Bonding (F)

1. What is the position of **carbon** in the Periodic Table?

A Period 1, Group 4
B Period 2, Group 4
C Period 4, Group 1
D Period 4, Group 2

Your answer ☐

[1]

2. Which substance has **ionic** bonding?

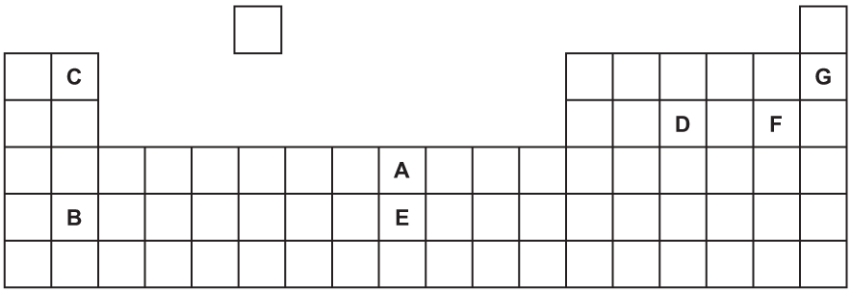
A Carbon dioxide
B Carbon monoxide
C Magnesium oxide
D Oxygen

Your answer ☐

[1]

3. The positions of some elements in the Periodic Table are shown by the letters **A** to **G**.

The letters shown are **not** the symbols of the elements.



Which elements are in Period 2?

A **A** and **E**
B **C** and **B**
C **C** and **G**
D **D** and **F**

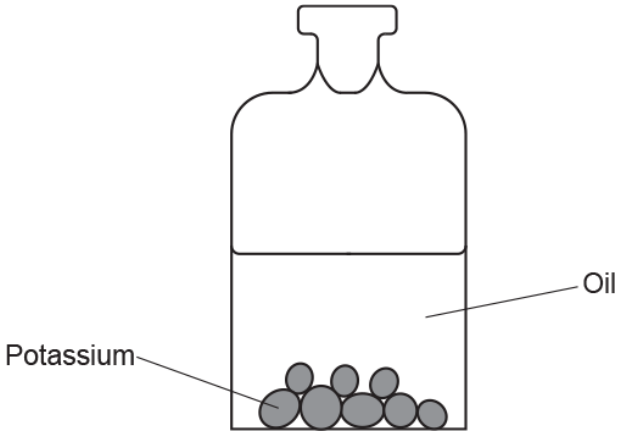
Your answer ☐

[1]

4. Group 1 is a group of elements in the Periodic Table.

i. Potassium is a Group 1 metal.

Potassium is stored under oil because it is very reactive.



What does the oil stop the potassium reacting with?

.....

ii. Sodium is another Group 1 metal.

Sodium reacts in a similar way to potassium.

Explain why.

Use ideas about atomic structure in your answer.

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[1]

5 (a). Dmitri Mendeleev produced a Periodic Table of elements which is the basis for our modern Periodic Table. He left gaps for elements that had not been discovered yet as shown in **Fig. 23.1**.

I	II	III	IV	V	VI	VII
H						
Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl
K	Ca		Ti	V	Cr	Mn
Cu	Zn			As	Se	Br
Rb	Sr	Y	Zr	Nb	Mo	
Ag	Cd	In	Sn	Sb	Te	I
Ce	Ba	La		Ta	W	
Au	Hg	Tl	Pb	Bi		

Fig. 23.1

Describe **two** ways Mendeleev arranged the elements in his Periodic Table.

1 ---

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2 ---

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[2]

(b). Describe how the elements are arranged in the modern Periodic Table.

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[1]

(c). Mendeleev left gaps in his Periodic Table for undiscovered elements. He predicted properties of these elements.

Table 23.1 shows the predicted properties for one of these elements in one of the gaps.

Mendeleev called this element 'eka-silicon'.

Appearance	Grey metal
Melting point (°C)	Over 800
Relative atomic mass	72
Density (g / cm^3)	5.5

Table 23.1

Table 23.2 shows some of the elements that were discovered after Mendeleev published his Periodic Table.

	Scandium (Sc)	Gallium (Ga)	Germanium (Ge)	Technetium (Tc)
Appearance	Silver-white metal	Silver-blue metal	Grey-white metal	Grey metal
Melting point (°C)	1541	30	947	2157
Relative atomic mass	45.0	69.7	72.6	98.0
Density (g / cm^3)	3.0	5.9	5.35	11.0

Table 23.2

i. Which element matches Mendeleev's predictions for 'eka-silicon'?

Tick (✓) **one** box.

Scandium ☐

Gallium ☐

Germanium ☐

Technetium ☐

[1]

ii. Give **two** reasons for your answer to **(c)(i)**.

1 ----------

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2 ----------

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[2]

(d).

i. Mendeleev did not predict the existence of argon, neon, krypton or xenon.

The electron arrangement of argon is 2,8,8.

What does this tell you about the reactivity of argon?

Explain your answer.

---

[2]

ii. Neon is an element that has isotopes. Two of the isotopes are shown below.

$^{20}_{10}Ne$ $^{22}_{10}Ne$

Complete **Table 23.3** to show the number of protons, neutrons and electrons in each neon isotope.

	$^{20}_{10}Ne$	$^{22}_{10}Ne$
Proton		
Neutron		
Electron		

Table 23.3

[3]

6(a). This question is about structure and bonding.

Look at the two structures, **A** and **B**, in **Fig. 22.1**.

