6. White light from the Sun is analysed to produce the following absorption spectrum.

The spectral lines are known as Fraunhofer lines.

(a) Some Fraunhofer lines are produced by the transition of electrons between energy levels in hydrogen atoms.

Some of the energy levels of the hydrogen atom are shown.

E_4 —————— $-0{\cdot}871 \times 10^{-19}$ J

E_3 —————— $-1{\cdot}36 \times 10^{-19}$ J

E_2 —————— $-2{\cdot}42 \times 10^{-19}$ J

E_1 —————— $-5{\cdot}45 \times 10^{-19}$ J

E_0 —————— $-21{\cdot}8 \times 10^{-19}$ J

(i) One of the Fraunhofer lines is due to the electron transition from E_1 to E_4.

Determine the frequency of the photon absorbed when an electron makes this transition. **3**

Space for working and answer

6. (a) (continued)

(ii) Calculate the wavelength of the photon absorbed. **3**

Space for working and answer

(iii) Determine the colour of the light absorbed during this electron transition. **1**

[Turn over

6. (continued)

(b) The spectral lines observed in the spectrum from a distant galaxy are redshifted. A galaxy known as NGC 6745 has a recessional velocity of $4{\cdot}51 \times 10^6$ m s^{-1}.

Calculate the redshift of the light from this galaxy. **3**

Space for working and answer

(c) The light from the majority of galaxies in the Universe is redshifted.

Explain how this evidence supports the Big Bang theory. **2**