Q5 The light from very distant galaxies is bluer than that from nearby galaxies (after the effects of redshift are taken into account). What might be the *two* most important factors that lead to this observation? Pencil across *two* cells in row 5.

KEY for Q5

A The first generation of stars was bluer than later generations.

B Young star populations are dominated by the brightest main sequence stars.

C In many types of galaxy, the rate of star formation has declined since soon after the galaxy formed.

D Young galaxies are dominated by blue supergiants.

E The rate of star formation in irregular galaxies does not vary enormously over the lifetime of the galaxy.

F Few low mass main sequence stars formed in young galaxies.

Q6 Which *one* statement in the key, about galaxy interactions, is *false*? Pencil across *one* cell in row 6.

KEY for Q6

A In an elliptical galaxy, the evolution of a triaxial distribution of mass into an oblate spheroidal distribution, requires gravitational interaction with another galaxy.

B The features of many peculiar galaxies are the result of gravitational interactions between galaxies.

C The Antenna Galaxy (NGC 4038-4039) could well be the result of a collision between two spiral galaxies.

D Mergers in the densely packed centres of large clusters of galaxies might have led to the cD galaxies found in such regions.

E It is plausible that galaxy mergers have increased the proportion of galaxies that are of the elliptical class.

F When galaxies collide, at most an extremely small fraction of the stars collide.

PART B

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

Q7 What is the main distinction between the optical spectral lines from a starburst galaxy, and those from a normal galaxy? Pencil across *one* cell in row 7. NB: Not all of the statements in the key are necessarily true.

KEY for Q7

A The spectral lines from a starburst galaxy are more red-shifted than those from a normal galaxy.

B A normal galaxy spectrum exhibits few emission lines, whereas a starburst galaxy spectrum exhibits a 'forest' of lines.

C The spectral *emission* lines of a normal galaxy are *narrower* than those from a starburst galaxy.

D The spectral *absorption* lines of a normal galaxy are *wider* than those from a starburst galaxy.

E The spectral *emission* lines of a normal galaxy are *weaker* than those from a starburst galaxy.

F The spectral *absorption* lines of a normal galaxy are *stronger* than those from a starburst galaxy.

Q8 What is thought to be the main physical distinction between a starburst galaxy and an active galaxy, which gives rise to the differences in their characteristic properties? Pencil across *one* cell in row 8. NB: Not all of the statements in the key are necessarily true.

KEY for Q8

A A starburst galaxy has a burst of star formation throughout the galactic disc, whereas the burst of star formation in an active galaxy extends throughout only the nuclear bulge.

B A starburst galaxy has a burst of star formation in an extended region in the galactic disc, whereas an active galaxy has a tiny central region that emits enormous power.

C A starburst galaxy has a black hole at its centre with a mass of about a million solar masses, whereas an active galaxy has a far more massive central black hole.

D An active galaxy has powerful magnetic fields and energetic electrons emanating from its central regions, whereas a starburst galaxy does not.

E An active galaxy contains far less gas and dust than a starburst galaxy.

F The internal motions throughout an active galaxy are far faster than those throughout a starburst galaxy.

Q9 If there is a black hole of mass $10^6 M_\odot$ at the centre of our galaxy, what is the *theoretically maximum possible* luminosity of any accretion disc surrounding it? Choose from the key the value closest to yours, and pencil across *one* cell in row 9.

KEY for Q9

A $3 \times 10^2 L_\odot$

B $3 \times 10^4 L_\odot$

C $3 \times 10^6 L_\odot$

D $3 \times 10^8 L_\odot$

E $3 \times 10^{10} L_\odot$

F $3 \times 10^{12} L_\odot$

G $3 \times 10^{14} L_\odot$

Q10 If the age of the Universe is 15 billion years, then how many billion years after the Universe came into being do we see the most distant galaxies in a borehole survey that extends out to 2 200 Mpc? Choose from the key the value closest to yours, and pencil across *one* cell in row 10.

KEY for Q10

A 8 billion years

B 6 billion years

C 4 billion years

D 2 billion years

E 1 billion years

F 0.5 billion years