

Q5 For the galaxy shown in Figure 1, which item in the key best matches its classification according to the Hubble scheme?

KEY for Q5

- A E0-E3 ☒ E SBa or SBb
 B E4-E7 ☒ F SBc ☒
 C Sa or Sb ☒ G Irr ☒
 D Sc ☒

Pencil across *one* cell in row 5.

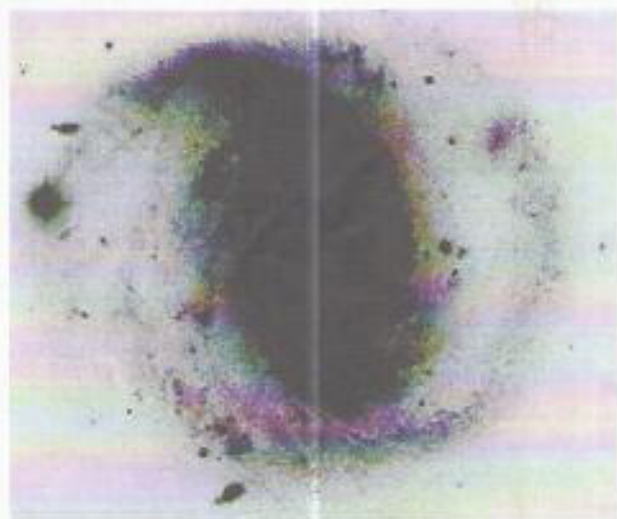


Figure 1

Q6 Which *one* of the following types of data, or laws, is used to obtain the mass of many spiral galaxies?

KEY for Q6

- A Rotation curves ☒
 B Hubble's law ☒
 C Velocity dispersion within the galaxy ☒
 D Brightness of standard candles ☒
 E Tully-Fisher relation ☒
 F X-rays from galactic halos ☒

Pencil across *one* cell in row 6.

Q7 A spectral line from a distant galaxy is observed to have a wavelength of 520.0 nm and the equivalent spectral line identified in the laboratory has a wavelength of 500.0 nm. Calculate the distance to the galaxy, assuming $H_0 = 75 \text{ km s}^{-1} \text{ Mpc}^{-1}$. Select from the key the value closest to yours.

KEY for Q7

- A $6 \times 10^{-3} \text{ Mpc}$
 B $6 \times 10^{-2} \text{ Mpc}$
 C $1.6 \times 10^2 \text{ Mpc}$
 D $1.0 \times 10^3 \text{ Mpc}$
 E $1.6 \times 10^4 \text{ Mpc}$
 F $1.0 \times 10^5 \text{ Mpc}$

Pencil across *one* cell in row 7.

PART B

This part relates mainly to Book 3, Chapters 3 and 4, and carries 43% of the marks for this assignment.

Q8 What is the main distinction between the optical spectral lines from a starburst galaxy and those from a normal galaxy?

KEY for Q8

- A The absorption spectrum lines from a starburst galaxy are broadened with respect to those from a normal galaxy. ☒
 B The absorption spectrum lines from a starburst galaxy are narrower than those from a normal galaxy. ☒
 C The emission spectrum lines from a starburst galaxy are broadened with respect to those from a normal galaxy. ☒
 D The emission spectrum lines from a starburst galaxy are narrower with respect to those from a normal galaxy. ☒
 E The absorption spectrum lines from a starburst galaxy are brighter than those from a normal galaxy. ☒
 F The emission spectrum lines from a starburst galaxy are brighter than those from a normal galaxy. ☒

Pencil across *one* cell in row 8.

Q9 Which *two* of the features listed in the key do starburst and BL Lacertae objects normally have in common?

KEY for Q9

- A Absorption and emission spectrum lines. ☒
 B Rapid variability. ☒
 C Far-infrared excess emission. ☒
 D Most radiation from a very small region in the nucleus. ☒
 E A total energy output that is several times greater than that of a normal galaxy. ☒
 F Can be observed at very great distances. ☒

Pencil across *two* cells in row 9.

Q10 What is the Schwarzschild radius for an object whose mass is $10^6 M_\odot$? Choose from the key the value closest to yours.

KEY for Q10

- A $3 \times 10^{-10} \text{ m}$ D $3 \times 10^9 \text{ km}$
 B $3 \times 10^{-10} \text{ km}$ E $9 \times 10^{17} \text{ m}$
 C $3 \times 10^9 \text{ m}$ F $9 \times 10^{17} \text{ km}$

Pencil across *one* cell in row 10.

$$0.04 = 75 \times d$$

$$d = 0.04 / 75$$

$$d = 0.000533 \text{ Mpc}$$

$$d = 0.533 \text{ kpc}$$

$$d = 533 \text{ pc}$$

$$0.04 \times 10^6 \times 75$$

$$3000$$