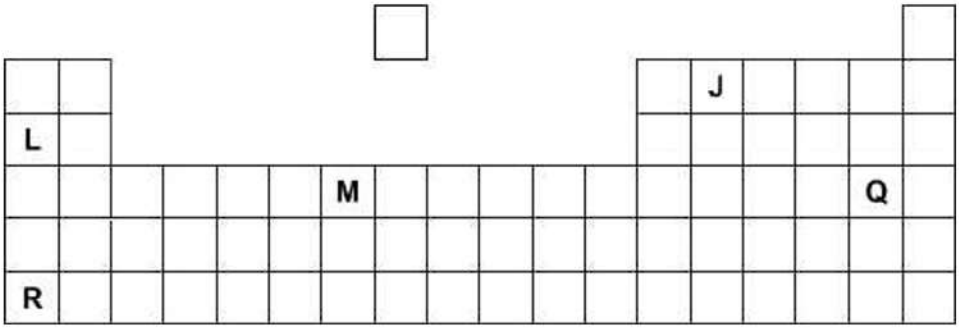
**1.** **Figure 1** shows an outline of the modern periodic table.

**Figure 1**




**J**, **L**, **M**, **Q** and **R** represent elements in the periodic table.

(a) Which element has four electrons in its outer shell?

Tick (✓) **one** box.

**J** ☐ **L** ☐ **M** ☐ **Q** ☐ **R** ☐

**(1)**

(b) Which **two** elements in **Figure 1** are in the same period?

_____ and _____

**(1)**

(c) Which element reacts with potassium to form an ionic compound?

Tick (✓) **one** box.

**J** ☐ **L** ☐ **M** ☐ **Q** ☐ **R** ☐

**(1)**

(d) Which element forms ions with different charges?

Tick (✓) **one** box.

**J** ☐ **L** ☐ **M** ☐ **Q** ☐ **R** ☐

**(1)**

(e) Which element has three electron shells?

Tick (✓) **one** box.

**J** ☐ **L** ☐ **M** ☐ **Q** ☐ **R** ☐

**(1)**

(f) In the 1860s scientists were trying to organise elements.

**Figure 2** shows the table published by John Newlands in 1865.

The elements are arranged in order of their atomic weights.

**Figure 2**

| | | | | | | |
|---|---|---|---|---|---|---|
| H | Li | Be | B | C | N | O |
| F | Na | Mg | Al | Si | P | S |
| Cl | K | Ca | Cr | Ti | Mn | Fe |
| Co,Ni | Cu | Zn | Y | In | As | Se |
| Br | Rb | Sr | Ce,La | Zr | Di,Mo | Ro,Ru |
| Pd | Ag | Cd | U | Sn | Sb | Te |

**Figure 3** shows the periodic table published by Dmitri Mendeleev in 1869.

**Figure 3**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| H | | | | | | | |
| Li | Be | B | C | N | O | F | |
| Na | Mg | Al | Si | P | S | Cl | |
| K Cu | Ca Zn | ? ? | Ti ? | V As | Cr Se | Mn Br | Fe Co Ni |
| Rb Ag | Sr Cd | Y In | Zr Sn | Nb Sb | Mo Te | ? I | Ru Rh Pd |

Mendeleev's table became accepted by other scientists whereas Newlands' table was not.

Evaluate Newlands' and Mendeleev's tables.

You should include:

- a comparison of the tables
- reasons why Mendeleev's table was more acceptable.

Use **Figure 2** and **Figure 3** and your own knowledge.

**(6)**

**(Total 11 marks)**

**2.** This question is about elements and the periodic table.

(a) Use the correct answers from the box to complete the sentences.

| atoms | atomic weights | electrons | proton numbers |
|---|---|---|---|

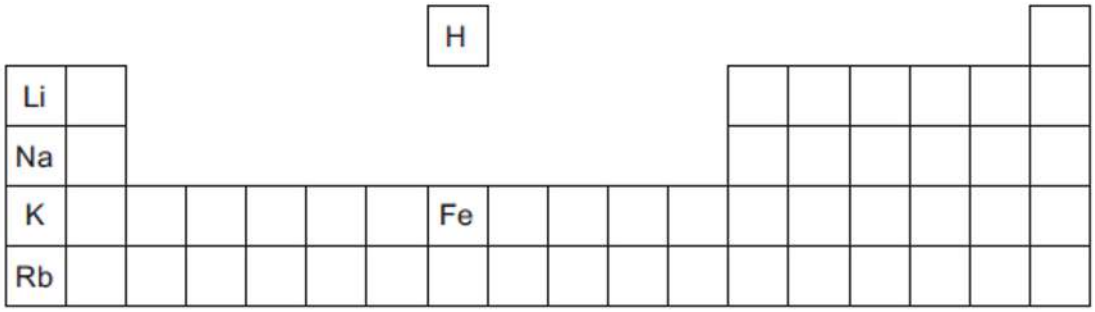
Newlands' and Mendeleev's periodic tables show the elements in order of their _____ .

