

Chemical Bonds; Ionic; Covalent; Metal

Question Paper 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Chemistry
Exam Board	AQA
Topic	5.2 Bonding Structure + Props Matter
Sub-Topic	Chemical Bonds; Ionic; Covalent; Metal
Difficulty Level	Gold Level
Booklet	Question Paper 1

Time Allowed: 59 minutes

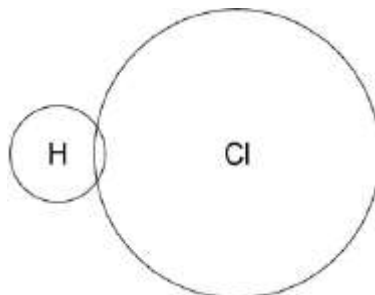
Score: /57

Percentage: /100

Grade Boundaries:

Q1.Hydrogen chloride (HCl) is a gas.

- (a) Complete the diagram to show all of the arrangement of the outer shell electrons of the hydrogen and chlorine atoms in hydrogen chloride.



(1)

- (b) Hydrochloric acid is a strong acid.
Ethanoic acid is a weak acid.

Describe a reaction that could be used to show the difference between a weak acid and a strong acid.

You should explain why the weak acid and the strong acid give different results.

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(6)
(Total 7 marks)

Q2. Aqamed is a medicine for children.

- (a) The medicine is a formulation.

What is meant by a formulation?

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(1)

- (b) Children often do not like taking medicine.

Suggest a substance that could be added to Aqamed to increase the desire for children to take it.

Give a reason for your suggestion.

Substance

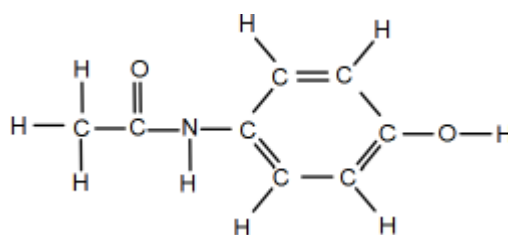
Reason

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(2)

- (c) The main ingredient in Aqamed is a painkiller called paracetamol.

The figure below represents a molecule of paracetamol.



Give the molecular formula of paracetamol.

Calculate its relative formula mass (M_r).

Relative atomic masses (A_r): H = 1; C = 12; N = 14; O = 16

Molecular formula

Relative formula mass

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M_r =

(2)

- (d) Aspirin is a medicine for use by adults.

An aspirin tablet contains 300 mg of acetylsalicylic acid.

Calculate the number of moles of acetylsalicylic acid in one aspirin tablet.

Give your answer in standard form to three significant figures.

Relative formula mass (M_r) of aspirin = 180

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Number of moles =

(4)
(Total 9 marks)

Q3. This question is about copper.

- (a) Copper can be extracted by smelting copper-rich ores in a furnace.

The equation for one of the reactions in the smelting process is:



Explain why there would be an environmental problem if sulfur dioxide gas escaped into the atmosphere.

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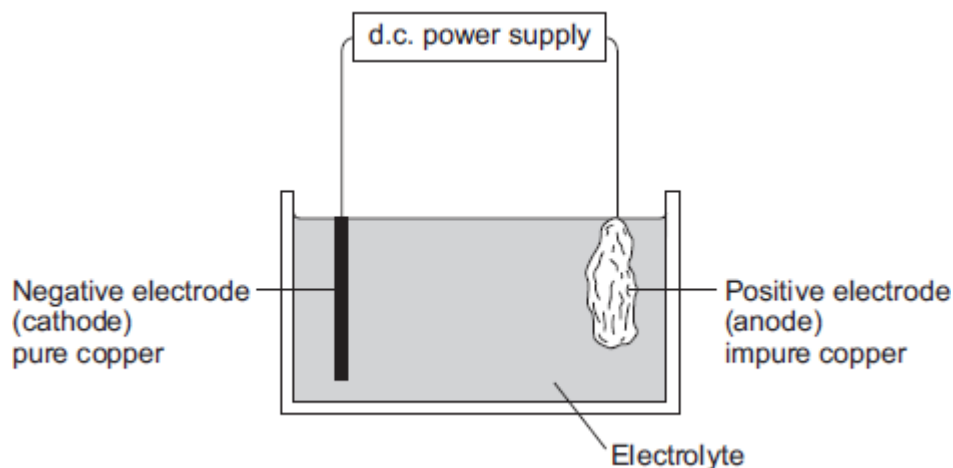
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(2)

- (b) The impure copper produced by smelting is purified by electrolysis, as shown below.



Copper atoms are oxidised at the positive electrode to Cu^{2+} ions, as shown in the half equation.



- (i) How does the half equation show that copper atoms are oxidised?

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(1)

- (ii) The Cu^{2+} ions are attracted to the negative electrode, where they are reduced to produce copper atoms.

Write a balanced half equation for the reaction at the negative electrode.

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(1)

- (iii) Suggest a suitable electrolyte for the electrolysis.

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(1)

- (c) Copper metal is used in electrical appliances.

Describe the bonding in a metal, and explain why metals conduct electricity.

