

RATU NAVULA COLLEGE
YEAR 12 TRIAL EXAMINATION 2020

CHEMISTRY

QUESTION PAPER

Time Allowed: 3 hours

(An extra 10 minutes is allowed for reading this paper)

INSTRUCTIONS

- Name _____ Year Level _____
- Write your **Index Number** on the front page and inside the back flap of the **Answer Booklet**.
 - Write **all** your answers in the **Answer Booklet** provided.
 - If you use extra sheets of paper, be sure to show clearly the question number(s) being answered and to tie each sheet in your **Answer Booklet** at the appropriate places. Ensure that your **Index Number** is written on the extra sheets.
 - Answer **all** the questions with a blue or black ballpoint pen or ink pen. Do **not** use red ink. You may use a pencil **only** for drawing.
 - You may use a calculator, provided it is silent, battery-operated and non-programmable.
 - There are five strands in this paper. All the strands are **compulsory**.
- Note:**
- A Periodic Table of Elements is provided for your use during the examination. Both the **atomic number** and the **relative atomic mass** for each element are given.
 - Final answers to calculations must be expressed to **two** decimal places.

SUMMARY OF QUESTIONS

Strand	Multiple-choice questions	Short answer questions	Total marks	Suggested time
1 General Chemistry All the questions are compulsory.	2	8	10	18 minutes
2 Investigating Matter All the questions are compulsory.	4	16	20	36 minutes
3 Reactions All the questions are compulsory.	6	24	30	54 minutes
4 Materials All the questions are compulsory.	5	20	25	45 minutes
5 Consumer Chemistry All the questions are compulsory.	3	12	15	27 minutes
Total	20	80	100	180 minutes

INSTRUCTIONS

☐ MULTIPLE-CHOICE QUESTIONS

The multiple-choice questions are **all compulsory**. Each question is worth 1 mark.

1. In your **Answer Booklet**, **circle** the letter of the **best** answer. If you change your mind, put a line through your first circle and draw a circle around the letter of your next choice.

12	A	B	C	D
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For example:

If you change your mind again and like your first answer better, put a line through your second circle and tick (✓) your first answer.

2.

12	A	R	C	D
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For example:

3. **No mark** will be given if you circle more than one letter as the answer for a question.

STRAND 1 GENERAL CHEMISTRY

[10 marks]

- This strand has **5 Questions**.
- Circle** the letter of the **best** answer in the **Answer Booklet** for **Questions 1 and 2**.
- Write the answer for **Questions 3 – 5** in the space provided in the **Answer Booklet**.

1. Which of the following is a correct statement about systematic errors?

- They are consistent in magnitude.
- Their magnitude depends on the experimenter's skill.
- They arise due to incorrect judgment of a measurement.
- They occur as a result of a person's inability to perform the experiment correctly.

(1 mark)

2. The exponential base unit for the prefix mega is denoted by _____.

- A. 10^{-9}
- B. 10^3
- C. 10^6
- D. 10^9

(1 mark)

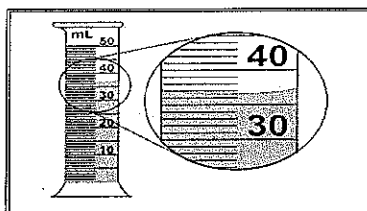
3. In an experiment on precision and accuracy, three different groups obtained the mass of the same stone five times as shown in the table below.

Measurement	Group 1	Group 2	Group 3
1	16.50 g	15.45 g	14.90 g
2	14.45 g	15.50 g	14.90 g
3	14.00 g	15.55 g	14.85 g
4	17.00 g	15.50 g	14.90 g
5	14.50 g	15.50 g	14.85 g

Note: The actual mass of the stone was 15.50 g.

- (i) Using the results of the experiment, determine the group whose results were of:
- I - Low accuracy and high precision. (1 mark)
 - II - Low accuracy and low precision. (1 mark)
- (ii) Identify the group that obtained the best results. (1 mark)
- (iii) State a reason for your answer to part (ii) above. (1 mark)

4. Determine the volume of the liquid present in the measuring cylinder below with its uncertainty value. (2 marks)



5. A liquid has a mass of 0.25 kg and occupies a volume of 0.30 L, at room temperature. Calculate the density of the liquid at room temperature in g mL^{-1} . (2 marks)

4. STRAND 2 INVESTIGATING MATTER [20 marks]

- This strand has 10 Questions.
- Circle the letter of the best answer in the Answer Booklet for Questions 1 – 4.
- Write the answer for Questions 5 – 10 in the space provided in the Answer Booklet.

