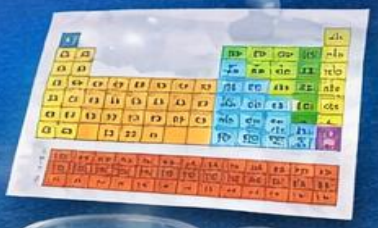
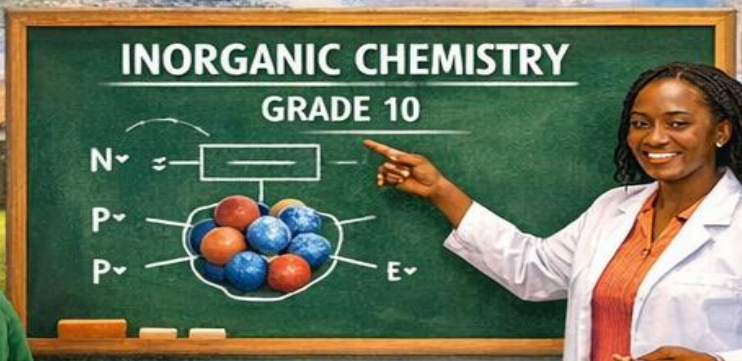
COMPETENCE BASED EDUCATION | SENIOR SCHOOL

GRADE 10

CHEMISTRY

TOPICAL REVISION BOOK





CONTENTS

AUTHORS: COMPETENCE EDUCATION GROUP

1.0 INORGANIC CHEMISTRY

1.1 INTRODUCTION TO CHEMISTRY

SECTION A: QUESTIONS (1–30)

1. Define the term Chemistry. (2 marks)

_____

_____

2. State two reasons why Chemistry is called a field of science. (2 marks)

i. _____

ii. _____

3. Outline five branches of chemistry.

i. _____

ii. _____

iii. _____

iv. _____

v. _____

4. List four careers related to the field of Chemistry. (4 marks)

i. _____

ii. _____

iii. _____

iv. _____

5. Match the branch of Chemistry to the correct description. (4 marks)

Branch	**Description**
(i) Organic chemistry	A. Study of energy changes
(ii) Physical chemistry	B. Study of carbon compounds
(iii) Analytical chemistry	C. Study of metals and salts
(iv) Inorganic chemistry	D. Identifying substances

6. (a)State three ways Chemistry is applied in agriculture. (3 marks)

i. _____

ii. _____

iii. _____

(b)Mention the relationship between chemistry and these science fields

a) Biology

_____

_____

b) Physics

_____

_____

d) Environmental Science

_____

_____

7. A farmer sprays crops with pesticide without protective clothing.

(a) State **two dangers** of this action. (2 marks)

i. _____

ii. _____

(b) Suggest **two safety precautions** the farmer should take. (2 marks)

i. _____

ii. _____

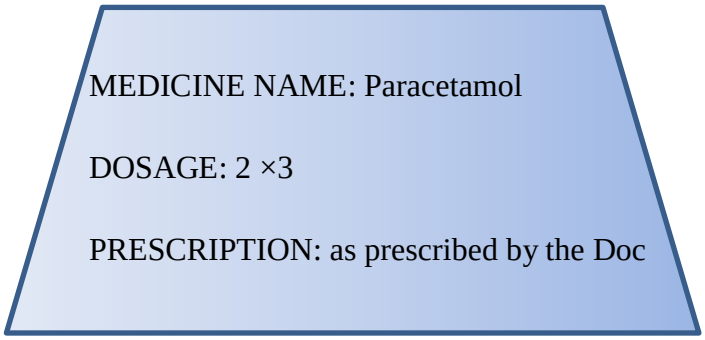
8. Explain how Chemistry is useful in the pharmaceutical industry. (3 marks)

i. _____

ii. _____

iii. _____

9. The diagram below represents a medicine label.



(a) What is meant by the term **dosage**? (1 mark)

_____

_____

(b) What is meant by the term **prescription**? (1 mark)

_____

_____

(c) State **one danger** of ignoring dosage instructions. (2 marks)

_____

_____

10. State two differences between a drug and a substance. (2 marks)

Drug	*Substance*

11. Give three examples of substances that are commonly abused in society. (3 marks)

i. _____

ii. _____

iii. _____

12. (a)Explain three effects of drug and substance abuse on a learner. (3 marks)

i. _____

ii. _____

iii. _____

(b)Give an example of a drug under the following category

Category of Drugs	**Two Examples**
a) Stimulants	_____ , _____
b) Depressants	_____ , _____
c) Narcotics (Painkillers)	_____ , _____
d) Hallucinogens	_____ , _____

13. A learner takes cough syrup in large amounts to "feel high".

(a) State the type of substance misuse shown. (1 mark)

_____

_____

(b) Give **two possible effects** on the learner's health. (2 marks)

i. _____

ii. _____

(c) Suggest **one way** the school can help prevent such misuse. (2 marks)

_____

_____

14. State three ways Chemistry is applied in manufacturing industries. (3 marks)

i. _____

ii. _____

iii. _____

15. The diagram below shows a simple soap-making process.

FATS/OILS + ALKALI → SOAP + GLYCEROL

(a) Identify one product shown in the equation. (1 mark)

_____

(b) State **one use** of soap in daily life. (1 mark)

_____

_____

(c) Explain why Chemistry is important in soap production. (2 marks)

i. _____

ii. _____

16. State two roles of Chemistry in the food industry. (2 marks)

17. The diagram below shows a food label.

Ingredients: Sugar, Colour, Flavour, Preservative (E211)

(a) What is a **preservative**? (1 mark)

_____

_____

(b) Give **one reason** preservatives are added to foods. (1 mark)

_____.

_____.

(c) State **one possible disadvantage** of consuming too many preservatives. (2 marks)

_____.

_____.

18. Explain how Chemistry is used in medicine and healthcare. (3 marks)

i. _____.

ii. _____.

iii. _____.

19. A hospital uses oxygen cylinders.

(a) Name the gas stored in the cylinder. (1 mark)

_____.

(b) State **two uses** of this gas in a hospital. (2 marks)

i. _____.

ii. _____.

(c) Explain why proper handling of the cylinder is important. (2 marks)

i. _____.

ii. _____.

20. State two applications of Chemistry in the energy sector. (2 marks)

i. _____.

ii. _____.

21. The diagram below shows a battery.

(a) State one use of the battery. (1 mark)

_____.

_____.

(b) Explain how Chemistry is involved in the production of batteries. (2 marks)

i. _____.

ii. _____.

22. Explain how Chemistry is used in sports and entertainment. (3 marks)

i. _____.

ii. _____.

23. The diagram below shows fireworks.

(a) State one chemical reason why fireworks produce colours. (2 marks)

_____.

_____.

(b) Mention two safety precautions to observe when using fireworks. (2 marks)

i. _____.

ii. _____.

24. Explain the meaning of nuclear chemistry. (2 marks)

_____.

_____.

25. State two uses of nuclear chemistry in society. (2 marks)

i. _____.

ii. _____.

26. The diagram below shows a Chemistry laboratory.

X

Y

Z

(a) Identify **two laboratory apparatus** shown. (2 marks)

X: _____.

Y: _____.

Z: _____.

(b) State two **safety rules while handling the** apparatus identified. (2 marks)

i. _____.

ii. _____.

27. Learners are required to promote the rights and responsibilities for a safe learning environment.

(a) State **two learner rights** in a Chemistry laboratory. (2 marks)

i. _____.

ii. _____.

(b) State **two learner responsibilities** in a Chemistry laboratory. (2 marks)

i. _____.

ii. _____.

28. A student spills acid on the table.

(a) State the first action the student should take. (1 mark)

i. _____.

ii. _____.

(b) State **two actions** the teacher/lab technician should take. (2 marks)

i. _____.

ii. _____.

(c) State **one reason** why acids should not be touched directly. (2 marks)

i. _____.

ii. _____.

29. The table below shows different careers.

Career	**Field**
Pharmacist	
Chemical Engineer	
Laboratory Technologist	
Environmental Scientist	

Fill in the missing field for each career. (4 marks)

30. Gender stereotyping sometimes affects career choices.

(a) Explain what is meant by **gender stereotyping**. (2 marks)

_____.

_____.

(b) State **two ways** gender stereotyping affects learners' career choices. (2 marks)

i. _____.

ii. _____.

(c) Suggest **two ways** schools can reduce gender stereotyping in science careers. (2 marks)

i. _____.

ii. _____.

SET 2

1.1 Introduction to Chemistry

1. Define Chemistry. (2 marks)

_____.

_____.

2. State four branches of Chemistry. (4 marks)

i. _____.

ii. _____.

iii. _____.

iv. _____.

3. Explain two ways Chemistry is applied in each of the following industries: (6 marks)

a) Agriculture

i. _____.

ii. _____.

b) Food industry

i. _____.

ii. _____.

c) Pharmaceutical industry

i. _____.

ii. _____.

4. (a) Name two careers in Chemistry. (2 marks)

i. _____.

ii. _____.

(b) For each career, state one required skill. (2 marks)

i. _____.

ii. _____.

5. (a) Identify one example of Chemistry in energy production. (1 mark)

i. _____.

ii. _____.

(b) Identify one example of Chemistry in sports. (1 mark)

i. _____.

ii. _____.

(c) Explain why Chemistry is important in medicine. (2 marks)

i. _____.

ii. _____.

6. (a) Mention three concepts learned in Junior School that relate to Chemistry. (3 marks)

i. _____.

ii. _____.

iii. _____.

(b) Explain one concept in detail. (2 marks)

_____.

_____.

_____.

_____.

7. Drug and Substance Use:

(a) Define the terms:

Drug,

_____.

_____.

Prescription,

_____.

_____.

Dosage,

_____.

_____.

Substance Use. (4 Marks)

_____.

_____.

(b) State two effects of substance abuse on day-to-day life. (2 marks)

i. _____.

ii. _____.

8. Safety in the Chemistry Classroom:

(a) State two learner rights in a chemistry laboratory. (2 marks)

i. _____.

ii. _____.

(b) State two learner responsibilities. (2 marks)

i. _____.

ii. _____.

9. Applied Question with Diagram:

The diagram below shows a simple experiment with tablets dissolving in water:

(a) Identify what is happening to the tablet. (1 mark)

_____.

_____.

(b) Name the type of reaction occurring. (1 mark)

_____.

_____.

(c) Suggest one chemical safety precaution to follow. (1 mark)

_____.

_____.

10. Using electronic/print media, search for **one career opportunity related to Chemistry that is influenced by gender stereotyping.**

(a) Name the career. (1 mark)

_____.

_____.

(b) Explain how stereotyping affects career choice. (2 marks)

i. _____.

ii. _____.

11. Develop a poster to sensitise peers/community on the risks of drug and substance use.

(a) List three key points you would include. (3 marks)

i. _____.

ii. _____.

iii. _____.

(b) Suggest two visual elements to make your poster attractive. (2 marks)

i. _____.

ii. _____.

12. (a) Identify two household products that involve Chemistry. (2 marks)

i. _____.

ii. _____.

(b) For each product, explain the chemical process involved. (2 marks)

i. _____.

ii. _____.

13.

Match the branch of Chemistry with its example: **(4 marks)**

Branch	Example
i. Organic Chemistry	a) Fertilizers
ii. Inorganic Chemistry	b) Medicines
iii. Biochemistry	c) Digestion of food
iv. Physical Chemistry	d) Energy changes in reactions

14. Short Answer with Scenario:

A learner observes fizzing when a tablet is dropped into water in the laboratory.

