FORM TWO CHEMISTRY TOPICAL QUESTIONS

AIR AND COMBUSTION (24 LESSONS)

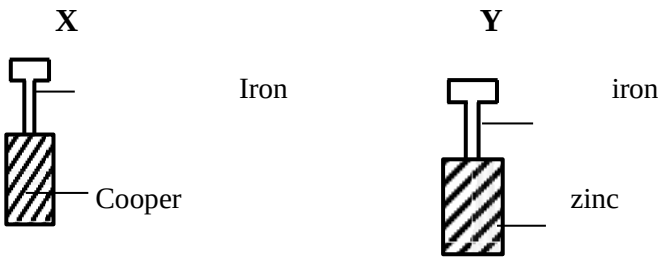
1. A piece of burning magnesium was lowered into a gas jar of Carbon (IV) oxide.

   (a) State the observations made. (2 marks)
   (b) Write an equation for the reaction in (a) above. (1 mark)

2. When the oxide of metal Z is heated in the presence of metal X, it is reduced. The oxide of metal X is reduced by metal Y. Arrange the three metals in order of increasing reactivity. (2mks)

3. (a) State the **two** conditions necessary for rusting to occur. (1mk)
   (b) State **two** reasons why tin coating is used in food cans. (2mks)

4. A form two student in an attempt to prevent rusting, put copper and zinc in contact with iron as shown below.



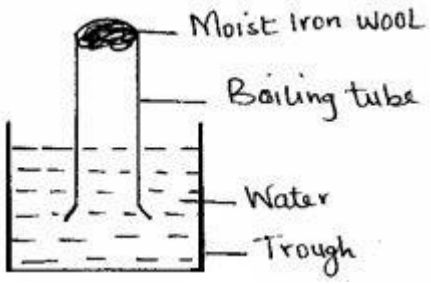
(i) State what would happen in set up **X** and **Y** after one week. (2 marks)

(ii) Explain your answer in diagram **Y**. (1mark)

TURN OVER

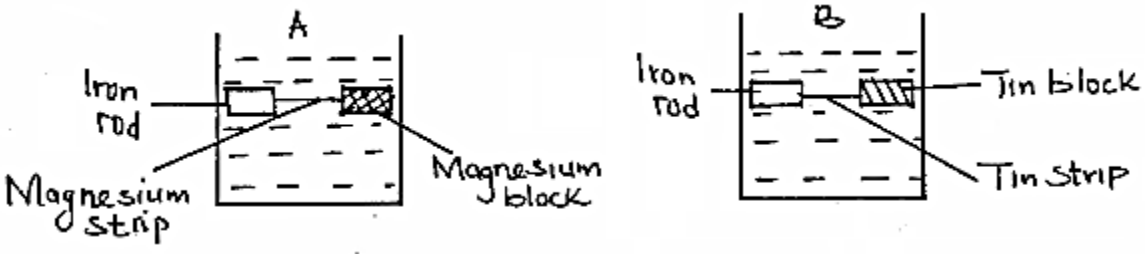
FOR MARKING SCHEMES INBOX 0724351706

5. A student set-up an experiment as shown below. Moist iron wool was placed in a boiling tube and inverted over water.



(a) What was observed after two days? (1 mark)
(b) Explain the observations. (1 mark)
(c) What would be observed if a large piece of iron wool was used? (1 mark)

6. The diagrams below were set up by form 4 students to investigate methods of preventing rusting.



(i) It was observed that rusting occurred in set up B and not in set up A. Explain. (2 marks)
(ii) State **one** other method of preventing rusting in iron. (1 mark)

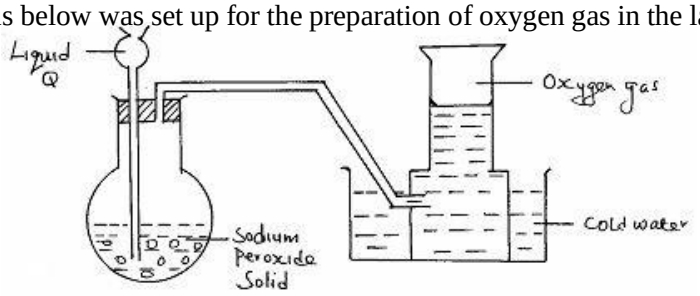
7. Rusting leads to fast wearing out of farm tools and equipment as well as buildings.
   (a) Give the chemical name of rust. (1 mark)
   (b) What ***two*** conditions accelerate rusting process? (2 marks)

8. Excess iron was allowed to rust in 2dm³ of most air and the volume of air remaining was measured at 1 atmospheric pressure each day. The results were as follows.

