Experiment worksheet answers

3.3 Groups in the periodic table have properties in common

Pages 74–75 and 195

Experiment 3.3: Reactivity of metals

Discussion

1 Which metal was the most reactive?

magnesium

2 Which metal was the least reactive?

aluminium (although the others may take a week to react by rusting)

3 Why were the metals cleaned with steel wool first?

The metals form an outer layer of metal oxide. Steel wool removes this layer.

4 Why was detergent added to the test tubes with the hydrochloric acid?

Detergent allows the bubbles formed by the production of hydrogen to hold their shape long enough for them to be seen and measured.

5 What properties would you think the most reactive metal would also exhibit?

The reactive metal will also be softer and have a low melting point and boiling point.

6 Is there any link between the reactivity of the metals and where they are located in the periodic table?

The metals closest to the bottom left of the periodic table (e.g. francium) will be most reactive.

Experiment worksheet answers

3.4 Non-metals have properties in common

Pages 76–77 and 196

Challenge 3.4: Identifying patterns in the periodic table

Results

Students should colour the following sections:

• the metals

• the noble gases

• the non-metals (other than noble gases)

• the metalloids.

The noble gases (He, Ne and Ar) should have labels ‘stable structure, does not form an ion’.

Group 14 elements (C and Si) should have labels ‘needs to gain or lose more than three electrons for a stable structure, does not form an ion’.

Discussion

1 What patterns do you notice in the entries for the alkali metals?

The alkali metals will all lose one electron and form a +1 ion.

2 What patterns do you notice in the entries for the alkaline earth metals?

The alkaline earth metals will all lose two electrons and form a +2 ion.

3 What patterns apply to all the metals listed?

All metals will form positive ions.

4 What patterns do you notice in the entries for the halogens?

All halogens can gain one electron to form a −1 ion.

5 What patterns do you notice in the entries for the group 16 metals?

Group 6 elements can gain two electrons to form −2 ions.

6 What patterns apply to the non-metals, except for hydrogen and the noble gases?

All non-metals can form negative ions.

7 In general, what do you expect to happen when a metal atom and a non-metal atom meet? Which groups of non-metals will not react in this way? Why?

Metals form positive ions and non-metals form negative ions. When a metal atom donates an electron to a non-metal atom, they form negative and positive ions, respectively. The two ions will then attract each other in an ionic bond. The exception to this is the noble gases, which do not form ions.

8 Predict what might happen if a:

a potassium atom and a fluorine atom meet

The potassium atom will lose its outer electron to the fluorine atom. An ionic bond will form between the two ions.

b calcium atom and an oxygen atom meet

The calcium atom will lose its two outer shell electrons to the oxygen atom. An ionic bond will form between the two ions.

9 Suggest why hydrogen and the metalloids were not considered in this activity.

Hydrogen and the metalloids are not considered because they have some properties of metals and some properties of non-metals. For example carbon needs to gain or lose more than three electrons to form a stable structure. Hydrogen can gain an electron to complete its shell or lose an electron to form a proton. Both of these happen under different conditions.

Experiment worksheet answers

3.5 Metal cations and non-metal anions combine to form ionic compounds

Pages 78–79 and 197

Experiment 3.5: Conductivity of ionic compounds

Discussion

1 Sea salt is a mixture of different ionic compounds, including sodium chloride. What can you conclude about the ability of solid ionic compounds to conduct electricity, whether they are pure or mixed up together?

The solid ionic compounds are unable to conduct electricity.

2 What effect does dissolving an ionic compound in water have on its ability to conduct electricity?

Dissolving the ionic compounds in water allows the ions to separate. This allows electricity to pass through the substance, completing the circuit.

3 To conduct electricity, a substance must have charged particles that can move about. Suggest an explanation for your findings.

Electricity needs freely moving charged particles in order to complete a circuit. The electrons in crystallised ionic compounds cannot move freely and therefore will be unable to complete the electrical circuit. When the ionic compounds are dissolved in water, they are able to separate and therefore move freely, allowing electricity to pass through.

4 The melting point of sodium chloride is 801°C, so it is not practical to melt it in the school laboratory. Predict whether molten sodium chloride would conduct electricity. Justify your answer.

All liquids have molecules that are able to flow freely around each other. Molten sodium chloride will have this property. The freely moving charged particles will allow electricity to pass through and therefore will conduct electricity.

Experiment worksheet answers

3.5 Metal cations and non-metal anions combine to form ionic compounds

Pages 78–79 and 198

Skills lab 3.5: Ionic compounds

Your turn

Write the formulas for:

a lithium bromide

LiBr

b iron(III) chloride

FeCl3

c sodium nitride

Na3

d aluminium oxide

Al2O3

Experiment worksheet answers

3.6 Non-metals combine to form covalent compounds

Pages 80–81 and 199

Challenge 3.6: Modelling covalent molecules

Discussion

1 What type of bond occurs between a metal and a non-metal?

Ionic bonding

2 What type of bond occurs between two non-metals?

Covalent bonding

3 What is a valency shell?

The outermost shell of an atom that contains electrons.

4 What is meant by the term ‘sharing electrons’ in covalent bonds?

The electrons spend time moving around the nuclei of both atoms.

Conclusion

What do you know about covalent bonds?

Covalent bonds involve the sharing of electrons between two non-metals.

Experiment worksheet answers

3.7 Metals form unique bonds

Pages 82–83 and 199

Challenge 3.7: Modelling alloys

Discussion

1 Which ‘alloy’ was most malleable (able to be rolled out easily when cold)?

The alloy with the least sand.

2 Which ‘alloy’ was most ductile (able to be drawn out into a wire easily)?

The alloy with the least sand.

3 Which ‘alloy’ was most brittle (snapped quickly)?

The alloy with the most sand.

4 Did the amount of sand in the ‘alloy’ affect the size of the largest fracture surface? Explain your observation.

Yes. The more sand in the plasticine, the larger the fracture surface.

Conclusion

How does the alloying of metal affect its properties?

Alloying metal (by adding sand) interferes with the way atoms in the metal move against each other. This affects the metals properties.