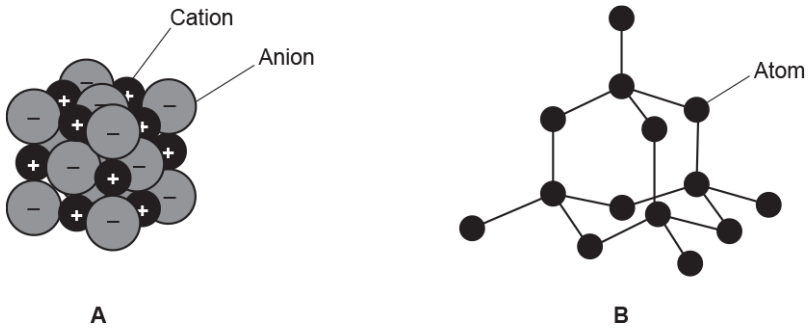

Fig. 22.1

i. Identify the bonding in structure **A**.

Explain your answer.

Bonding

Explanation

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[2]

ii. Explain why structure **B** has a high melting point.

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[2]

iii. Explain why structure **B** does **not** conduct electricity.

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[1]

(b). Look at the structure of a metal in **Fig. 22.2**. Metals are malleable, which means they can be hammered or pressed into shape without breaking or cracking.

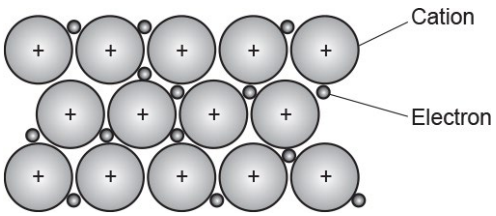

Fig. 22.2

Explain why metals are **malleable**.

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[2]

7 (a). The table shows the properties of different substances.

Substance	Melting point (°C)	Boiling point (°C)	Soluble in water?	Conducts electricity in solid state?	Conducts electricity in molten state?
A	−210	−196	No	No	No
B	1084	2562	No	Yes	Yes
C	605	1137	Yes	No	Yes
D	−78	−34	Yes	No	No

i. Which **two** substances are gases at room temperature?

Tick (✓) **two** boxes.

A ☐

B ☐

C ☐

D ☐

[1]

ii. Substance **C** is an ionic substance.

Use the information in the table to explain why.

_____

_____

_____ **[2]**

(b). You are provided with a mixture of substances **B** and **C**.

Substance **B** is insoluble in water. Substance **C** is soluble in water.

i. Describe how you could separate substance **B** from the mixture.

_____

_____

_____

_____

_____ **[3]**

ii. Describe how you would then obtain substance **C** after separating substance **B**.

_____

_____

_____ **[2]**

8. Lithium is a metal found in Group 1 of the Periodic Table.

i. Describe the structure and bonding in a metal.

You may include a diagram in your answer.

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[2]

ii. Lithium is **malleable** even though metallic bonds are strong.

Explain why metals are malleable.

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[1]

iii. Lithium can conduct electricity in the solid and liquid state.

Explain why metals can conduct electricity.

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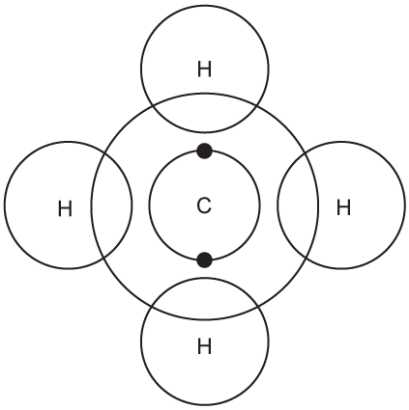
[2]

9.

i. Carbon reacts with hydrogen to make methane, CH_4.

Complete the dot and cross diagram to show the bonding in methane.



[2]

ii. Methane has a low melting point.

Explain why methane has a low melting point.

Use ideas about structure and bonding in your answer.

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[2]

10. *Scientists find out some information about a new compound called compound **X**.

Compound X

	YES	NO
High melting point	✓	✗
Conducts electricity when solid	✗	✓
Conducts electricity when molten	✓	✗

Describe and explain the type of bonding found in compound **X**.

Use all the information above to justify your answer.

[6]

11(a). Look at the table. It shows information about some atoms and ions.

Particle	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons	Electronic structure
A	11	23	11	.....	11	2.8.1
B	9	19	9	10	9	.....
C	.....	37	17	.....	17	2.8.7
D	13	27	.....	.....	10	2.8

Complete the table.

[4]

(b). Particle **A** is a metal **atom**, particle **D** is an **ion**.

Explain why.

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[2]

(c). Element **C** has the electronic structure 2.8.7.

What does this tell you about the position of element **C** in the periodic table?

Explain your answer.

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[4]

(d). Complete the table below to give information about protons, neutrons and electrons.

	Charge	Mass in atomic mass units
proton	.....	1
neutron	.....	.....
electron	negative	.....

[2]

(e). Rutherford was a scientist who helped to develop the atomic model.

State how Rutherford's work contributed to the development of the atomic model

_____

_____ **[1]**

12. What is the relative formula mass of sodium carbonate, Na_2CO_3?

A. 83.0
B. 90.0
C. 106.0
D. 130.0

Your answer ☐

[1]

13. Lead is a metal.

Which statement is true about lead **because** it is a metal?

A. It is a dull grey colour.
B. It is in Group 4 of the Periodic Table.
C. It is in Period 6 of the Periodic Table.
D. It is malleable so can be easily shaped.

Your answer ☐

[1]

14. The Group 7 elements are known as the halogens.
The halogens have similar chemical properties.
Their physical properties vary with increasing atomic number.
All halogens react with alkali metals to make a salt.

i. All halogens have similar chemical reactions.

Explain why in terms of electronic structure.

_____

_____ **[1]**

ii. Sodium reacts with bromine to make sodium bromide, NaBr.

Construct the **balanced symbol** equation for this reaction.

_____ **[2]**

iii. What is the formula of the product of the reaction between astatine and potassium?

_____ **[1]**

END OF QUESTION PAPER