Day	0	1	3	4	5	6	7	8
Volume (cm^3)	2000	1900	1720	1660	1620	1600	1600	1600

   (i) Write an equation for the formation of rust. (1mk)
   (ii) On which day was the reaction complete. Explain. (1mk)
   (iii) What is the percentage volume of oxygen in air. Show your working. (1mk)

9. The apparatus below was set up for the preparation of oxygen gas in the laboratory.

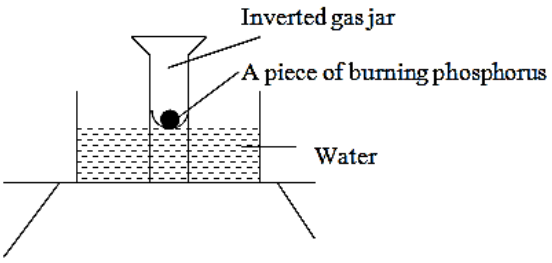


   (a) Name liquid **Q**. (1mk)
   (b) Write a balanced chemicals equation for the reaction that takes place in the reaction flask. (1mk)
   (c) Give a reason why it is preferred to use warm water to cold water when collecting oxygen gas. (1mk)

10. What is the colour of the following. (2 marks)

Metal oxide	Colour when hot	Colour when cold
Zinc (II)oxide		
Lead (II) oxide		

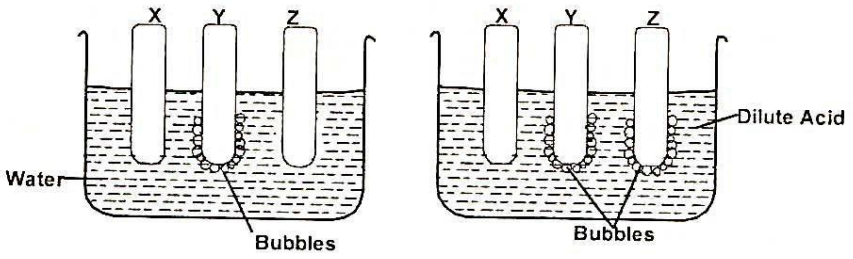
11. The diagram below represents a set up that was used to show that part of air which is used during burning.



   a. If excess phosphorus was used in the set up. Draw a diagram of the set up at the end of the experiment when there was no further observable change. (2 marks)
   b. Suggest one modification that should be made on the apparatus if the percentage of the air used is to be determined. (1 mark)

12. In an experiment, rods of metal X, Y, Z were cleaned with sand paper and placed in a beaker containing water. Another set of rods was also placed in a beaker containing dilute acid. After placing the rods in the two liquids,

bubbles of gas were seen around some of the rods as shown in the diagram below.

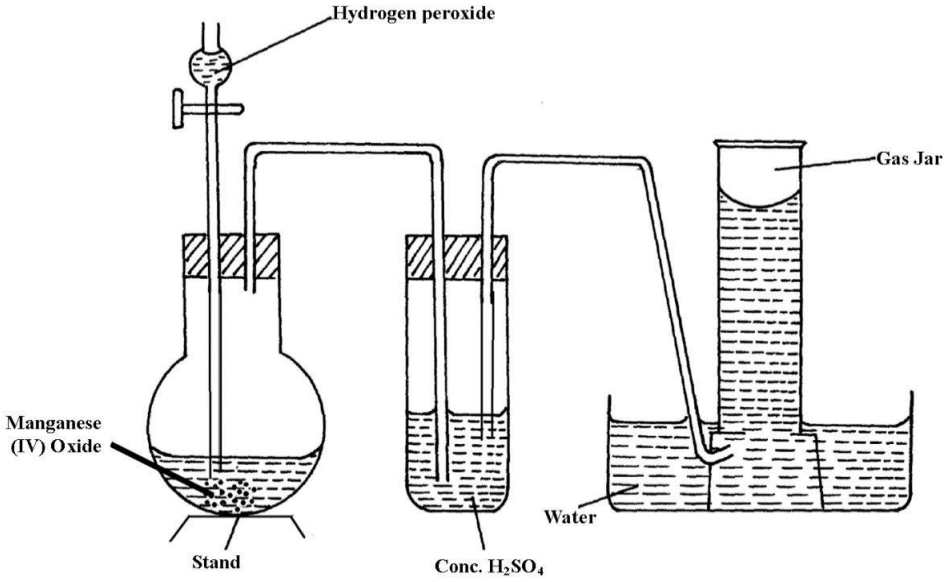


a) Why is it necessary to clean the rods with sand paper before dipping them into the liquid. (1 mark)
b) Arrange the three metals in order of their reactivity starting with the most reactive. (2 marks)

13. a) Why is air considered as a mixture rather than a compound ? (1mark)
b) State one similarity between rusting and combustion of iron. (1mark)
c) Explain why iron nails rust faster in sodium chloride solution than in tap water. (1mark)

14. a) What is air pollution ? (1 mark)
b) State four gaseous substances present in unpolluted air.(2marks)

15. The diagram below shows the set-up that can be used to prepare and collect oxygen gas. Study it and answer the questions that follow.



