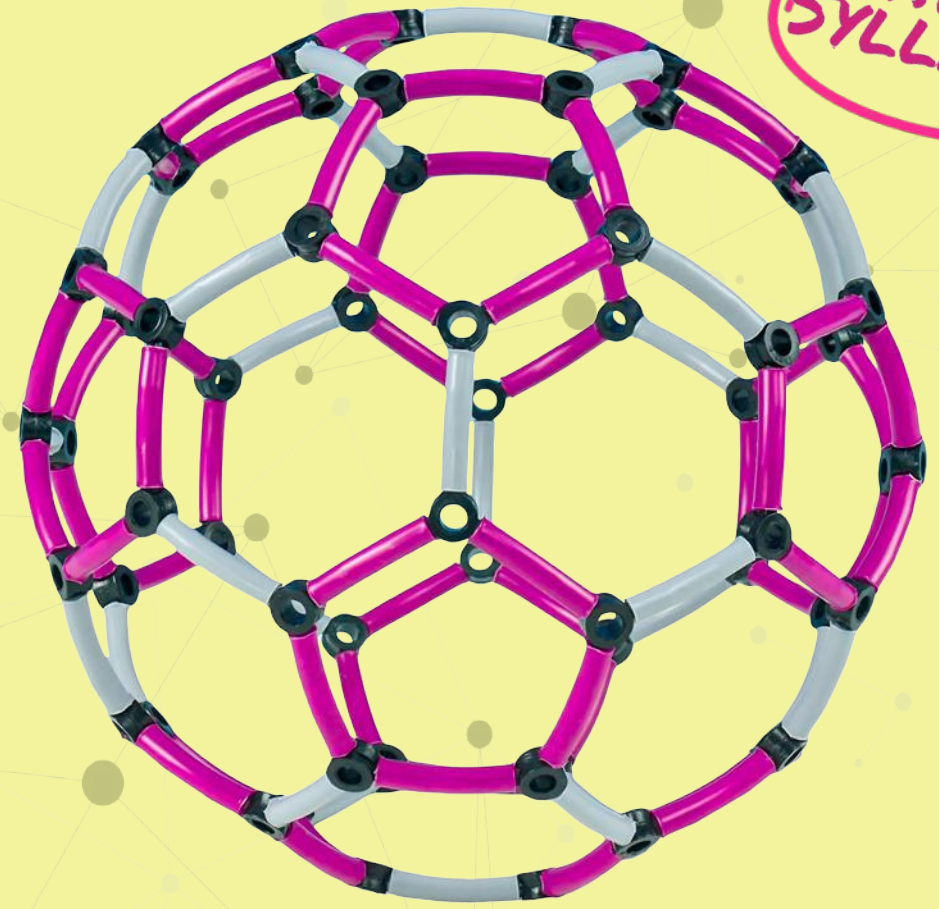
edexcel

AS Chemistry

LATEST SYLLABUS



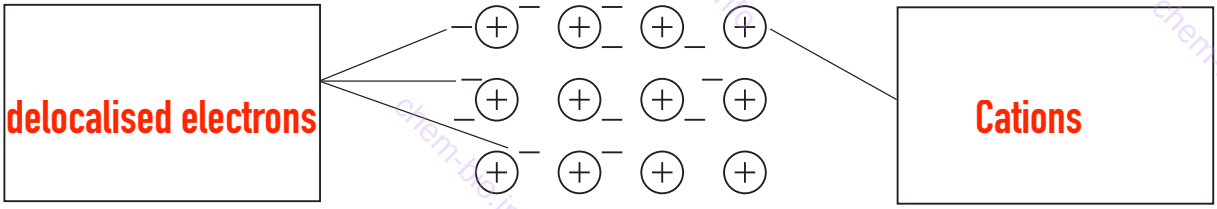
Unit 1 Classified Past Papers

SCAN ME

1 The diagram below illustrates a model of the metallic bonding in rubidium.

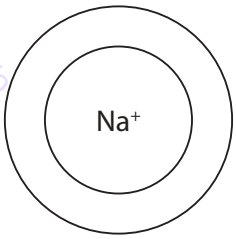
Write appropriate labels in the two empty boxes in order to complete the diagram.

(2)



(ii) Draw an electron density map for the iodide ion in sodium iodide showing any effect the sodium ion has on the iodide ion.

(1)



*(c) The lattice energies of sodium fluoride and magnesium fluoride are shown in the table below.

Compound	Lattice energy / kJ mol^{-1}
Sodium fluoride, NaF	–918
Magnesium fluoride, MgF_2	–2957

Explain, in terms of the sizes and charges of the ions involved, why the lattice energy of MgF_2 is more negative than that of NaF.

