Name: _____

Class: _____

Date: _____

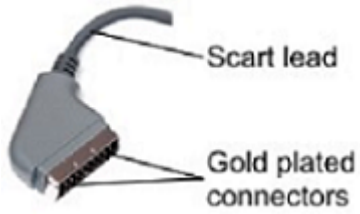
Bonding, Structure & Properties part 5 AQA Triple Chemistry

Time: **42 minutes**

Marks: **42 marks**

Comments:

1. High quality connectors are used to connect a satellite box to a television.
The connectors should conduct electricity very well and should not corrode.



By Alphathon (Own work) [CC-BY-SA-3.0 or GFDL], via Wikimedia Commons

The connectors on this scart lead are coated with gold.

(a) Gold is a typical metal.

(i) Describe the structure and bonding of gold.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(ii) Why is gold a good conductor of electricity?

_____

_____

(1)

(b) The surface of some metals, such as iron, corrode when exposed to the air.

Suggest why this reduces the electrical conductivity of the metal.

_____

_____

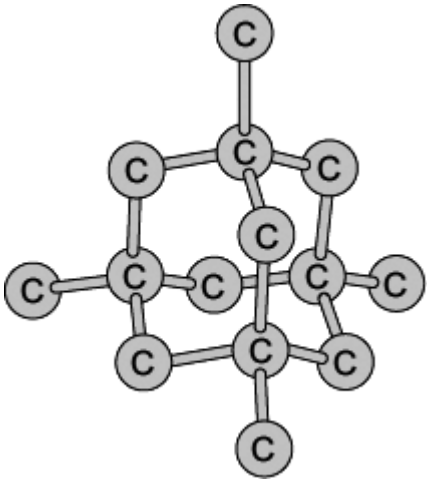
_____

_____

(2)

(Total 6 marks)

2. Diamonds are used as abrasives.



Model of part of the diamond structure

Diamonds are very hard.
Explain why.

A good answer will include information on the structure and bonding in diamonds.

_____

_____

_____

_____

_____

_____

_____

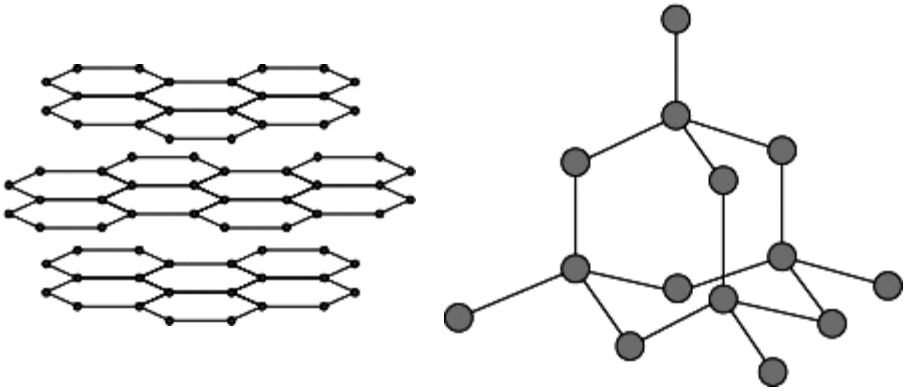
_____

(3)

(Total 3 marks)

3. Graphite and diamond are different forms of the element carbon.
Graphite and diamond have different properties.

The structures of graphite and diamond are shown below.



Graphite **Diamond**

(a) Graphite is softer than diamond.

Explain why.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(b) Graphite conducts electricity, but diamond does not.

Explain why.

_____

_____

_____

_____

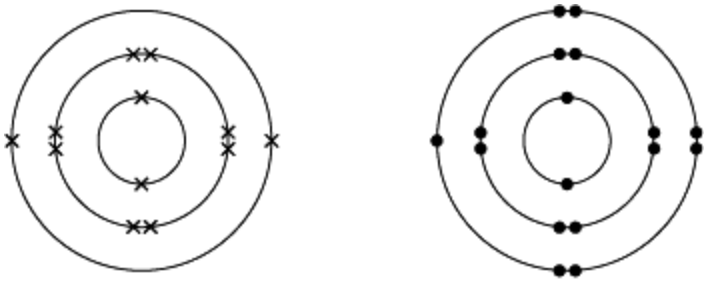
_____

_____

(3)

(Total 7 marks)