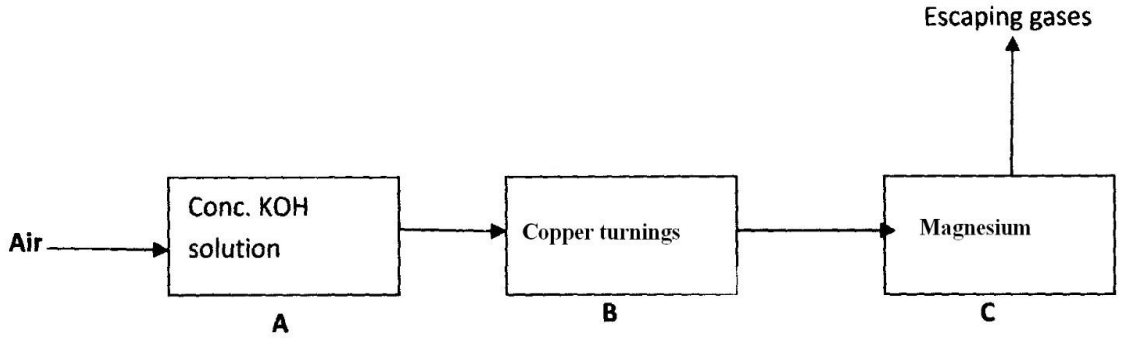
a) Identify two mistakes from the diagram which must be corrected for one to collect dry oxygen gas. (2marks)
b) What property of oxygen gas makes it possible to be collected over water. (1mark)

16. The table below gives information about some reactions of metals A,B, C and D and their rates.

METAL	Reaction with acid	Reaction with water	Action of heat on its
A	Hydrogen evolved	No reaction	Oxide formed
B	NO reaction	No reaction	Metal formed
C	Hydrogen evolved	Hydrogen evolved	Oxide formed
D	NO reaction	NO reaction	Oxide formed

Arrange the metals in order of decreasing activity. (2marks)

17. Air is passed through several reagents as shown in the flow diagram below

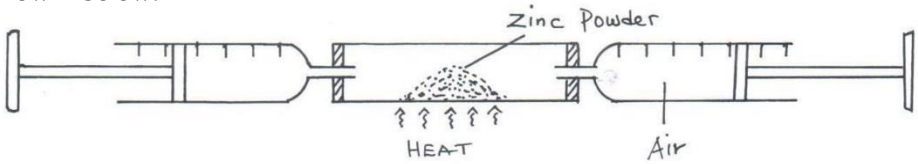


Name one gas which escapes from chamber C. Give a reason for your answer (3marks)

18. Explain the change in mass expected when each of the following substances is heated in an open crucible.

(a) Copper metal. (1 mark)
(b) Copper (II) nitrate. (2 marks)

19. In an experiment a certain volume of air was repeatedly passed between two syringes over heated zinc powder as shown below.

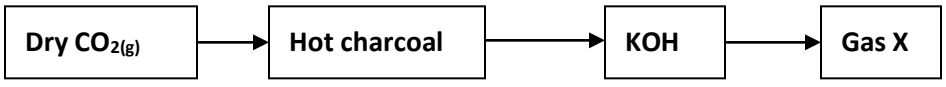


The same experiment was repeated using magnesium turnings instead of zinc powder. In which of the two experiments was the overall change in volume greater? Explain. (3 marks)

20. Your friend"s clothes have caught fire. Inorder to extinguish the fire you decide to cover with a damp blanket. What is the purpose of the clamp blanket? (1mk)

CARBON AND SOME OF ITS COMPOUNDS (20 LESSONS)

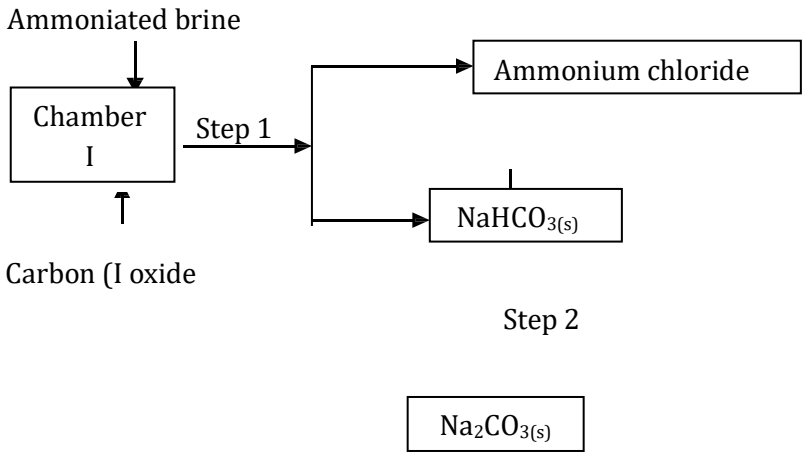
1. Study the scheme below and answer the questions that follow.