(3)

Lattice energy of MgF2 more exothermic than that of NaF because Mg2+ is smaller than Na+

Mg2+ higher charge density than Na+

So electrostatic forces of attraction between ions stronger in MgF2 than in NaF

(Total for Question 1 = 5 marks)

2 Barium chloride can be made by reacting solid barium carbonate with dilute hydrochloric acid in the following reaction.

$$BaCO_3 + 2H^+ \rightarrow Ba^{2+} + CO_2 + H_2O$$

(a) (i) Write the ionic equation for the reaction of solid barium carbonate with hydrogen ions from the hydrochloric acid. State symbols are not required.

(1)

(ii) State **two** observations you would make while the reaction is taking place. No change of colour occurs.

(2)

Observation 1 Effervescence (bubbles)

Observation 2 Solid disappears (dissovles)

(b) In an experiment to prepare crystals of hydrated barium chloride, $BaCl_2.2H_2O$, a volume of 25.0 cm^3 of 2.00 mol dm^{-3} hydrochloric acid, HCl, was transferred to a beaker and solid barium carbonate, $BaCO_3$, was added until it was in excess.

(i) How many moles of acid were used in the reaction?

(1)

n = vol(dm3) x c

25/1000 x 2 = 0.05

(ii) What mass of barium carbonate, in grams, reacts with this amount of acid?

The molar mass of barium carbonate is 197.3 g mol^{-1}.

(1)

m = n x Mr

0.05/2 x 197.3 = 4.9

n BaCO3 **Mr**

	BaCO3	HCl
ratio	1	2
n	x	0.05

n BaCO3 = 0.05/2

(iii) Why was an **excess** of barium carbonate used in the experiment?

(1)

So that all acid was neutralised (reacted)

(iv) How would you separate the barium chloride solution from the reaction mixture in part (iii)?

(1)

Filtration

(v) The barium chloride solution was left to crystallize. The crystals were separated and dried carefully. A sample of 5.35 g of hydrated crystals, $BaCl_2.2H_2O$, which has molar mass 244 g mol^{-1}, was obtained. Calculate the percentage yield of this reaction.

(2)

actual mass

in the equation, crystals are Ba ions

use mol ratio from previous page

mol of BaCl2 = mol of BaCO3 = 0.05/2 = 0.025

maximum mass of BaCl2 = n x Mr

maximum mass = 0.025 x 244 = 6.1

%Yield = actual ÷ maximum x 100

%Yield = 5.32 ÷ 6.1 x 100 = 87.2%

(vi) Give **one** reason why the yield of crystals is less than 100%, even when the reactants contain no impurities.

(1)

Not all solid crystallises

Some barium chloride remains in solution

Product lost during filtration

*(c) The lattice energies of sodium fluoride, sodium chloride and magnesium fluoride are shown in the table below.

Compound	Lattice energy / kJ mol^{-1}
Sodium fluoride, NaF	–918
Sodium chloride, NaCl	–780
Magnesium fluoride, MgF_2	–2957

Explain, in terms of the sizes and charges of the ions involved, the differences between the lattice energy values of

(i) NaF and NaCl

(2)

NaF more negative (exothermic) than NaCl because F- smaller than Cl-

F- forms stronger electrostatic attractions than Cl–

(ii) NaF and MgF_2

(2)

Mg2+ smaller than Na+

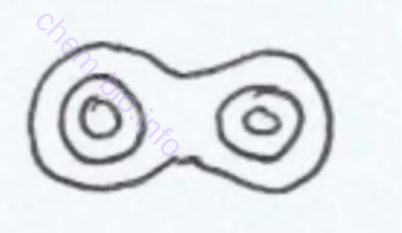
Mg2+ has a greater charge density than Na+

(Total for Question 2 = 12 marks)

3 Sodium and chlorine react together to produce sodium chloride. The bonding in the product is different from that in both of the reactants. Evidence for the type of bonding present can be obtained in a number of different ways.

(a) Draw the electron density map for a chlorine molecule to show covalent bonding.

(1)



(b) Sodium chloride is ionically bonded. What is meant by the term **ionic bond**?

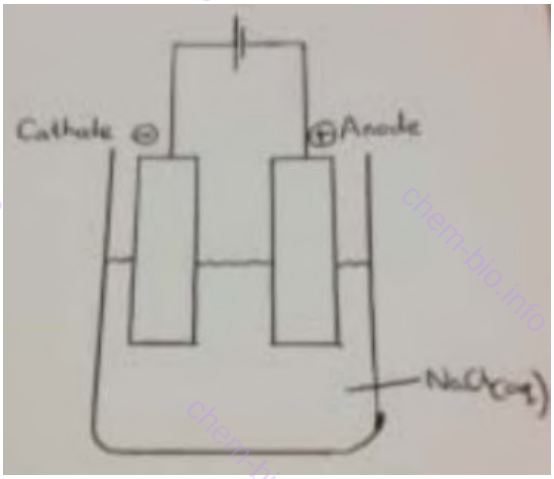
(1)

Electrostatic attraction between oppositely charged ions

(c) Electrolysis is an experiment which you could carry out in a school or college laboratory on an aqueous solution of sodium chloride, to provide evidence for the presence of ionic bonding.

