# Atomic Structure

## Question Paper

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|---|---|
| Level | GCSE |
| Subject | Chemistry |
| Exam Board | Edexcel IGCSE |
| Module | Double Award (Paper 1C) |
| Topic | Principles of Chemistry |
| Sub-Topic | Atomic Structure |
| Booklet | Question Paper |

**Time Allowed:** **59 minutes**

**Score:** **/49**

**Percentage:** **/100**

**Grade Boundaries:**

| A* | A | B | C | D | E | U |
|---|---|---|---|---|---|---|
| >85% | 75% | 70% | 60% | 55% | 50% | <50% |

**1** The element carbon has three common isotopes. These are carbon-12, carbon-13 and carbon-14.

(a) Complete the table to show the number of protons and neutrons in each isotope of carbon.

**(2)**

| Isotope | Mass number | Number of protons | Number of neutrons |
|---|---|---|---|
| carbon-12 | 12 | 6 | 6 |
| carbon-13 | 13 | | |
| carbon-14 | 14 | | |

(b) Explain, in terms of electrons, why the three isotopes have the same chemical properties.

**(1)**

.....

.....

(c) (i) State what is meant by the term **relative atomic mass, $A_r$**

**(2)**

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(ii) A sample of carbon contained 98.90% carbon-12 and 1.10% carbon-13.

Use this information to calculate the relative atomic mass of carbon in the sample. Give your answer to **two** decimal places.

**(3)**

Relative atomic mass.....

**(Total for Question 1 = 8 marks)**

**2** This question is about the element beryllium.

(a) Use words from the box to complete the sentences about beryllium.

Each word may be used once, more than once or not at all.

**(7)**

| | | | |
|---|---|---|---|
| **electrons** | **negative** | **neutral** | **neutrons** |
| **nucleus** | **positive** | **protons** | **shells** |

An atom of beryllium has a central ..... that

contains particles called ..... and

..... . Around these

particles there are ..... orbiting in
..... .

An atom of beryllium has no charge because it contains equal numbers

of ..... and

..... .

The particles with the lowest mass in an atom of beryllium are called
..... .

(b) Beryllium forms a compound with the formula $Be(OH)_2$

(i) How many different elements are there in $Be(OH)_2$?

**(1)**

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

(ii) What is the total number of atoms in the formula $Be(OH)_2$?

**(1)**

..... .....

**(Total for Question 2 = 9 marks)**

**3** This question is about bromine and some of its compounds.

(a) Atoms of bromine can be represented as $^{79}Br$ and $^{81}Br$

(i) State the number of protons, neutrons and electrons in an atom of $^{79}Br$

**(2)**

Protons .....

Neutrons .....

Electrons .....

(ii) What name is used for atoms of bromine that have different numbers of neutrons?

**(1)**

.....

(iii) Why do all atoms of bromine have the same chemical properties?

**(1)**

.....

.....

(iv) The relative atomic mass of bromine is given in the Periodic Table as 80, but a more accurate value is 79.9

Suggest, with a reason, which of the atoms $^{79}Br$ and $^{81}Br$ exists in greater numbers in a sample of bromine.

**(2)**

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(b) Hydrogen bromide (HBr) and sodium bromide (NaBr) are compounds of bromine.

(i) Draw a dot and cross diagram to represent a hydrogen bromide molecule.

Show only the outer electrons in each atom.

**(2)**

(ii) Explain how the atoms are held together in a hydrogen bromide molecule.

**(2)**

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.....

.....

(iii) Explain why sodium bromide has a higher melting point than hydrogen bromide.

**(3)**

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.....

(c) A compound has the percentage composition 13.8% sodium, 47.9% bromine and 38.3% oxygen by mass.

Calculate its empirical formula.

**(3)**

Empirical formula = .....

**(Total for Question 3 = 16 marks)**

**4** Boron is an element in Group 3 of the Periodic Table.

An atom of boron can be represented as $^{11}_{5}B$

(a) Use numbers from the box to complete the sentences about this atom of boron.

| | | | | |
|---|---|---|---|---|
| 3 | 5 | 6 | 11 | 16 |

Each number may be used once, more than once or not at all.

(i) The atomic number of boron is .....

**(1)**

(ii) The mass number of boron is .....

**(1)**

(iii) This atom of boron contains ..... protons.

**(1)**

(iv) This atom of boron contains ..... neutrons.

**(1)**

(v) This atom of boron contains ..... electrons.

**(1)**

(b) Aluminium is another element in Group 3 of the Periodic Table.

Select a word or phrase from the box to complete each sentence about an atom of aluminium.

| | | |
|---|---|---|
| fewer | more | the same number of |

Each word or phrase may be used once, more than once or not at all.

(i) Compared to an atom of boron, an atom of aluminium has

..... protons.

**(1)**

(ii) Compared to an atom of boron, an atom of aluminium has

..... neutrons.

**(1)**

(iii) Compared to an atom of boron, an atom of aluminium has

..... electrons in its outer shell.

**(1)**

(c) The electronic configuration of aluminium is

**(1)**

☒ **A** 2.3

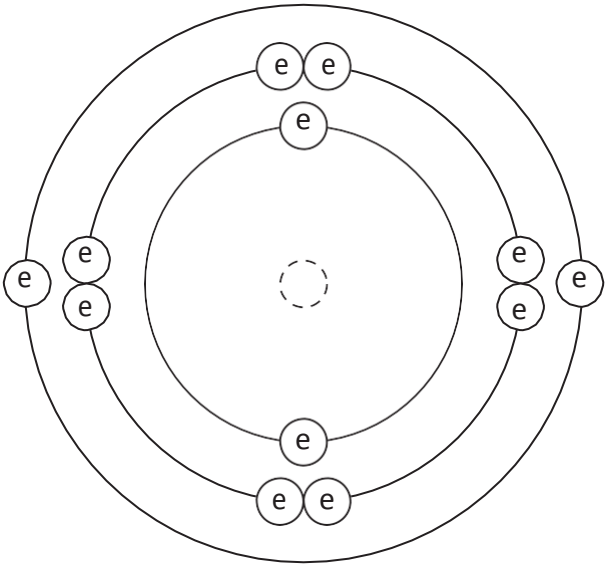
☒ **B** 2.2.3

☒ **C** 2.2.8

☒ **D** 2.8.3

**(Total for Question 4 = 9 marks)**

**5** The diagram shows the electronic configuration of an atom of element X.




key

= nucleus

e = electron

(a) (i) How many protons does the nucleus of the atom contain?

**(1)**

.....

(ii) Which group of the Periodic Table contains element X?

Give a reason for your choice.

**(2)**

.....

.....

.....

.....

(iii) Give the formula of the ion formed by element X in its compounds.

**(1)**

.....

(b) Element X has three isotopes.

The table gives the mass number of each isotope and its percentage abundance in a sample of element X.

| Mass number | Percentage abundance (%) |
|---|---|
| 24 | 79.0 |
| 25 | 10.0 |
| 26 | 11.0 |

Calculate the relative atomic mass($A_r$) of element X.

Give your answer to one decimal place.

**(3)**

relative atomic mass of X = .....

**(Total for Question 5 = 7 marks)**