(a) Explain why fizzing occurs. (2 marks)

_____.

_____.

(b) Identify the gas produced. (1 mark)

_____.

_____.

(c) Suggest one way to collect the gas safely. (1 mark)

_____.

_____.

15. Which of the following is NOT a branch of Chemistry? **(1 mark)**

A. Organic Chemistry

B. Biochemistry

C. Sports Science

D. Physical Chemistry

16. Fill-in-the-Blank Questions:

(a) Chemistry is the study of _____. (1 mark)

(b) The _____ in Chemistry involves the study of substances containing carbon. (1 mark)

(c) _____ Chemistry studies energy changes in reactions. (1 mark)

17. True/False:

(a) Chemistry is only important in the laboratory. (_____) (1 mark)

(b) Inorganic Chemistry studies compounds that do not contain carbon. (_____) (1 mark)

(c) All careers in Chemistry require lab work. (_____) (1 mark)

18. A community uses fertilizers in agriculture.

(a) Identify one chemical used in fertilizers. (1 mark)

_____.

_____.

(b) Explain one environmental effect if fertilizers are misused. (2 marks)

_____.

_____.

(c) Suggest one safe practice when using chemicals in agriculture. (1 mark)

_____.

_____.

19. Draw and label a diagram showing three types of laboratory safety equipment used when handling chemicals. (3 marks)

20. (a) Explain the importance of Chemistry in the entertainment industry. (2 marks)

i. _____.

ii. _____.

(b) Suggest one example of a chemical used in the industry. (1 mark)

_____.

_____.

21. (a) State one consumer right related to chemicals. (1 mark)

_____.

_____.

(b) Explain how a learner can promote this right. (1 mark)

_____.

_____.

22. Discuss the role of Chemistry in energy production, citing one renewable and one non-renewable source. (3 marks)

i. _____.
ii. _____.
iii. _____.

23. A student measures the pH of household solutions: vinegar (pH 3), soap (pH 9), water (pH 7).

(a) Classify each solution as acidic, basic, or neutral. (3 marks)

Acidic	Basic	Neutral

(b) Explain why water is neutral. (2 marks)

i. _____.
ii. _____.

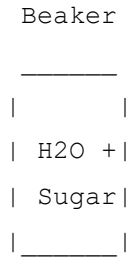
24. (a) Name two chemicals commonly used in medicines. (2 marks)

i. _____.
ii. _____.

(b) Explain one effect of incorrect dosage. (1 mark)

_____.
_____.

25. A beaker contains a mixture of sugar and water.



(a) Name the type of mixture. (1 mark)

_____.
_____.

(b) Suggest one method to separate sugar from water. (1 mark)

_____.

26. (a) Chemistry only studies substances that can be seen. (2 marks)

_____.

_____.

(b) Substance use can affect chemical experiments in school. (2 marks)

_____.

_____.

27. A student accidentally spills a chemical in the lab.

(a) List two immediate safety steps. (2 marks)

i. _____.

ii. _____.

(b) Explain why it is important to follow laboratory rules. (2 marks)

i. _____.

ii. _____.

28. Explain the importance of Chemistry in:

(a) Food industry (2 marks)

i. _____.

ii. _____.

(b) Medicine (2 marks)

i. _____.

ii. _____.

(c) Energy (2 marks)

i. _____.

ii. _____.

29. Data Analysis Question:

A student collects data on chemical careers:

i. 40% in pharmaceuticals
ii. 25% in food industry
iii. 20% in energy
iv. 15% in entertainment

(a) Draw a pie chart to represent this data. (4 marks)

(b) Identify the career with the highest percentage. (1 mark)

_____

30. Discuss one challenge a learner may face in Chemistry due to gender stereotyping. Suggest two ways to overcome it. (3 marks)

_____.
_____.
_____.
_____.
_____.
_____.

1.2 THE ATOM

1. Define the term atom. (2 marks)

_____.

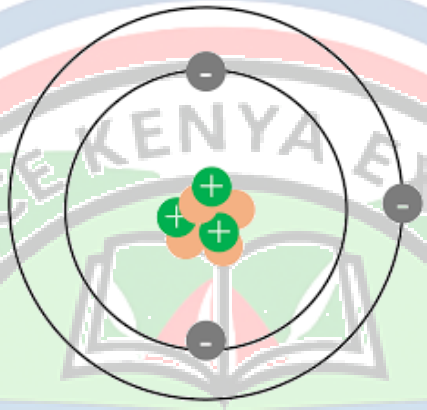
_____.

2. State two particles found in the nucleus of an atom. (2 marks)

i. _____.

ii. _____.

3. The diagram below represents an atom.



(a) Name the particles labelled **e**$^-$. (1 mark)

_____

(b) State the charge on a proton. (1 mark)

_____

(c) State the charge on a neutron. (1 mark)

_____

(d) State where electrons are found in an atom. (1 mark)

_____.

_____.

4. Distinguish between:

(a) **Atomic number** and **mass number**. (2 marks)

_____.

_____.

_____.

(b) **Protons** and **electrons**. (2 marks)

_____.

_____.

_____.

_____.

5. An element has atomic number 12 and mass number 24.

(a) State the number of protons. (1 mark)

_____.

_____.

(b) State the number of neutrons. (1 mark)

_____.

_____.

(c) State the number of electrons. (1 mark)

_____.

_____.

6. Fill in the table below. (4 marks)

Particle	**Symbol**	**Relative charge**	**Relative mass**
Proton			
Neutron			
Electron			

7. State two similarities between Dalton's and Rutherford's atomic models. (2 marks)

i. _____.

ii. _____.

8. The diagram below represents Dalton's atomic model.

(a) What did Dalton believe about the atom? (2 marks)

_____.

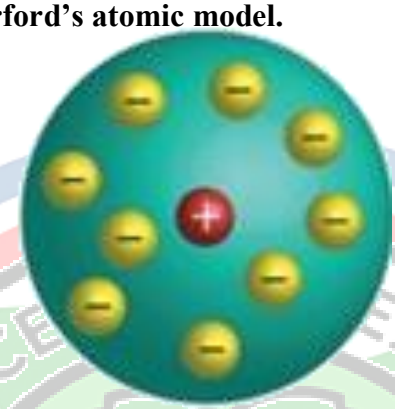
_____.

(b) State **one limitation** of Dalton's model. (2 marks)

_____.

_____.

9. The diagram below represents Rutherford's atomic model.



(a) State **two key features** of Rutherford's model. (2 marks)

i. _____.

ii. _____.

(b) State **one limitation** of Rutherford's model. (2 marks)

_____.

_____.

10. Describe what is meant by energy levels in an atom. (2 marks)

_____.

_____.

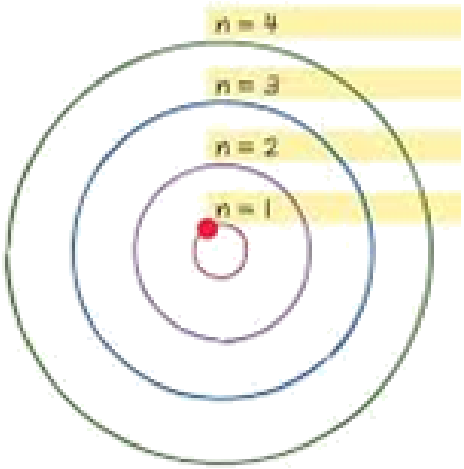
11. The diagram below shows energy levels.

N=4

n=3

n=2

n=1



(a) Which level is closest to the nucleus? (1 mark)

_____.

_____.

(b) Which level has the lowest energy? (1 mark)

_____.

_____.

(c) Which level is filled first? (1 mark)

i. _____.

ii. _____.

12. State the maximum number of electrons that can occupy:

(a) First energy level (n=1) _____. (1 mark)

(b) Second energy level (n=2) _____. (1 mark)

(c) Third energy level (n=3) _____. (1 mark)

13. Define the term orbital. (2 marks)

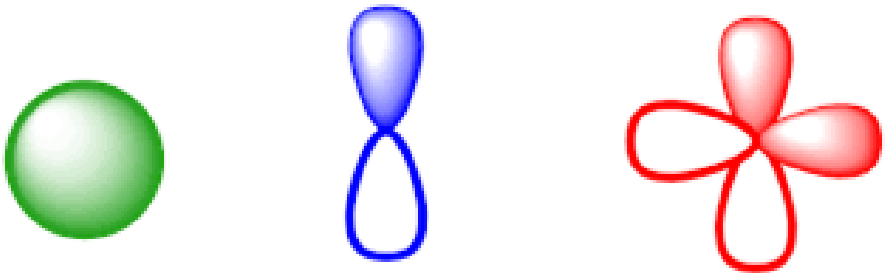
_____.

_____.

14. State two differences between an energy level and an orbital. (2 marks)

	Energy Level	Orbital
i		
ii		

15. The diagram below represents s and p orbitals.



X **Y** **Z**

a) Identify the orbitals

S:_____

P:_____

(b) State **one shape difference** between s and p orbitals. (1 mark)

_____.

_____.

(c) State the number of p orbitals in one p-subshell. (1 mark)

_____.

_____.

(d) State the maximum number of electrons in a p-subshell. (2 marks)

i. _____.

ii. _____.

16. State the order of filling orbitals starting from the lowest energy. (3 marks)

(Use: 1s, 2s, 2p, 3s, 3p, 4s)

_____.

_____.

_____.

_____.

17. Write the electron arrangement of Carbon (Z = 6) using s and p notation. (3 marks)

_____.

_____.

_____.

_____.

18. Write the electron arrangement of Oxygen (Z = 8) using s and p notation. (3 marks)

_____.

_____.

_____.

_____.

19. Write the electron arrangement of Sodium (Z = 11) using s and p notation. (3 marks)

_____.

_____.

_____.

_____.

20. Write the electron arrangement of Calcium (Z = 20) using s and p notation. (3 marks)

_____.

_____.

_____.

_____.

21. The diagram below shows orbital filling.

1s: ↑↓

2s: ↑↓

2p: ↑ ↑ ↑

(a) Name the rule followed in 2p filling. (1 mark)

i. _____.

ii. _____.

(b) State the name of the rule that electrons fill lowest energy first. (1 mark)

_____.

_____.

(c) Identify the element represented above. (2 marks)

_____.

_____.

22. Define the term isotope. (2 marks)

_____.

_____.

23. The following are isotopes of chlorine:

Cl-35 and Cl-37

(a) State the number of protons in both isotopes. (1 mark)

_____.

_____.

(b) State the number of neutrons in Cl-35. (1 mark)

_____.

_____.

(c) State the number of neutrons in Cl-37. (1 mark)

_____.

_____.

(d) State **one similarity** between isotopes. (1 mark)

_____.

_____.

24. Explain why isotopes of the same element have the same chemical properties. (2 marks)

i. _____.

ii. _____.

