

Candidate Name

Candidate Number

Centre Name

Centre Number

Paper 2: (Year 11 Content unit 6 onwards)

Sample Paper

(2 hours)

It is necessary to respond on the answer sheets provided alongside this question paper. Additionally, you must have a soft pencil (preferably of type B or HB), a clean eraser and a dark blue or black pen.

INSTRUCTIONS:

- You must write your name, candidate number, centre name and centre number on the answer sheets in the designated spaces.
- Objective section consists of 25 questions, and it is essential that you attempt all of them.
- Each question has four options labelled A, B, C, and D. Select the option that you think is correct. Mark it on the multiple-choice answer sheet using a soft pencil.
- Attempt all the questions from subjective section using a dark blue or black pen.
- For practical component, complete the labels on Question paper where required.
- It is important to follow the instructions provided on the answer sheets.
- Do not use correction fluid.
- Avoid writing on any bar codes.

INFORMATION:

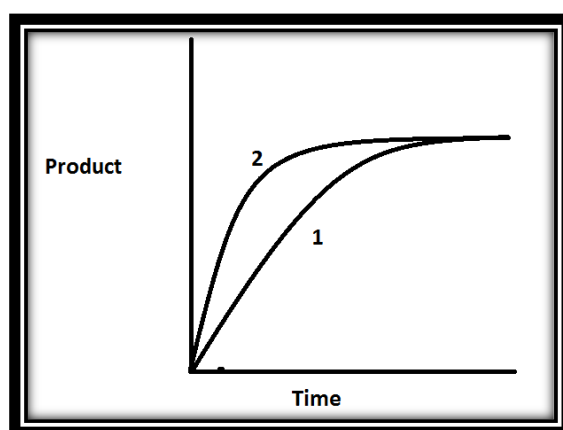
- This paper has a total of 100 marks.
- In objective section there are 25 questions, each carries one mark. There is no negative marking for incorrect responses.
- In subjective section, 45 marks are for extended theory and 30 marks for practical component.
- The number of marks assigned for every question or its parts is indicated within brackets [].
- Rough work must be completed on this question paper.

OBJECTIVE SECTION:**[Total 25 marks]**

1. Which of the following is not a correct method of measuring rate of reaction?

- A: Calculating mass gain of reactants in a given time.
- B: Calculating volume of product in a given time.
- C: Calculating the time taken in a precipitation reaction.
- D: Calculating pH change over time using a pH meter.

2. The graph below is a rate of reaction curve for a metal carbonate and acid.



Which of the following are possible reasons for the observed change in rate of reaction from results 1 to 2?

- 1. Increase in concentration of acid
- 2. Increase in pressure
- 3. Decrease in temperature
- 4. Increased surface area of metal carbonate

- A: 1 and 3
- B: 1, 2 and 4
- C: 1 and 2
- D: 1 and 4

3. Which of the following are examples of photochemical reactions?

1. Photosynthesis
2. Bioluminescence
3. Breaking down of CFC's in the ozone layer
4. Decomposition of silver bromide

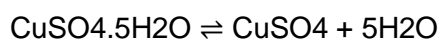
A: 1, 2 and 4

B 1 and 2

C: 1, 2, 3 and 4

D: 1, 3 and 4

4. Which of the following statements best describes the following reaction?



A: Thermal decomposition

B: Reversible reaction

C: Irreversible reaction

D: Water of crystallisation

5. Which one of the following is a correct statement for the term equilibrium?

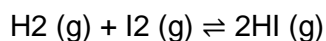
A: Can occurs in an open and closed system

B: Concentrations of reactants and products are not fixed.

C: Forward and reverse reaction take place at the same rate.

D: Equilibrium of reactions cannot be changed.

6. In the following reaction:



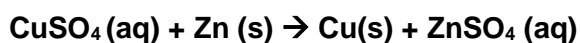
The forward reaction is endothermic, which of the following would lead to a decrease in the yield of Hydrogen iodide?

