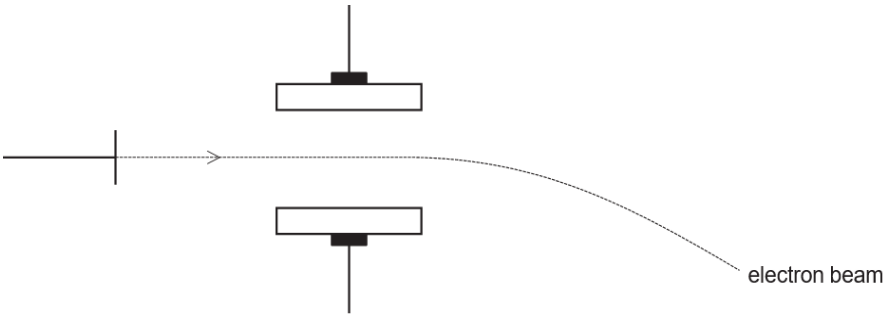
1.1 PARTICLES IN ATOMS AND ATOMIC RADIUS

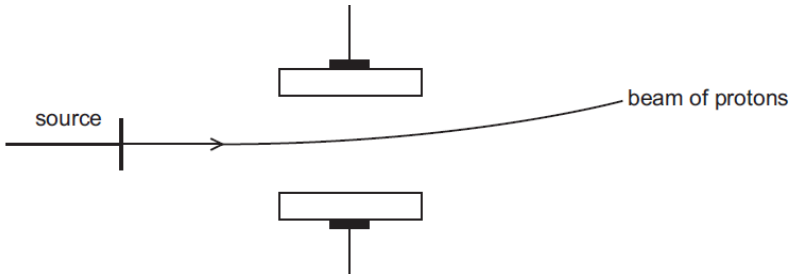
Protons, neutrons and electrons in the electric field

1. Beams of protons, neutrons, and electrons behave differently in an electric field due to their differing properties.
   The diagram shows the path of an electron beam in an electric field.
   Add and label lines to represent the paths of beams of protons and neutrons in the same field.

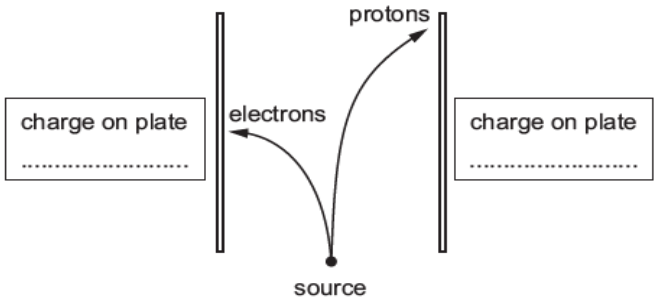


[3]

2. The following figure shows the behaviour of a beam of protons in an electric field.
   Complete the figure to show the behaviour of separate beams of neutrons and electrons in the same electric field.
   Label your diagram clearly. Assume that the beams of each particle are moving at the same velocity. [3]



3. Atoms contain the subatomic particles electrons, protons, and neutrons. Protons and electrons were discovered by observations of their behaviours in electric fields.
   (a) The diagram shows the behaviour of separate beams of electrons and protons in an electric field.



   (i) Complete the diagram with the relative charge of each of the electrically charged plates. [1]
   (ii) On the diagram, draw a line to show how a separate beam of neutrons from the same source behaves in the same electric field. [1]

Determination of the number of protons, neutrons, and electrons

4. Complete the following table using relevant information from the Periodic Table.

	nucleon number	proton number	number of electrons
Mg^{2+}	24		
Al^{3+}	27		

[2]

5. Complete Table 1.1 to show the total numbers of protons and electrons in the molecular ions NH_4^+, CO_3^{2-} and PO_4^{3-}. [3]

Molecular ion	total number of protons	total number of electrons
NH_4^+		
CO_3^{2-}		
PO_4^{3-}		

6. All the Group 2 elements except beryllium have more than one stable isotope.
Beryllium exists as the single isotope $^{9}_{4}Be$. Describe the distribution of mass within an atom of $^{9}_{4}Be$.

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..... [2]

7. Complete Table 2.1 to show the number of protons and nucleons in one atom of ^{56}Fe. [2]
Table 2.1

particle	number of particles in one atom of ^{56}Fe
protons	
nucleons	

8. Tellurium is an element in Group 16. The most common isotope of tellurium is ^{130}Te. Its electronic configuration is [Kr] $4d^{10}\ 5s^2\ 5p^4$.
Complete the following table. [3]

	nucleon number	number of neutrons	number of electrons
^{130}Te			

9. $_{12}{}^{25}Mg$ is an isotope of magnesium.
Determine the number of protons and neutrons in an atom of $^{25}{}_{12}Mg$. [1]

10. The composition of atoms and ions can be determined from knowledge of atomic number, nucleon number and charge.
Complete the table. [2]

atomic number	nucleon number	number of electrons	number of protons	number of neutrons	symbol
3		2			$^{6}_{3}Li^+$
		23	26	32	

Variations in atomic radius and ionic radius

11. The elements silicon, phosphorus and sulfur are in Period 3 of the Periodic Table.
Describe the variation in atomic radius from silicon to sulfur. [1]

12. State the trend in ionic radius shown by P^{3-}, S^{2-} and Cl^{-}.
Explain your answer. [2]

13. Explain the variation in anionic radius for the elements with atomic numbers 14 to 17. [2]

14. The table shows information about some of the elements in the third period.

element	Na	Mg	Al	P	S	Cl
atomic radius / nm	0.186	0.160	0.143	0.110	0.104	0.099
radius of most common ion / nm	0.095	0.065	0.050	0.212	0.184	0.181

(i) Explain why the atomic radius of elements in the third period decreases from Na to Cl. [3]

(ii) The radius of the most common ion of Mg is much smaller than the radius of the most common ion of S.
Identify both ions and explain the difference in their radii. [2]

15. State & explain the difference in the ionic radius of Al^{3+} compared to Mg^{2+}. [3]

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