25. An element X has two isotopes:

i. X-10 (abundance 20%)

ii. X-11 (abundance 80%)

Calculate the relative atomic mass of X. (4 marks)

26. Copper exists as:

i. Cu-63 (69%)

ii. Cu-65 (31%)

Calculate the relative atomic mass of copper. (4 marks)

27. The table below shows isotopes of element Y.

Isotope	**Abundance (%)**
Y-24	75
Y-25	25

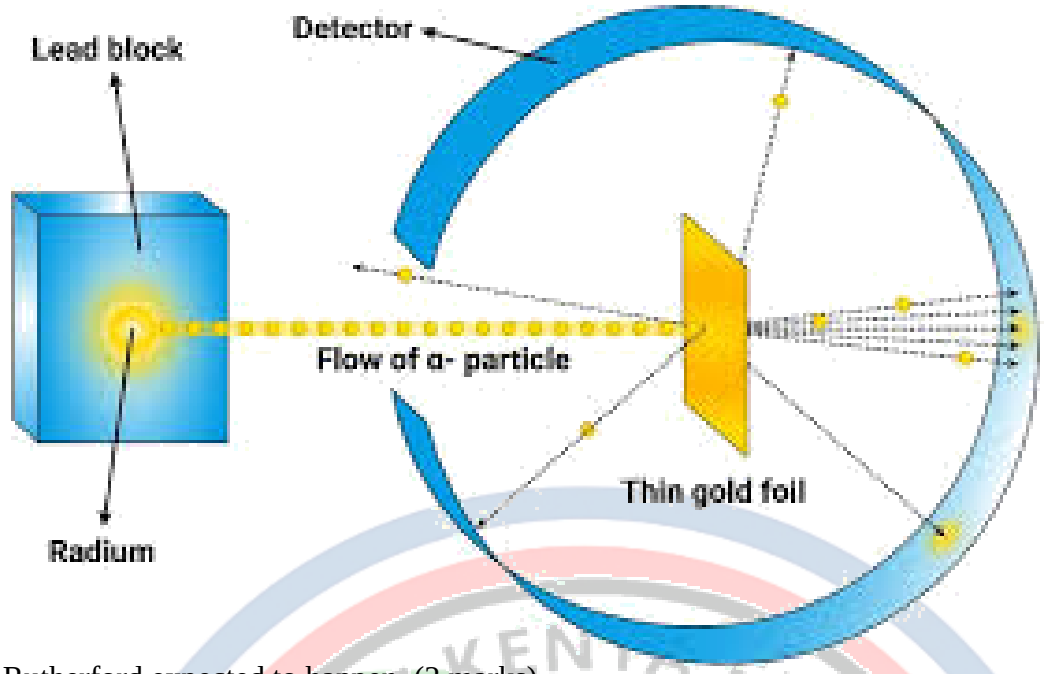
(a) Calculate the relative atomic mass of Y. (3 marks)

(b) State one importance of relative atomic mass in Chemistry. (2 marks)

_____.

_____.

28. The diagram below represents Rutherford's Gold Foil experiment.



(a) State what Rutherford expected to happen. (2 marks)

_____.

_____.

(b) State what Rutherford observed. (2 marks)

_____.

_____.

(c) State the conclusion Rutherford made about the atom. (2 marks)

_____.

_____.

29. Complete the table for the first 20 elements. (6 marks)

Element	**Symbol**	**Atomic number**	**Electron arrangement (s,p notation)**
Hydrogen	H	1	
Helium	He	2	
Lithium	Li	3	
Neon	Ne	10	
Magnesium	Mg	12	
Argon	Ar	18	

30. A Grade 10 learner says

"Electrons move around the nucleus like planets around the sun."

(a) State whether the statement is correct or incorrect. (1 mark)

_____.

_____.

(b) Explain your answer using the concept of orbitals. (3 marks)

_____.

_____.

_____.

_____.

(c) Suggest **one reason** why learning about atomic structure is important in Chemistry. (2 marks)

_____.

_____.

31. Element A has atomic mass 23 and element B has atomic mass 7 and also have 12neutorns and 4 neutrons respectively.

    a. Write the electronic arrangement of A and B

    _____

    b. Which element has higher ionization energy? Explain

    _____

    _____

32. The table below shows the relative atomic masses and the percentage abundance of isotope M_1 and M_2 of element M.

	Relative atomic mass	**% abundance**
M_1	62.93	69.09
M_2	64.93	30.91

Calculate the relative atomic mass of element M

33.

a. Element V has two isotopes. Two thirds of V and one third of V . What is the relative atomic mass of element V?

b. The following refers to element Y

Isotope	A	B	C
Isotope mass	54	56	57

Given that isotope C contains 31 neutrons in its nucleus find the number of protons in isotope B

34. The table below shows the relative atomic masses and the percentage abundance of the isotopes L_1 and L_2 of element L.

	Relative atomic mass	**% abundance**
L_1	62.93	69.09
L_2	64.93	30.91

Calculate the relative atomic mass of element K.

35. An element M has two isotopes M and M . The relative atomic mass of the naturally occurring is 63.55. Calculate the percentage of each isotope

36. An oxide of element G has the formula as G_2O_3

a. State the valency of element G

_____

b. In which group f the periodic table is element G?

_____

37. The table below gives information about the ions T^+ and Z^{2-}

Ion	**T^+**	**Z^{2-}**
Electron arrangement	2.8	2.8.8
Number of neutrons	12	16

a. How many protons are there in the nucleus of ?

i. Element T?:_____

ii. Element Z? :_____

b. Determine the relative formula mass of the compound formed between T and Z

c. State two conditions under which the compound would conduct electricity

i. _____.

ii. _____.

1.3 THE PERIODIC TABLE

1. Define the term periodic table. (2 marks)

_____.

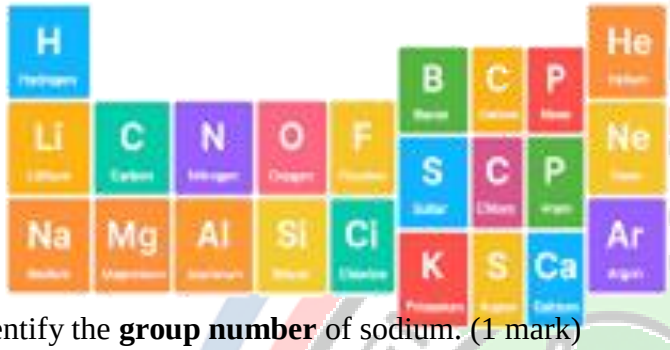
_____.

2. State two reasons why the periodic table is important in Chemistry. (2 marks)

i. _____.

ii. _____.

3. The diagram below shows a simplified periodic table layout.



(a) Identify the **group number** of sodium. (1 mark)

_____.

(b) Identify the **period number** of magnesium. (1 mark)

_____.

(c) State the family to which fluorine belongs. (1 mark)

_____.

(d) State the family to which neon belongs. (1 mark)

_____.

4. Distinguish between:

(a) **Groups** and **periods** in the periodic table. (2 marks)

_____.

_____.

(b) **Metals** and **non-metals**. (2 marks)

i. _____.

ii. _____.

c) Alkali and alkaline metals

_____.

_____.

_____.

_____.

d) Halogens and noble gases

i. _____.

ii. _____.

iii. _____.

iv. _____.

5.(a) State four chemical families found in the periodic table. (4 marks)

i. _____.

ii. _____.

iii. _____.

iv. _____.

(b)Mention four transition elements

i. _____.

ii. _____.

iii. _____.

iv. _____.

6. Identify an elements under each: (4 marks)

(a) Group 1

i. _____.

ii. _____.

(b) Group 8

i. _____.

ii. _____.

(c) Period 1

i. _____.

ii. _____.

(d) Period 3

i. _____.

ii. _____.

7. The first 20 elements are listed below:

(a) Write in full.

H, _____

He, _____

Li, _____

Be, _____

B, _____

C, _____

N, _____

O, _____

F, _____

Ne, _____

Na, _____

Mg, _____

Al, _____

Si, _____

P, _____

S, _____

Cl, _____

Ar, _____

K, _____

Ca_____

8. The table below shows electron arrangements.

Element	Electron arrangement
A	2,8,1
B	2,8,7
C	2,8,8

(a) Identify which element is a noble gas. (1 mark)

_____.

_____.

(b) Identify which element is an alkali metal. (1 mark)

_____.

_____.

(c) Identify which element is a halogen. (1 mark)

_____.

_____.

(d) Explain your answer using outer shell electrons. (2 marks)

_____.

_____.

_____.

_____.

(e) Draw the electron configuration for elements A, B and C above

A	B	C

9. State the relationship between:

(a) Group number and valence electrons (2 marks)

_____.

_____.

_____.

_____.

(b) Period number and number of energy levels (2 marks)

_____.

_____.

_____.

_____.

10. The illustration below shows energy levels.

Element X: 2, 8, 2

(a) State the group of element X. (1 mark)

_____.

(b) State the period of element X. (1 mark)

_____.

(c) Name element X. (1 mark)

_____.

(d) State whether X is a metal or non-metal. (1 mark)

_____.

_____.

11. Explain why noble gases are chemically unreactive. (2 marks)

_____.

_____.

12. The diagram below shows a chlorine atom.

Cl: 2,8,7

(a) State the type of ion chlorine forms. (1 mark)

_____.

_____.

(b) Write the ion formed. (1 mark)

_____.

_____.

(c) Explain how the ion is formed. (2 marks)

_____.

_____.

13. The diagram below shows a sodium atom.

Na: 2,8,1

(a) State the type of ion sodium forms. (1 mark)

_____.

_____.

(b) Write the ion formed. (1 mark)

_____.

_____.

(c) Explain how the ion is formed. (2 marks)

_____.

_____.

14. Write the electron arrangement of the following ions using shells. (4 marks)

(a) Na^+:_____

(b) Mg^{2+}_____

(c) Cl^-_____

(d) O^{2-}_____

15. The illustration below shows electron transfer.

$Na \rightarrow Na^+ + e^-$

$Cl + e^- \rightarrow Cl^-$

(a) Name the type of bonding formed between Na and Cl. (1 mark)

_____

(b) Write the formula of the compound formed. (1 mark)

_____.

_____.

(c) Explain why Na^+ and Cl^- attract. (2 marks)

_____.

_____.

16. Define the term valency. (2 marks)

_____.

_____.

17. Define the term oxidation number. (2 marks)

_____.

_____.

18. State the oxidation number of each element in the following: (4 marks)

(a) NaCl: _____.
(b) MgO: _____.
(c) H_2O: _____.
(d) $CaCl_2$:_____.

19. The following are radicals:

i. SO_4^{2-}

ii. NO_3^-

iii. CO_3^{2-}

iv. OH^-

(a) Define the term **radical**. (2 marks)

_____.

_____.

(b) State the charge on nitrate radical. (1 mark)

_____.

_____.

(c) State the name of CO_3^{2-}. (1 mark)

_____.

_____.

20. Use valencies to write the formulae of the following compounds: (6 marks)

(a) Sodium chloride: _____.
(b) Magnesium oxide: _____.
(c) Calcium chloride: _____.
(d) Aluminium oxide: _____.
(e) Potassium nitrate: _____.
(f) Calcium carbonate: _____.

21. Write the correct formula of each: (4 marks)

(a) Sodium sulphate: _____.
(b) Magnesium hydroxide: _____.
(c) Aluminium nitrate: _____.
(d) Calcium sulphate: _____.