- A: Decrease the temperature
- B: Use of a catalyst
- C: Increase in pressure
- D: Increase temperature

7. Which row correctly describes the follow terms in redox reactions?

	Term:	Hydrogen	Oxygen	Electrons
A	Reduction	Gain	Loss	Loss
B	Oxidation	Loss	Loss	Gain
C	Reduction	Gain	Gain	Gain
D	Oxidation	Loss	Gain	Loss

8. Which of the following is the correct half equation for this reaction?

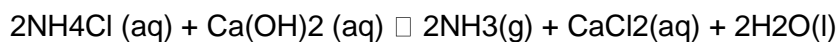


- A: $\text{Zn}^{2+} + 2\text{e}^- \rightarrow \text{Zn}$
- B: $\text{Cu}^{2+} \rightarrow \text{Cu} + 2\text{e}^-$
- C: $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$
- D: $\text{Zn} + 2\text{e}^- \rightarrow \text{Zn}^{2+}$

9. Which of the following compounds is not used in making NPK fertiliser?

- A: Potassium chloride
- B: Ammonium phosphate
- C: Ammonium nitrate
- D: Calcium chloride

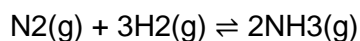
10. Calcium oxide can dissolve in water in soils to form slaked lime, calcium hydroxide. The following reaction can take place in the soil when slaked lime reacts with ammonium salts to release ammonia.



- A: Ammonification
- B: Displacement
- C: Decomposition
- D: Hydration
11. In the Haber process where is the source of Hydrogen in the reaction?
- A: Electrolysis of water
- B: Cracking of ethane
- C: Cracking of ethane
- D: Reacting methane with oxygen
12. Which row of conditions is used to manufacture ammonia?

	Catalyst	Temperature °C	Pressure (atm)
A	Vanadium (V) oxide	450	200
B	Iron	250	2
C	Vanadium (V) oxide	250	2
D	Iron	450	200

13. The Haber process reaction has the following equation:



Which of the following statements are correct?

A: Increasing pressure will shift equilibrium to the left

B: Decrease in temperature will shift equilibrium to the left

C: Increase in pressure will shift equilibrium to the right

D: Increase in temperature will shift equilibrium to the right

14. Which one of the following is not a use of sulphur dioxide?

A: Manufacturing of sulphuric acid

B: Bleaching wood pulp

C: Food preservatives

D: Manufacturing of zinc blende

15. Lime is produced when limestone is strongly heated and breaks down to form calcium oxide, which one of the following is not a reactant or product of this equation?

A: O₂

B: CaCO₃

C: CO₂

D: CaO

16. Which statements are correct uses for calcium carbonate?

1. Used in flue gas desulphurisation
2. Extraction of iron
3. Manufacturing of cement

A: 1, 2 and 3

B: 1 and 2

C: 2 and 3

D: 1 and 3

17. What is meant by the term homologous series?

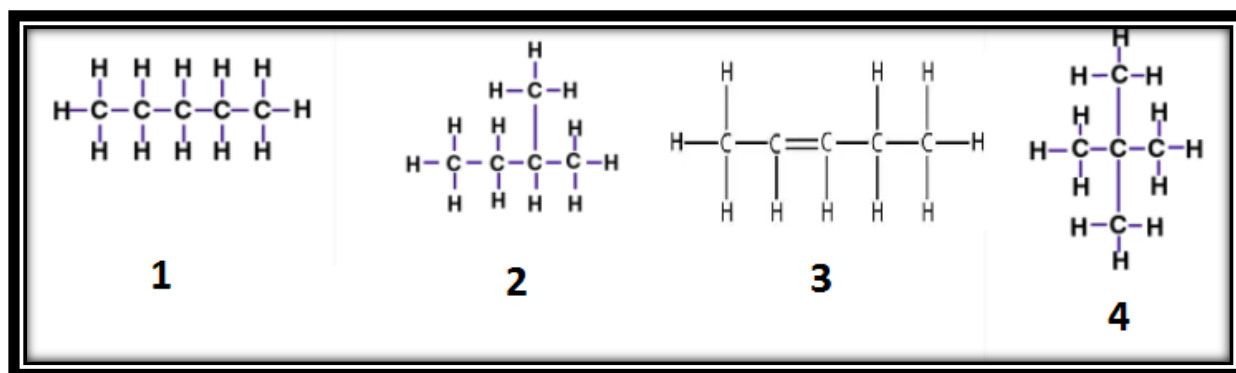
A: A group of organic compounds with similar physical properties

B: A group of compounds with same chemical formula but different arrangement of atoms

C: A group of organic compounds with similar chemical properties

D: A groups of compounds with a different functional group

18. Which one of the following are isomers of C₅H₁₂



A: 1, 2 and 3

B: 1, 2 and 4

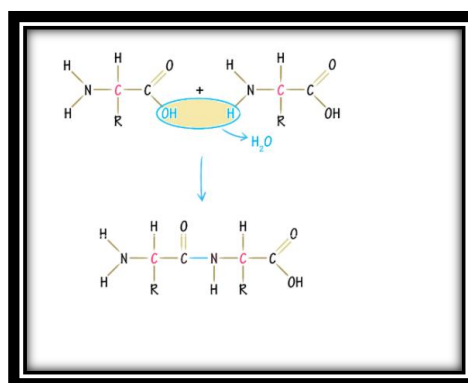
C: 3 Only

D: 1 and 2

19. Cracking is a process whereby oil companies break large hydrocarbon molecules into smaller more useful ones. Which of the follow statements are incorrect?