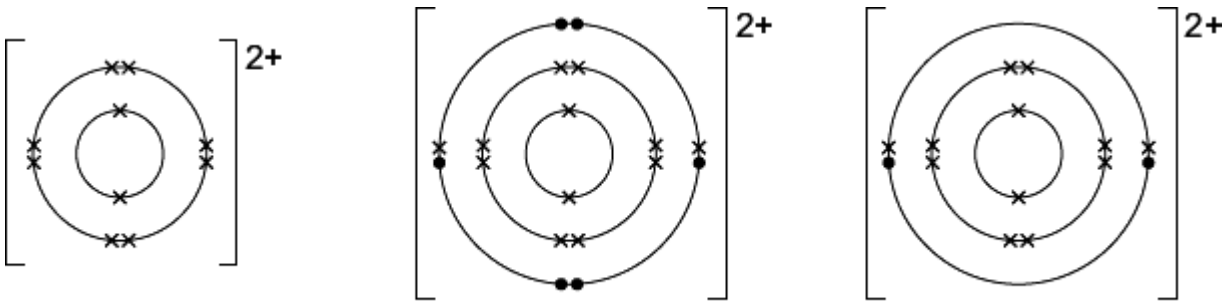
4. The diagrams represent the electronic structure of a magnesium atom and a chlorine atom.



Magnesium atom **Chlorine atom**

Magnesium reacts with chlorine to make the ionic compound called magnesium chloride. This contains magnesium ions, Mg^{2+}, and chloride ions, Cl^{-}

(a) (i) Which structure, **A**, **B** or **C**, represents a magnesium ion?

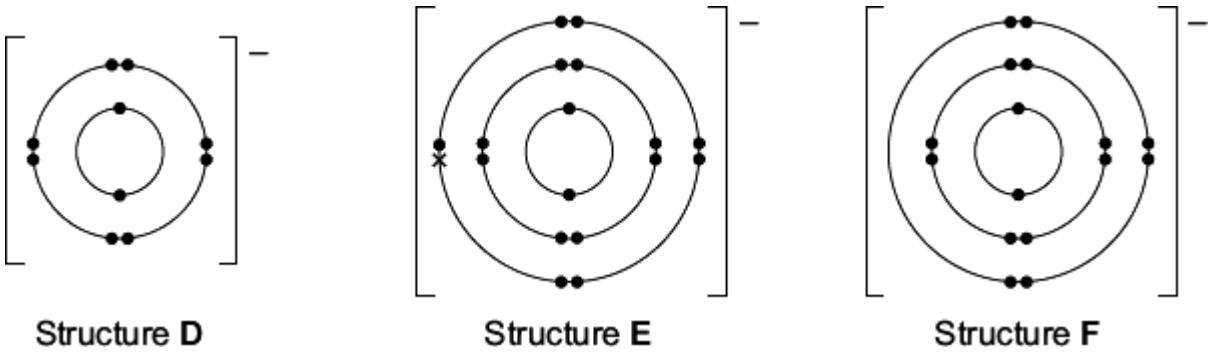


Structure **A** Structure **B** Structure **C**

The magnesium ion is Structure ☐

(1)

(ii) Which structure, **D**, **E** or **F**, represents a chloride ion?



Structure **D** Structure **E** Structure **F**

The chloride ion is Structure ☐

(1)

(b) Magnesium metal can be extracted from sea water.
Sea water contains magnesium chloride, $MgCl_2$

(i) Calcium hydroxide, $Ca(OH)_2$, is added to the sea water.
Magnesium hydroxide, $Mg(OH)_2$, is produced as a solid.

This is the equation for the reaction:

$$MgCl_2(aq) + Ca(OH)_2(aq) \rightarrow Mg(OH)_2(s) + CaCl_2(aq)$$

Draw a ring around the correct answer to complete each sentence.

Magnesium hydroxide forms as a solid because it is [soluble / insoluble / dissolved] in water.

This type of reaction is called [precipitation. / neutralisation. / thermal decomposition.]

(2)

(ii) How is the solid magnesium hydroxide separated from the solution?

_____

(1)

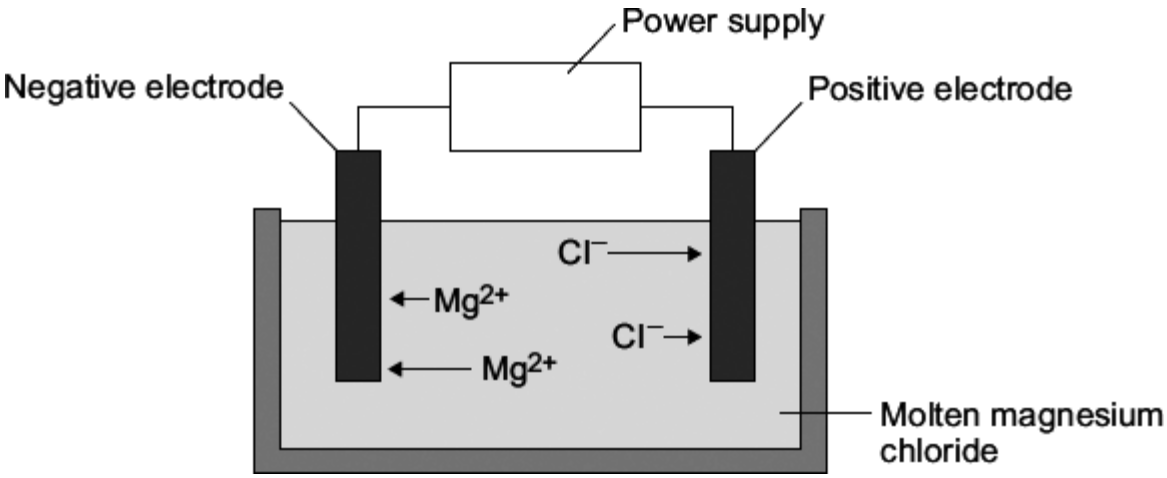
(iii) An acid is then added to the solid magnesium hydroxide to make magnesium chloride.