22. Balance the following chemical equations: (6 marks)

(a) $Mg + O_2 \rightarrow MgO$
(b) $Na + Cl_2 \rightarrow NaCl$
(c) $Ca + H_2O \rightarrow Ca(OH)_2 + H_2$
(d) $Al + O_2 \rightarrow Al_2O_3$

23. The diagram below shows a reaction between magnesium and oxygen.

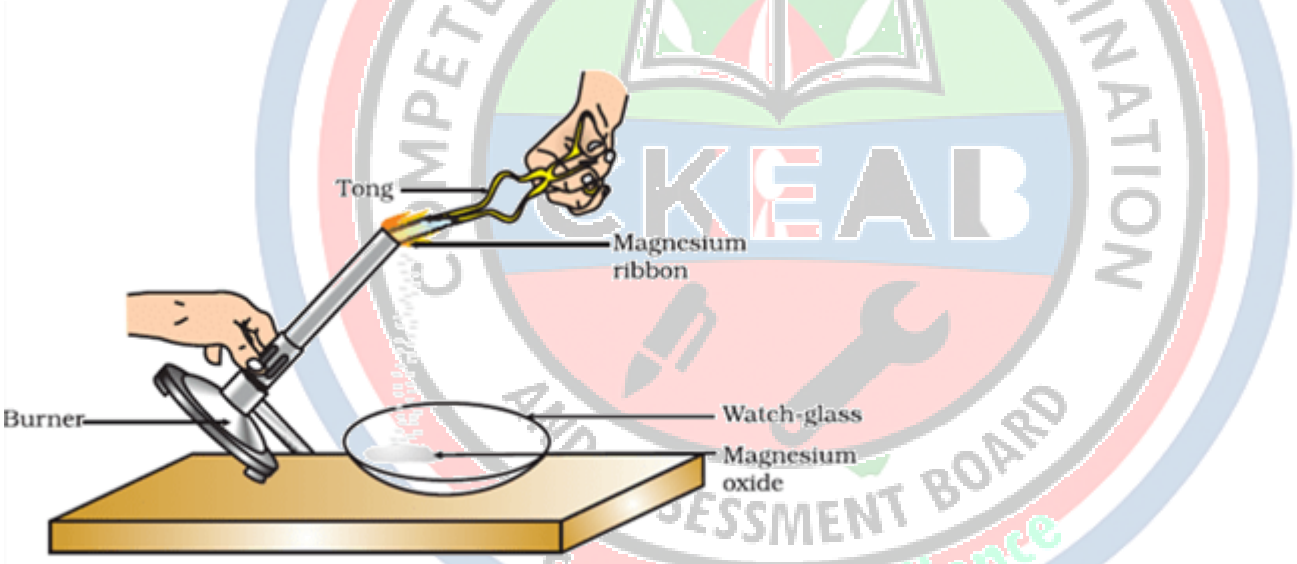


Figure 1.1
Burning of a magnesium ribbon in air and collection of magnesium oxide in a watch-glass

Magnesium ribbon burns → White powder formed

(a) Name the white powder formed. (1 mark)

_____

_____

(b) Write a balanced equation for the reaction. (2 marks)

_____

_____

(c) State one observation during burning. (1 mark)

_____

_____

24. State two differences between alkali metals and alkaline earth metals. (4 marks)

	Alkali metals	**Alkaline earth metals**
i		
ii		

25. The table below shows some elements.

Element	**Group**	**Property**
Sodium	1	Very reactive
Magnesium	2	Reactive
Chlorine	17	Reactive non-metal
Argon	18	Inert

(a) Explain why sodium is more reactive than magnesium. (2 marks)

_____

_____

_____

_____

(b) Explain why argon is inert. (2 marks)

_____

_____

26. (a) Name two transition elements. (2 marks)

_____

_____

(b) State two properties of transition metals. (2 marks)

i. _____

ii. _____

27. Some elements show variable oxidation numbers.

(a) Name one element that shows variable oxidation states. (1 mark)

i. _____

ii. _____

(b) State two oxidation numbers shown by iron. (2 marks)

i. _____

ii. _____

(c) Explain why transition metals show variable oxidation numbers. (2 marks)

_____

_____

28. Use oxidation numbers to determine whether the following is correct:

$FeCl_2$ contains Fe^{2+} and $2Cl^-$

(a) State the oxidation number of Fe in $FeCl_2$. (1 mark)

_____

_____

(b) State the oxidation number of Cl in $FeCl_2$. (1 mark)

_____

_____

(c) Write the name of $FeCl_2$. (2 marks)

_____

_____

(d) Write the formula of iron(III) chloride. (2 marks)

_____

_____

29. Complete the table below. (6 marks)

Element	**Electron arrangement**	**Group**	**Period**	**Ion formed**
Na	2,8,1			
Mg	2,8,2			
Cl	2,8,7			

30. A student wrote the following formula:

MgCl

(a) Explain why the formula is incorrect. (2 marks)

i. _____

ii. _____

(b) Write the correct formula. (1 mark)

_____

(c) Explain using valency or oxidation numbers. (3 marks)

(d) Write a balanced equation for forming magnesium chloride from magnesium and chlorine gas. (2 marks)

31.

a. Element X is found in period III and group IV. It consists of two isotopes ^{28}X and ^{Q}X.
A sample of X was found to consist of 90% of ^{28}X.If the relative atomic mass of X is 28.3, work out the number of neutrons in ^{Q}X

b. Draw an electrochemical cell for the above cell

32. Study the table below and answer the questions that follows:- (Letters are not the actual symbols of element)

Element	Electronic arrangement	Electrical conductivity
L_1	2.8.2	Higher electrical conductivity
L_2	2.8.1	High electrical conductivity
L_3	2.8.3	Highest electrical conductivity

L_3 has the highest electrical conductivity. Explain

33. Use the information in the table below to answer the questions that follow.
(The letters do not represent the actual symbols of the elements).

Element	Q	P	R	S	T
Atomic number	1	5	3	5	20
Mass number	40	10	7	11	40

a. Which two letters represent the same element? Give a reason

_____
_____
_____
_____

b. Give the number of neutrons in an atom of element R

_____
_____

34. The table below gives some elements in the periodic table. Use it to answer the questions that follow. The letters do not represent the actual symbols of the elements.

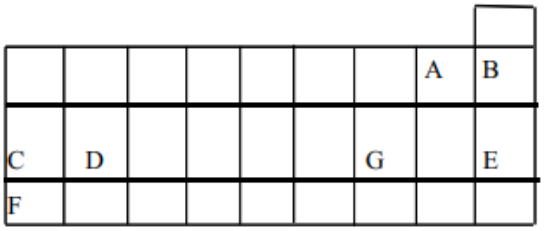
Element	A	B	C	D	E
Atomic number	12	13	14	15	16

Which of the above letters represent:

a. A metallic element which forms ions with the smallest ionic radius? Explain

b. A non metallic element with the largest bbatomic size? Explain

35. The grid below is part of the periodic table. Use it to answer the questions that follow:
(The letters are not the actual symbols).



a. Write down the formula of the compound formed between C and A.

b. Which element has the same electron arrangement as the stable ion of:
(i) F …….

(ii) A ……..

c. Element Q has atomic number 15. Indicate its position on the grid.

36. The number of protons, neutrons and electrons in atoms A to F are given in the table below the letters do not represent the actual symbol of the elements:-

Atoms	**Protons**	**Neutrons**	**Electrons**
A	3	4	2
B	9	10	10
C	12	12	12
D	17	18	17
E	17	20	17
F	18	22	18

a. Choose from the table the letters that represent:

i. An atom of a metal .....

ii. A neutral atom of a non-metal .....

iii. An atom of a noble gas .....

iv. A pair of isotopes .....

v. A cation .....

b. The grid below shows a part of the periodic table. The letters do not represent the actual symbols. Use it to answer the questions that follow:-

C								T
	K					U		
X	Y		M			Q	W	
J								Z

i. How do the atomic radius of element X and Y compare ii.

I. Using crosses (X) to represent electrons, draw the atomic structure of element Q

II. State the period and the group to which element Q belong

I. The ionic configuration of element G is 2.8 G forms an ion of the type G-1. Indicate on the grid, the position of element G.

II. To which chemical family does element G belong?

III. State one use of element U

IV. What is the nature of the compound formed between K and U

37. Study the table below and answer the questions that follow.

Particle	**Atomic number**	**Ionic configuration**	**Formula of oxide**	**Atomic radii**	**Ionic radii**
P	4	……..	……	0.110	0.031
Q	……...	2.8.8	QO	0.200	0.099
R	……	2.8.8	R2O	0.230	0.133
S	17	2.8.8	S2O7	0.099	0.181
T	16	……	……	0.104	0.231

i. Complete the table above

ii. From the table, choose the most reactive metal. Explain

iii. Which element is the most electronegative. Explain

iv. Using dots (.) and crosses (x) to represent electrons, show the bonding in the chloride of Q

v. Explain the solubility of element T in water

b.

i. Why is aluminium used to make utensils yet it is a reactive metal?

ii. Distinguish between valency and oxidation number

38.

a. Work out the oxidation number of phosphorous in the following compound H_3PO_3

b. Study the equation below:

$Mg(s) + 2H2O(l) \rightarrow Mg(OH)2(aq) + H2(g)$

Which species has undergone oxidation .Explain

39. The grid below represents part of the periodic table. The letters do not represent the actual symbols of the elements. Study it and answer the questions that follow:

L							L	
M	P			T		J	U	X
N	Q		R	S			V	Y
							W	

a. Explain why element L appears in two different groups in the grid above

b. State the name of the chemical family to which P and Q belong

c. Write the formula of the compound formed between P and V

d. Compare the melting points of Q and S. Explain

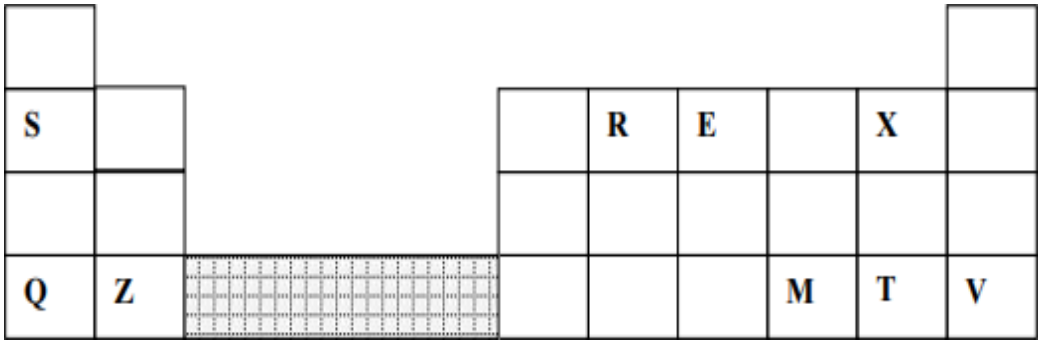
e. Identify an element whose oxide dissolves in both acids and alkalis

f. Write the equation for the burning of T in excess air

g. Using dots (•) and cross (x) to represent electrons, draw a diagram to illustrate bonding in the sulphide of Q

h. State one use of element X

40. The grid below represents part of the periodic table. Study it and answer the questions that follow:



a.

i. Identify the element that gains electrons most readily

ii. Which of the metal is most reactive? Explain

iii. What name is given to the family of elements to which elements X and T belong?

iv. Explain why:-

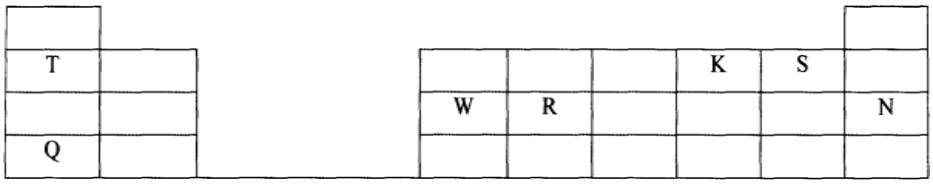
I. Ionic radius of Q is larger than that of M

II. Atomic radius of Q is greater than that of S

v. Which of the element in the table does not have the ability to form an ionic or covalent bond? Explain

vi. Give the formula of the compound formed between R and Z

41. The grid below is part of the periodic table. The elements are not represented by their actual symbols. Use the



information to answer the questions that follow.

a.

i. Which is the most reactive

I. Non - metal? Explain

II. Metal? Explain

ii. Name the family to which elements T and Q belongs.

iii. Write the formula of the compound formed when W reacts with S.

iv. Name the type of bond and structure formed when elements R and K react.

v. Explain why element N doesn't form compounds with other elements.

vi. Compare the atomic radii of T and Q. Explain.