- A: Cracking can be done using a catalytic (cat) cracker
- B: Cracking can be done under high pressures and use of a catalyst
- C: Cracking can be done under high temperatures and use of a catalyst
- D: Cracking can be done under high temperatures using steam without a catalyst

20. Which term best describes the reaction below?



- A: Amide linkage
- B: Ester linkage
- C: Hydrolysis
- D: Glycosidic linkage

21. Polysaccharides are polymers when they are mixed with acid and heated to break down into their monomers. Which method can be used to identify the monomers present?

- A: Benedict's solution
- B: Chromatography
- C: Biuret solution
- D: Colorimetry

22. Which of the following biological molecules is not made of monomers?

- A: Cellulose
- B: Proteins
- C: Lipids
- D: Starch

23. Which of the following processes is not commonly used in making potable water?

- A: Filtration
- B: Chlorination
- C: Distillation
- D: Reverse osmosis

24. Using catalytic converters is one strategy used to reduce air pollution, which pollutants do catalytic converters help reduce their release into the atmosphere?

- 1. Carbon monoxide
- 2. Carbon dioxide
- 3. Nitrogen oxides
- 4. Sulphur dioxide

- A: 1 and 3
- B: 3 and 4
- C: 1 and 4
- D: 2 and 3

25. Which of the following is not a method of rust prevention?

- A: Vulcanising
- B: Galvanising
- C: Sacrificial protection
- D: Application of grease

EXTENDED THEORY:

[Total 45 marks]

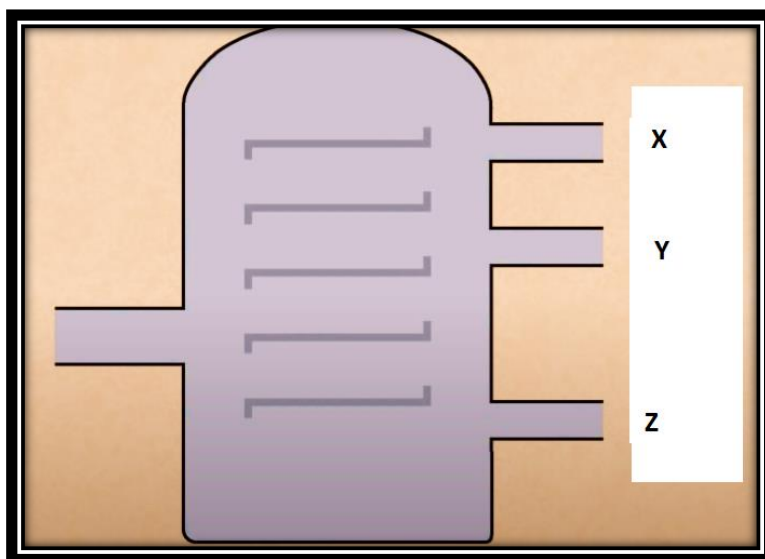
Q1) Air is a mixture of gases; it can be separated into its components using fractional distillation.

a) Outline the two steps before fractional distillation of air occurs? [2 marks]

Step 1: _____

Step 2: _____

b) Three gases that have the highest relative percentage gases in the Earth's atmosphere have been separated into their fractions?



Deduce the gases and their relative composition in the atmosphere? [3 marks]

Gas X: _____ % _____

Gas Y: _____ % _____

Gas Z: _____ % _____

c) State one uses of gas Z? [1 marks]

[Total 6 marks]

Q2) Carboxylic acids are similar to laboratory acids; they are a colourless liquid and taste sour.

acid	molecular formula	melting point /°C	boiling point /°C	density in g/cm ³
	CH ₂ O ₂	8	101	1.22
	C ₂ H ₄ O ₂	17	118	1.05
propanoic acid	C ₃ H ₆ O ₂	-21	141	0.99
	C ₄ H ₈ O ₂	-5	164	
pentanoic acid	C ₅ H ₁₀ O ₂	-34		0.93

- a) Describe characteristics properties of acids; include reactions with metals, metal hydroxides and metal carbonates? [3 marks]
- b) Below is a table of carboxylic acids from 1 C to 5 C molecules:
 - i. Using your knowledge complete the missing names of the acids?[1 marks]
 - ii. Suggest missing data values from the table? [1 mark]
 - iii. Describe the relationship density between C1 to C5 carboxylic acids? [1 marks]
 - iv. Predict the state of propanoic acid at 0 °C, explain your answer? [2 marks]

Carboxylic acids can react with alcohols to form compounds called esters, this reaction is called esterification.

