

PART I

Q1 Figure 1 shows three regions of the Sun, drawn approximately to scale, and labelled A, B and C. In which region(s) do photons travel in a random walk? Select one option from the key and pencil across *one* cell in row 1.

KEY for Q1

- A In all three regions
- B In regions A and B
- C In regions A and C
- D In regions B and C
- E Only in region A
- F Only in region B
- G Only in region C

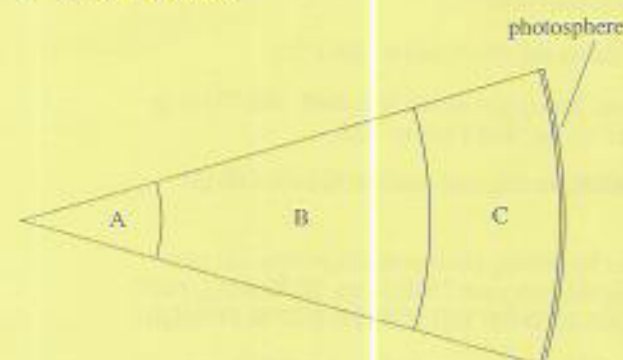


Figure 1

Q2 The parallax of the star G158-27 is 0.213 arcsec. Calculate the distance from the Earth to this star. Select from the key the value closest to yours, and pencil across *one* cell in row 2. Take notice of the units!

KEY for Q2

- A 4.69 AU
- B 4.69 light years
- C 15.3 parsecs
- D 15.3 light years
- E 0.213 parsec
- F 0.213 light year
- G 4.22 light years
- H 4.22 parsecs

Q3 The key lists seven statements about radiative processes that are relevant to different components of the interstellar medium. Select from the key the *two* statements that are TRUE, and pencil across *two* cells in row 3.

KEY for Q3

- A The distribution of molecular hydrogen in dense clouds can be mapped by 21 cm radio emission. ☒
- B Extinction by interstellar dust is strongest in the infrared part of the spectrum. ☒

- C HII regions show optical emission arising from electronic transitions. ☒
- D Circumstellar dust shells emit strongly in the ultraviolet by thermal emission from dust. ☒
- E The warm intercloud medium can be mapped using the infrared emission from the vibrational transition lines of the CO molecule. ☒
- F Electrons passing through the magnetic field of the Galaxy produce synchrotron emission that shows sharp emission lines at radio and microwave wavelengths. ☒
- G The collisional excitation of the rotational states of the CO molecule can occur in dense clouds with temperatures of 10 K to 20 K. ☒

Q4 Kepler's third law relates a planet's orbital period about the Sun to the planet's average distance from the Sun. Which *one* of the statements in the key is a correct expression of this law? Pencil across *one* cell in row 4.

KEY for Q4

- A The planet's orbital period is proportional to its average distance from the Sun.
- B The planet's orbital period is proportional to the square of its average distance from the Sun.
- C The planet's orbital period is proportional to the cube of its average distance from the Sun.
- D The square of the planet's orbital period is proportional to the cube of its average distance from the Sun. ☒
- E The square of the planet's orbital period is proportional to its average distance from the Sun.
- F The cube of the planet's orbital period is proportional to its average distance from the Sun.
- G The cube of the planet's orbital period is proportional to the square of its average distance from the Sun.

Q5 Which *two* of the statements in the key about impact craters are FALSE? Pencil across *two* cells in row 5.

KEY for Q5

- A Secondary craters are *not* randomly distributed around the primary impact. ☒
- B Unless secondary craters are recognized and excluded from crater-counting statistics, the age of a lunar surface can appear anomalously old. ☒
- C Impact craters on icy satellites do not show central peaks, whatever the size of the crater. ☒
- D Some Martian craters show ejecta patterns consistent with mobilization of ground water or melting of permafrost ice on impact. ☒
- E All craters on Mars are of impact origin. ☒
- F Large areas of the planet Mercury are heavily cratered. ☒