Draw a ring around the name of this acid.

nitric acid **hydrochloric acid** **sulfuric acid**

(1)

(c) Electrolysis is used to extract magnesium metal from magnesium chloride.



(i) What must be done to solid magnesium chloride to allow it to conduct electricity?

_____

(1)

(ii) Why do the magnesium ions move to the negative electrode?

_____

_____

(1)

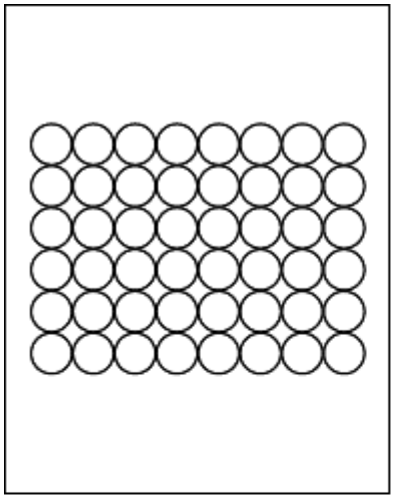
(iii) Name the product formed at the positive electrode.

_____

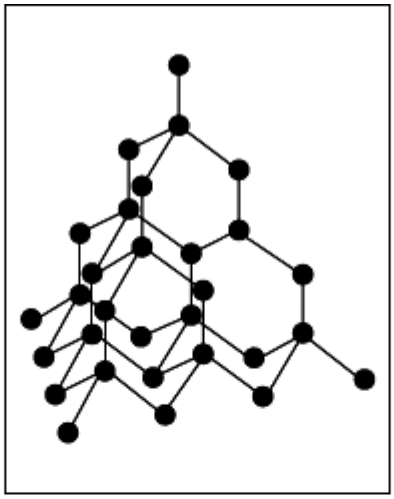
(1)

(Total 9 marks)

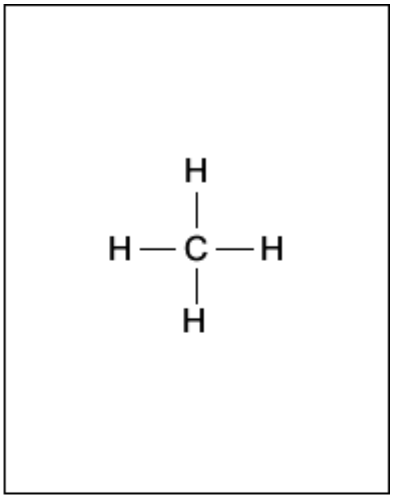
5. The diagrams represent the structures of five substances, **A**, **B**, **C**, **D** and **E**.



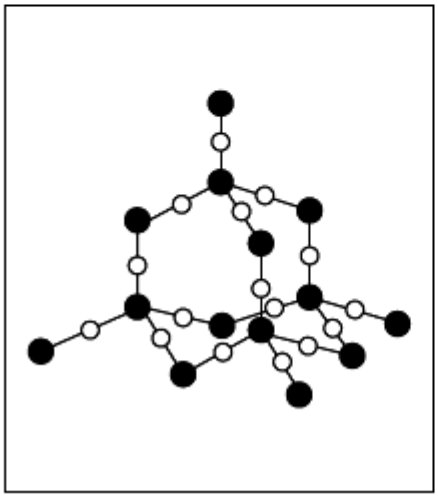
A



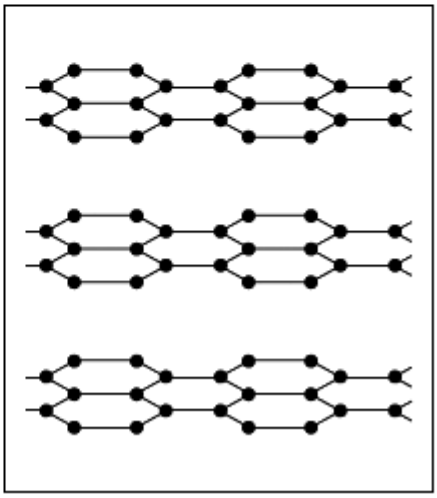
B



C



D



E

(a) Give **one** substance, **A**, **B**, **C**, **D** or **E**, that:

(i) has a very low boiling point

(1)

(ii) is a compound

(1)

(iii) is a metal.

