

5th Year

Separate Award

Chemistry



REIGATE GRAMMAR SCHOOL

Practice Paper 2

Instructions:

Attempt **ALL** the questions.

Make your answers in the spaces provided on the question paper.

Mark allocations are given in brackets.

This exam paper consists of 10 questions plus a
PERIODIC TABLE AT THE BACK

Total / 106 Marks

1. This question is about the elements in Group 1 of the periodic table.

Sodium reacts violently with sulphur to form sodium sulphide, Na_2S .

a) i) Draw a dot and cross diagram to show the bonding present in sodium sulphide.

[3]

ii) Explain in terms of the bonding involved why like sodium sulphide has a higher melting point than sodium chloride.

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[2]

b) Potassium reacts even more violently with sulphur.
Explain why potassium reacts more violently than sodium.

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[3]

Total 8 marks

2. Diamond and graphite are both formed from carbon atoms.
Diamond is the hardest substance on Earth and graphite is soft enough to be used in pencils.

a) Draw a diagram to show the arrangement of the carbon atoms in diamond and use it to explain why diamond is the hardest substance on Earth.

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[4]

b) Draw a diagram to show the arrangement of the carbon atoms in graphite and use it to explain why graphite is soft enough to be used in pencils.

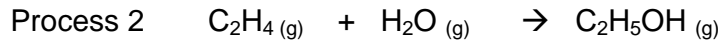
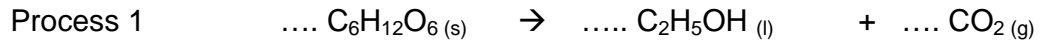
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[4]

Total 8 marks

3. The most common member of the alcohol homologous series is ethanol. It may be produced by both fermentation or by the catalytic hydration of ethene.

The equations for these reactions are;



- a) Balance the equation for process 1. [1]

- b) i) Which process is the equation for fermentation?
 [1]

- ii) State two essential conditions for fermentation.
 Condition 1.....
 Condition 2 [2]

- iii) Give a use for the ethanol produced by fermentation.
 [1]

- c) i) State two essential conditions for the catalytic hydration of ethene.
 Condition 1.....
 Condition 2 [2]

- ii) Give a use for the ethanol produced by the catalytic hydration of ethene.
 [1]

- d) Suggest two reasons why countries like Cuba manufacture their ethanol by fermentation rather than the catalytic hydration of ethene.

 [2]

e) Ethanol can be converted back into ethene



i) State the type of reaction used.

..... [1]

ii) State three conditions used for the reaction.

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

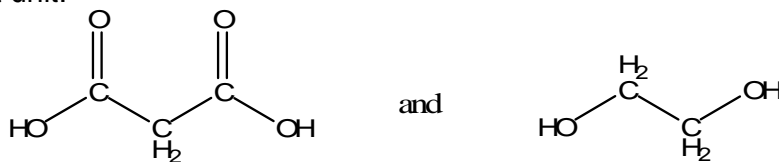
f) i) Calculate the volume of ethene gas, measure at room temperature and pressure (rtp), that can be formed from 322 kg of ethanol, $\text{C}_2\text{H}_5\text{OH}$.
(The molar volume of any gas = 24 dm^3 at rtp).

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..... [3]

ii) Use the answer from part i) to calculate the percentage yield if 42000 dm^3 of ethene is formed from 322 kg of ethanol at rtp.

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..... [1]

g) Ethene can be used to form an important monomer $\text{HOCH}_2\text{CH}_2\text{OH}$.
Draw the polymer formed by the monomers below, showing the structure of the repeat unit.



[3]

Total 20 marks

4. Magnesium is extracted by electrolysis of molten magnesium chloride.

a) Write equations for the processes which occur at the anode and cathode.

Cathode

Anode [4]

b) State one difference between the way in which current is conducted through molten magnesium chloride, and the way in which it is conducted through a metal wire.

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..... [2]

c) Explain why magnesium cannot be extracted from the electrolysis of magnesium chloride solution.

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..... [2]

d) Calculate the mass of magnesium produced in one hour when a current of 200 amps flows. (One faraday is 96000 coulombs).