(a) Write an equation involving hot charcoal and dry carbon (IV) oxide gas. (1mk)

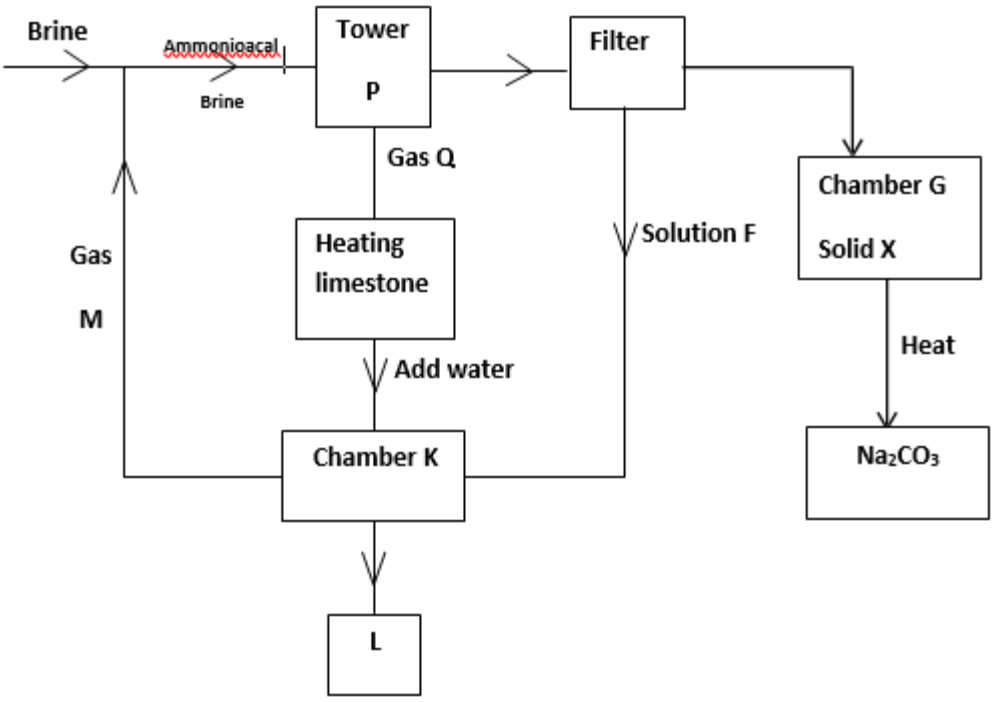
(b) Name gas X and state one chemical property of the gas. (2mks)

2. Study the following part of the solvay process for the manufacture of sodium carbonate and answer the questions that follows:



a. State the main source of Carbon (IV) oxide in the process. (1 mark)
b. Write down the overall equation for the reaction in chamber I. (1 mark)
c. Name process in step 1. (1 mark)

1. 3. The flow chart below is for the manufacture of sodium carbonate using Solvay process. Use it to answer the questions that follow.



2.

(a) Name
(i) Gas **M**..... (1mk)
(ii) Solution **F** .....(1mk)
(iii) Solid X .....(1mk)
(iv) The product **L**..... (1mk)

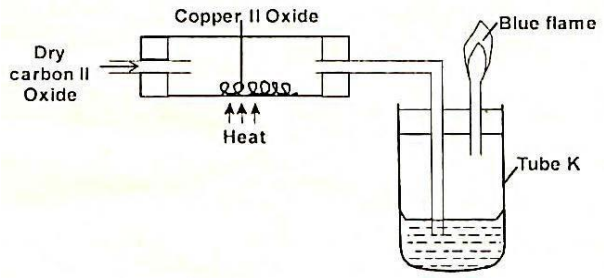
(b) Write an equation for the reaction in chamber **K**. (1mk)

(c) Name **two** raw materials used in Solvay process. (2mks)

(d) (i) Name **one** substance recycled in Solvay process.
(ii) Give **two** reasons why carbon (IV) oxide is used as fire extinguisher. (2mks)

(iii) Explain why lead carbonate is not reacted with dil. H_2SO_4 in preparation of carbon (IV) oxide in the laboratory.

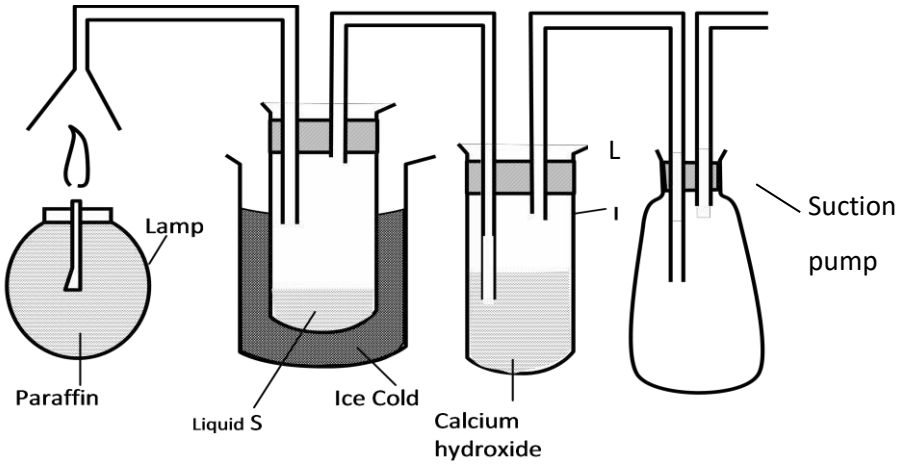
4. The apparatus shown below was used to investigate the effect of carbon II oxide on copper II oxide.



a) State the observation that was made in the combustion tube by the end of the experiment.(1 mark)
b) Write an equation for the reaction that took place in the combustion tube.(1mark)
c) Why is it necessary to burn gas coming out of tube K (1mark)