(1)

(b) Draw a ring around the type of bonding holding the atoms together in substance **C**.

covalent **ionic** **metallic**

(1)

(c) Explain why substance **E** is soft and slippery.

_____

_____

_____

_____

(2)

(Total 6 marks)

6. Oil rigs are used to drill for crude oil.

(a) Drill heads are made from steel. Steel is an alloy.

Explain why alloys are harder than pure metals.

_____

_____

_____

_____

_____

_____

(3)

(b) Drill heads also contain diamonds.

Describe, as fully as you can, the structure and bonding in diamond.

(4)

(c) Polymers are produced from crude oil.

Describe the structure and bonding in a thermosoftening polymer and explain why thermosoftening polymers melt when heated.

(4)

(Total 11 marks)

1. (a) (i) *mention of molecules **or** any reference to incorrect bonding = max 2*

giant structure / lattice or particles arranged in a regular pattern
allow close packed / layers

1

sea of electrons / delocalised electrons
allow free electrons

1

positive ions and electrons attract each other
ignore metallic bonds
appropriately labelled diagrams can gain first two marks

1

(ii) (sea of) electrons can move <u>through the structure</u>
allow free / roaming / mobile electrons

or delocalised electrons

1

(b) (metal) oxide / ionic compound formed

1

ions not free to move

or

electrons cannot move <u>through the structure</u>
allow no / fewer delocalised / free / roaming / mobile electrons

1

[6]

2. any **three** from:
any reference to incorrect bonding = max 2

- giant structure / lattice / macromolecule
- covalent (bonds)
- bonds are (very) strong
  allow bonds difficult to break
  ***or** takes a lot of energy to break bonds*
- each atom / carbon joined to <u>four</u> others
  accept each atom / carbon forms <u>four</u> bonds

3

[3]

3. (a) **Graphite:**

because the layers (of carbon atoms) in graphite can move / slide

it = graphite

1

this is because there are only weak intermolecular forces **or** weak forces between layers

accept Van der Waals' forces allow no covalent bonds between layers

1

Diamond:

however, in diamond, each carbon atom is (strongly / covalently) bonded to 4 others

allow diamond has three dimensional / tetrahedral structure

1

so no carbon / atoms able to move / slide

*allow so no layers to slide **or** so diamond is rigid*

1

(b) because graphite has delocalised electrons / sea of electrons

allow free / mobile / roaming electrons

1

which can carry charge / current **or** move through the structure

1

however, diamond has no delocalised electrons

accept however, diamond has all (outer) electrons used in bonding

1

[7]

4. (a) (i) A

1

(ii) E

1

(b) (i) insoluble

precipitation

2

(ii) filtration

*accept decant **or** centrifuge*

1

(iii) hydrochloric acid

1

(c) (i) melt

allow add to / dissolve in water

allow heat until liquid

allow turn it to liquid / make it molten

ignore heat

1

(ii) they are positive

or

opposite charges **or** opposites attract

*do **not** accept electrodes attracting*

*do **not** accept positive electrons*

1

(iii) chlorine

accept Cl_2

*do **not** accept chloride*

1

[9]

5. (a) (i) C

1

(ii) C **or** D

1

(iii) A

1

(b) covalent

1

(c) layers

1

can slide / move over each other

accept are weakly bonded (owtte)

allow no bonds between layers

ignore slip / rub

1

[6]

6. (a) because atoms / ions / particles in alloy are different (sizes)

*do **not** allow reference to molecules*

ignore reference to compounds

1

so layers distorted

(and layers / atoms / ions / particles) don't slide **or** slide less easily

accept all marking points in a suitably labelled or annotated diagram

1

*if no other mark awarded accept an alloy is a mixture **or** contains different metals / elements for **1** mark*

1

(b) giant structure **or** lattice **or** macromolecule

*max **3** marks if incorrect bonding*

1

strong bonds (between carbon / atoms)

1

covalent (bonds)

1

each carbon / atom forms 4 bonds

accept tetrahedral

*if no other marks awarded, allow carbon (atoms) for **1** mark*

1

(c) *reference to incorrect bonding = max **3***
*reference to 'weak covalent bonds' = max **2***
allow correctly drawn diagram for first two marking points eg. (tangled) lines with no cross-links

chains **or** large molecules

ignore layers

1

with intermolecular forces **or** forces between chains

allow bonds for forces accept no cross-links

1

that are weak

must relate to 2 nd marking point

1

and are easily overcome/ broken (when heated)

accept molecules / chains can flow / move

1

[11]