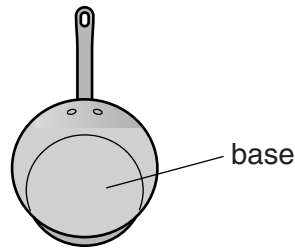


1 Kylie is choosing a metal to make a base for a saucepan.



Look at the information about some metals.

| Metal | Melting point in °C | Relative electrical conductivity (1= low, 10= high) | Relative conductivity of heat (1= low, 25= high) | Density in g/cm <sup>3</sup> |
|-------|---------------------|---|--|------------------------------|
| A     | 1535                | 1   | 4.2  | 7.9                          |
| B     | 98                  | 2   | 7.8  | 1.0                          |
| C     | 1083                | 6   | 22.3   | 8.9                          |
| D     | 660                 | 4   | 11.8   | 2.7                          |

(a) Which metal should Kylie choose to make a base for a saucepan?

.....

Explain your answer.

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

(b) Describe **metallic bonding** and explain why metals are good conductors of electricity.

You may wish to draw a labelled diagram.

.....  
.....  
..... [3]

[Total: 5]

2 (a) An element **X** has the electronic structure 2.8.8.2.

Explain how you can tell that element **X** is calcium.

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

(b) Chlorine has the electronic structure 2.8.7.

Chlorine,  $Cl_2$ , is a covalent molecule.

Use the 'dot and cross' model to describe the bonding in a molecule of chlorine,  $Cl_2$ .

You only need to draw the outer shell electrons.

[2]

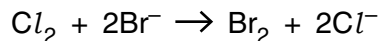
(c) Sodium chloride,  $NaCl$ , contains sodium ions,  $Na^+$ , and chloride ions,  $Cl^-$ .

Explain why sodium ions are positively charged and chloride ions are negatively charged.

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

(d) Chlorine reacts with sodium bromide solution.

Look at the **ionic** equation for this reaction.



Explain why chlorine is **reduced** in this reaction.

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

(e) Chlorine also reacts with potassium iodide solution, KI.

Iodine and potassium chloride are made.

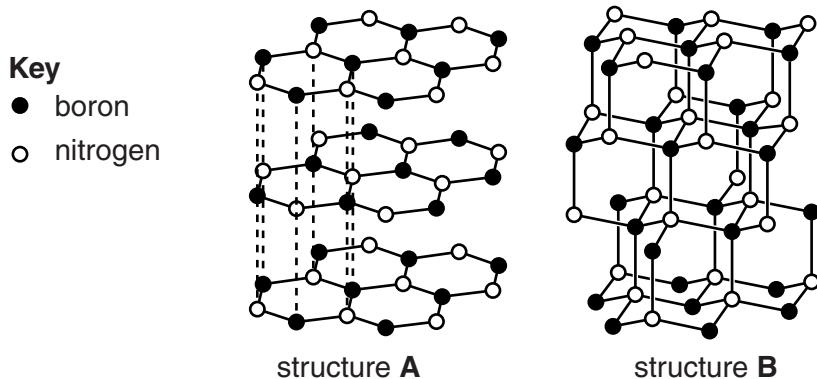
Construct a **balanced symbol** equation for this reaction.

..... [2]

[Total: 8]

3 Boron nitride, BN, exists in two physical forms.

The structures of these forms are shown below.



These two forms of boron nitride resemble graphite and diamond, the two allotropes of carbon.

(a) Boron nitride, with structure **A**, is slippery.

Explain why, in terms of structure and bonding.

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

(b) Boron nitride, with structure **B**, has a very high melting point.

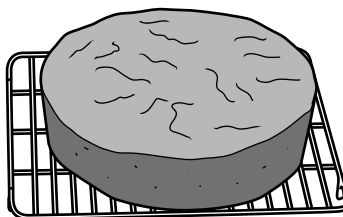
Explain why, in terms of structure and bonding.

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

[Total: 4]

4 This question is about chemical changes.

(a) Amir is making a cake.



He adds baking powder to the cake mixture.

Baking powder contains sodium hydrogencarbonate.

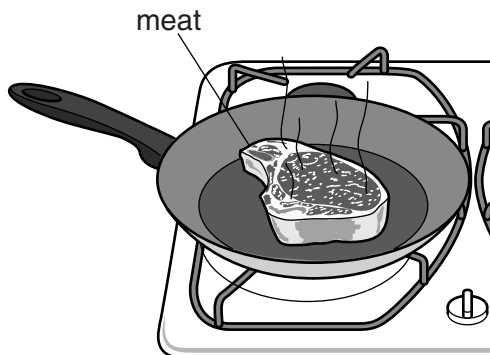
Sodium hydrogencarbonate breaks down when heated in an oven.

Sodium carbonate, water and a gas are the products made.

What gas is made?

..... [1]

(b) Amir cooks some meat.



Meat contains protein.

What happens to the **protein molecules** when the meat is cooked?

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

[Total: 2]

5 Some foods contain additives.

An emulsifier stops oil and water in a food from separating.

(a) Phil finds some information about four substances.

Look at this information.

| Substance | Is it poisonous? | Does it have a smell? | Cost of making 1g of substance in pence | Does it stop oil and water from separating? |
|-----------|------------------|-----------------------|---|---|
| A         | yes              | no                    | 3                                       | yes   |
| B         | no               | no                    | 6                                       | yes   |
| C         | no               | no                    | 1                                       | no  |
| D         | no               | yes                   | 5                                       | yes   |

Which substance is the most suitable to be used as an emulsifier in food?

