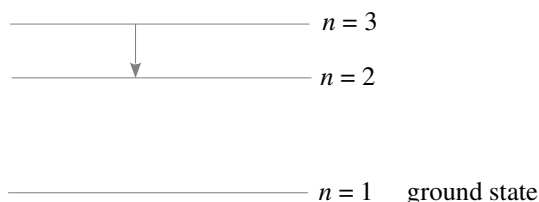


Structure of The Atom Questions

1. a) Describe a line emission spectrum. /1
b) Explain how line emission spectra can help identify the elements in some given hot vapour sample. /2
2.
 - a) Draw an example emission spectrum for hydrogen /2
 - b) Show the electromagnetic spectrum regions (ultraviolet, visible and infrared) on your diagram. /1
 - c) Describe the relationship between energy transitions in the atom and the position of lines on the spectrum. /2
3. Define the ionisation energy of an atom, and compare it to the work function of a metal. /2
4. Describe the changes in the spectrum of a filament globe as the temperature of the filament increases. /2
5. Explain why there are no absorption lines in the visible region for hydrogen at room temperature. /2
6. Explain the presence of absorption lines in the visible part of the sun's spectrum. /1
7. With the aid of an energy level diagram, explain the process of fluorescence. /2
8. Explain the difference between stimulated emission and spontaneous emission. /2
9. Draw an energy-level diagram showing an arrow to represent the transition corresponding to the lowest energy absorption line for that element. /1
10. A helium–neon gas laser emits photons of frequency $f = 4.74 \times 10^{14}$ Hz. These photons are emitted when an excited neon atom makes a transition from the $n = 3$ to the $n = 2$ energy level, as shown in the diagram below:



- (a) Show that the energy of these photons is 1.96 eV. /2
- (b) Calculate the wavelength of the photons. /2
- (c) State the region of the electromagnetic spectrum in which this wavelength occurs. /1
- (d) Photons of this frequency are produced by stimulated emission in a helium–neon gas laser.
 - (i) Explain why a population inversion of the neon atoms is necessary in a helium–neon gas laser. /2
 - (ii) Describe what is meant by a metastable state. /1
 - (iii) State which energy level on the diagram above corresponds to the metastable state. /1
- (e) Describe how a helium–neon gas laser produces its amplified light. /3
- (f) State two useful properties of the light produced by a laser. /1
- (g) State two uses of lasers. /1
- (h) Discuss the requirements for safe handling of lasers. /2