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..... [3]

Total 11 marks

5. Brine, sodium chloride solution, is an important material for the manufacture of chlorine by electrolysis.

a) Write equations for the processes which occur at the anode and cathode during the electrolysis of brine.

Cathode

Anode [4]

b) Explain how the electrolysis products are prevented from reacting together in the electrolysis equipment.

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..... [2]

c) i) Describe a test to show the presence of bromide ions in a sample of sea water.

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..... [2]

ii) Sea water can be used to make the brine. It contains many a significant amount of halide ions.

Explain why the test for bromide ions carried out on sea water would not be reliable.

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..... [2]

Total 10 marks

6. A titration was carried out using 20.00 cm³ samples of dilute sulphuric acid and sodium hydroxide solutions.
The results are shown in the table.

	1st titration	2nd titration	3rd titration
2nd burette reading	15.00	12.30	14.70
1st burette reading	2.30	0.10	2.50
Total volume of NaOH used	12.70		

- a) Complete the table.

[2]

- b) Using the results in the table, explain why it was necessary to carry out three titrations.

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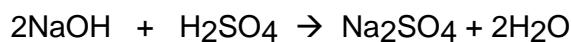
[2]

- c) State two pieces of glass apparatus (other than a burette) needed to carry out a titration.

.....

[2]

- d) The equation for the reaction is



The concentration sodium hydroxide (NaOH) solution used in the titration is 0.2 mol dm⁻³.

Using the results from the 3rd titration, calculate the concentration in mol dm⁻³ of the dilute sulphuric acid.

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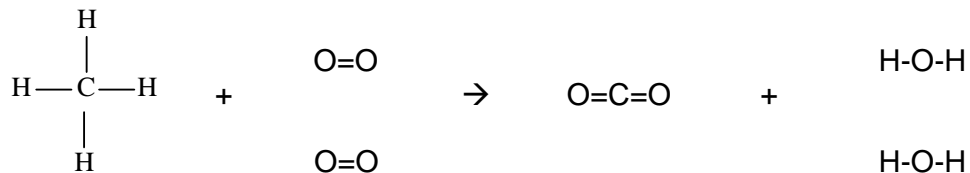
[4]

Total 10 marks

7. a) When methane is burnt heat energy is released into the surroundings.
What name is given to this type of reaction?

..... [1]

- b) The reaction between methane (CH₄) and oxygen (O₂) which takes place during burning produces is represented using the display formulae below.



- i) Name two different bonds which are broken during the reaction.

1. [1]

2. [1]

- ii) Which two bonds are made during the reaction?

1. [1]

2. [1]

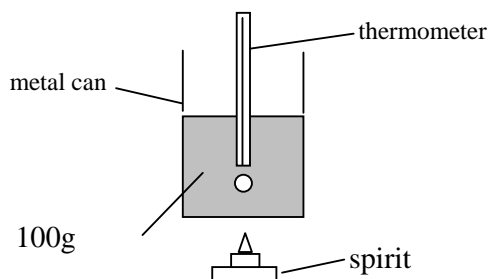
- iii) Calculate the overall energy change for the reaction between methane and oxygen.
The bond energies (in kJ mol⁻¹) are C-H: 435 , O=O: 497 , C=O: 803 , H-O: 464)

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 [4]

Total 9 marks

8. Look at the diagram. It shows the apparatus used to calculate the energy released when fuel is burnt.



The table below shows the results when 1.0 g of each fuel is burnt.

fuel	temperature of water at start	temperature of water at end
ethanol	20°C	40°C
paraffin	19°C	58°C
petrol	21°C	42°C

- a) Which fuel released the least amount of heat energy?

..... [1]

Explain your answer

..... [1]

- b) Calculate the energy transferred when 1.0 g of ethanol burns.
(The specific heat of capacity of water is $4.2 \text{ J}^{-1} \text{ g}^{-1} \text{ } ^\circ\text{C}$).

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..... [3]

- c) Calculate the enthalpy change, in kJ mol^{-1} , when 2.0 g of ethanol, $\text{C}_2\text{H}_5\text{OH}$, burns.
Give your answer the correct sign.
(Relative atomic masses: O = 16; H = 1; C = 12)

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..... [4]

Total 9 marks