Draw a labelled diagram of the apparatus that you would use for this experiment, indicating how your results would show that the bonding was ionic.

(3)

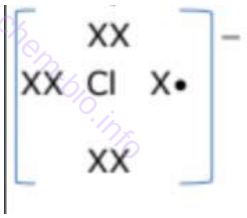


)5))

(d) Chlorine gains an electron when it reacts with sodium to form sodium chloride.

(i) Draw the dot and cross diagram of a chloride ion showing outer electrons only.

(1)



Cl 17 + 1 = 18

(ii) Give the formula of an ion from **Period 3** that is isoelectronic with the chloride ion.

(1)

S2- or P3-

P 15 +

(e) Sodium and sodium chloride can both be good conductors of electricity.

Under what conditions do these substances conduct electricity?

Compare the method of conductivity in each case.

(3)

Sodium conducts when solid and molten

Sodium chloride conducts when molten and in solution but not as a solid

Charge carriers in sodium are delocalised electrons but ions in sodium chloride

(Total for Question 3 = 10 marks)

)5))

4 Metals are good conductors of heat and electricity and usually have high melting temperatures and boiling temperatures.

(a) (i) Describe the **structure** of a metal.

(2)

Lattice of cations and delocalised electrons

(ii) Describe the **bonding** in a metal.

(2)

Electrostatic attraction between the cations and the delocalised electrons

(b) Explain why the melting temperature of magnesium (650 °C) is much higher than that of sodium (98 °C).

(3)

Magnesium ion has a larger charge density than the sodium ion
Due to the smaller radius in magnesium ion and its 2+ charge
The Mg2+ ions have stronger electrostatic forces of attraction with the delocalised electrons

(c) Explain how metals conduct electricity.

(2)

The delocalised electrons flow when a voltage is applied

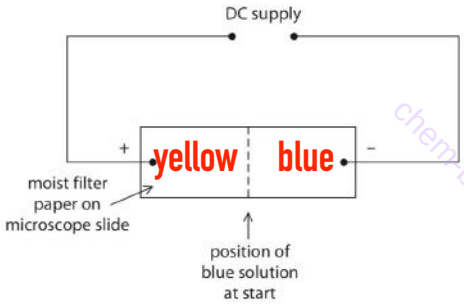
(Total for Question 4 = 9 marks)

5 (a) Briefly describe an experiment, with a diagram of the apparatus you would use, which shows that there are oppositely charged ions in copper(II) chromate(VI), $CuCrO_4$. Describe what you would expect to see.

Formula of ion	Colour
$Cu^{2+}(aq)$	blue
$CrO_4^{2-}(aq)$	yellow

(4)

Diagram



yellow ions move to the positive

blue ions move to the negative

(b) The ions in an ionic lattice are held together by an **overall** force of attraction.

(i) Describe the forces of attraction in an ionic lattice.

(1)

electrostatic forces of attraction between oppositely charged ions

(ii) Suggest **two** forces of repulsion which exist in an ionic lattice.

(2)

between ions of the same charge

between nuclei

and between electron clouds

(d) The lattice composed of the ions Mg^{2+} and O^{2-} is stronger than a lattice composed of the ions Mg^{+} and O^{-}.

(i) Explain, in terms of the charges on the ions and the size of the cations, why this is so.

(2)

Mg2+ has a smaller radius than Mg+

Both Mg2+ and O2- have higher charge density than the other set of ions

So stronger electrostatic forces of attraction between Mg2+ and O2-

(ii) Suggest how the lattice energy of $Mg^{2+}O^{2-}$ would differ from that of $Mg^{+}O^{-}$.

(1)

More exothermic in Mg2+ and O2-

(Total for Question 5 = 15 marks)

)5))

6 This question is about the element chlorine (atomic number = 17).

(a) Complete the electronic structure of chlorine.

(1)

$1s^2\ 2s^2$ 2p6 3s2 3p5

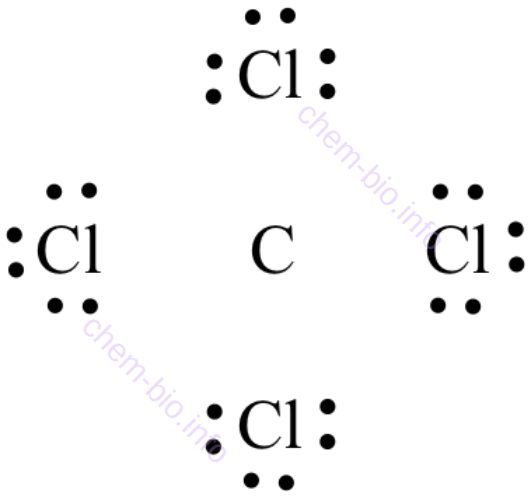
(b) Chlorine forms compounds with magnesium and with carbon.