Following the discovery of protons and _____, the modern periodic table shows the elements in order of their _____ .

**(3)**

(b) **Figure 1** shows the position of six elements in the modern periodic table.

**Figure 1**




(i) Which **one** of these six elements has the lowest boiling point?

_____

**(1)**

(ii) Complete the sentence.

In the periodic table, rubidium (Rb) is in Group _____ .

**(1)**

(iii) Which of these three elements is the most reactive?

Tick (✓) **one** box.

Lithium (Li) ☐

Sodium (Na) ☐

Potassium (K) ☐

**(1)**

(iv) Which **two** statements are correct?

Tick (✓) **two** boxes.

Iron has a higher density than potassium. ☐

Iron is softer than potassium. ☐

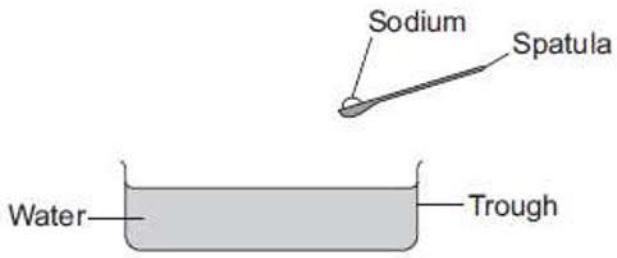
Iron reacts vigorously with water. ☐

Iron forms ions that have different charges. ☐

**(2)**

(c) **Figure 2** shows sodium being put into water.

**Figure 2**




Describe **three** observations that can be seen when sodium is put into water.

1. _____

_____

2. _____

_____

3. _____

_____

**(3)**

**(Total 11 marks)**

**3.** This question is about elements and the periodic table.

(a) Newlands and Mendeleev both produced early versions of the periodic table.

(i) Complete the sentence.

In their periodic tables, Newlands and Mendeleev arranged the elements in

order of _____ .

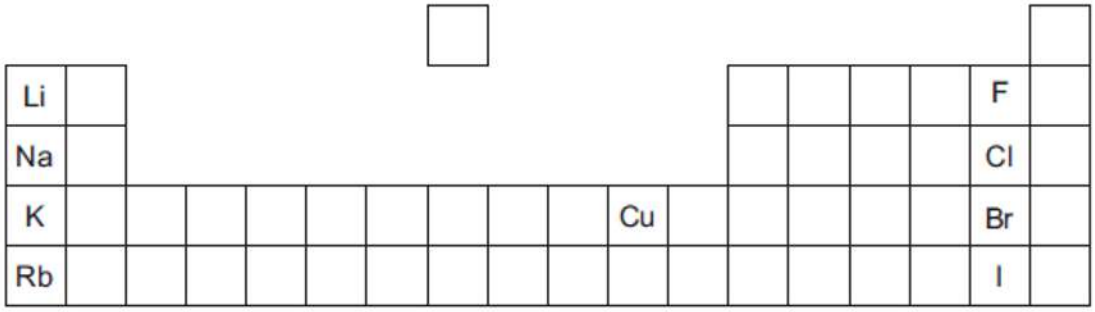
**(1)**

(ii) Name the particle that allowed the elements to be arranged in order of their atomic number in the modern periodic table.

_____

**(1)**

(b) The diagram below shows the position of nine elements in the modern periodic table.




(i) Which **one** of the nine elements shown in the diagram above has the lowest boiling point?

_____

**(1)**

(ii) Copper and potassium have different melting points and boiling points.
Give **one other** difference between the properties of copper and potassium.

