7 **(a)** The emission spectrum of atomic hydrogen consists of a number of discrete wavelengths. Explain how this observation leads to an understanding that there are discrete electron energy levels in atoms.

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..... [2]

(b) Three electron energy levels in atomic hydrogen are represented in Fig. 7.1.

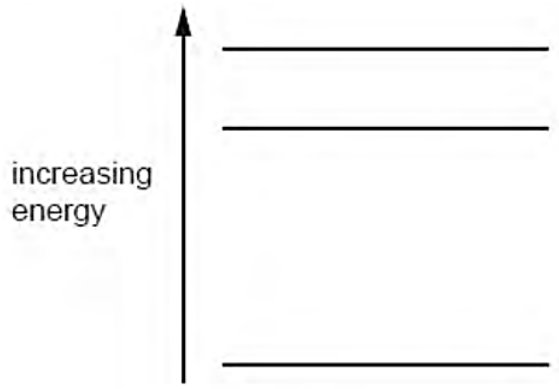

Fig. 7.1

The wavelengths of the spectral lines produced by electron transitions between these three energy levels are 486 nm, 656 nm and 1880 nm.

(i) On Fig. 7.1, draw arrows to show the electron transitions between the energy levels that would give rise to these wavelengths.
Label each arrow with the wavelength of the emitted photon. [3]

(ii) Calculate the maximum change in energy of an electron when making transitions between these levels.

energy = …… J [2]

(iii) When an electron undergoes transition, there is a change in momentum of the hydrogen atom.

1. Explain the origin of the change in momentum of the hydrogen atom.

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…… [2]

2. For the electron transition in **(ii)**, calculate the change in momentum of the hydrogen atom.

change in momentum = …… kg m s^{-1} [1]

[Total: 10]

Section B

Answer **one** question from this Section in the spaces provided.