1. Electronegativity of elements increases across the period due to the

- A. addition of new energy levels.
- B. decrease in the nuclear charge.
- C. increase in the shielding effect.
- D. addition of electrons to the same energy level. (1 mark)

2. The molecule that has a tetrahedral shape is _____.

- A. Cl_2
- B. BF_3
- C. NH_3
- D. CCl_4 (1 mark)

3. Which of the following is a polar molecule?

- A. O_2
- B. NH_3
- C. CH_4
- D. BCl_3 (1 mark)

4. A discrete molecular solid has

- A. electrostatic forces of attraction.
- B. van der Waals forces of attraction.
- C. 3-dimensional network of covalent bonds.
- D. positive metal ions held by valence electrons. (1 mark)

5. Arrange the following elements from highest to lowest electronegativity.

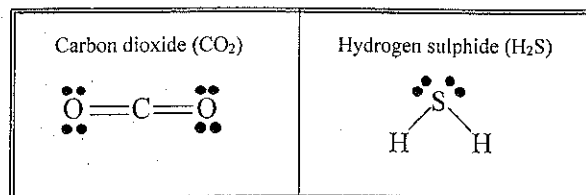
Sodium (Na)	Hydrogen (H)	Potassium (K)	Lithium (Li)
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(2 marks)

6. Draw the Lewis structure of nitrogen trichloride (NCl_3) and determine its electron group geometry. (3 marks)

5.

Both, carbon dioxide (CO_2) and hydrogen sulphide (H_2S) have two atoms bonded to the central atom as shown in the structures below.



Explain why CO_2 has a linear shape while H_2S has a V-shape based on their structures shown above.

(2 marks)

8. A group of Year 12 students wanted to carry out an experiment to determine the polarity of water molecules.

- (i) Describe the **experimental procedure** students would use to determine the polarity of water molecules.

(Note: The **experimental procedure** should include the use of a burette and a charged plastic ruler.)

(2 marks)

- (ii) State an observation from this experiment.

(1 mark)

- (iii) Provide a reason for the observation stated in part (ii) above.

(1 mark)

9. State a reason for the following properties of different solids mentioned below.

- (i) Ionic solids, such as potassium chloride (KCl), conducts electricity in solution form.

(1 mark)

- (ii) Metallic solids, such as copper (Cu), is shiny and lustrous.

(1 mark)

- (iii) 3-dimensional solids, such as diamond, is very hard.

(1 mark)

10. The breaking down of the ionic lattice occurs in the presence of water as a solvent and is known as hydration.

Draw a diagram showing the hydration of sodium chloride (NaCl) in water (H_2O). (2 marks)

6.

STRAND 3 REACTIONS

[30 marks]

- This strand has 13 Questions.
- Circle the letter of the best answer in the Answer Booklet for Questions 1 – 6.
- Write the answer for Questions 7 – 13 in the space provided in the Answer Booklet.

1. One mole of a substance contains _____ atoms.

- A. 3.03×10^{23}
 B. 4.02×10^{23}
 C. 5.02×10^{23}
 D. 6.02×10^{23}

(1 mark)

2. An oxidation reaction can be defined as the

- A. loss of oxygen.
 B. gain of hydrogen.
 C. gain of electrons.
 D. increase in the oxidation number.

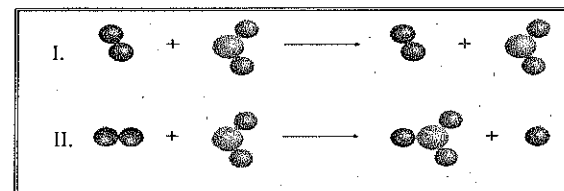
(1 mark)

3. Which of the following is a source from which aluminium can be extracted?

- A. Azurite
 B. Bauxite
 C. Malachite
 D. Chalcocite

(1 mark)

4. The illustration below shows particles of a reaction.



Source: <https://chem.libretexts.org>

This illustration shows that a reaction is possible if reacting particles have

- A. very high energy.
 B. correct orientation.
 C. a large surface area.
 D. very high concentration.

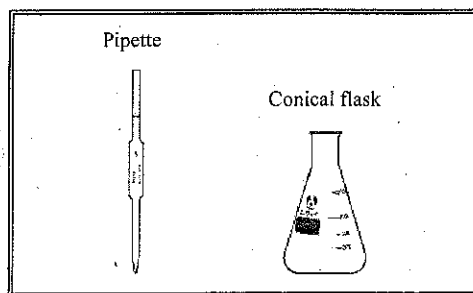
7.

