ASTROPHYSICS

3-3 Quasars

1. A quasar:

- has radio emissions stronger than expected from an ordinary star

- has a visible spectrum containing very strong lines due to a very large redshift because it is 5000 to 10 000 light years away

- has a luminosity greater than a star and more like a galaxy

- has a size like that of a star

2. laboratory λ = 486 nm (= 486 x 10^{-9} m)

quasar λ = 540 nm (= 540 x 10^{-9} m)

$\Delta\lambda$ = (540 – 486) nm (= 54 nm = 54 x 10^{-9} m)

(a) redshift, $z = \frac{\Delta\lambda}{\lambda} = \frac{540 - 486}{486} = \frac{54}{486}$ = 0.11111 = 0.11 to 2 sf

(b) Ignoring relativistic effects v = zc = 0.11 x 3.00 x 10^{8} = 3.3 x 10^{7} ms^{-1}

3. (a) Its spectrum contains very strongly redshifted lines in the visible which give its velocity and hence its distance, from which its luminosity can be calculated to be greater than that of a star.

(b) Variations in its brightness of the order of years or less indicate that the diameter is only a few light years or less, i.e. smaller than a galaxy.

4. Supermassive black holes are believed to exist at the centre of certain galaxies because quasars are found in galaxies which are distorted. Black holes would emit jets of hot matter in opposite directions along their axis of rotation. Quasars are thought to be such black holes in action. We are seeing light from the matter becoming very hot due to compression as it nears the event horizon.