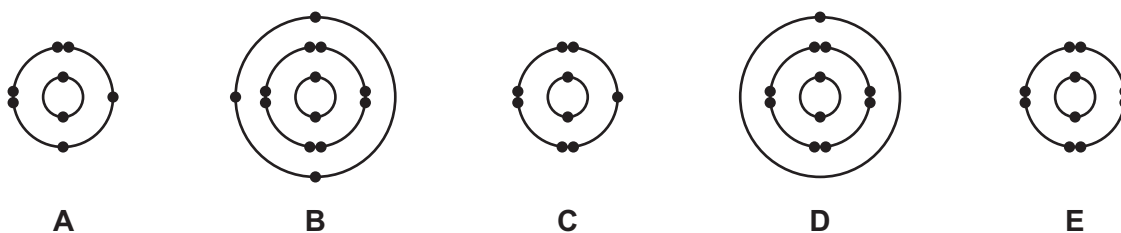


1 The electronic structures of five atoms, **A**, **B**, **C**, **D** and **E**, are shown.



Answer the following questions about these atoms.
Each atom may be used once, more than once or not at all.

Which atom, **A**, **B**, **C**, **D** or **E**:

(a) has a total of 8 electrons

..... [1]

(b) is in Group III of the Periodic Table

..... [1]

(c) has 13 protons

..... [1]

(d) is a noble gas

..... [1]

(e) forms a stable ion with a single negative charge?

..... [1]

[Total: 5]

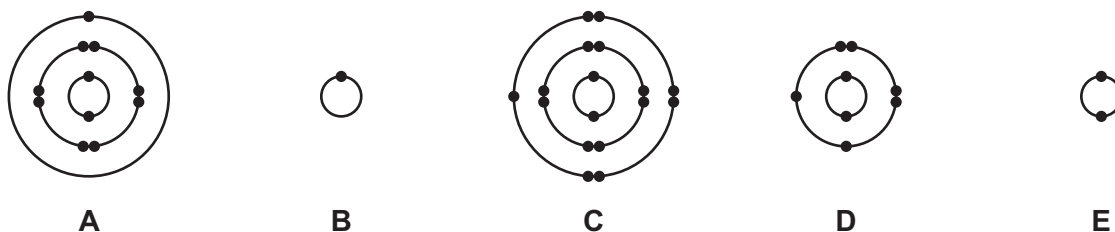
2 Complete the table to show the number of electrons, neutrons and protons in the sulfur atom and oxide ion shown.

	number of electrons	number of neutrons	number of protons
$^{34}_{16}\text{S}$	16		
$^{18}_8\text{O}^{2-}$		10	

[3]

[Total: 3]

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



Answer the following questions about these atoms.
Each atom may be used once, more than once or not at all.

Which atom, **A**, **B**, **C**, **D** or **E**:

(a) is in Group VIII of the Periodic Table,

.....

[1]

(b) is a chlorine atom,

.....

[1]

(c) has 17 protons in its nucleus,

.....

[1]

(d) is an atom of an element in the same period as carbon,

.....

[1]

(e) is an atom of a metal?

.....

[1]

[Total: 5]

4 The table shows the ions present in a 1000 cm³ sample of mineral water.

ion present	formula of ion	mass present in mg / 1000 cm ³
calcium	Ca ²⁺	52
chloride	Cl ⁻	10
hydrogencarbonate	HCO ₃ ⁻	50
magnesium	Mg ²⁺	
sodium	Na ⁺	12
sulfate	SO ₄ ²⁻	10
	NO ₃ ⁻	8
	total	150

Answer these questions using the information from the table.

- (a) Calculate the mass of magnesium ions in the 1000 cm^3 sample of mineral water.

mass of magnesium ions = mg [1]

- (b) Which negative ion is present in the highest concentration?

..... [1]

- (c) State the name of the ion NO_3^- .

..... [1]

- (d) Calculate the mass of hydrogencarbonate ions present in 250 cm^3 of this sample.

mass of hydrogencarbonate ions = mg [1]

[Total: 4]

- 5 Complete the table to show the number of electrons, neutrons and protons in the magnesium atom and calcium ion shown.

	number of electrons	number of neutrons	number of protons
${}_{12}^{26}\text{Mg}$	12		
${}_{20}^{44}\text{Ca}^{2+}$		24	

[3]

[Total: 3]

6 Which statements about isotopes of the same element are correct?

1. They are atoms which have the same chemical properties because they have the same number of electrons in their outer shell.
2. They are atoms which have the same number of electrons and neutrons but different numbers of protons.
3. They are atoms which have the same number of electrons and protons but different numbers of neutrons.