42. Study the data given in the following table and answer the questions that follow. The letters are not the actual symbols of elements.

Element	**Number of protons**	**Melting point**	**Bpt oC**
A	11	98	890
B	12	650	1110
C	13	60	2470
D	14	1410	2360
E	15	442 590	280
F	16	113 119	445
G	17	-101	-35
H	18	-189	-186

i. State and explain the trend in melting point in A B C

ii. Explain why the melting point and boiling points of element D is the highest

iii. Explain why the element represented by letter E has two melting point values

iv. Write down the chemical formula between element C and sulphate ions

v. Name the chemical family in which H belong and state one use of the element

vi. What is the nature of the oxide of the elements represented by letters C and F?

43. An element W has an atomic number 13.

a. Write the electronic configuration of the most stable ion of W

b. Write the formula of the oxide of the element W

44. Identify the particles that facilitate the electric conductivity of the following substances

i. Sodium metal

ii. Sodium Chloride solution

iii. Molten Lead Bromide

45. Compare with a reason the atomic radius of Sodium to that of Aluminum.

46. Study the information in the table below and answer the questions that follow:

Ion	No. of protons	No. of electrons
P^{3-}	7	10
Q^{+}	19	18
R^{2+}	12	10

a. Write the electron arrangement of element P.

b. Give the group and period to which elements Q and R respectively.

Q ……

R ……

47. Ethanol is a liquid at room temperature but does not conduct electricity. Explain.

48. Electronic configuration for elements represented by

P, Q, R and S are:-

P= 2.8.6,

Q= 2.8.2,

R= 2.8.1

S= 2.8.8.

Select the element which forms

i. A double charged ion

ii. A soluble carbonate

49. The table below gives information on four elements by letters K, L, M and N. Study it and answer the questions that follow. The letters do not represent the actual symbol of the elements.

Element	**Electron arrangement**	**Atomic radius (nm)**	**Ionic radius (nm)**
K	2.8.2	0.136	0.065
L	2.8.7	0.099	0.181
M	2.8.8.1	0.203	0.133
N	2.8.8.2	0.174	0.099

a. Which two elements have similar properties? Explain

b. What is the most likely formula of the oxide of L?

c. Which element is non-metal? Explain

50. Study the information given below and answer the questions that follow:

Element	Atomic radius (nm)	Ionic radius (nm)	Formula of oxide	Melting point of oxide(oC)
A	0.364	0.421	A2O	-119
D	0.830	0.711	DO2	837
E	0.592	0.485	E2O3	1466
G	0.381	0.446	G2O5	242
J	0.762	0.676	JO	1054

a. Write the formula of the compound formed when J combined with G

b. Explain why the melting point of the oxide of E is higher than that of the oxide of G

51. An oxide of element G has the formula as G_2O_3

a. State the valency of element G

_____

b. In which group f the periodic table is element G?

_____

1.4 CHEMICAL BONDING

1. Define the term chemical bond. (2 marks)

_____

_____

2. State two reasons why atoms form chemical bonds. (2 marks)

_____

_____

3. What is meant by:

(a) **Octet rule** (1 mark)

_____

_____

(b) **Duplet rule** (1 mark)

_____

_____

4. State three types of chemical bonding. (3 marks)

i. _____

ii. _____

iii. _____

5. The diagram below shows electron transfer.

Na (2,8,1) $\rightarrow$ Na^+ (2,8) + e^-

Cl (2,8,7) + e^- $\rightarrow$ Cl^- (2,8,8)

(a) Name the type of bond formed. (1 mark)

_____

_____

(b) Name the compound formed. (1 mark)

_____

_____

_____

(c) Explain why this bond forms. (2 marks)

_____

_____

_____

6. Draw a dot (.) and cross (x) diagram for sodium chloride (NaCl). (4 marks)

7. State two physical properties of ionic compounds. (2 marks)

i. _____

ii. _____

8. Explain why ionic compounds:

(a) Have high melting points (2 marks)

_____

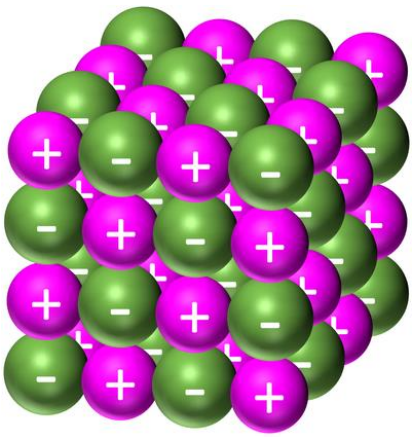
_____

(b) Conduct electricity when molten but not when solid (2 marks)

_____

_____

9. The diagram below represents a giant ionic lattice.



(a) Name the structure shown. (1 mark)

_____

(b) State one property caused by this structure. (2 marks)

i. _____

ii. _____

10. Define the term covalent bond. (2 marks)

_____

_____

11. Draw the Lewis dot structure for:

(a) Hydrogen molecule (H_2) (2 marks)

(b) Chlorine molecule (Cl_2) (2 marks)

12. The diagram below shows methane (CH_4).

```
    H
    |
H — C — H
    |
    H
```

(a) State the bond type in methane. (1 mark)

_____

(b) State one property of methane linked to its bond type. (2 marks)

_____

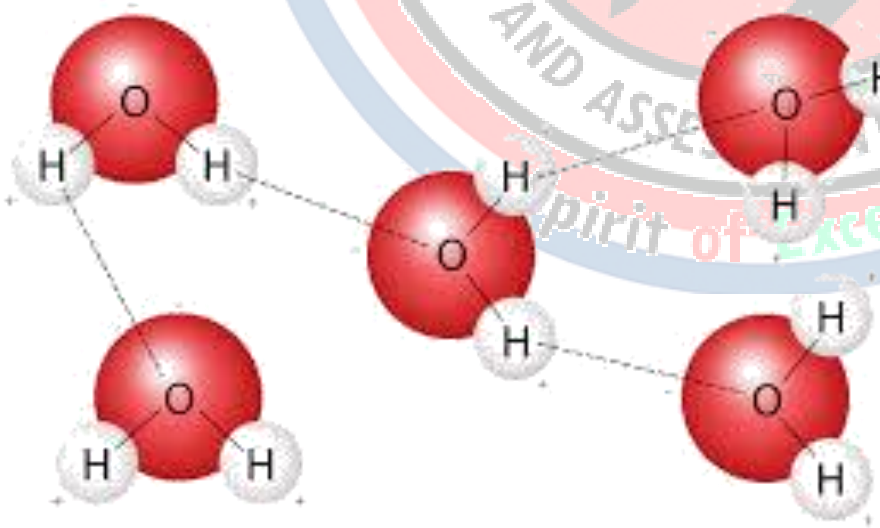
_____

13. State two differences between ionic bonding and covalent bonding. (4 marks)

	Ionic bonding	Covalent bonding
i		
ii		

14. Draw a dot and cross diagram for water (H_2O). (3 marks)

15. Water molecules attract each other as shown.



(a) Name the intermolecular force shown by dotted line. (1 mark)

(b) State one condition necessary for this force to exist. (2 marks)

(c) State one effect of this force on water's properties. (2 marks)

16. Explain why water has a higher boiling point than methane. (3 marks)

17. Define Van der Waals forces. (2 marks)

18. Give two examples of substances where Van der Waals forces exist strongly. (2 marks)

19. Define dative covalent bond (coordinate bond). (2 marks)

20. The diagram below represents bond formation.

$NH_3 + H+ \rightarrow NH_4^+$

(a) Name the bond formed between NH_3 and H^+. (1 mark)

(b) Explain how the bond is formed. (3 marks)

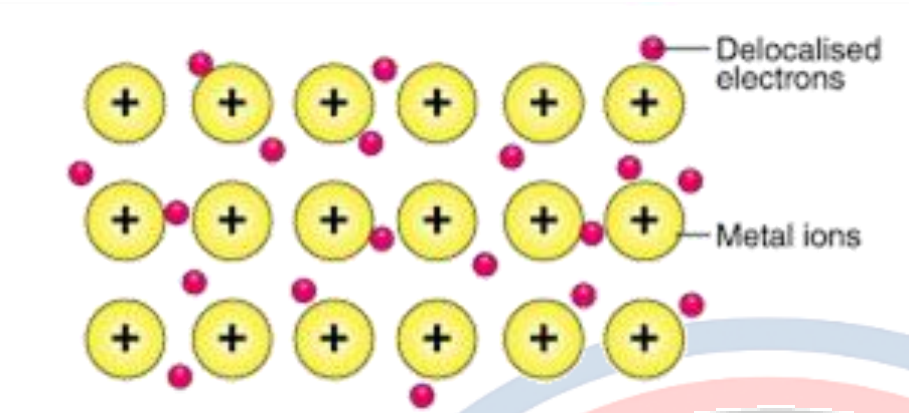
21. Draw a dot and cross diagram for the ammonium ion (NH_4^+) showing the dative bond. (4 marks)

22. Define metallic bonding. (2 marks)

_____

_____

23. The diagram below represents metallic bonding.



(a) Identify the particles labelled "+". (1 mark)

_____

_____

(b) Name the electrons shown. (1 mark)

_____

_____

(c) State two properties of metals explained by this bonding. (2 marks)

_____

_____

24. Explain why metals are:

(a) Good conductors of electricity (2 marks)

_____

_____

(b) Malleable and ductile (2 marks)

_____

_____

25. Diamond and graphite are both forms of carbon.

(a) State the type of structure in diamond. (1 mark)

_____

_____

(b) State the type of structure in graphite. (1 mark)

_____

_____

(c) Explain why graphite conducts electricity but diamond does not. (3 marks)

_____

_____

_____

_____

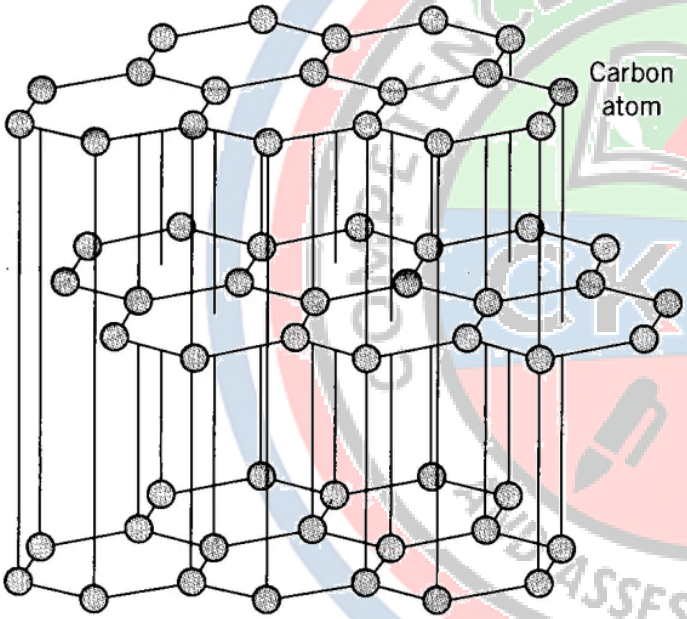
(d) State one use of diamond and explain using structure. (2 marks)

_____

_____

(Total: 7 marks)

26. The diagram below shows graphite layers.



(a) Name the forces between the layers. (1 mark)

_____

(b) Explain why graphite is soft and slippery. (2 marks)

_____

_____

27. Silicon dioxide (SiO_2) is a giant covalent compound.

(a) State one property of SiO_2. (1 mark)

_____

_____

(b) Explain why SiO_2 has a very high melting point. (2 marks)

(c) State one use of SiO_2 based on its structure. (2 marks)

28. Complete the table below. (6 marks)

Substance	Bond type	Structure type	One physical property
Sodium chloride			
Methane			
Diamond			

29. A learner tests substances in the laboratory.

Substance P: Conducts electricity when solid.