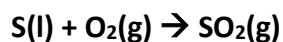
- c i). State the catalyst of this reaction? [1 mark]
- c ii). One product of esterification is water, name the ester formed from a reaction of pentanoic acid and ethanol? [1 mark]
- c iii) Deduce the chemical formula of the ester formed in the reaction cii)? [2 mark]
- d). Give two uses of esters? [1 mark]

[Total 13 marks]

Q3) Sulphuric acid, H_2SO_4 is made by reacting sulphur, air and water together.

a) Name the process that describes how sulphuric acid is made? [1 mark]

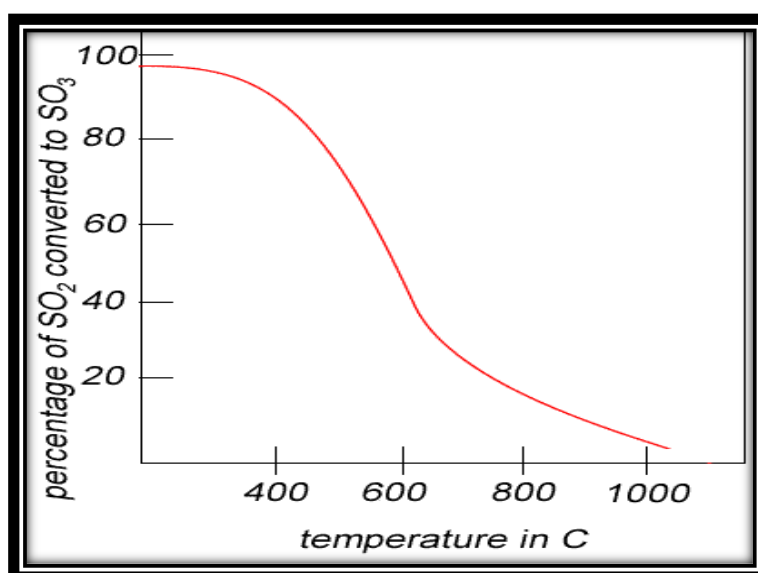
The first stage of this process involves reacting molten sulphur with oxygen to form sulphur dioxide



b) Name two sources of sulphur for this reaction? [2 marks]

The next stage of this process involves the reaction between sulphur dioxide and oxygen to form sulphur trioxide, this is an equilibrium reaction.

c) Write the balanced chemical reaction for this equation. [2 marks]



d) Deduce from the graph whether this reaction is exothermic or endothermic? [1 mark]

e) State and explain the effect of increase temperature and pressure on the yield of sulphur trioxide in this reaction? [6 marks]

In the final stages of this process sulphur trioxide is reacted with sulphuric acid to make a compound called oleum.

f) A sample of oleum has the following composition H 1.13%, S 37.27% and O 61.60%

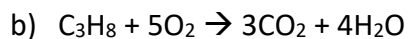
Calculate the empirical formula of oleum?

Show your working [3 marks]

[Total 15 marks]

Q4) Alkanes can be used as fuel to release energy.

a) Calculate the energy change in kJ/mol for the combustion of propane. Show your working.



Bond energy values:

C-H = 413, C-C = 348, O=O = 495, C=O = 802, O-H = 463

[4 marks]

c) 1.96 kg of propane was burned, assuming complete combustion how many moles of oxygen were used in this reaction? [2 marks] Give your answer to 3 significant figures.

d) Calculate the mass of carbon dioxide produced in this reaction? [1 marks]

e) Carbon dioxide is a greenhouse gas; describe what is meant by the term greenhouse gas? [1 mark]

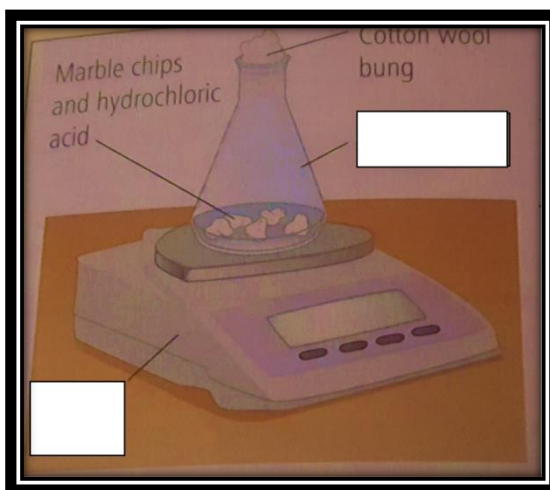
f) Describe and explain the greenhouse effect? [3 marks]

Total [11 marks]

PRACTICAL COMPONENT:

[Total 30 marks]

Q1) Razeal and Richelle wanted to investigate the rate of reaction by adding 20g of calcium carbonate to a 100cm³ of 2.5 mol/dm³ of hydrochloric acid. The equipment used is shown in the diagram below.