A 1 and 2 B 1 and 3 C 2 only D 3 only

[1]

[Total: 1]

7 Element Q has 4 electrons in its outer shell and has 69 neutrons. Q conducts electricity.

What is Q?

- A carbon (C)
- B lead (Pb)
- C thulium (Tm)
- D tin (Sn)

[1]

[Total: 1]

8 Which statement describes positive ions?

- A Positive ions have more electrons than neutrons.
- B Positive ions have more protons than neutrons.
- C Positive ions have more electrons than protons.
- D Positive ions have more protons than electrons.

[1]

[Total: 1]

- 9 Two atoms, X and Y, can be represented as shown.



Which statement is **not** correct?

- A** X and Y are atoms of different elements.
B X and Y are isotopes.
C X and Y have different mass numbers.
D X and Y have the same number of electrons.

[1]

[Total: 1]

- 10 Two atoms have the same relative atomic mass but different chemical properties.

Which row about the proton and neutron numbers of these atoms is correct?

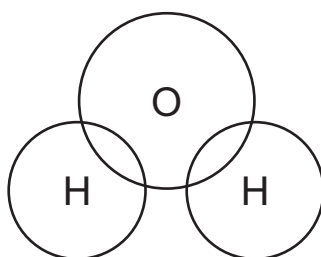
	proton numbers	neutron numbers
A	different	different
B	different	same
C	same	different
D	same	same

[1]

[Total: 1]

- 11 Hydrogen chloride dissolves in water to form hydrochloric acid.

- (a) Complete the dot-and-cross diagram to show the arrangement of the outer shell electrons in water.



[2]

[Total: 2]

12 Complete the following sentence about isotopes using words from the list below.

atoms ions molecules neutrons nuclei protons

Isotopes are of the same element with the same number of
..... but different numbers of

[3]

[Total: 3]

13 Hydrochloric acid is formed when hydrogen chloride gas is dissolved in water.
Draw a dot-and-cross diagram to show the electron arrangement in a molecule of hydrogen chloride.
Show only the outer electron shells.
Show hydrogen electrons as x.
Show chlorine electrons as ●.

[2]

[Total: 2]

14 Draw the electronic structure of a fluorine atom.

[2]

[Total: 2]

15 A metal can is made of mild steel coated with tin.

- (a) Steel is an alloy.
What is meant by the term *alloy*?

.....
..... [1]

- (b) Why does the tin prevent the steel can from rusting?

.....
..... [2]

[Total: 3]

16 Hydrochloric acid is made by dissolving hydrogen chloride gas, HCl , in water.
Draw a dot-and-cross diagram to show a molecule of hydrogen chloride.
Show hydrogen electrons as x.
Show chlorine electrons as ●.

[2]

[Total: 2]

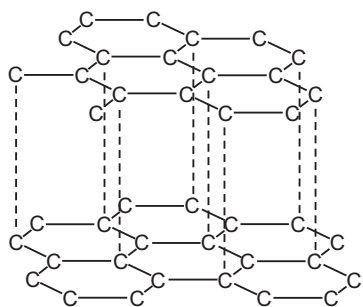
17 Complete the table below to show the number of protons, neutrons and electrons in two isotopes of uranium.

isotope	${}_{92}^{235}\text{U}$	${}_{92}^{238}\text{U}$
protons		
neutrons		
electrons		

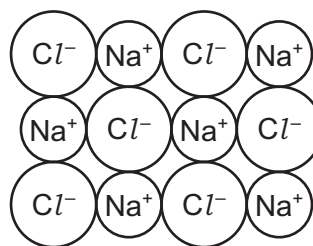
[3]

[Total: 3]

18 The structures of graphite and sodium chloride are shown below.



graphite



sodium chloride

(a) Describe the similarity and differences in these structures.

.....

.....

.....

.....

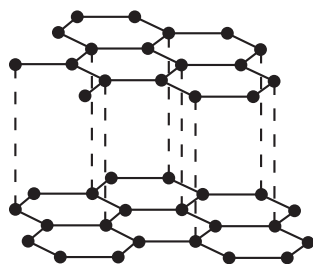
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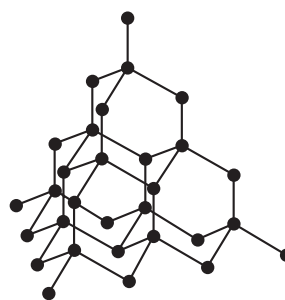
[4]

[Total: 4]

19 Two macromolecular forms of carbon are graphite and diamond. The structures of graphite and diamond are given below.



graphite



diamond

Silicon(IV) oxide also has a macromolecular structure.

