

GCSE Chemistry (9 – 1)

Atomic Structure

Name:

Group:

Instructions

- Read each question carefully before you begin to answer it.
- Use black ink or black ball-point pen for your answers.
- Fill in the boxes at the top of this page with your name and group.
- Attempt to answer every question in the booklet.
- Answer the questions in the spaces provided – there may be more space than you need in some answer spaces.
- Calculators may be used for this booklet.
- For any calculations, you **must** show all your working.
- Any and all drawings or graphs should be completed in pencil.



For markers use	
Question	Mark
1	/5
2	/7
3	/17
4	/9
5	/10
6	/10
Total	/58
%	
Grade	

Information

- The maximum mark for this paper is 58 marks.
- The marks for each question are shown in brackets.
- Please be aware that good English and clear presentation are required in your answers.



1. Atomic structure describes the arrangement of the protons, neutrons, and electrons that make up every atom. Circle the letter of the correct answer for each of the following questions.

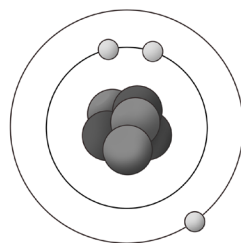
a. Where is most of the mass that is in an atom found?

- | | | | |
|-----------------|-----------|----------|----------|
| A | B | C | D |
| Protons | Electrons | Neutrons | Nucleus |
| (1 mark) | | | |

b. The radius of a helium atom is 0.14 nm.
What is the radius of a helium atom in metres?

- | | | | |
|---------------------------------|----------------------------------|--------------------------------|-------------------------------|
| A | B | C | D |
| $1.4 \times 10^{-10} \text{ m}$ | $0.14 \times 10^{-10} \text{ m}$ | $1.4 \times 10^{-9} \text{ m}$ | $14 \times 10^{-9} \text{ m}$ |
| (1 mark) | | | |

c. The figure below shows a neutral atom. Using the information in this image, identify this atom.



- | | | | |
|-----------------|----------|----------|-----------|
| A | B | C | D |
| Carbon | Lithium | Sodium | Potassium |
| (1 mark) | | | |

d. Which statement about the subatomic particles in an atom is **correct**?

- A** Neutrons and electrons are both found in the nucleus.
- B** Electrons have a relative mass of one.
- C** Neutrons have a positive charge.
- D** Protons have a relative mass of one.

(1 mark)

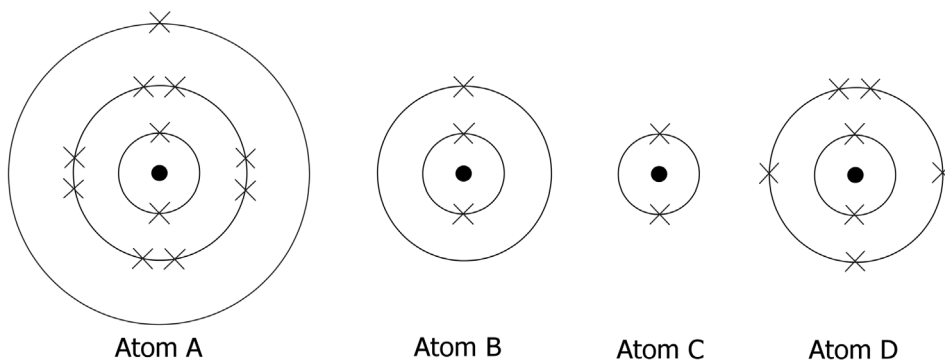
e. Oxygen has three naturally occurring isotopes.
Which statement about isotopes of oxygen is correct?

- A** All isotopes of oxygen have 8 electrons and 8 neutrons.
- B** All isotopes of oxygen have 8 electrons and 8 protons.
- C** All isotopes of oxygen have 8 neutrons and 8 protons.
- D** All isotopes of oxygen have the same mass number.

(1 mark)

(Total for Question 1 is 5 marks)

2. The diagrams show the electronic structure of four different atoms.



a) Name the **two** subatomic particles in the nucleus of an atom.

.....
(1 mark)

b) Why is there no overall electrical charge on each atom?

.....
(1 mark)

c) Why is atom C unreactive?

.....
(1 mark)

d) Which two of these atoms have similar chemical properties?
Give a reason for your answer.

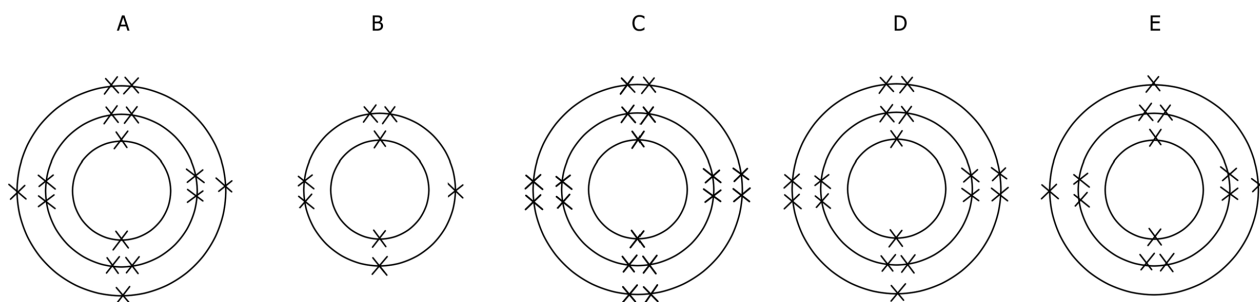
.....
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(2 marks)

e) Atom B reacts to form an ion.
What is the charge on this ion? Explain your answer in terms of electrons.