Explain your answer.

.....

.....

.....

.....

..... [3]

(b) A processed food contains an emulsifier.

(i) Draw a diagram of an emulsifier molecule.

Label the **two** important parts of the molecule.

[2]

(ii) The processed food also contains cooked potato.

Potato is easier to digest when it is cooked rather than raw.

Explain why.

.....

.....

.....

..... [2]

6 Look at the electronic structures of some atoms.

| Atom | Electronic structure |
|------|----------------------|
| W    | 2.8.1                |
| X    | 2.8.4                |
| Y    | 2.8.7                |
| Z    | 2.8.8                |

(a) (i) One of the atoms is a metal which makes a positive ion.

Which one? Choose from the table.

answer .....

[1]

(ii) One of the atoms has a stable electronic structure and is unreactive.

Which one? Choose from the table.

answer .....

[1]

(iii) Two of the atoms can combine together by **transferring** electrons to form an **ionic** bond.

Which two? Choose from the table.

..... and .....

[1]



(b) Ammonia has the formula,  $\text{NH}_3$ .

The electronic structure of nitrogen is 2.5.

The electronic structure of hydrogen is 1.

Draw a 'dot and cross' diagram to show the **covalent** bonding in ammonia.

Show all the electrons.

[2]

(c) Sodium chloride is an **ionic** compound.

Sodium chloride

- will not conduct electricity when it is a solid
- will conduct electricity when it is dissolved in water.

Explain these two observations in terms of structure and bonding.

.....

.....

.....

..... [2]

7 Look at the table. It shows information about the Group 1 metals.

| Element   | Symbol | Electronic structure | Melting point in °C | Boiling point in °C | Atomic radius in nm |
|-----------|--------|----------------------|---------------------|---------------------|---------------------|
| lithium   | Li     | 2.1                  | 181                 | 1342                | 0.152               |
| sodium    | Na     | 2.8.1                | .....               | 883                 | 0.185               |
| potassium | K      | 2.8.8.1              | 64                  | 760                 | 0.227               |
| rubidium  | Rb     | 2.8.18.8.1           | 39                  | 688                 | .....               |

(a) Predict the melting point of sodium and the atomic radius of rubidium.

Write your answers in the table.

[2]

(b) Sodium reacts with water.

Sodium hydroxide, NaOH, and hydrogen, H<sub>2</sub>, are made.

Write a **balanced symbol** equation for this reaction.

..... [2]

(c) The Group 1 elements all react in a similar way.

Explain why.

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

(d) Sodium reacts with fluorine. Sodium ions and fluoride ions are made.

The electronic structure of fluorine is 2.7.

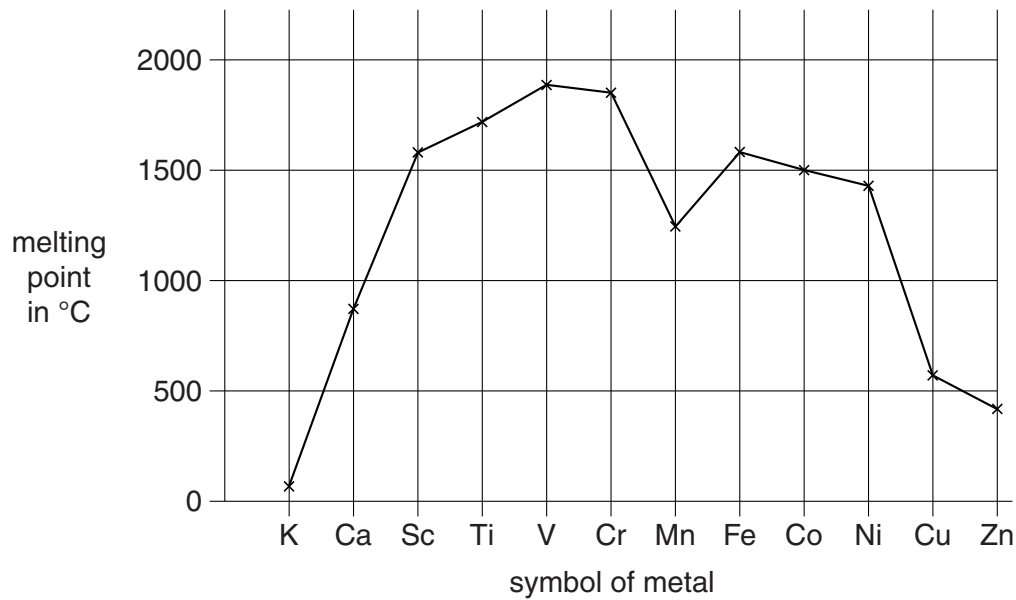
Draw a 'dot and cross' diagram to show the electronic structure of a sodium ion and of a fluoride ion. Include the charges on the ions.

[2]

[Total: 7]

8 Most metals have high melting points.

Look at the graph. It shows the melting points of some metals.



(a) Write the symbol of the metal which has the **weakest** metallic bonds.

..... [1]

(b) Describe, using a labelled diagram, what is meant by metallic bonding.

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

[Total: 3]