Substance Q: Does not conduct electricity in any state.

Substance R: Conducts electricity when molten only.

(a) Identify the most likely bonding in P. (1 mark)

(b) Identify the most likely bonding in Q. (1 mark)

(c) Identify the most likely bonding in R. (1 mark)

(d) Explain your answers using bonding and particles present. (3 marks)

30. A group is asked to make bonding models using locally available materials (wire, clay, beads, toothpicks).

(a) Suggest a model for NaCl and explain what each item represents. (3 marks)

_____

_____

_____

_____

(b) Suggest a model for diamond or graphite and explain. (3 marks)

_____

_____

(c) State one benefit of making bonding models for learning Chemistry. (2 marks)

_____

_____

_____

_____

31. Match the type of bonding in Column A with the correct description in Column B.

Column A		Column B
i. Ionic bonding		A. Sharing of electrons between atoms
ii. Covalent bonding		B. Attraction between metal ions and a "sea" of electrons
iii. Metallic bonding		C. Transfer of electrons from one atom to another
iv. Hydrogen bonding		D. Weak attraction between molecules containing hydrogen
v. Van der Waals forces		E. Very weak forces between neutral molecules

32. Match each molecule in Column A with the type of bond found in it in Column B.

Column A		Column B
i. Sodium chloride (NaCl)		A. Metallic bond
ii. Water (H_2O)		B. Ionic bond
iii. Oxygen gas (O_2)		C. Covalent bond
iv. Copper (Cu)		D. Double covalent bond
v. Carbon dioxide (CO_2)		E. Polar covalent bond

33. Match the bond term in Column A with the correct definition in Column B.

Column A		Column B
i. Single covalent bond		A. Bond formed by sharing two pairs of electrons
ii. Double covalent bond		B. Bond formed when one atom donates a pair of electrons
iii. Triple covalent bond		C. Bond formed by sharing one pair of electrons
iv. Dative (coordinate) bond		D. Bond formed by sharing three pairs of electrons
v. Ionic bond		E. Bond formed by complete transfer of electrons

SET 2 QUESTIONS

1. Ethanol is a liquid at room temperature but does not conduct electricity. Explain.
2.
    a. Distinguish between a covalent bond and a co-ordinate bond.
    b. Draw a diagram to show bonding in an ammonium ion. (N = 7, H = 1)
3.
    a. Explain why the metals magnesium and aluminium are good conductors of electricity.
    b. Other than cost, give two reasons why aluminium is used for making electric cables while magnesium is not.
4. Explain why the boiling point of ethanol is higher than that of hexane. (Relative molecular mass of ethanol is 46 while that of hexane is 86).
5. What is meant by dative covalent bond?
6. Sodium and Magnesium belong to the same period on the periodic table and both are metals. Explain why magnesium is a better conductor of electricity than sodium.
7. Using dots and crosses to represent electrons, draw the structures of the following:
    a. Phosphorous chloride (PCl_3)
    b. Hydroxonium ion (H_3O^+)
8. Between aluminium and copper which one is a better conductor? Explain
9. Water has a boiling point of 100oC while hydrogen chloride has a boiling point of -115^{o}C. Explain
10. Explain why luminous flame is capable of giving out light and soot
11. When blue litmus paper is dipped in a solution of aluminium chloride it turns red. Explain
12. Carbon and Silicon are in the same group of the periodic table. Silicon (IV) Oxide melts at 2440^{o}C while solid Carbon (IV) Oxide sublimes at -70^{o}C. In terms of structure and bonding, explain this difference
13. Element A has an atomic number of 6 and b has an atomic number of 9:

i. Write the electron arrangements for elements A and B

ii. Using dot (•) and cross (x)diagram, show how A and B combine to form a compound

14.

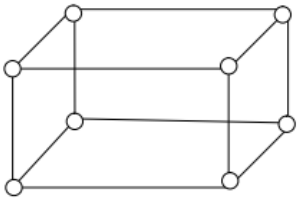
. Explain why aluminium is a better conductor of electricity than magnesium

a. Other than cost and ability to conduct, give a reason why aluminium is used for making cables while magnesium is not

15. Explain how electrical conductivity can be used to distinguish between magnesium oxide and silicon (IV) oxide

16.

. The diagram below represents part of the structure of sodium chloride crystal



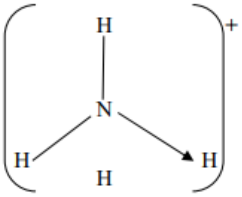
The position of one of the sodium ions in the crystal is shown as;

i. On the diagram, mark the positions of the other three sodium ions

ii. The melting and boiling points of sodium chloride are 801^{o}C and 1413^{o}C respectively. Explain why sodium chloride does not conduct electricity at 25^{o}C, but does not at temperatures between 801C and 1413C

a. Give a reason why ammonia gas is highly soluble in water

b. The structure of ammonium ion is shown below;



Name the type of bond represented in the diagram by N → H

c. Carbon exists in different crystalline forms. Some of these forms were recently discovered in soot and are called fullerenes

i. What name is given to different crystalline forms of the same element

ii. Fullerenes dissolve in methylbenzene while the other forms of carbon do not. Given that soot is a mixture of fullerenes and other solid forms of carbon, describe how crystals of fullerenes can be obtained from soot

iii. The relative molecular mass of one of the fullerenes is 720. What is the molecular mass of this fullerene

17. Explain the following observations:-

. NaCl allows electric current to pass through them in molten state

i. Graphite is a non-metal yet it is a conductor of electricity

18. Study the table below and answer the questions that follow:-

Substance		A	B	C	D	E	F
Melting Point (^oC)		801	113 119	-39	5	-101	1356
Boiling point (^oC)		1410	445	457	54	-36	2860
Electrical Conductivity	Solid	Poor	Poor	Good	Poor	Poor	Poor
	Liquid	Good	Poor	Good	Poor	Poor	Poor

19. Identify with reasons the substances that:

. Have a metallic structure (1½mk)

i. Have a molecular structure and exist in the liquid state at room temperature and pressure

ii. Suggest a reason why substance B has two melting points

iii. Substances A and C conduct electric current in the liquid state. State how the two substances differ as conductors of electric current

20.

. Sodium metal tarnishes when exposed to the air where a white powder is formed on its surface. A small piece of this sodium metal was dropped into 25g of ethanol and 1200cm^3 of hydrogen gas was evolved at r.t.p. The unreacted ethanol was evaporated and a white solid remained. (Na=23, molar gas volume at r.t.p = 24dm^3, C=12, O =16, H=1)

i. Write a chemical equation for the reaction between ethanol and sodium metal

ii. Determine the mass of sodium that reacted with ethanol

iii. What mass of ethanol evaporated?

iv. The ethanol was evaporated at 80oC, while the white solid remained unaffected at this temperature. What is the difference in structure of ethanol and the white solid?

a.

i. Name an inorganic liquid which liberates hydrogen gas with sodium metal

ii. What two differences would you observe if similar pieces of sodium were dropped separately into small beakers containing equal amount of ethanol and the liquid named in (b)(i) above respectively

b.

i. Give the name of the white powder formed on the original piece of sodium metal

ii. Explain how the white powder named in (c)(i) is formed

21. The grid below represents part of the periodic table. The letters do not represent actual symbols of the elements. Study it and answer the questions that follow:-

F			P			G	N	I
	Q		J	K		L	M	
N		X - Z						

. What type of bond would you expect in the compound formed between H and F. Explain

a.

i. Which of the elements J and M will have a greater atomic radius? Explain

ii. Elements F and N are in the same group of periodic table. How do their atomic radius compare? Explain

b. An element W has atomic number 15. Indicate the position it would occupy in the table above

c. What is the name given to elements X – Z?

d. Why is J used in electric cables where Q is not

e. P and J are termed as metalloids. What does the term metalloid mean?

f. How would you expect the reactivity of H and M to compare? Explain

22.

. Part of the periodic table is given below study it and answer the questions that follow.
The letters do not represent the actual elements

Y							Z	
			A				B	

i. What type of bond is formed when Y reacts with Z. Explain

ii. Explain the difference in the atomic radii of element A and B

iii. Explain the difference in the reactivity of Z and B

1.5 PERIODICITY

1. Define the term periodicity. (2 marks)

_____

_____

2. State two reasons why elements in the same group show similar chemical properties. (2 marks)

_____

_____

3. The diagram below shows part of the periodic table.

Group →	I	II	VII	VIII
Period 2	Li	Be	F	Ne
Period 3	Na	Mg	Cl	Ar
Period 4	K	Ca	Br	Kr

(a) Name the group containing Li, Na and K. (1 mark)

_____

_____

(b) Name the group containing F, Cl and Br. (1 mark)

_____

_____

(c) Name the group containing Ne, Ar and Kr. (1 mark)

_____

_____

(d) Name the group containing Be, Mg and Ca. (1 mark)

_____

_____

4. State three physical properties that change down Group I. (3 marks)

_____

_____

_____

_____

5. The diagram below shows atomic size trend.

Across a period: Na → Mg → Al → Si → P → S → Cl → Ar

Atomic size: BIG ----------> *SMALL*

(a) State the trend shown. (1 mark)

(b) Give a reason for this trend. (2 marks)

6. Explain why atomic radius increases down a group. (2 marks)

7. The table shows atomic radii (not actual values).

Element	**Na**	**Mg**	**Al**	**Si**
Radius	3.0	2.7	2.4	2.1

(a) State the trend across the period. (1 mark)

(b) Explain the cause of the trend. (2 marks)

8. Define ionisation energy. (2 marks)

9. The diagram below shows ionisation energy trend across Period 3.

Na Mg Al Si P S Cl Ar

LOW ----------> HIGH

(a) State the trend shown. (1 mark)

(b) Give one reason for the trend. (2 marks)

10. Explain why ionisation energy decreases down a group. (2 marks)

11. Define electron affinity. (2 marks)

12. Across a period, electron affinity generally becomes more negative.

(a) State what this means. (2 marks)

(b) Explain why this trend occurs. (2 marks)

13. The diagram below shows ionic size.

Na atom (2,8,1) → Na^+ ion (2,8)

Cl atom (2,8,7) → Cl^- ion (2,8,8)

(a) Which is larger: Na or Na^+? (1 mark)

(b) Which is larger: Cl or Cl^-? (1 mark)

(c) Explain both answers. (2 marks)

14. Arrange the following in order of increasing atomic size: (3 marks)

Na, Mg, Al

15. Arrange the following in order of increasing ionic size: (3 marks)

Na^+, Mg^{2+}, Al^{3+}

16. The diagram below shows melting point trend.

Group I: Li Na K Rb Cs

m.p.: HIGH -----> LOW

(a) State the trend shown. (1 mark)

_____

_____

(b) Explain why the melting points decrease down Group I. (2 marks)

_____

_____

17. State two physical properties of Group I metals. (2 marks)

_____

_____

18. Explain why Group I metals are soft and can be cut with a knife. (2 marks)

_____

_____

19. Group II metals are less reactive than Group I metals.

(a) Explain why Group II metals are less reactive. (2 marks)

_____

_____

(b) State one similarity between Group I and Group II metals. (1 mark)

_____

_____

20. The diagram below shows reaction with water.

Metal + Water → Metal hydroxide + Hydrogen gas

(a) Name the gas produced. (1 mark)