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(4)

- (d) Soil near copper mines is often contaminated with low percentages of copper compounds.

Phytomining is a new way to extract copper compounds from soil.

Describe how copper compounds are extracted by phytomining.

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(3)

- (e) A compound in a copper ore has the following percentage composition by mass:

55.6% copper, 16.4% iron, 28.0% sulfur.

Calculate the empirical formula of the compound.

Relative atomic masses (A_r): S = 32; Fe = 56; Cu = 63.5

You must show all of your working.

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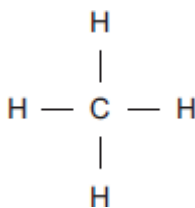
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Empirical formula =

(4)
(Total 16 marks)

Q4. Methane (CH_4) is used as a fuel.

(a) The displayed structure of methane is:



Draw a ring around a part of the displayed structure that represents a covalent bond.

(1)

(b) Why is methane a compound?

Tick (✓) **one** box.

Methane contains atoms of two elements, combined chemically.

☐

Methane is not in the periodic table.

☐

Methane is a mixture of two different elements.

☐

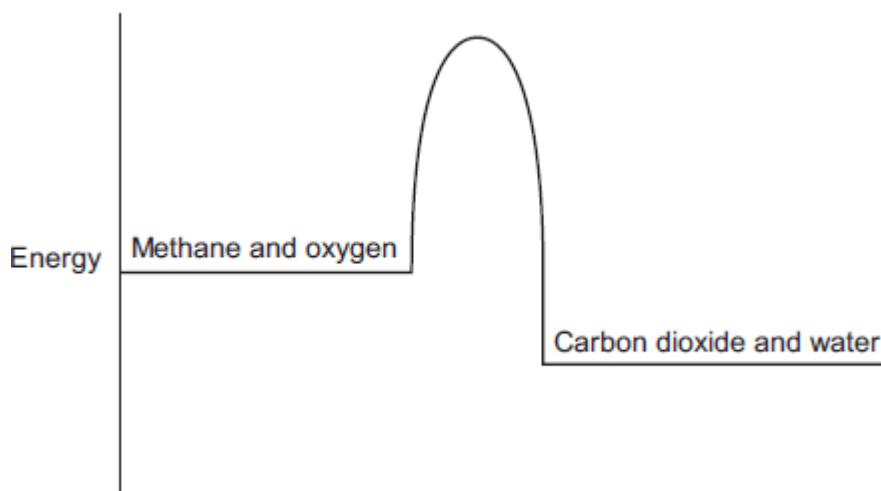
(1)

(c) Methane burns in oxygen.

(i) The diagram below shows the energy level diagram for the complete combustion of methane.

Draw and label arrows on the diagram to show:

- the activation energy
- the enthalpy change, ΔH .



(2)

(ii) Complete and balance the symbol equation for the complete combustion of methane.



(2)

(iii) Explain why the **incomplete** combustion of methane is dangerous.

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(2)

- (iv) Explain why, in terms of the energy involved in bond breaking and bond making, the combustion of methane is exothermic.

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(3)

- (d) Methane reacts with chlorine in the presence of sunlight.

The equation for this reaction is:



Some bond dissociation energies are given in the table.

Bond	Bond dissociation energy in kJ per mole
C-H	413
C-Cl	327
Cl-Cl	243
H-Cl	432

- (i) Show that the enthalpy change, ΔH , for this reaction is -103 kJ per mole.

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(3)

- (ii) Methane also reacts with bromine in the presence of sunlight.



This reaction is less exothermic than the reaction between methane and chlorine.

The enthalpy change, ΔH , is -45 kJ per mole .

What is a possible reason for this?

Tick (✓) **one** box.

CH_3Br has a lower boiling point than CH_3Cl

☐

The C-Br bond is weaker than the C-Cl bond.

☐

The H-Cl bond is weaker than the H-Br bond.

☐

Chlorine is more reactive than bromine.

☐

(1)
(Total 15 marks)

Q5. This question is about compounds.

- (a) The table gives information about the solubility of some compounds.

Soluble compounds
All potassium and sodium salts
All nitrates
Chlorides, bromides and iodides, except those of silver and lead

Use information from the table to answer these questions.

- (i) Name a soluble compound that contains silver ions.

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(1)

- (ii) Name a soluble compound that contains carbonate ions.

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(1)

- (b) Metal oxides react with acids to make salts.

What type of compound is a metal oxide?

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(1)

- (c) Lead nitrate solution is produced by reacting lead oxide with nitric acid.

- (i) State how solid lead nitrate can be obtained from lead nitrate solution.

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(1)

- (ii) Balance the equation for the reaction.



(1)

- (iii) Give the total number of atoms in the formula $\text{Pb}(\text{NO}_3)_2$

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(1)

- (d) An oxide of lead that does **not** have the formula PbO contains 6.21 g of lead and 0.72 g of oxygen.

Calculate the empirical formula of this lead oxide.

Relative atomic masses (A_r): O = 16; Pb = 207

You must show your working to gain full marks.

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Empirical formula =

(4)

(Total 10 marks)