(i) Draw a dot and cross diagram to show the electronic structure of the compound magnesium chloride (only the outer electrons need be shown).
Include the charges present.

(2)

(ii) Draw a dot and cross diagram to show the electronic structure of the compound tetrachloromethane (only the outer electrons need be shown).

(2)



E

*(iii) Suggest why the melting temperature of magnesium oxide is higher than that of magnesium chloride, even though both are almost 100% ionic.

(3)

O2- has a smaller radius and higher charge than Cl-
so higher charge density in O2-
So more attraction between ions in MgO
and more energy is needed to break the electrostatic forces of attraction in MgO

(c) Magnesium chloride may be prepared from magnesium by reaction with chlorine or with hydrochloric acid. Compare these two preparations in terms of the atom economies of the reactions. No calculation is required.

(2)

When magnesium reacts with chlorine it forms only one product
Two products (one waste product) are formed when Mg reacts with HCl
So higher atom economy in the first case

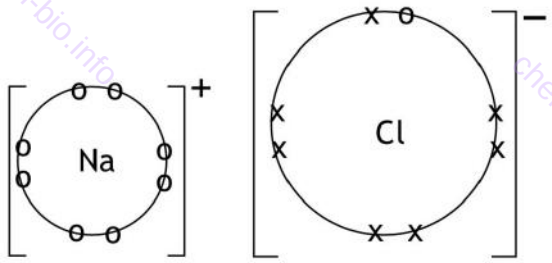
(Total for Question 6 = 10 marks)

7 Chlorine forms ionic bonds with metals such as sodium and silver. The lattice energies of ionic compounds provide information about their bonds. The table below shows the experimental and calculated values for the lattice energy of sodium chloride and silver chloride.

Compound	Lattice energy / kJ mol^{-1}	
	Experimental	Calculated
sodium chloride	−780	−770
silver chloride	−905	−833

(i) Draw a dot-and-cross diagram of sodium chloride, showing outer electrons only.

(1)



*(ii) Explain why the experimental and calculated values for the lattice energy of sodium chloride are similar whereas those for silver chloride differ significantly.

(3)

Sodium chloride is almost 100% ionic

Silver chloride is partly covalent

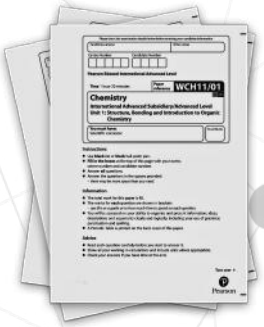
Ag+ is polarising because of its high charge density

causing the chloride ion to be distorted

(Total for Question 7 = 4 marks)

The Complete Course for IAL AS Chemistry

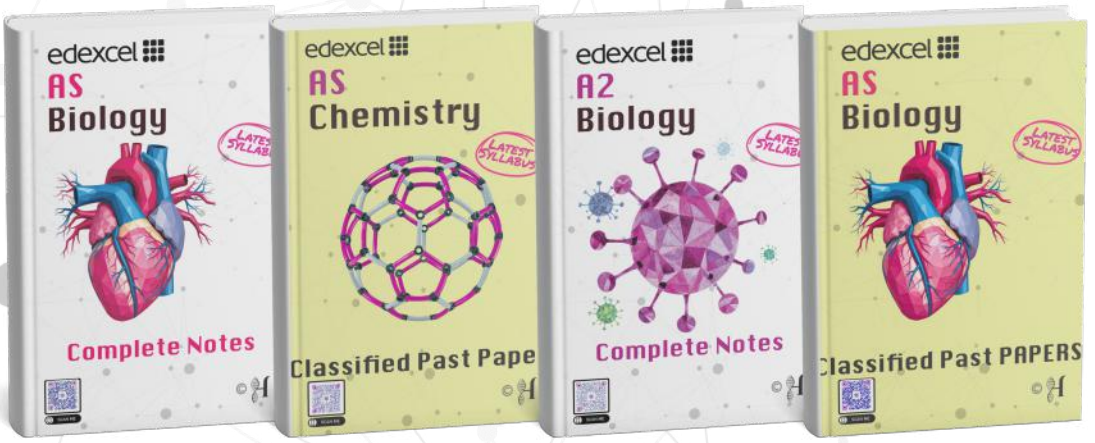
Videos that cover the entire syllabus



Exam-expert solved past papers

Full explanation of Unit 3 practicals

JOIN NOW



CHEM-BIO.INFO

WHATSAPP

51375709

50144115

chem_bio.info