_____

_____

(b) State the test for this gas. (2 marks)

_____

_____

(c) Write a balanced equation for sodium reacting with water. (2 marks)

_____

_____

21. Magnesium reacts slowly with cold water but reacts faster with steam.

(a) Write the word equation for Mg + steam. (2 marks)

(b) Write the balanced symbol equation. (2 marks)

(c) State one observation. (1 mark)

22. Calcium reacts with dilute hydrochloric acid.

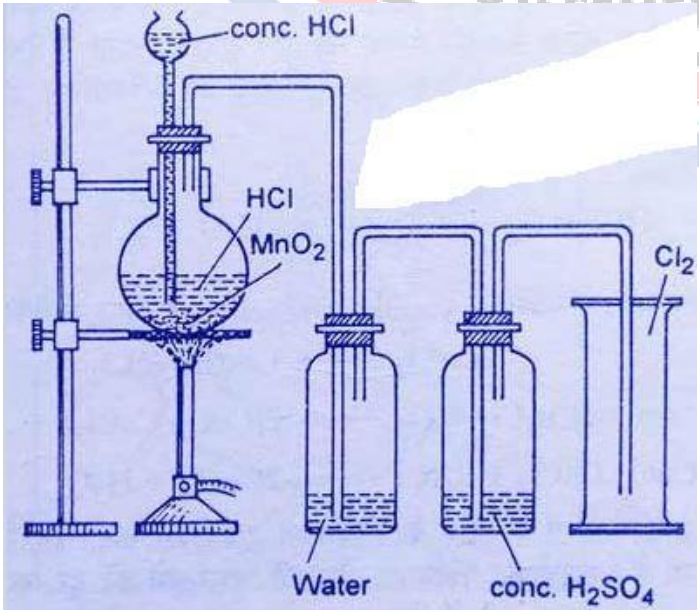
(a) Write the balanced chemical equation. (2 marks)

(b) Name the salt formed. (1 mark)

(c) Name the gas formed. (1 mark)

(d) State one test for the gas. (2 marks)

23. The diagram below shows preparation of chlorine gas in the lab.



(a) Name the chemicals used to prepare chlorine gas. (2 marks)

(b) State one safety precaution when preparing chlorine gas. (2 marks)

(c) State one physical property of chlorine gas. (1 mark)

24. Complete the table for halogens. (6 marks)

Halogen	**Physical state at room temperature**	**Colour/appearance**
Chlorine		
Bromine		
Iodine		

25. Chlorine is slightly soluble in water.

(a) State what happens when chlorine dissolves in water. (2 marks)

(b) Explain why chlorine water is used as a disinfectant. (2 marks)

26. Chlorine reacts with metals.

(a) Write a balanced equation for iron reacting with chlorine to form iron(III) chloride. (3 marks)

(b) State one observation. (1 mark)

27. The diagram below shows halogen displacement.

Test tube A: $Cl_2 + KBr \rightarrow ?$

Test tube B: $Br_2 + KCl \rightarrow ?$

(a) Complete the products in both test tubes. (2 marks)

(b) Explain why displacement occurs in one case but not the other. (3 marks)

(c) State the trend in reactivity down Group VII. (2 marks)

28. Chlorine has a bleaching action.

(a) Explain what is meant by bleaching. (1 mark)

(b) State one substance that chlorine can bleach. (1 mark)

(c) Explain briefly how chlorine bleaches coloured substances. (3 marks)

29. The Period 3 elements include:

Na Mg Al Si P S Cl Ar

(a) State one element that is a metal. (1 mark)

(b) State one element that is a non-metal. (1 mark)

(c) State one element that is a noble gas. (1 mark)

(d) Explain why electrical conductivity decreases from Na to Si. (2 marks)

(e) State why Ar is unreactive. (2 marks)

30.

A learner researches uses of elements in groups I, II, VII and VIII.

(a) State one use of sodium or potassium. (2 marks)

(b) State one use of magnesium or calcium. (2 marks)

(c) State one use of chlorine or iodine. (2 marks)

(d) State one use of a noble gas (argon/neon/helium). (2 marks)

(e) Explain how the properties of each element make it suitable for the use. (4 marks)

2.0 PHYSICAL CHEMISTRY

2.1 ACIDS AND BASES

1. Define the term acid according to the Arrhenius theory. (2 marks)

2. Define the term base according to the Arrhenius theory. (2 marks)

3. State three properties of acids in aqueous solution. (3 marks)

4. State three properties of bases (alkalis) in aqueous solution. (3 marks)

5. The diagram below shows a beaker containing an acid solution.

Beaker A

[H+ H+ H+]

[Cl- Cl- Cl-]

(a) Name the acid represented. (1 mark)

(b) Name the ions responsible for acidity. (1 mark)

(c) State why the solution conducts electricity. (2 marks)

6. Explain what is meant by dissociation of an acid in water. (2 marks)

7. Write the dissociation equation for: (4 marks)

(a) Hydrochloric acid in water

(b) Sulphuric(VI) acid in water

8. State two safety precautions when handling acids and bases in the laboratory. (2 marks)

9. A learner spills concentrated acid on the skin.

(a) State the first aid action to take immediately. (2 marks)

(b) Give one reason why this action is important. (1 mark)

10. Complete the table below. (6 marks)

Substance	Acid/Base	Strong/Weak	One use
Hydrochloric acid			
Ethanoic acid			
Sodium hydroxide			

11. Define the term indicator. (2 marks)

12. The diagram below shows three indicators.

(i) Litmus

(ii) Methyl orange

(iii) Universal indicator

(a) Name the indicator that shows a full range of colours. (1 mark)

(b) State one advantage of using universal indicator over litmus. (2 marks)

13. The table shows results of testing solutions.

Solution	Blue litmus	Red litmus
P	Turns red	No change
Q	No change	Turns blue
R	No change	No change

(a) Identify which solution is an acid. (1 mark)

(b) Identify which solution is a base. (1 mark)

(c) Identify which solution is neutral. (1 mark)

(d) Give one example of a neutral solution. (1 mark)

14. Timothy was using a pH scale during a chemistry lesson.

(a) State the pH of a neutral solution. (1 mark)

(b) State the pH range of acids. (1 mark)

(c) State the pH range of bases. (1 mark)

15. A solution has pH 2.

(a) State whether it is an acid or base. (1 mark)

(b) State whether it is strong or weak. (2 marks)

(c) Give one example of such a solution. (1 mark)

16. A solution has pH 12.

(a) State whether it is an acid or base. (1 mark)

(b) State whether it is strong or weak. (2 marks)

(c) Give one example of such a solution. (1 mark)

17. The following solutions are of the same concentration:

i. Hydrochloric acid
ii. Sulphuric(VI) acid
iii. Ethanoic acid
iv. Sodium hydroxide
v. Sodium carbonate
vi. Ammonia solution

(a) Name two strong acids from the list. (2 marks)

(b) Name one weak acid from the list. (1 mark)

(c) Name two strong bases from the list. (2 marks)

(d) Name one weak base from the list. (1 mark)

18. Explain why ethanoic acid is classified as a weak acid. (2 marks)

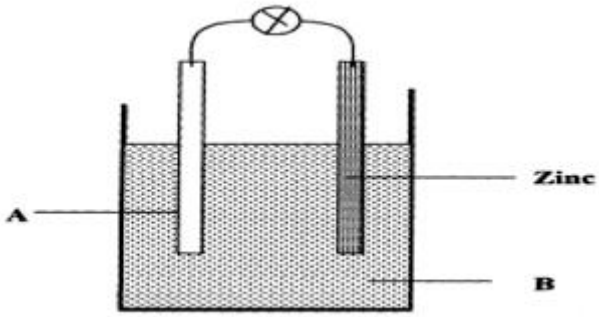
_____

_____

_____

_____

19. The diagram below shows conductivity apparatus.



Name;

i. electrode A. (1 mk)

_____

ii. Solution B. (1 mk)

_____

iii. Name the defect that takes place in electrode A and how it can be minimized. (2 mks)

_____

_____

20. Arrange the following in order of increasing electrical conductivity (same concentration). (3 marks)

Ethanoic acid, Hydrochloric acid, Distilled water

_____

_____

_____

_____

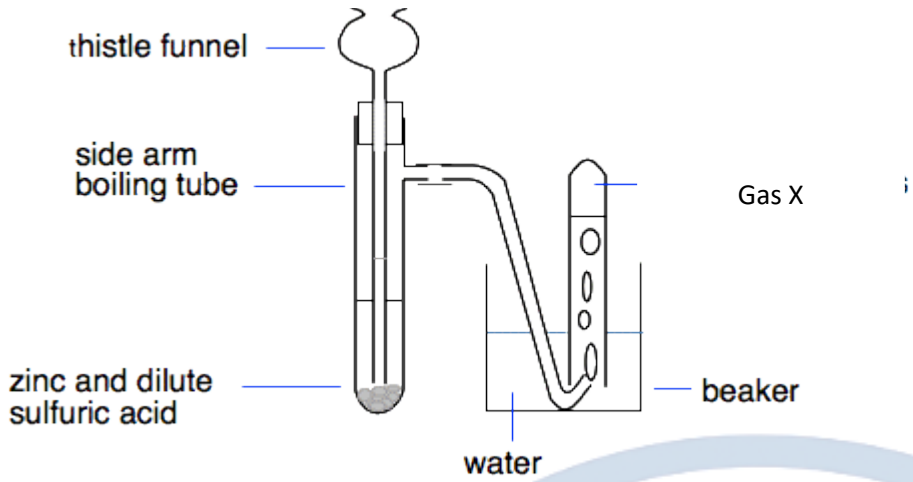
21. Write balanced equations for reactions of acids with metals. (6 marks)

(a) $Mg + HCl \rightarrow$ _____

(b) $Zn + H_2SO_4 \rightarrow$ _____

(c) $Na + HCl \rightarrow$ _____

22. The diagram below shows a zinc metal reacting with dilute sulphuric acid.



(a) Name the gas produced. (1 mark)

_____

_____

(b) State the test for the gas. (2 marks)

_____

_____

(c) State one observation in the test tube. (1 mark)

_____

_____

(d) State one safety precaution during the experiment. (2 marks)

_____

_____

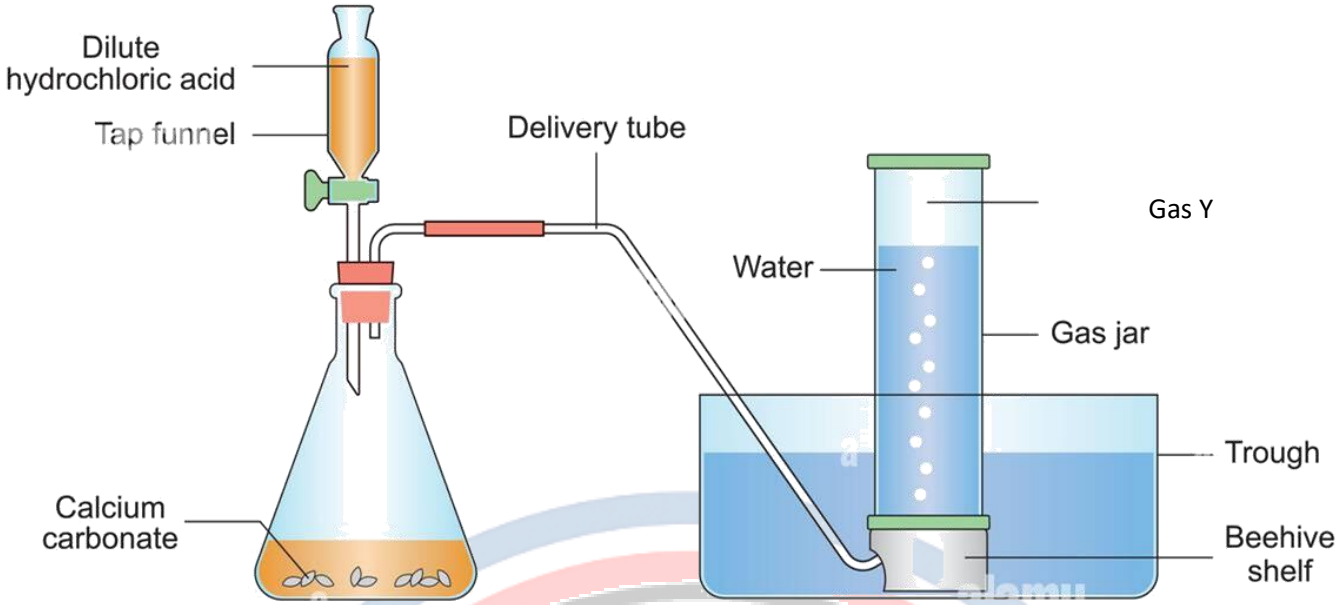
23. Write balanced equations for acids reacting with carbonates. (6 marks)