.....
.....
.....
.....
.....
.....
(2 marks)

(Total for Question 2 is 7 marks)

3. The electronic structures of five atoms, A, B, C, D and E, are shown.



a) The following questions refer to the structures labelled A, B, C, D and E in the figure above.

For each question, write the letter of the structure it describes. Any letter may be used more than once

- i. An atom of a metallic element.
- ii. An atom with a proton number of 13.
- iii. An atom of phosphorus.
- iv. An atom with only two shells of electrons.
- v. An atom which forms a stable ion with a single negative charge. **(5 marks)**

b) There are a number of isotopes of sulfur and many of these can be found in seawater.

i. Explain, in terms of subatomic particles, what is meant by the term isotopes.

.....

.....

.....

.....

(2 marks)

ii. The figure below shows three different isotopes of sulfur, draw a line from each isotope of sulfur to its correct description.

Isotope	Description
16 S 32	This isotope contains 17 neutrons.
16 S 33	This isotope has a full outer shell of electrons.
16 S 34	This isotope has more protons than neutrons.
	This isotope has the highest mass number.
	This isotope has the same number of neutrons and protons.

(3 marks)

- c) A sample of seawater containing these isotopes contains the following abundances of these sulfur isotopes:

Sulfur 32: 95.0%

Sulfur 33: 1.0%

Sulfur 34: 4.0%

Calculate the relative atomic mass (A_r) of this sample of sulfur.
Give your answer to **two** decimal places.

.....

.....

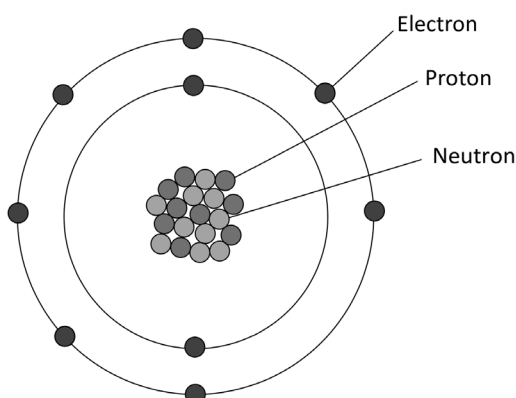
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.....

relative atomic mass = ...

(3 marks)

- d) The figure below shows an atom of an element.



- i. Identify this atom based on the information in the figure.

.....

(1 mark)

- ii. State the electronic configuration of this atom.

.....

(1 mark)

- iii. Explain why this atom has no overall electrical charge.
Use information from the figure in your answer.

.....

.....

.....

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.....

(2 marks)

(Total for Question 3 is 13 marks)

- a) Atoms are made up of subatomic particles, these are protons, neutrons and electrons.

Complete the following table.

Particle	Relative charge	Relative mass
Proton	+1	1
Neutron	0	.....
Electron	.....	.....

(3 marks)

- b) An atom of silicon can be shown as:



What can be deduced from this information about the structure of an atom of silicon and the position of silicon in the periodic table?

[illegible]

(6 marks)

(Total for Question 4 is 9 marks)

5. An atom of potassium can be shown as:



a) Complete the table to show the number of protons, neutrons and electrons in this potassium atom.

Number of		
Protons	Electrons	Neutrons
.....		

(3 marks)

b) Describe the positions of these particles in the potassium atom.

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

(2 marks)

c) State the electronic configuration of this potassium atom.

.....
(1 mark)

d) The charge on an electron is -1.6×10^{-19} C.
What is the charge on a proton?

.....
(1 mark)

e) Magnesium (Mg) has three naturally occurring isotopes.
The table below shows the mass number and the relative abundance of each one.

Magnesium 24	79.0%
Magnesium 25	10.0%
Magnesium 26	11.0%

Calculate the relative atomic mass (A_r) of magnesium.
Give your answer to **one** decimal place.

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

relative atomic mass = ...
(3 marks)

(Total for Question 5 is 10 marks)

6. Look at the information below about three different atoms of neon.

20

Ne

10

21

Ne

10

22

Ne

10

The atomic number of neon is 10.

a) What is meant by atomic number?

.....

.....

(1 mark)

These three atoms of neon are isotopes.

b) Explain, in terms of subatomic particles, what is meant by the term isotopes.

.....

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.....

(2 marks)

c) The table below gives information about other atoms and ions.

Complete the missing values in the table.

Particle	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons	Electronic structure
C	6	12	.....	.....	.....	.....
Al	13	27	.....	.....	.....	.....
Cl ⁻	17	37	.....	.....	.....	.....
Ca ²⁺	20	40	.....	.....	.....	.....

(4 marks)

The relative atomic mass (A_r) of neon is 20.2. In a sample of neon, the abundance of the neon 21 isotope is so small it can be considered to not be part of the sample.

d) Calculate the percentage abundances of neon 20 and neon 22 in the sample.

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(3 marks)

(Total for Question 6 is 10 marks)