5. (a) Graphite is a non- metal most commonly used as an electrode. State two properties that makes it suitable for use as an electrode. (2marks)
(b) Graphite is an allotrope of carbon. Distinguish between allotropes and isotopes. (1marks)

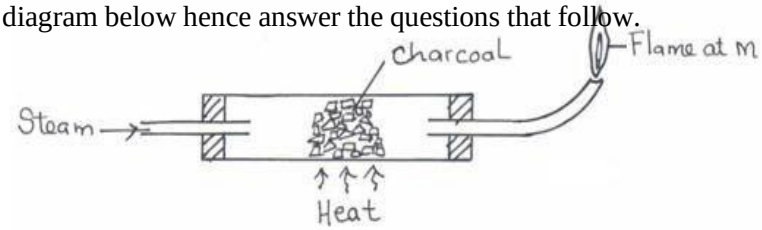
6. Study the set-up of apparatus below and answer the questions that follow.



a) State and explain the observation that would be made in tube L as the experiment progresses in the first few minutes.
   Observation.(1mark)
   Explanation.(1mark)
b) How would the observations in the tube L change if the experiment is carried out for a long time. Explain using a chemical equation.
   Observation.(1mark)
   Equation.(1mark)
c) State three observations made when liquid S is reacted with sodium metal.(3marks)
d) State the use of the suction pump in this experiment.(1mark)
e) Diamond and graphite are allotropes of carbon. Graphite conducts electricity and diamond does not. Explain this phenomenon.(2marks)
f) State two uses of carbon (IV) oxide.(2marks)

7. Explain why graphite is used as a lubricant in moving machine parts where a lot of heat is produced.

8. (a) Study the diagram below hence answer the questions that follow.



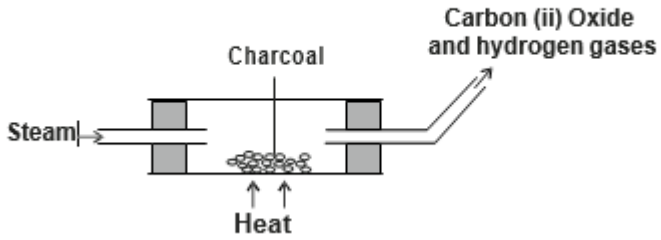
i) Explain why it is necessary to have the flame at **M**.(1 mark)
i) Write down the equation for the reaction inside the combustion tube.(1 mark)
(a) Explain potassium hydroxide is not a suitable reagent for testing carbon (IV) oxide.(1 mark)

9. a) Carbon exhibits allotropy. Name one element other than carbon that has the same characteristic. (1mk)
   b) In terms of structure explain why graphite conducts electricity while diamond does not?(2mks)
   c) Define allotropy.(½ mark)

10. a) Write down the equation between burning magnesium and carbon (IV) oxide. (1mk)
b) Carbon (IV) oxide does not support combustion yet burning magnesium continues to burn; Explain.(2mks)

11. When wood is burnt, a grey powder called ash remains. When the ash is stirred with water and filtered, a colourless solution is obtained.
a. What is the name of the main component of the colourless solution (1 mark)
b. Explain your answer in (a) above. (2 marks)

12. When steam was passed over heated charcoal as shown in the diagram below, hydrogen-gas and carbon (II) oxide gas were formed.



a) Write the equation for the reaction which takes place. (1 mark)
b) Name **two** uses of carbon (II) oxide gas which are also uses of hydrogen gas. (2 marks)

13. a) Describe how carbon(IV) oxide can be distinguished from carbon (II) oxide using calcium hydroxide solution. (2 marks)
b) What is the role of carbon (IV) oxide in fire extinguishing?

14. When excess carbon (II) oxide gas was passed over heated lead (II) oxide in a combustion tube, lead (II) oxide was reduced.
a) Write an equation for the reaction which took place. (1 mark)
b) What observation was made in the combustion tube when the reaction was complete ? (1 mark)
c) Name another gaseous compound which could be used to reduce lead (II) oxide. (1 mark)

CHEMICAL FAMILIES: PATTERNS IN PROPERTIES (28 LESSONS)

1. The table below shows elements in the halogen group of the periodic table. Study the table and answer the questions that follow.

Element	Atomic number	Melting point ^{0}C
Fluorine	9	-218
Chlorine	17	-101
Bromine	35	-7
Iodine	53	114

(i) Name the element likely to be a solid at room temperature. Explain (1 mark)

(ii) Explain why the melting point increases from fluorine to iodine. (2 marks)

2. Briefly explain the following observations.

(i) Alkaline earth metals are generally less reactive than the alkali metals. (1mk)

(ii) The order of reactively increases down group I elements but decreases down group (VII) elements. (2mks)

3. (a) The grid given below represents part of the periodic table. Study it and answer the questions that follow. Letters do not represent the actual symbols of the elements.

								A
				B				
	C		D			E		
	F							

(i) What name is given to the group of elements to which **C** and **F** belong?

(ii) Which letter represents the element that is the least reactive? (½mk)

(iii) What type of bond is formed when **B** and **E** react? Explain. (2mks)

(iv) Write the formula of the compound formed when D and oxygen gas reacts.

