8 **(a)** Fig. 8.1 shows 5 energy levels A, B, C, D and E within an atom with E being the lowest energy state. An electron transition from level A to D results in the emission of a photon of light.

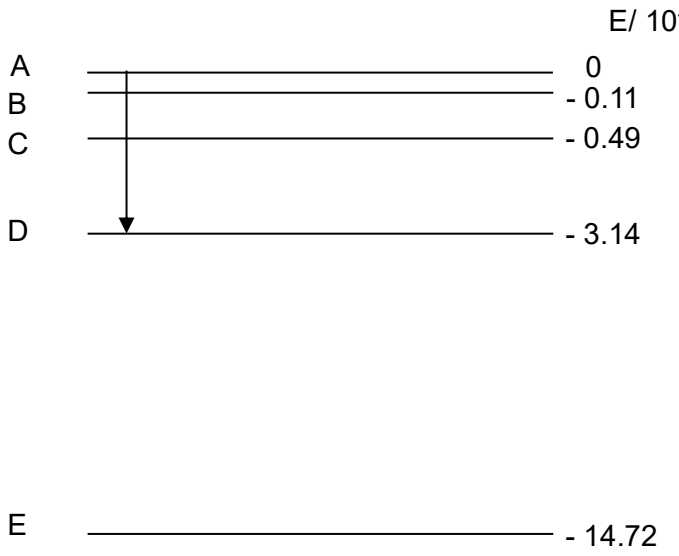


Fig. 8.1

(i) Deduce the type of electromagnetic radiation emitted resulting from the electron transition from A to D.

type of radiation is ..... [2]

(ii) The transition from A to D is a result of a collision between the cool gas atom and an electron having kinetic energy 9.38 eV.
Calculate the recoil speed of the electron after the collision. You may assume that the recoil speed of the atom is negligible.

speed = ... m s^{-1} [3]

(iii) The cool atom makes an collision with an electron of energy 1.44×10^{-18} J, indicate on Fig. 8.1 the possible electron transitions which result in photon emissions from the excited atom. Justify your answer.

.....

.....

..... [3]

(iv) Determine the maximum value of the wavelength of the photons that are emitted from the excited atom in (iii)

maximum wavelength = ... m [2]

(b) When the spectrum of γ radiation from a nucleus is examined, it is found that it too has a line emission spectrum. Suggest what can be deduced from this observation.

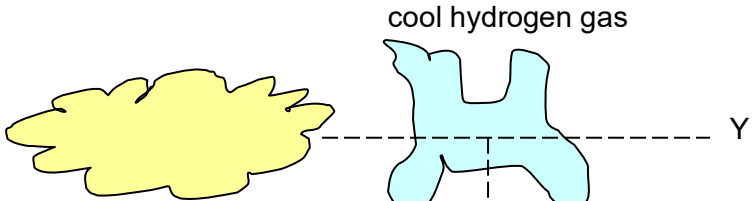
.....

.....

.....

..... [2]

(c) Fig. 8.2 shows a region of cool hydrogen gas surrounding a hot gas cloud emitting white light.



State and explain the type of hydrogen spectrum observed from

(i) Point X,

.....

.....

.....

..... [2]

(ii) Point Y,

.....

.....

.....

..... [2]

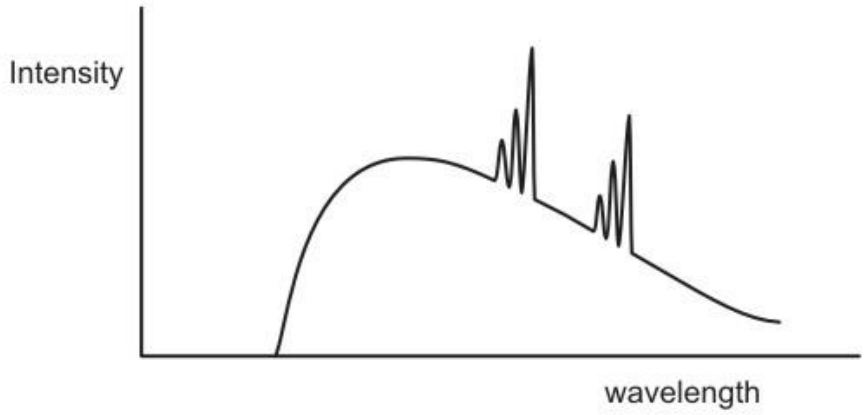
(d) The accelerating potential difference in a X-ray tube is 40 kV.

(i) Calculate the shortest wavelength of the X-ray photon emitted from the X-ray tube.

wavelength = ... m [2]

(ii) The X-ray spectrum produced is shown in Fig. 8.3.

Sketch, on Fig. 8.3, the X-ray spectrum that is produced when the accelerating potential difference is increased to 50 kV.



[2]

Fig. 8.3