_____

_____

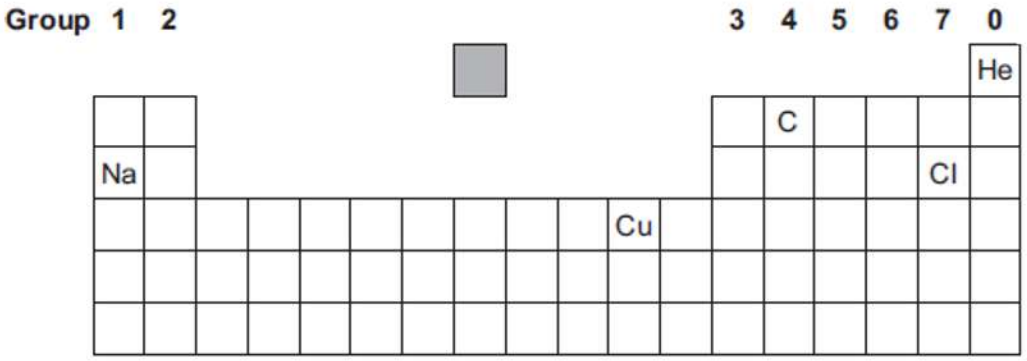
**(1)**

(iii) Explain why the reactivity of the elements increases going down Group 1 from lithium to rubidium but decreases going down Group 7 from fluorine to iodine.

**(4)**

**(Total 8 marks)**

**4.** The diagram shows the chemical symbols of five elements in the periodic table.




(a) Choose the correct chemical symbol to complete each sentence.

(i) The element that is an alkali metal is _____ .

**(1)**

(ii) The element that is a transition metal is _____ .

**(1)**

(iii) The element in Group 4 is _____ .

**(1)**

(iv) The element with a full outer energy level (shell) of electrons is

_____ .

**(1)**

(b) Which other element goes in the shaded box?

_____

**(1)**

**(Total 5 marks)**

**5.** (a) The symbols for seven different elements are shown in **Figure 1**.

**Figure 1**

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | He |
| | Be | | | | | | | | | | | | | | | | |
| Na | | | | | | | | | | | | | | | S | | Ar |
| | Ca | | | | | | Fe | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |

Choose the correct symbol from **Figure 1** to answer each question.

You may use each symbol once, more than once or not at all.

Write the symbol that represents:

(i) a Group 1 element

_____

**(1)**

(ii) a transition metal

_____

**(1)**

(iii) an element with electrons in the same number of energy levels as an atom of argon (Ar)

_____

**(1)**

(iv) an element which forms an oxide that dissolves in water to form an acidic solution

_____

**(1)**

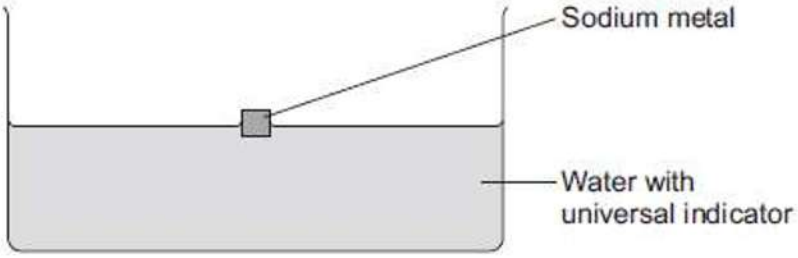
(v) an element that forms a chloride with the formula XCl

_____

**(1)**

(b) A teacher put a cube of sodium metal into water containing universal indicator, as shown in **Figure 2**.

**Figure 2**




The equation for the reaction is:

$$2Na(s) + 2H_2O(l) \longrightarrow 2NaOH\ (aq) + H_2(g)$$

sodium + water ⟶ sodium hydroxide + hydrogen

(i) The sodium floated on the surface of the water. The universal indicator turned purple.

Give **three other** observations that would be seen during the reaction.

1. _____

_____

2. _____

_____

3. _____

_____

**(3)**

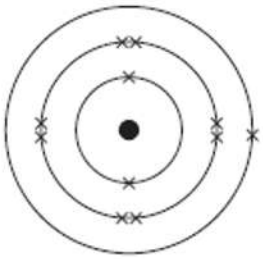
(ii) Name the ion that made the universal indicator turn purple.

_____

**(1)**

(c) **Figure 3** represents the electronic structure of a sodium atom.

**Figure 3**



In the space below, draw the electronic structure of a sodium ion. Include the charge on the ion.

**(2)**

**(Total 11 marks)**

**6.** In 1869, Dmitri Mendeleev produced his periodic table of the elements.

Mendeleev placed the alkali metals in the same group.

(a) What evidence did Mendeleev use to decide that the alkali metals should be in the same group?

_____

_____

**(1)**

(b) Describe how the elements in the modern periodic table are arranged:

(i) in terms of protons

_____

_____

**(1)**

(ii) in terms of electrons.

_____

_____

**(1)**

(c) State **two** properties of transition elements that make them more useful than alkali metals for making water pipes.

_____

_____

_____

_____

_____

**(2)**

(d) Describe and explain the trend in reactivity of the alkali metals (Group 1).

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

**(4)**

**(Total 9 marks)**