(v) On the grid, indicate with a tick (✓) the position of element G which is in the third period of the periodic table and forms G^{3-} ion. (1mk)

(b) Study the information in the table below and answer the questions that follow. Letters do not represent the actual symbols of the substances.

Substance	**Melting point (°C)**	**Boiling point (°C)**	**Solubility in water**	**Density at room temp. (g/cm^3)**
H	-117	78.5	Very soluble	0.8
J	-78	-33	Very soluble	7.7×10^{-4}
K	-23	77	Insoluble	1.6
L	-219	-183	Slightly soluble	1.33×10^{-3}

(i) Which substance would dissolve in water and could be separated from the solution by fractional distillation. Give a reason. (2mks)

(ii) Which substance is a liquid at room temperature and when mixed with water, two layers would be formed. (1mk)

(iii) Which letter represents a substance that is a gas at room temperature and which can be collected.

I Over water? Explain. (2mks)

II By downward displacement of air?
(Density of air = 1.29 x 10^{-3}g/cm³ at room temperature). (1mk)

5. Study the table below and answer the questions that follow:

Element	Atomic radius (nm)	Ionic radius (nm)
P	0.168	0.095
Q	0.094	0.133
R	0.124	0.156
S	0.146	0.086

i) State the elements which are metals.

ii) Identify the strongest reducing agent. Give a reason.

6. The table below gives some elements of the periodic table (not actual symbols) and their atomic masses, atomic numbers and melting points.

Element	B	C	D	E	F	G	H	I	J	K
Atomic Nº	7	8	19	15	2	9	6	16	12	11
Atomic mass	14	16	39	31	4	19	12	32	40	23
Mpt (ºC)	-	-	63.7	44	-272	-223	Vary	113	669	98

(a) Select **two** elements with oxidation states of -3. (1 mark)
(b) Which elements represents:-
(i) the most powerful reducing agent. (½ mark)
(ii) the most powerful oxidizing agent. (½ mark)
(c) Which metallic element has the highest first ionization energy? (1 mark)
(d) Select **two** elements which when reacted form a compound that conducts electricity in both molten and aqueous state.
(e) Select any **two** elements which when reacted form a compound that dissolves in water to form an acidic solution.
(f) Using dots (•) and crosses (x) to represent valency electrons, draw diagrams to show bonding between **B** and **J**. (2 marks)
(g) Explain why for some elements the atomic mass is not twice the atomic number. (1 mark)
(h) Explain why the melting point of element K is higher than that of element D. (1 mark)
(i) Describe how a solid mixture of the sulphate of element K and lead (II) sulphate can be separated. (3 marks)

7. Given elements A, B and C with atomic numbers 11, 19 and 13 respectively.
i) Compare the atomic radius of A and C. Explain. (2 marks)
ii) Compare reactivity of A and B. (1 mark)

8. The number of protons and neutrons of atoms W, X, Y and Z are shown in the table below.

Atom	No. of protons	No. of neutrons
W	6	6
X	12	12
Y	6	8
Z	17	20

(a) Write down the electronic configuration of X. (1 marks)
(b) (i) Which one of the atoms is of an element in group (VII) of the periodic table.
(ii) Name the type of bond which is formed when X and Z reacts. (1 mark)

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

				Q				
O						R	S	
	T						U	
V							Z	

a) (i) Which element will require the least amount of energy to remove one of its outermost electrons, explain. (1mark)
(ii) Select the most reactive non-metal (1mark)
(iii) What name is given to the family of elements to which T belong? (1mark)
(iv) Between S and R, which element has a smaller atomic radius, explain. (2marks)
(v) Which of the elements have a tendency of forming covalent bonds? Explain. (1mk)
(vi) Write the formula of the compound formed when U reacts with T, state the type of body formed.
Formula (1mark)
Bond (2marks)

10. Both molten sodium chloride and molten sodium metal conducts electricity. Explain how each of these conducts electricity

(i) Molten sodium chloride (1mark)
(ii) Molten sodium metal (1mark)

11. Two elements X and Y are represented as shown below
$_{17}X$ and $_{20}Y$

i) Write the formula of the compound formed when X and Y react. (1mark)
ii) State the family name to which element X belongs. (1mark)
iii) Element Y has a mass number of 40, how many neutrons are present in its nucleus? (1mark)

12. Study the table below and answer the questions that follow. The letters do not represents the actual symbols of the elements

Formula of ion	Electron configuration
A^{2+}	2.8
B^{3+}	2.8
C-	2.8.8
D-	2.8
E^{2+}	2

a) Select elements found in:
i) The same group (1 mark)
ii) Period three (1 mark)

iii) What is the family name given to the group to which elements identified in a(i) above belongs. (1 mark)

b) How does the atomic radius of element B and A compare. Explain. (2 marks)

c) State two industrial use of element **B.** (2 marks)

d) With reason, compare the reactivity of C and D. (2 marks)

e) Write the formula of compound formed when A and D react. (1 mark)

f) What type of bond is formed when element E react with oxygen. Give a reason for your answer. (2marks)

13. Study the information in the diagram below and answer the questions that follow. (the letters do not represent the actual symbols of the elements)

Element	Electronic configuration	Ionization energy KJ/Mol
P	2.1	519
Q	2.8.1	494
R	2.8.8.1	418

a) What is the general name given to the group in which elements P, Q and R belong? (1 mark)

b) What is meant by ionization energy? (1 mark)

c) Explain why element P has the highest ionization energy (1 mark)

14. The grid below is part of the periodic table. Study it and answer the questions that follow. The letters are not actual symbols of elements.