(a) Describe the macromolecular structure of silicon(IV) oxide.

.....

.....

[1]

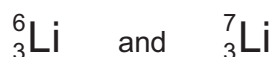
(b) Predict **two** physical properties which diamond and silicon(IV) oxide have in common.

.....

[2]

[Total: 3]

20 Lithium has two naturally-occurring isotopes. These can be written as:



Describe the difference between these isotopes.

..... [1]

[Total: 1]

21 Complete the following sentences about compounds using words from the list below.

chemically **different** **fixed**
mixed **physically** **similar**

A compound is a substance which consists of two or more different elements
 combined together.

The properties of a compound are from those of the elements from which
 it is formed.

In a compound, the elements are combined in proportions. [3]

[Total: 3]

22 In the 1860s, John Newlands listed the elements in order of increasing atomic mass. Part of his table is shown.

H 1	Li 2	Be 3	B 4	C 5	N 6	O 7
F 8	Na 9	Mg 10	Al 11	Si 12	P 13	S 14
Cl 15	K 16	Ca 17	Cr 18	Ti 19	Mn 20	Fe 21

- (a) (i) Describe the differences between Newlands' table and the Periodic Table we use today.

.....

.....

.....

.....

.....

..... [3]

- (ii) What evidence is there, from Newlands' table, that some elements with similar properties are grouped together?

.....

..... [1]

[Total: 4]

- 23 Dmitri Mendeleev published his first Periodic Table in 1869.
Part of this table is shown below.

			Ti = 50
			V = 51
			Cr = 52
			Mn = 55
			Fe = 56
			Co = 59
			Cu = 63.4
H = 1	Be = 9.4	Mg = 24	Zn = 65.2
	B = 11	Al = 27.4	?
	C = 12	Si = 28	?
	N = 14	P = 31	As = 75
	O = 16	S = 32	Se = 79.4
	F = 19	Cl = 35.5	Br = 80
Li = 7	Na = 23	K = 39	Rb = 85.4

(a) What differences are there between Mendeleev’s table and the Periodic Table we use today?

.....

.....

.....

.....

.....

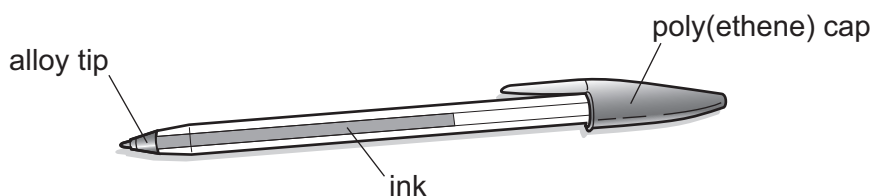
..... [4]

(b) State the names of any **two** elements in the table above which exist as diatomic molecules.

.....and..... [1]

[Total: 5]

24 The diagram shows the ball-point pen used in an experiment.



(a) The cap of the pen is made from poly(ethene).

Describe the formation of poly(ethene) from ethene. In your answer, include the words:

- monomer,
- polymer.

.....

.....

..... [2]

(b) The tip of the pen is made from an alloy.

what is meant by the term *alloy*?

.....

..... [1]

[Total: 3]

25 The table gives information about atoms and ions **A**, **B** and **C**.

Complete the table.

	number of electrons	number of neutrons	number of protons	symbol
A		14	13	${}_{13}^{27}\text{Al}$
B			12	${}_{12}^{25}\text{Mg}^{2+}$
C	10	10	9	

[6]

[Total: 6]

26 Magnesium exists as three isotopes, ${}_{12}^{24}\text{Mg}$, ${}_{12}^{25}\text{Mg}$ and ${}_{12}^{26}\text{Mg}$.

All isotopes of magnesium react with dilute hydrochloric acid to make hydrogen and a salt.

(a) Why do all isotopes of magnesium react in the same way?

.....

 [2]

(b) Write a chemical equation for the reaction between magnesium and dilute hydrochloric acid.

..... [2]

(c) Describe a test for hydrogen.

test

result [2]

[Total: 6]

- 27 Complete the table to identify the atoms and ions which have the following numbers of protons, neutrons and electrons.

