



Figure 1 For use with Q4.

Q6 Which two of the statements in the key are *false*? Pencil across *two* cells in row 6.

KEY for Q6

- A The virial theorem does not apply to spiral galaxies because the dominant internal motions are not random. ✓
- B Compared with irregular galaxies, elliptical galaxies have a greater proportion of their mass in interstellar gas and dust. ✗
- C On average, stars in elliptical galaxies are older than those in spiral galaxies. ✓

- D Galaxies observed at very large distances have a greater proportion of blue stars than nearby galaxies. ✓
- E The greater the luminosity of a spiral galaxy, the broader the 21-cm emission lines are in its radio spectrum. ✓
- F Collisions and mergers between galaxies are likely to produce slowly-rotating ellipticals. ✗
- G Models of galaxy formation indicate that they formed independently of any dark matter that may have been present. ✗

PART B

This part relates to Book 3, Chapters 3 and 4, and carries 50% of the marks for this assignment.

Q7 One of the features that distinguishes an active galaxy from a normal galaxy is its spectrum. Which two of the statements in the key are *false*? Pencil across *two* cells in row 7.

KEY for Q7

- A Active and starburst galaxies have emission lines in their optical spectra, but normal galaxies do not. ✗
- B Active and starburst galaxies have emission lines in their optical spectra that are stronger than those in the optical spectra of normal galaxies. ✓
- C Active galaxies generally have optical emission lines that are much broader than those in the spectra of starburst and normal galaxies. ✓
- D Active and starburst galaxies have overall spectra with significant radiation at wavelengths other than the optical. ✓
- E Most active and starburst galaxies emit strongly at wavelengths of around 100 μm . ✓
- F Active and starburst galaxies emit strongly at X-ray wavelengths. ✗

Q8 If the radiation from an active galaxy varies on a one-week time-scale, what is the upper limit on the diameter of its active galactic nucleus (AGN)? Select from the key the value closest to yours, and pencil across *one* cell in row 8.

KEY for Q8

- A 52 pc
- B 1.0 pc
- C 0.02 pc
- D 0.006 pc
- E 8×10^{-4} pc
- F 2×10^{-4} pc
- G 1×10^{-4} pc

Q9 Active galaxies are currently understood as being normal spiral or elliptical galaxies with the addition of an active galactic nucleus (AGN) in their centre. Which two of the statements about AGNs in the key are *false*? Pencil across *two* cells in row 9.

KEY for Q9

- A Many AGNs exhibit variability. ✓
- B An AGN has a high luminosity. ✓
- C A typical AGN is enormous compared to the distance from the Sun to the nearest stars. ✗
- D An AGN can account for the observed properties of Seyfert galaxies, quasars, BL Lac objects, and the lobes of radio galaxies. ✓
- E A massive black hole, accreting about 1% of the mass of the host galaxy per year, is needed to account for the power of the engine in the AGN. ✗
- F If quasars are very distant they must have high luminosity AGNs in order to be visible. ✓