A			D	E			H	I
B	C		M		F	G		J

(c) What is the name given to the chemical family of element **C**? (1 mark)

(d) Would element **B** react with **J**? Explain. (1 mark

(e) Compare the melting points of **B** and **M**. (1 mark)

15. The atomic numbers of nitrogen, oxygen and sodium are 7, 8 and 11 respectively.

i) Write the electron arrangements of their ions, N^{3-}, O^{2-} and Na^{+}. (1 mark)

ii) Arrange the 3 ions in increasing order of size. Give a reason for your answer. (2 marks)

16. Compare the atomic sizes of sodium and magnesium. Explain. (2mks)

17. Compare the reactivity of chlorine and bromine. (2mks)

18. The table below shows the atomic and ionic radii of some period three elements, the letters do not represent the actual symbols.

Element	**Atomic radius**	**Ionic radius**
P	0.186	0.175
Q	0.160	0.135

R	0.104	0.184

From the table identify;

a) The strongest reducing agent. Give a reason for your answer. (2mks)

b) An element whose oxide has pH of below seven when dissolved in water. (1 mark)

19. The table below gives some properties of three elements in group VII of the periodic table. Study it and answer the questions that follow.

Element	Atomic No.	Melting point (°C)	Boiling point
Chlorine	17	-101	-34.7
Bromine	35	-7	58.8
Iodine	53	114	184

a) Which element is in liquid form at room temperature ? Give a reason. (1 mark)

b) Explain why the boiling point of Iodine is much higher than that of chlorine. (2 marks

20. The diagram below represents part of the periodic table. Use it to answer the question that follow.

M					Q			
T	V		W					

a) Write the electronic arrangement for the stable ion formed by W. (1 mark)

b) Write an equation for the reaction between V and Q (1 mark)

c) How do the ionisation energies of element M and T compare? Explain. (1 mark

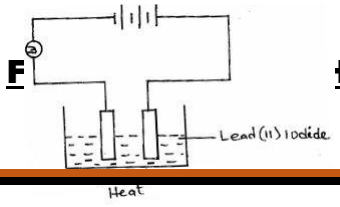
21. Chlorine and iodine are elements in the same group in the periodic table. Chlorine gas is yellow while aqueous iodine, $I_{2(aq)}$ is brown.

a) What observation would be made if chlorine gas is bubbled through aqueous potassium iodide ? Explain using an ionic equation. (2 marks)

b) Under certain conditions, chlorine and iodine react to give iodine trichloride, $ICl_{3(s)}$. What type of bonding would you expect to exist in iodine trichloride ? Explain. (1 mark)

EFFECT OF ELECTRIC CURRENT ON SUBSTANCES (16 LESSONS)

1. The diagram below shows an experiment for investigating electrical conductivity in lead (II) iodide. Study it and answer the questions that follow.

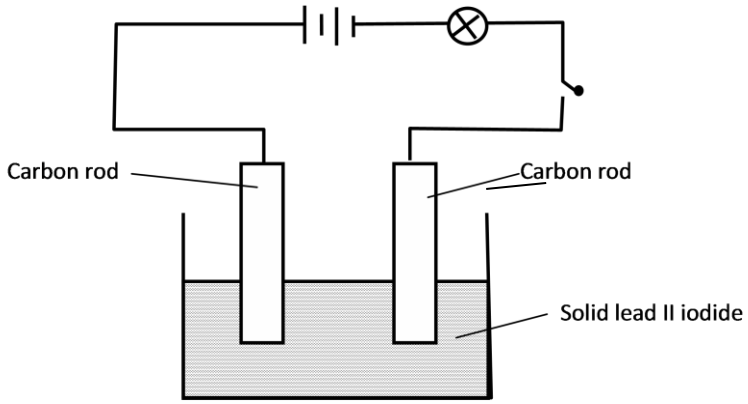


(a) On the diagram;

(i) Label the cathode. (1 mark)

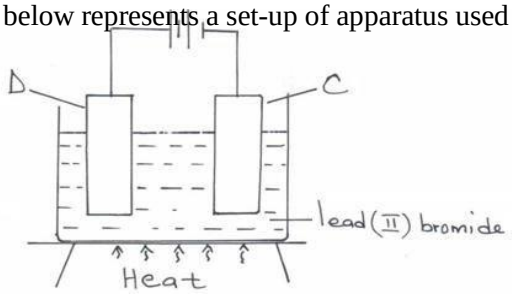
(ii) Show the direction of movement of electrons. (1 ma

