NAME_____

Structure of The Atom Assignment

1. Describe a line emission spectrum and 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

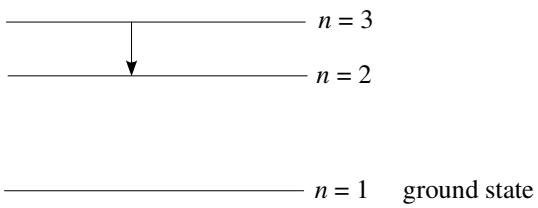
6. Explain the presence of absorption lines in the visible part of the sun's spectrum. /1

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

TOTAL /35