Higher Spectra Answers

1. a) Emission Spectra – The range of colours emitted by a source of light.

b) Continuous Spectra and Line Spectra.

c) The Bohr model of the atom suggested that electrons existed in certain orbits around the nucleus.

The electrons have different energies in different orbits with a minimum number for each orbit.

The minimum energy level is nearest the nucleus and is called the ground state, with electrons being able to move between the levels but cannot stay between the levels.

2. a) 15 transition lines.

b) E_o = Ground state.

c) i) E_4 -> E_5.

ii) E_0 -> E_5.

d) $\Delta E = hf = 6.63\times10^{-34} \times 6.88\times10^{14} = 4.56\times10^{-19}$J

This is shown by E_4 -> E_1.

3. a) E_4 -> E_0 will produce the highest frequency radiation.

b) $f = 3.15 \times10^{15}$Hz.

4. a) Monochromatic light is light of a single wavelength or frequency.

Coherent waves are waves of the same frequency that are in-phase with each other.

b) i) $f = 2.84 \times 10^{13}$Hz.

$\lambda = 1.06 \times 10^{-5}$m.

ii) λ = Infra – Red in the electromagnetic spectrum.

c) The energy is spread over a very small area.

A large number of photons are emitted from the laser per second.

5. a) i) $E_4 \rightarrow E_3$. As this gives the smallest energy jump.

ii) $f = 4.83 \times 10^{14}$Hz.

b) i) Frequency is constant = 4.74×10^{14}Hz.

ii) $\lambda = 3.96 \times 10^{-7}$m.

6. a) i) $E_3 \rightarrow E_0$.

The shortest wavelength will be the largest frequency.

The largest frequency produces the greatest energy level jump.

ii) $f = 5.7 \times 10^{14}$Hz.

b) $\lambda = 4.10 \times 10^{-7}$m.

7. a) i) Nuclear Fusion.

ii) $E = 2.7 \times 10^{-11}$J.

b) i) λ =489nm.

ii) Blue or Blue-Green.

8. a) i) Electrons are moving to a lower energy level during emission.

ii) Energy difference = 3.38×10^{-19}J.

b) i) Photons emitted from the sodium lamp and passing through the flame containing vaporised sodium will be absorbed by sodium electrons.

This means that sodium light passing through the flame will be reduced in intensity and produce a dark shadow behind the flame.

ii) There is no energy gap in cadmium with the same energy as a photon emitted from the sodium lamp. Therefore, no absorption will take place and there will be no shadow region.