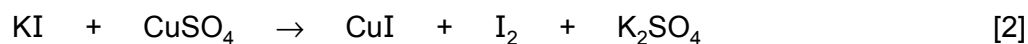
	number of protons	number of neutrons	number of electrons
${}_{11}^{23}\text{Na}^+$	11	12	10
	4	5	4
	17	20	18

[4]

[Total: 4]

- 28 Aqueous potassium iodide reacts with aqueous copper(II) sulfate to produce iodine.

- (a) Balance the chemical equation for this reaction.



- (b) Deduce the charge on the copper ion in CuI.

..... [1]

- (c) In terms of electron transfer, explain why copper is reduced in this reaction.

..... [1]

- (d) Identify the reducing agent.

..... [1]

[Total: 5]

- 29 Complete the table to show the number of nucleons, neutrons and electrons in an ${}_{13}^{27}\text{Al}^{3+}$ ion.

	number in ${}_{13}^{27}\text{Al}^{3+}$
nucleons	
neutrons	
electrons	

[3]

[Total: 3]

30 Lithium nitride is an ionic compound. Nitrogen trifluoride is a covalent compound.

Lithium nitride has a high melting point, 813 °C. Nitrogen trifluoride has a low melting point, -207 °C.

Explain why the melting points are different.

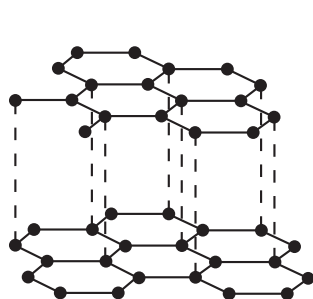
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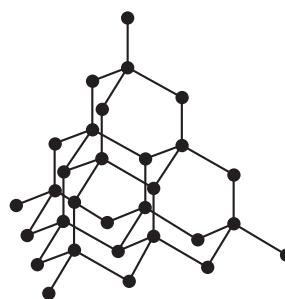
..... [2]

[Total: 2]

31 Two macromolecular forms of carbon are graphite and diamond. The structures of graphite and diamond are given below.



graphite



diamond

(a) Explain in terms of its structure why graphite is soft and is a good conductor of electricity.

.....

.....

.....

.....

..... [3]

(b) State **two** uses of graphite which depend on the above properties.

It is soft

.....

It is a good conductor of electricity

..... [2]

[Total: 5]

32 Nitrogen can form ionic compounds with reactive metals and covalent compounds with non-metals.

Nitrogen reacts with lithium to form the ionic compound lithium nitride, Li_3N .

(a) Write the equation for the reaction between lithium and nitrogen.

..... [2]

(b) Lithium nitride is an ionic compound. Draw a diagram which shows its formula, the charges on the ions and the arrangement of the valency electrons around the negative ion.

Use x for an electron from a lithium atom.
Use o for an electron from a nitrogen atom.

[2]

[Total: 4]

33 Nitrogen fluoride is a covalent compound.

Draw a diagram showing the arrangement of the valency electrons in one molecule of the covalent compound nitrogen trifluoride, NF_3 .

Use x for an electron from a nitrogen atom.
Use o for an electron from a fluorine atom.

[2]

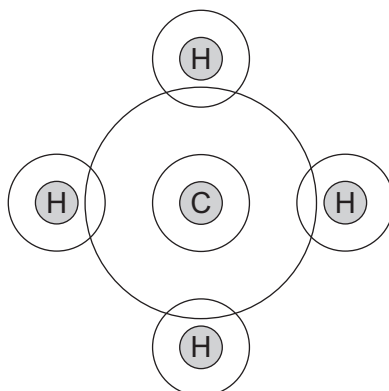
[Total: 2]

34 Draw the electronic structure of a potassium atom.

[2]

[Total: 2]

35 Complete the dot and cross diagram of methane to show **all** the electrons.



[2]

[Total: 2]

- 36** In the Periodic Table, the elements are arranged in columns called Groups and in rows called Periods.

(a) Complete the table for some of the elements in Period 3.

group number	I	II	III	IV	V	VI	VII
symbol	Na	Mg	Al	Si	P	S	Cl
number of valency electrons							
valency							

[2]

(b) What is the relationship between the group number and the number of valency electrons?

.....

.....

[1]

(c) Explain the relationship between the number of valency electrons and the valency for the elements Na to Al,

.....

.....

.....

for the elements P to Cl.

.....

.....

.....

[4]

[Total: 7]