5. In an exothermic reaction
- enthalpy change (ΔH) is positive.
 - heat is absorbed from the surrounding.
 - temperature of the surrounding increases.
 - enthalpy of products is greater than the enthalpy of reactants. (1 mark)

6. A strong acid dissociates
- partially and releases hydroxide ions.
 - partially and releases hydronium ions.
 - completely and releases hydroxide ions.
 - completely and releases hydronium ions. (1 mark)

7. An organic compound is found to contain 64.80 % carbon, 13.62 % hydrogen and 21.58 % oxygen. The molecular mass of this compound is 74 g mol^{-1} .
- Calculate the empirical formula of the compound. (2 marks)
 - Determine the molecular formula of the compound. (1 mark)

8. Shown below are two very important glasswares used in titration experiments.

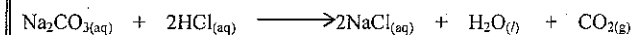


Describe how each of the glassware is rinsed prior to its use for a titration. (2 marks)

8.

9. In a titration experiment, 20 mL samples from a **standard solution** of 0.01 mol L^{-1} sodium carbonate (Na_2CO_3) was titrated with hydrochloric acid (HCl) solution. The reaction requires average of 16.50 mL of HCl to reach the end-point.

The balanced equation for the reaction is:



- Define **standard solution**. (1 mark)
 - Calculate the amount (in moles) of Na_2CO_3 that has reacted with HCl. (1 mark)
 - Determine the amount (in moles) of HCl required to completely react with Na_2CO_3 . (1 mark)
 - Calculate the concentration (in mol L^{-1}) of HCl solution. (1 mark)
10. Use the unbalanced oxidation-reduction reaction equation given below to answer the questions that follow.



- Calculate the oxidation number of manganese (Mn) in MnO_4^- . (1 mark)
- Write the balanced half-equation for the conversion of MnO_4^- to Mn^{2+} . (2 marks)
- State whether the conversion of MnO_4^- to Mn^{2+} is an **oxidation** or **reduction** reaction. (1 mark)
- State the role of $\text{SO}_3^{2-}_{(\text{aq})}$ in the reaction. (1 mark)

11. During an experiment on **energy changes in endothermic and exothermic reactions**, a group of Year 12 students dissolved sodium hydroxide pellets, ammonium chloride and magnesium sulphate in three separate test tubes with 2 mL of water. The initial and final temperatures in the three test tubes were recorded in the results table as shown below.

Reaction/ Test-tube number	Reagents (dissolved in water)	Initial temperature (of water)	Final temperature (of reaction mixture)
1	Sodium hydroxide	27 °C	40 °C
2	Ammonium chloride	27 °C	21 °C
3	Magnesium sulphate	27 °C	30 °C

Use the results from the table above to answer the questions that follow.

11.

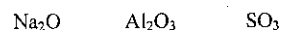
D. dehydration (1 mark)

5. An ester can be prepared by reacting a carboxylic acid with an _____

- A. alkane
 B. alkene
 C. alkyne
 D. alcohol

(1 mark)

6. The oxides of Period 3 elements in the key list given below are either acidic, basic or amphoteric.



(i) Define amphoteric oxide. (1 mark)

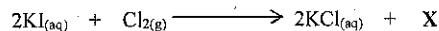
(ii) Identify the amphoteric oxide from the key list given above. (1 mark)

7. The melting point of silicon dioxide (SiO₂) is very high (1610 °C) whereas the melting point of silicon tetrachloride (SiCl₄) is comparably very low (68 °C).

Provide an explanation for the large difference in their melting points in terms of structure and bonding. (2 marks)

8. The presence of chlorine gas (Cl₂) can be tested by introducing a damp starch-iodide paper in a gas jar full of chlorine gas.

The incomplete equation for the reaction occurring on the starch-iodide paper is given below.



(i) State the colour of the starch-iodide paper if the test is positive. (1 mark)

(ii) Determine the name or formula of substance X responsible for the observed colour change in part (i) above. (1 mark)

12.

