

- 6 (a) **Fig. 6.1** shows the famous Orion Nebula, which is a large gas cloud in the Milky Way. It contains many young stars being formed. The gas cloud produces vast quantities of energetic UV rays that ionise the surrounding gas. The ions eventually recombine, leaving the gas atoms in an excited state. The excited atoms subsequently return to their ground state.

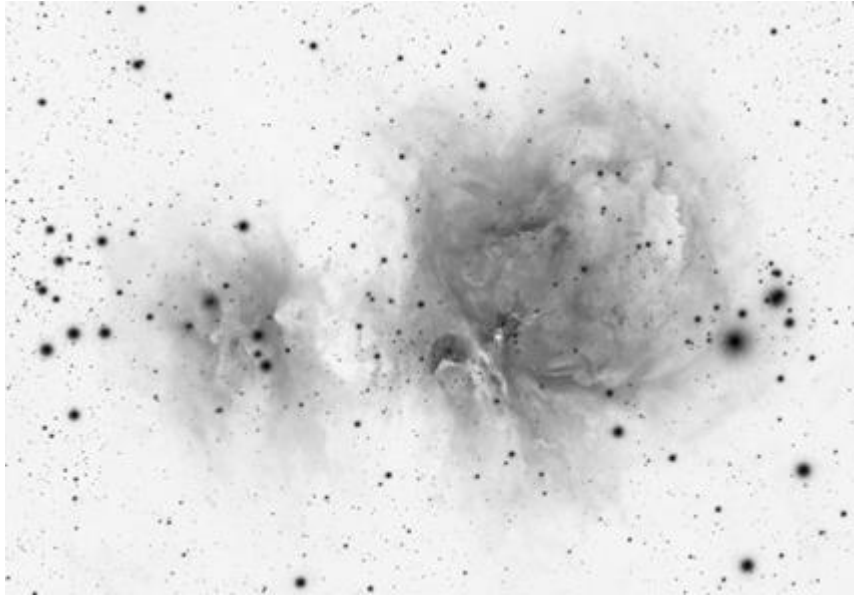


Fig 6.1

A simplified model of gas clouds is shown in **Fig. 6.2** below which depicts two different gas clouds. Cloud A is a hydrogen gas cloud in an excited state due to its proximity to a young star. Cloud B is a cool hydrogen cloud situated at a greater distance away and is not in an excited state.

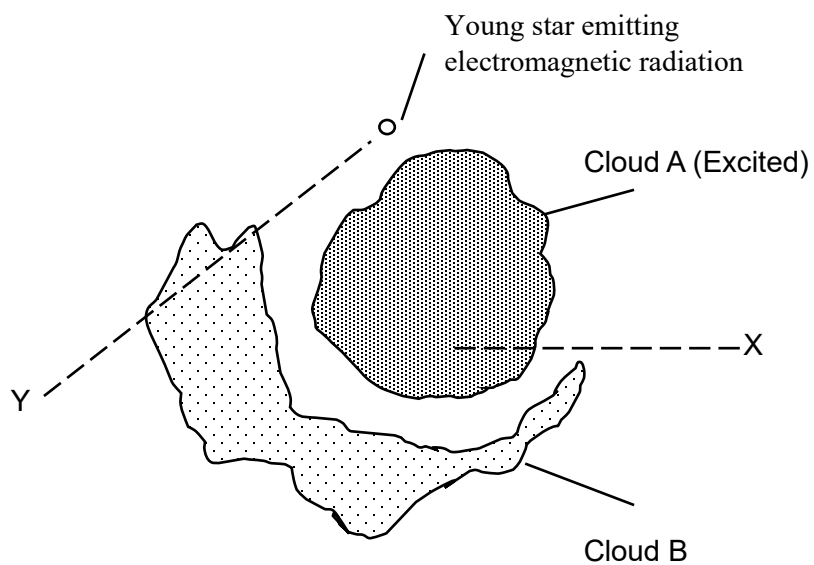


Fig. 6.2

(i) State and explain the type of hydrogen spectrum observed from point X along the dotted line.

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..... [2]

(ii) State and explain the type of hydrogen spectrum observed from point Y along the dotted line.

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(iii) Suggest how these observations provide evidence for discrete energy levels in atoms.

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(b) A metal target is bombarded by high-speed electrons. The spectrum of the emitted radiation is shown in **Fig. 6.3**.

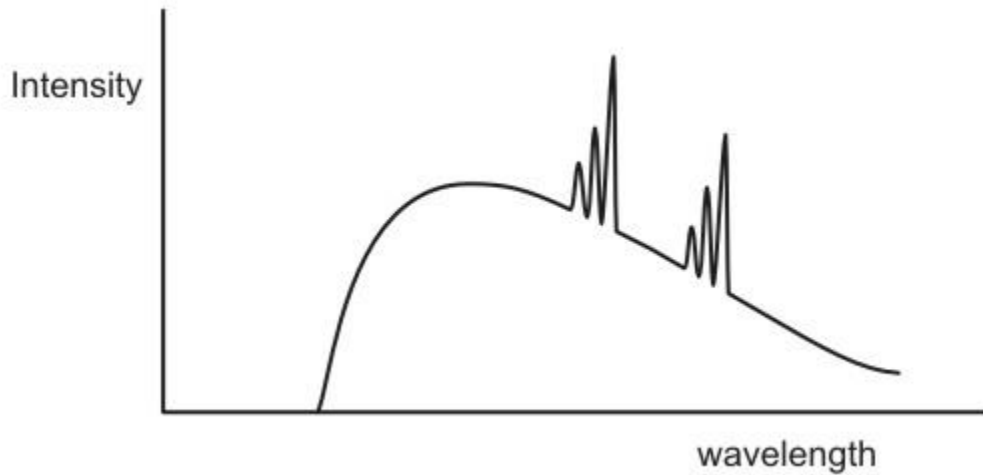


Fig. 6.3

(i) Explain why there is a continuous distribution of wavelengths.

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 [2]

(ii) Consider now incoming electrons that have half as much kinetic energy as before. Sketch a curve on **Fig. 6.3** showing the new spectrum of the emitted radiation. [2]

Section B

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