(a) $CaCO_3 + HCl \rightarrow$ _____

(b) $Na_2CO_3 + H_2SO_4 \rightarrow$ _____

(c) $MgCO_3 + HCl \rightarrow$ _____

24. The diagram below shows dilute hydrochloric acid reacting with calcium carbonate.



(a) Name the gas produced. (1 mark)

_____

(b) Write the test result that confirms this gas. (2 marks)

_____

_____

(c) State the general word equation for acid + carbonate. (2 marks)

_____

_____

25. Write balanced equations for acids reacting with hydrogen carbonates. (4 marks)

(a) $NaHCO_3 + HCl \rightarrow$ _____

(b) $KHCO_3 + HNO_3 \rightarrow$ _____

26. The following substances are metal oxides:

i. CuO

ii. MgO

iii. ZnO

(a) Name the oxide that reacts with both acids and bases. (2 marks)

_____

(b) State the term used to describe such an oxide. (1 mark)

_____

_____

(c) Write an equation for the oxide reacting with HCl. (2 marks)

_____

_____

27. Write balanced equations for acids reacting with hydroxides. (6 marks)

(a) $HCl + NaOH \rightarrow$_____

(b) $H_2SO_4 + KOH \rightarrow$_____

(c) $HNO_3 + Ca(OH)_2 \rightarrow$_____

28. The diagram below shows a neutralisation reaction.

Acid + Base → Salt + Water

(a) Define the term **neutralisation**. (2 marks)

_____

_____

(b) Give one example of neutralisation in daily life. (2 marks)

_____

_____

(c) State one importance of neutralisation in agriculture. (2 marks)

_____

_____

29. A student is given unknown solutions W, X and Y. Universal indicator results:

Solution	**Colour**	**pH**
W	Red	2
X	Green	7
Y	Purple	13

(a) Identify which is a strong acid. (1 mark)

_____

_____

(b) Identify which is neutral. (1 mark)

_____

_____

(c) Identify which is a strong base. (1 mark)

(d) Suggest one possible identity for W. (1 mark)

(e) Suggest one possible identity for Y. (1 mark)

(f) State one safety precaution when handling Y. (2 marks)

30.

(a) State two uses of sulphuric(VI) acid. (2 marks)

(b) State two uses of sodium hydroxide. (2 marks)

(c) State one use of ammonia solution. (1 mark)

(d) Explain why acids and bases must be stored in labelled containers. (2 marks)

(e) State two correct methods of disposing acid/base waste in the laboratory. (3 marks)

2.2 INTRODUCTION TO SALTS

1. Define the term salt. (2 marks)

_____

_____

2. Give two examples of salts found at home. (2 marks)

_____

_____

3. State two differences between a salt and an acid. (2 marks)

_____

_____

4. The following are types of salts:

Normal salts, acidic salts, basic salts, double salts.

(a) Define a **normal salt**. (1 mark)

_____

_____

(b) Define an **acidic salt**. (1 mark)

_____

_____

(c) Define a **basic salt**. (1 mark)

_____

_____

(d) Define a **double salt**. (1 mark)

_____

_____

5. Classify the following salts as normal, acidic, basic or double. (6 marks)

(a) NaCl_____

(b) $NaHSO_4$_____

(c) Na_2CO_3_____

(d) NH_4Cl_____

(e) $KAl(SO_4)_2 \cdot 12H_2O$ (Alum) _____

(f) $NaHCO_3$_____

6. The diagram below shows the structure of common salt.

[Na+] [Cl-] [Na+] [Cl-]

[Cl-] [Na+] [Cl-] [Na+]

(a) Name the type of bonding in sodium chloride. (1 mark)

_____

(b) State one property of salts caused by this bonding. (2 marks)

_____

_____

7. Name four general properties of salts. (4 marks)

_____

_____

_____

_____

8. Complete the table below by writing the correct ion present. (4 marks)

Salt	**Cation**	**Anion**
Na_2SO_4		
$CaCO_3$		

9. Solubility classification

State whether each salt is **soluble or insoluble** in water. (6 marks)

(a) NaCl_____
(b) AgCl_____
(c) $NaNO_3$_____
(d) $BaSO_4$_____
(e) K_2CO_3_____
(f) $CaCO_3$_____

10. A learner tested solubility of different salts and recorded results:

Salt	**Dissolves in water?**
Sodium nitrate	Yes
Lead(II) chloride	No
Potassium sulphate	Yes
Calcium carbonate	No

(a) Name one **soluble** salt. (1 mark)

_____

(b) Name one **insoluble** salt. (1 mark)

_____

_____

(c) Give one use of soluble salts. (1 mark)

_____

_____

(d) Give one use of insoluble salts. (1 mark)

_____

_____

11. State three safety rules when preparing salts in the laboratory. (3 marks)

_____

_____

_____

_____

12. A learner is preparing salts and notices that some chemicals are corrosive.

(a) Draw the symbol for a corrosive substance. (1 mark)

(b) Identify one substance in the lab that are corrosive. (1 mark)

_____

_____

(c) State one role of the lab technician in ensuring safety. (1 mark)

_____

_____

METHODS OF PREPARATION OF SALTS

13. List five methods of preparing salts. (5 marks)

14. A student burns magnesium in chlorine gas.

Magnesium ribbon + Chlorine gas → White solid

(a) Name the salt formed. (1 mark)

(b) Write a balanced equation for the reaction. (2 marks)

(c) State one observation. (1 mark)

15. A student reacts zinc with dilute hydrochloric acid.

(a) Name the salt formed. (1 mark)

(b) Name the gas produced. (1 mark)

(c) State the test for the gas. (2 marks)

(d) Write the balanced equation. (2 marks)

16. A student prepares sodium sulphate by reacting sodium hydroxide with sulphuric(VI) acid.

(a) Write the balanced equation. (2 marks)

(b) Name the process that occurs. (1 mark)

(c) State one use of sodium sulphate. (1 mark)

17. Calcium carbonate reacts with dilute nitric acid.

(a) Write the balanced equation. (3 marks)

(b) Name the gas produced. (1 mark)

(c) State the test for the gas. (2 marks)

18. Sodium hydrogen carbonate reacts with dilute hydrochloric acid.

(a) Write the balanced equation. (3 marks)

(b) State two observations. (2 marks)

19. A student mixes aqueous sodium sulphate with aqueous barium chloride.

$Na_2SO_4(aq) + BaCl_2(aq) \rightarrow BaSO_4(s) + NaCl(aq)$

(a) Name the type of reaction. (1 mark)

(b) State the observation. (1 mark)

(c) Name the insoluble salt formed. (1 mark)

(d) Write the balanced equation. (2 marks)

20. Write the ionic equation for the precipitation reaction in Question 19. (3 marks)

21. The flow chart below shows preparation of an insoluble salt.

Mix two soluble salt solutions

↓

A precipitate forms

↓

Filter

↓

Wash residue with distilled water

↓

Dry between filter papers

(a) Name the apparatus used for filtering. (1 mark)

_____

_____

(b) Give one reason for washing the residue. (2 marks)

_____

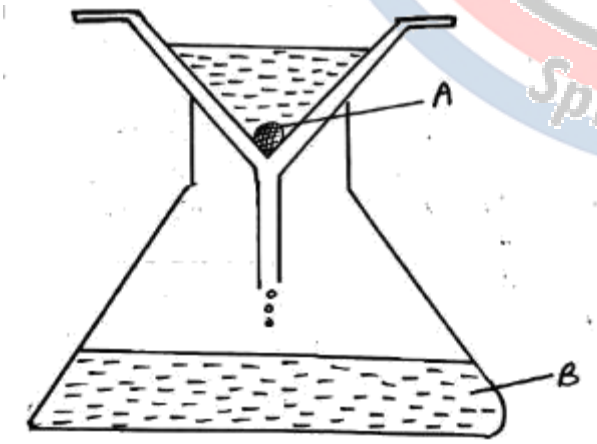
_____

(c) Give one reason for drying the residue. (1 mark)

_____

_____

22. The diagram below shows part of filtration setup.



(a) Name the apparatus labelled A and B. (2 marks)

A: _____ **B:** _____

(b) Name the solid left on the filter paper. (1 mark)

(c) Name the liquid collected in the beaker. (1 mark)

(d) State one mistake if the filter paper tears. (1 mark)

23. Explain why evaporation is used when preparing soluble salts such as sodium chloride. (3 marks)

24. A learner prepared copper(II) sulphate crystals using copper(II) oxide and dilute sulphuric acid.

(a) Name the method used. (1 mark)

(b) Write the balanced equation. (2 marks)

(c) Explain why excess copper(II) oxide is added. (2 marks)

(d) State why filtration is done after reaction. (1 mark)

25. Define the following terms: (6 marks)

(a) Hygroscopic

(b) Deliquescent

(c) Efflorescent

26. The diagram below shows three salts exposed to air.

Salt A: becomes wet and forms solution

Salt B: absorbs water but remains solid

Salt C: loses water and becomes powdery

(a) Identify Salt A behaviour. (1 mark)

(b) Identify Salt B behaviour. (1 mark)

(c) Identify Salt C behaviour. (1 mark)

(d) Give one example of Salt A. (1 mark)

(e) Give one example of Salt C. (1 mark)

27. A student leaves hydrated copper (II) sulphate crystals in an open dish.

(a) State what happens to the crystals after some time. (2 marks)

(b) Name the process responsible. (1 mark)

(c) State the colour change observed. (2 marks)

28. State two uses of each salt below. (6 marks)

(a) Sodium chloride

(b) Calcium carbonate

(c) Ammonium nitrate

29. Inorganic fertilisers are widely used in agriculture.

(a) State two positive effects of fertilisers in farming. (2 marks)

(b) State two environmental problems caused by excessive fertilizer use. (2 marks)

(c) Name the process that occurs when fertilisers cause water pollution. (1 mark)

(d) Suggest two ways of reducing fertilizer pollution. (2 marks)

30. Study the diagram below of a fertilizer bag label.

FERTILISER: NPK 17:17:17

(a) Explain what NPK means. (3 marks)

(b) State the role of nitrogen in plant growth. (1 mark)

(c) State the role of phosphorus in plant growth. (1 mark)

(d) State the role of potassium in plant growth. (1 mark)

(e) Give one advantage of using balanced fertilisers. (1 mark)