7 **(a)** Some energy levels for the electron in an isolated hydrogen atom are illustrated in Fig. 7.1.

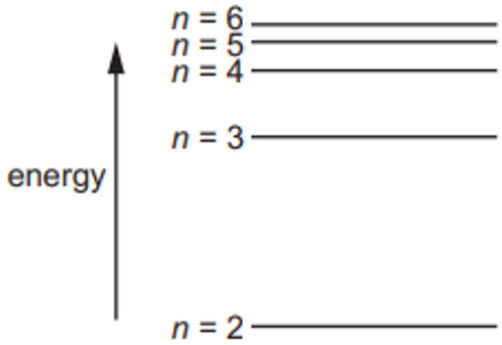

Fig. 7.1

Table 7.1 shows the wavelengths of photons that are emitted in the transitions to $n = 2$ from the other energy levels shown in Fig. 7.1.

wavelength / nm
412
435
488
658

Table 7.1

The energy associated with the energy level $n = 2$ is –3.40 eV.

Calculate the energy, in J, of energy level n = 3.

energy = ……... J [3]

(b) A beam of red light of intensity 160 W m^{-2} is incident normally on a plane mirror, as shown in Fig. 7.2. The wavelength of light is 7.0×10^{-7} m.

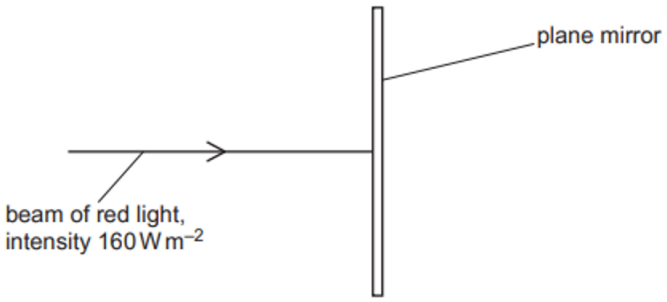

Fig. 7.2

All of the light is reflected by the mirror in the direction opposite to its original path.

The cross-sectional area of the beam is 2.5×10^{-6} m^2.

(i) Show that the number of photons incident on the mirror per unit time is 1.4×10^{15} s^{-1}.

[2]

(ii) Use the information in **(b)(i)** to determine the pressure exerted by the light beam on the mirror.

pressure = ... Pa [3]

(iii) The beam of red light in **(b)** is now replaced with a beam of blue light of the same intensity.

Suggest and explain whether the pressure exerted on the mirror by the beam of blue light is less than, the same as, or greater than the pressure exerted by the beam of red light.

……...

……...

……...

……. [2]

[Total: 10]