The periodic table and group trends

Pearson Edexcel 1CH0 Separate Chemistry · Foundation and Higher

Show your working where needed. Check the worked answers when you finish.

Name _____ Date _____

1. Read a position

A neutral atom has electronic configuration 2,8,7. Give its period and GCSE group number. Explain what each number tells you.

2. Why leave a gap?

Mendeleev left a gap in his periodic table and predicted the properties of the missing element. Explain how a later discovery could support his table.

3. Helium and neon

Helium, with electronic configuration 2, and neon, with configuration 2,8, rarely react. Explain why using their electronic configurations.

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4. Alkali metals and water

A teacher reacts separate pieces of lithium and sodium with water. Predict which metal reacts more vigorously. Name the substances produced by the reaction of sodium.

5. Halogen states

The boiling points of chlorine, bromine and iodine are −34 °C, 59 °C and 184 °C. Iodine melts at 114 °C. State iodine’s physical state at 20 °C and describe the trend in boiling point down Group 7.

6. Halogen displacement

A student adds bromine to potassium iodide solution. Predict any new halogen formed. Predict what happens when iodine is added to potassium bromide solution. Explain your predictions.

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7. Sodium and potassium

Which reacts more vigorously with water, sodium or potassium? Explain your choice using electronic structure.

8. Compare reactivity trends

Predict the change in reactivity from lithium to potassium and from chlorine to iodine. Explain the two trends using electronic structure.

9. Extra challenge · Identify an unknown halogen

A halogen is a dark solid at room temperature. In a separate test, its solution fails to displace bromine from potassium bromide. A student identifies it as iodine. Evaluate the identification using both results and suggest a comparison that would strengthen it.

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Worked answers

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1. Read a position

Period 3 because the atom has three occupied shells. Group 7 because it has seven electrons in its outer shell.

2. Why leave a gap?

A newly discovered element could fit the position and have properties close to his predictions. Matching evidence supported the way he grouped the elements.

3. Helium and neon

Both have full outer shells. Helium has a full first shell with two electrons and neon has a full second shell with eight. These arrangements are stable.

4. Alkali metals and water

Sodium reacts more vigorously. It forms sodium hydroxide in solution and hydrogen gas.

5. Halogen states

Iodine is solid at 20 °C because the temperature is below its melting point. The boiling point increases down Group 7.

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Worked answers

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6. Halogen displacement

Iodine forms in the first mixture. Bromine is more reactive than iodine, so it displaces iodine from potassium iodide. There is no displacement in the second mixture because iodine is less reactive than bromine.

7. Sodium and potassium

Potassium reacts more vigorously. It has an extra occupied shell, so its outer electron is further from the nucleus and more shielded. The nucleus attracts that electron less strongly, so potassium loses it more readily.

8. Compare reactivity trends

Group 1 reactivity increases. The outer electron is further from the nucleus and more shielded, so the nucleus attracts it less strongly and the atom loses it more easily.

Group 7 reactivity decreases. Extra shells make the incoming electron further from the nucleus and shield it more. The attraction is weaker, so the atom gains an electron less easily.

9. Extra challenge · Identify an unknown halogen

Iodine is a dark solid at room temperature and is less reactive than bromine, so it does not displace bromine. Both observations support the identification.

Failure to displace bromine alone only shows that the sample is no more reactive than bromine under the test conditions. Compare another measurable property, such as the sample’s melting point and the known melting point of iodine.

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