

- 7 (a) For a particular gas, the emission and absorption spectra are obtained for the visible light spectrum.

State one similarity and one difference between the discrete lines of the absorption and emission spectra of this gas.

Similarity: .....

.....

Difference: .....

..... [2]

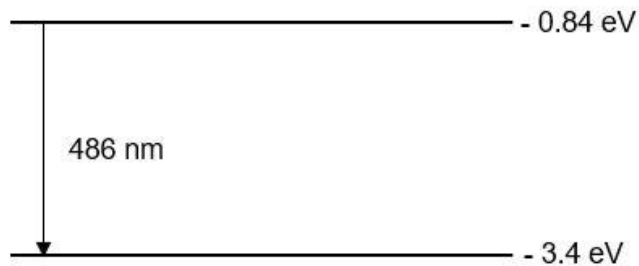
- (b) Fig. 7.1 gives information on three lines observed in the emission spectrum of hydrogen atoms.

wavelength / nm	energy of photon / eV
486	2.56
656	
1880	0.66

**Fig. 7.1**

- (i) Complete Fig. 7.1 and show your working clearly in the space below. [2]

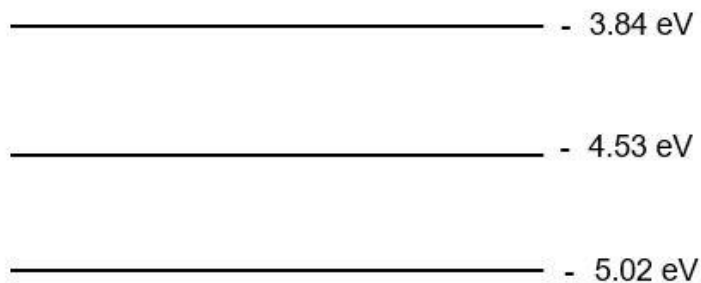
- (ii) Fig. 7.2 is a partially completed diagram to show energy levels of a hydrogen atom.



**Fig. 7.2**

On Fig. 7.2, draw an additional labelled energy level between the two given energy levels to account for the emission of the photons in Fig. 7.1 [1]

(c) Three of the energy levels of a lithium atom are shown in Fig. 7.3.



**Fig. 7.3**

One way to study the energy levels of an atom is to bombard the atom with electrons and measure the kinetic energies of the bombarding electrons before and after the collision. If a lithium atom which is originally in the  $-5.02$  eV level is bombarded with an electron of kinetic energy  $0.92$  eV, the scattered electron can have only two possible kinetic energies.

States these two kinetic energy values, and state what happens to the lithium atom in each case.

1<sup>st</sup> possible kinetic energy value: ..... eV

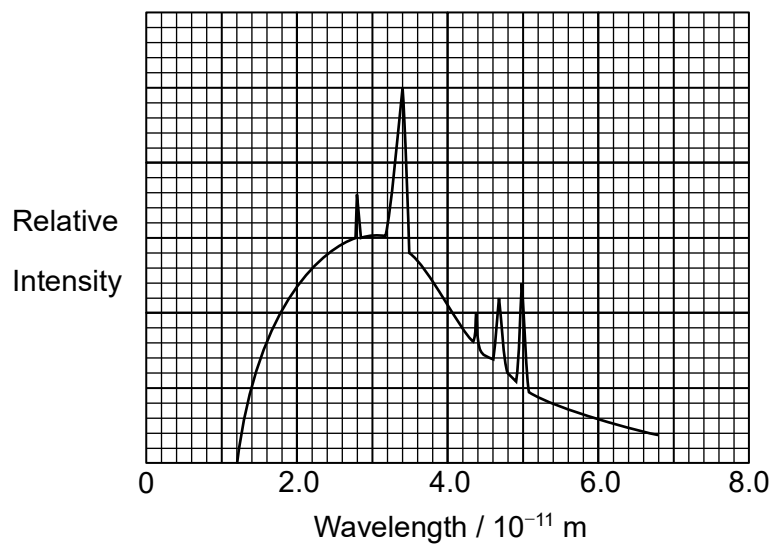
[1]

.....  
.....[1]

2<sup>nd</sup> possible kinetic energy value: ..... eV [1]

.....  
.....[1]

- (d) X-ray photons are produced in an X-ray tube when electrons are accelerated through a potential difference  $V_0$  towards a metal target. An X-ray spectrum is shown in Fig. 7.4.



**Fig. 7.4**

- (i) Explain how the characteristic X-ray photons are produced.

.....  
 .....  
 .....  
 ..... [2]

- (ii) Determine the minimum potential difference  $V_0$  applied across the X-ray tube.

$V_0 = \dots\dots\dots$  kV [2]

- (iii) The potential difference in (d)(ii) to accelerate the electrons is increased.

On Fig. 7.4, sketch the new spectrum obtained.

[1]

[Total: 14]

