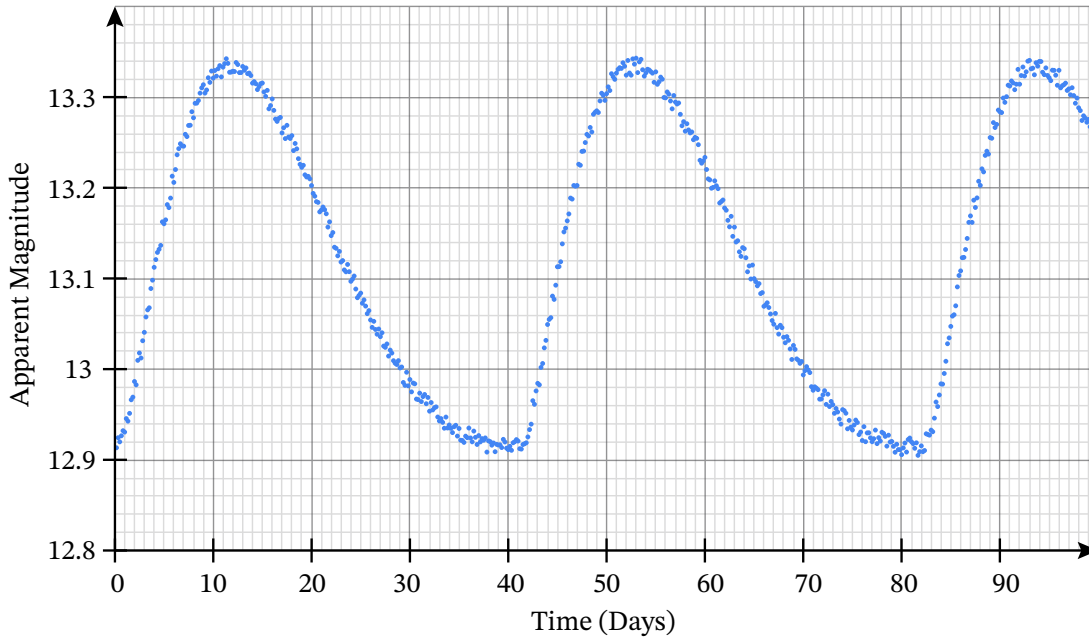
D -5.21

E -15.0

Q6: Using the formula $M = -2.4(\log_{10}(P) - 1) - 4.1$, where M is the mean absolute magnitude of a Cepheid variable star and P is its period, calculate the expected mean absolute magnitude for a Cepheid variable star that has a period of 26 days. Give your answer to 2 significant figures.

- A -9.5
- B -5.1
- C -7.5
- D -4.4
- E -1.0

Q7: The figure shows the apparent magnitude of a Cepheid variable star over time.



► What is the period of variation of the star? Give your answer in days to the nearest day.

A 12 days

B 81 days

C 94 days

D 41 days

E 37 days

► Using the formula $M = -2.4(\log_{10}(P) - 1) - 4.1$, where M is the mean absolute magnitude of a Cepheid variable star and P is its period, calculate the mean absolute magnitude of the star. Give your answer to 2 significant figures.

A -8.0

B -2.5

C -10.0

D -5.6

E -1.5

► The mean apparent magnitude of the star is 13.1. How far away from Earth is the star? Give your answer to 2 significant figures.

A 44 kpc

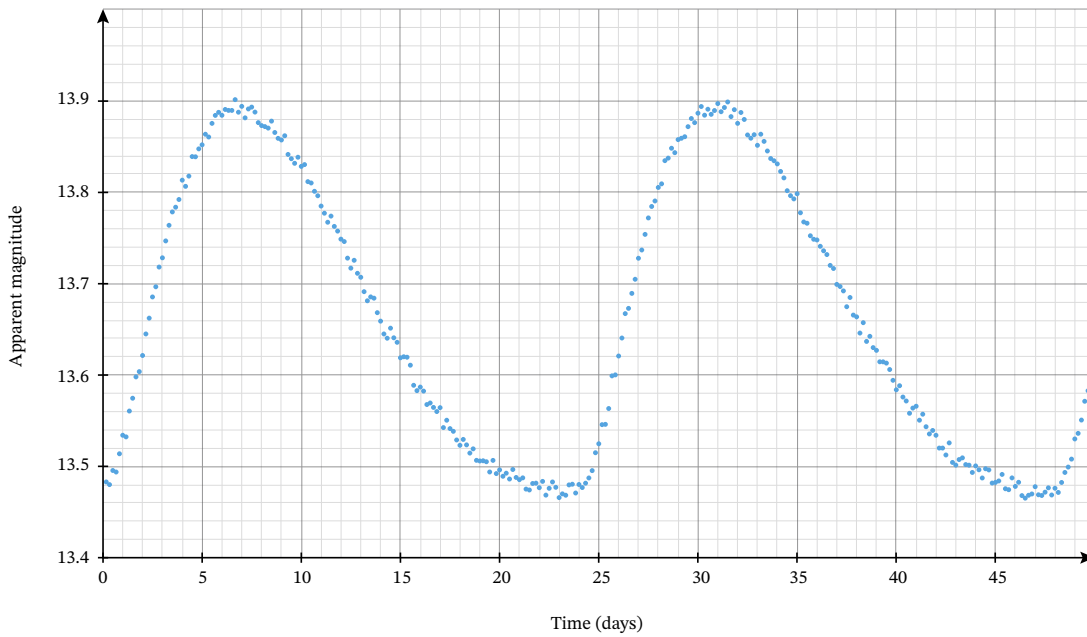
B 580 kpc

C 170 pc

D 54 kpc

E 0.32 kpc

Q8: The figure shows the apparent magnitude of a Cepheid variable star over time. What is the period of variation of the star? Give your answer in days to the nearest day.



- A 7 days
- B 24 days
- C 43 days
- D 49 days
- E 20 days