9. The practical, test for ions uses precipitation reactions to detect the presence of different ions.

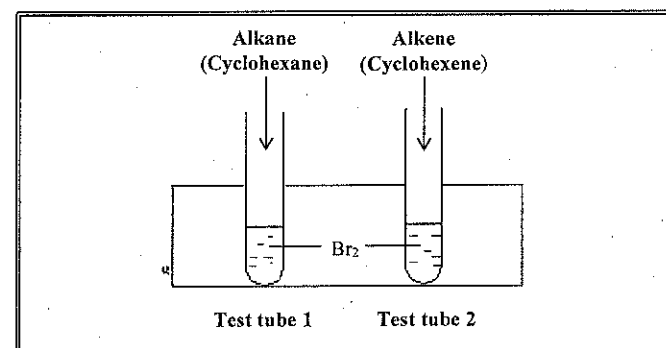
The following procedure was used to test for sulphate ions (SO₄²⁻).

To 1 mL of sodium sulphate (Na₂SO₄), add equal amounts of dilute hydrochloric acid (HCl) followed by 1 mL of barium chloride (BaCl₂) solution.

Write the net ionic equation for the test for sulphate ions using the information provided in the procedure given above. (2 marks)

10. Bromine water (Br₂) can be used to distinguish an alkane from an alkene.

In an experiment, students added cyclohexane and cyclohexene to two separate test tubes containing bromine water as shown in the set-up below. Rubber stoppers were placed on the mouth of the test-tubes and shaken.



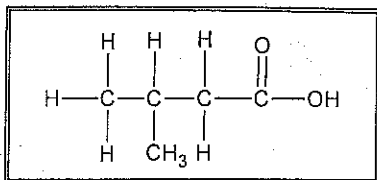
(i) Identify the test tube (1 or 2) in which bromine water gets decolourised. (1 mark)

(ii) Name the type of reaction responsible for the decolourisation of bromine water. (1 mark)

(iii) Determine the functional group responsible for the decolourisation of bromine water. (1 mark)

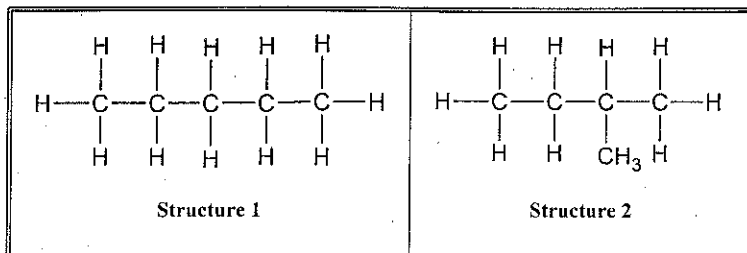
(iv) State one conclusion that can be made from this experiment. (1 mark)

Name the following organic compound using IUPAC rules.



(2 marks)

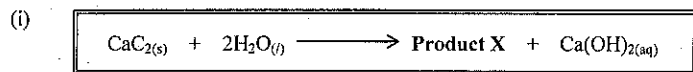
12. Use the structures of C_5H_{12} given below to answer the questions that follow.



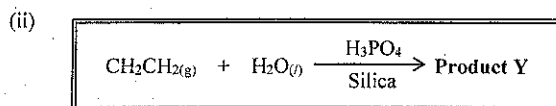
- (i) State whether the two structures shown above are **structural isomers** or **geometrical isomers** of each other. (1 mark)
- (ii) Provide a reason to justify your answer in part (i) above. (2 marks)

13. Determine the formula of **Products X, Y and Z** for the following reactions.

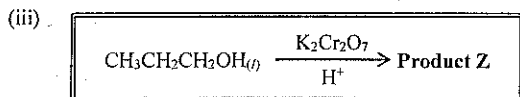
(Note: States of **Products X, Y and Z** are not important.)



(1 mark)



(1 mark)



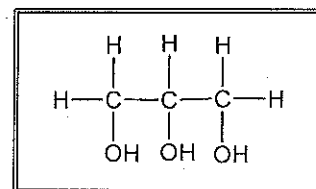
(1 mark)

STRAND 5 CONSUMER CHEMISTRY

[15 marks]

- This strand has 8 Questions.
- Circle the letter of the best answer in the Answer Booklet for Questions 1 – 3.
- Write the answer for Questions 4 – 8 in the space provided in the Answer Booklet.

1. The structure of a biochemical compound is shown below.



The name of the compound shown above is _____.

- A. alanine
 B. glucose
 C. glycerol
 D. fructose (1 mark)

2. Glucose, sucrose, starch and glycogen are all examples of _____.

- A. lipids.
 B. proteins.
 C. amino acids.
 D. carbohydrates. (1 mark)

3. Paracetamol can be classed as an _____ medicine.

- A. antacid
 B. analgesic
 C. antibiotic
 D. antipyretic (1 mark)

