

0160 440 4793

Course and assignment number:

Computer Marked Assignment

S357 44

Make sure you know how to use the CMA form: detailed instructions are given in your student handbook (or supplement).

Covering: Units 13–15

You are strongly advised to attempt every question in this assignment. If you do not wish to answer a question, pencil across the 'don't know' cell ('?').

Cut-off date:

Friday 19 September 1997

If you think that a question is unsound in any way, pencil across the 'unsound' cell ('U') in addition to pencilling across either an answer cell or the 'don't know' cell.

Note For each question you must pencil across either the required number of answer cells or the 'don't know' cell.

01992 503 679

Q1 to Q4 These questions are concerned with the information that can be deduced from astronomical observations of a particular red line in an atomic spectrum. Laboratory measurements show that the wavelength of the line is 656.3 nm. However, when the same line is observed in light coming from a certain distant galaxy, the rotation axis of which is perpendicular to the line of sight of the observer, it is found that at the extreme right-hand edge of the galaxy the wavelength of the line is 726.6 nm, whereas at the extreme left-hand edge of the galaxy it is 718.4 nm. Assume that the diameter of the distant galaxy is 60 000 light-years and take the value of the Hubble parameter at the present epoch to be $1.6 \times 10^{-18} \text{ s}^{-1}$. (You are only expected to work to first order in the redshift.)

Q1 Which item in the key is closest to the wavelength of the line that would be measured if the effects of the galaxy's rotation were subtracted? Pencil across one cell in row 1.

KEY for Q1

- | | |
|------------|------------|
| A 718.4 nm | D 727.6 nm |
| B 722.5 nm | E 734.8 nm |
| C 726.6 nm | F 796.9 nm |

Q2 Which item in the key is closest to the period of rotation of the galaxy? Pencil across one cell in row 2.

KEY for Q2

- | |
|---------------------------|
| A 1.2×10^8 years |
| B 7.5×10^7 years |
| C 6.0×10^7 years |
| D 4.6×10^7 years |
| E 3.3×10^7 years |

Q3 Which item in the key is closest to the distance between the galaxy and the Earth? (You may assume that Hubble's law is applicable.) Pencil across one cell in row 3.

KEY for Q3

- | |
|---------------------------------|
| A 0.3×10^9 light-years |
| B 0.9×10^9 light-years |
| C 1.4×10^9 light-years |
| D 1.9×10^9 light-years |
| E 3.0×10^9 light-years |
| F 4.0×10^9 light-years |
| G 5.0×10^9 light-years |

Q4 Which one of the statements in the key about the galaxy is true? Pencil across one cell in row 4.

KEY for Q4

- | | |
|--|---|
| A The galaxy is so far beyond the Local Group that Hubble's law will not provide a good method of working out the distance of the galaxy. | X |
| B The galaxy is outside the Local Group but sufficiently close that Hubble's law provides a good method of working out the distance of the galaxy. | B |
| C Because second-order terms in the redshift have been ignored, Hubble's law will not provide a good method of working out the approximate distance of the galaxy. | X |
| D Because of the motion of the Earth, Hubble's law will not provide a good method of working out the approximate distance of the galaxy. | X |
| E The galaxy is so far away that it must be part of the Milky Way, which is known to be well described by Hubble's law. | X |
| F The galaxy is part of the Local Group, so it is probably well described by Hubble's law. | X |
| G The galaxy is part of the Local Group, so it is probably not well described by Hubble's law. | X |