An image similar to this can be 2D or 3D, must include cotton wool bung, labelled contents and two missing boxes for top pan balance and conical flask.

a) Complete missing labels in the diagram [1 mark]

b i) What is the purpose of the cotton wool bung? [1 mark]

b ii) Suggest another piece of equipment not shown in the diagram which is needed to measure the rate of reaction. [1 mark]

b iii) Describe and explain what will happen during this investigation that will allow the rate of reaction to be calculated. [2 marks]

b iv) Describe two observations that Razeal and Richelle expect to signal the end of this reaction. [1 mark]

c) Draw a suitable simple table for this investigation. [2 marks]

d) Complete graph and sketch the predicted rate of reaction. [1 mark]

e) The experiment was repeated 3 times, describe how Razeal and Richelle can keep each repeat a fair test. [2 marks]

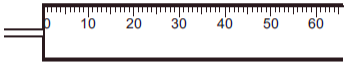
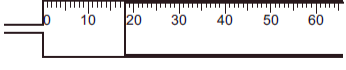
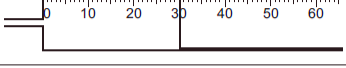
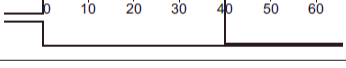
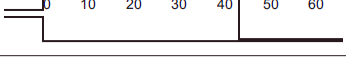
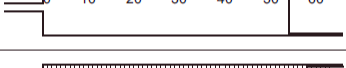
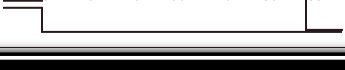
f) Suggest an improvement that can be done to improve the accuracy of results and explain your choice. [2 marks]

[Total 13 marks]

Q2) Jorge and Salma carried out an experiment by adding 1 mole of magnesium ribbon to excess hydrochloric acid.

a) The volume of gas produced was measured over time.

i) Complete the table of results [3 marks]

time / min	gas syringe diagram	volume of gas produced / cm ³
0		
1		
2		
3		
4		
5		
6		

Need an image/table similar to this alter values shown on the gas syringe image to match the following?

0 mins = 0 volume

1 min = 26

2 mins 35

3 mins 42

4 mins 49

5 mins 53

6 mins 55

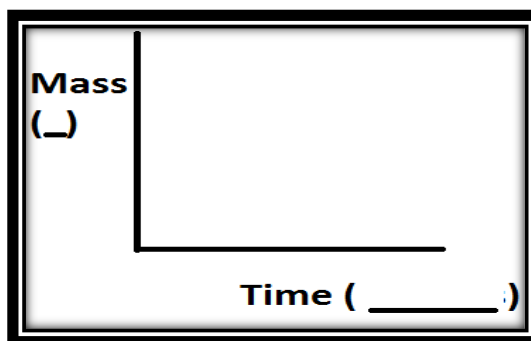
Leave all box values blank put keep 6 minutes value of 55 in the data table.

ii) Jorge concluded that final volume of gas produced was 55 cm³, Salma disagreed and suggested it should be more, who do you agree with and why? [1 mark]

b) Plot their results on a graph [4 marks]

c) What would be the volume produced after 3 minutes if 2 moles of magnesium was used in excess hydrochloric acid. Show your working. [2 marks]

- d) Using your knowledge, name the gas produced and describe the test used to identify this gas [1 mark]



Gas: _____
Test: _____

[Total 11 marks]

Q3) Organic compounds such as alkenes are referred to as unsaturated hydrocarbons.

a) What is meant by the term unsaturated hydrocarbons? [1 mark]

b) Alkenes are a product of cracking of alkanes, what is the chemical test used to test if hydrocarbons are saturated or unsaturated?

Test: _____ [1 mark]

Observation if unsaturated: _____ [1 mark]

Observation if saturated: _____ [1 mark]

c) Steam reacts with alkenes to form alcohols.

Ethene + steam \rightarrow ethanol

i) This an example of which type of reaction? [1 mark]

ii) Draw the structural formula for ethanol? [1 mark]

[Total 6 marks]