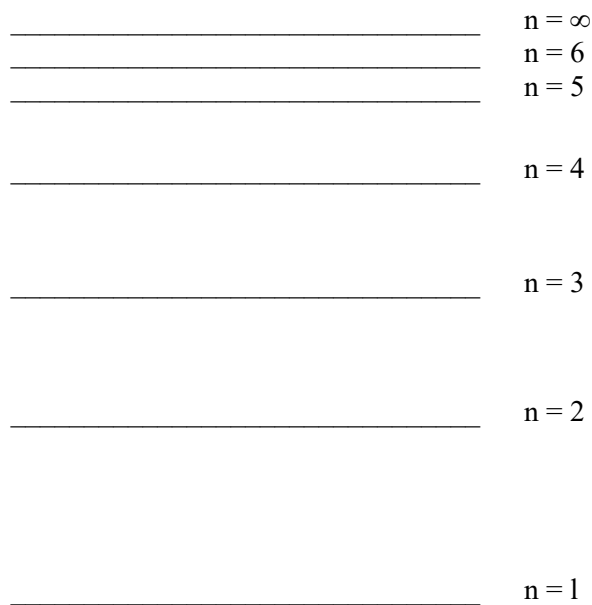


1. The diagram below (not to scale) represents some of the electron energy levels in the hydrogen atom.



(i) Draw an arrow on the diagram to represent the electron transition for the ionization of hydrogen. Label this arrow A.

(2)

(ii) Draw an arrow on the diagram to represent the lowest energy transition in the visible emission spectrum. Label this arrow B.

(2)

(Total 4 marks)

2. Tritium, ${}^3_1\text{T}$, is an isotope of hydrogen.

(i) State the number and type of sub-atomic particles in a tritium atom and the location of each type.

.....
.....
.....
.....

(2)

- (ii) Write balanced equations to represent the formation of the following compounds, starting with T_2 or T_2O .

NT_3 :

.....

$NaOT$:

.....

(4)
(Total 6 marks)

3. (i) State the full electron configuration for argon.

.....

(1)

- (ii) Give the formulas of **two** oppositely charged ions which have the same electron configuration as argon.

.....

(2)
(Total 3 marks)

4. State the number of protons, electrons and neutrons in the ion ${}^{15}_{7}N^{3-}$.

.....

.....

.....

(Total 2 marks)

5. Define the following terms.

(i) *atomic number*

.....
.....

(1)

(ii) *mass number*

.....
.....

(1)

(Total 2 marks)

6. Identify the numbers of protons, neutrons and electrons in the species $^{33}\text{S}^{2-}$.

.....
.....

(Total 1 mark)

7. The relative atomic mass of chlorine is 35.45. Calculate the percentage abundance of the two isotopes of chlorine, ^{35}Cl and ^{37}Cl in a sample of chlorine gas.

(Total 2 marks)

8. Naturally occurring copper has a relative atomic mass, (A_r), of 63.55 and consists of two isotopes ^{63}Cu and ^{65}Cu .

(i) Define the term *relative atomic mass*, A_r .

.....
.....
.....

(1)

(ii) State and explain which is the more abundant isotope.

.....
.....
.....

(1)
(Total 2 marks)

9. The element vanadium has two isotopes, ${}^{50}_{23}\text{V}$ and ${}^{51}_{23}\text{V}$, and a relative atomic mass of 50.94.

(a) Define the term *isotope*.

.....
.....

(1)

(b) State the number of protons, electrons and neutrons in ${}^{50}_{23}\text{V}$.

.....
.....

(2)

(c) State and explain which is the more abundant isotope.

.....
.....

(1)

(d) State the name and the mass number of the isotope relative to which **all** atomic masses are measured.

.....

(1)
(Total 5 marks)

10. (a) State a physical property that is different for isotopes of an element.

.....

(1)

(b) Chlorine exists as two isotopes, ^{35}Cl and ^{37}Cl . The relative atomic mass of chlorine is 35.45. Calculate the percentage abundance of each isotope.

.....
.....
.....
.....

(2)

(Total 3 marks)

11. (a) Define the term *isotope*.

.....
.....
.....

(2)

(b) A sample of argon exists as a mixture of three isotopes.

- mass number 36, relative abundance 0.337%
- mass number 38, relative abundance 0.0630%
- mass number 40, relative abundance 99.6%

Calculate the relative atomic mass of argon.

.....
.....
.....
.....

(2)

(c) State the number of electrons, protons and neutrons in the ion $^{56}\text{Fe}^{3+}$.

electrons: protons: neutrons:

(2)

(Total 6 marks)

12. (a) Define the term *isotope*.

.....
.....
.....

(2)

(b) A sample of gallium exists as two isotopes, ^{69}Ga , relative abundance 61.2%, and ^{71}Ga , relative abundance 38.8%. Calculate the relative atomic mass of gallium.

.....
.....
.....

(1)

(Total 3 marks)

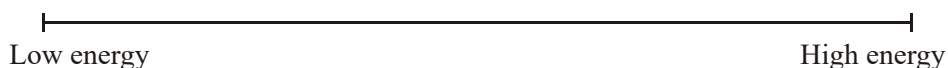
13. (a) Evidence for the existence of energy levels in atoms is provided by line spectra. State how a line spectrum differs from a continuous spectrum.

.....
.....

(1)

(b) On the diagram below draw **four** lines in the visible line spectrum of hydrogen.

(1)



- (c) Explain how the formation of lines indicates the presence of energy levels.

.....

(1)
 (Total 3 marks)

14. The element bromine exists as the isotopes ^{79}Br and ^{81}Br , and has a relative atomic mass of 79.90.

- (a) Complete the following table to show the numbers of sub-atomic particles in the species shown.

	an atom of ^{79}Br	an ion of $^{81}\text{Br}^-$
protons		
neutrons		
electrons		

(3)

- (b) State and explain which of the two isotopes ^{79}Br and ^{81}Br is more common in the element bromine.

.....

(1)

- (c) The element calcium is in the same period of the Periodic Table as bromine.

- (i) Write the electron arrangement for an atom of calcium.

.....

(1)

- (ii) Deduce the formula of the compound calcium bromide.

.....

(1)
 (Total 6 marks)

15. (a) List the following types of electromagnetic radiation in order of **increasing** wavelength (shortest first).

I. Yellow light

II. Red light

III. Infrared radiation

IV. Ultraviolet radiation

.....

(1)

(b) Distinguish between a continuous spectrum and a line spectrum.

.....

(1)

(c) The thinning of the ozone layer increases the amount of UV-B radiation that reaches the Earth's surface.

Type of Radiation	Wavelength / nm
UV-A	320–380
UV-B	290–320

Based on the information in the table above explain why UV-B rays are more dangerous than UV-A.

.....

(3)

(Total 5 marks)