2. The arrangements below shows a set-up to investigate the effect of an electric current on molten lead (II) iodide.



a) Identify two mistakes in the set-up. (2marks)
b) State three observations made after correcting the mistakes. (2marks)
c) What particles are responsible for electrical conductivity? (1mark)
d) Write the equations for the reactions taking place at the electrodes.
e) Indicate on the diagram direction of flow of electric current. (1mark)
f) State two industrial applications of electrolysis process. (2marks)

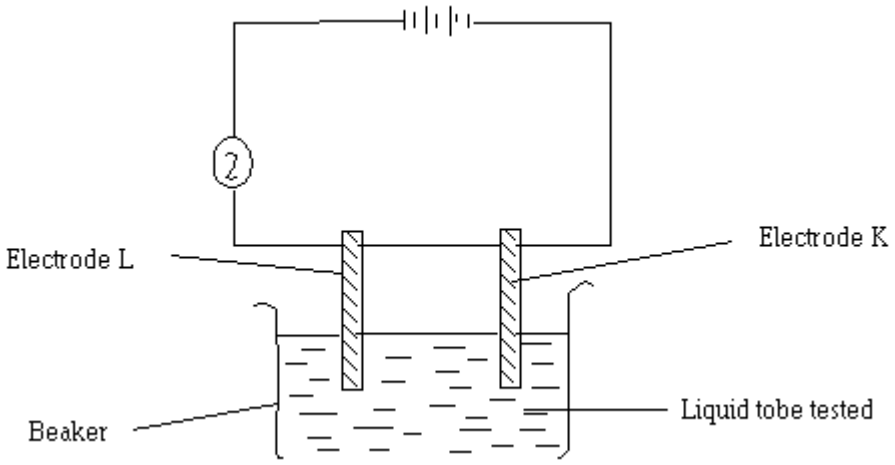
3. (a) The diagram below represents a set-up of apparatus used to investigate the effect of electric current on lead (II) bromide.



Describe what is observed at electrode C. (1 mark)

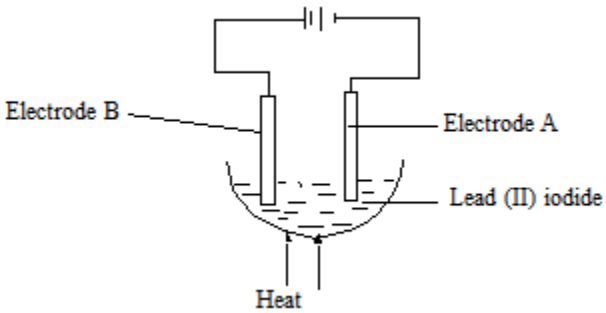
(b) A current of 2.5A was passed through a cell containing N^{2+} ions for 25 minutes. The mass of the cathode increased by 0.36g. Determine the R.A.M of N. ($F = 9.65 \times 10^{4} Cmol^{-1}$). (2 marks)

4. The diagram below illustrates an experiment to investigate the conduction of electricity in liquids. Study it and answer the questions that follows.



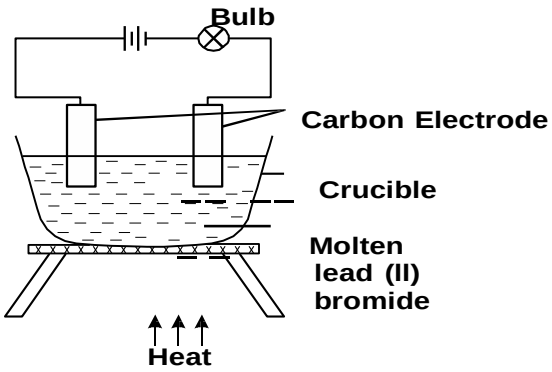
a) State one mistake in the set-up. (1mk)
b) If the liquid in the beaker was benzene. State what expected at the bulb? Explain (2mks)

5. The figure below shows a set-up used in electrolysis of lead (II) iodide.



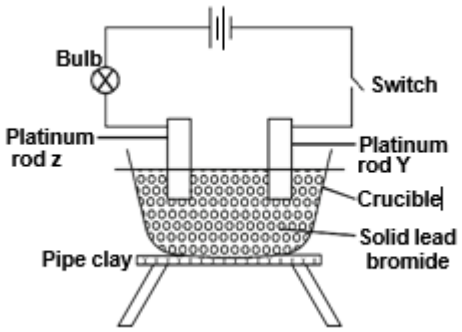
a) Why is heating necessary? (1mk)
b) Write the equation for the reaction that occurs at the cathode. (1mk)
c) At which electrode does reduction occur? (1mk)

6. Study the set-up below and then answer the questions that follow.



State and explain the observations that would be made when the circuit is completed. (3 marks)

7. a) The set-up below was used to electrolyse lead bromide.



i) Identify the anode .....
ii) Did the experiment succeed ? Explain (2 marks)
iii) The electrodes used in the experiment were made of platinum, give a reason. (1 mark)
iv) Give a reason why this experiment is carried out in fume cupboard. (1 mark)
v) When the switch was closed, some mass of metal were deposited. Described how the amount of metal deposited was determined. (3 marks)

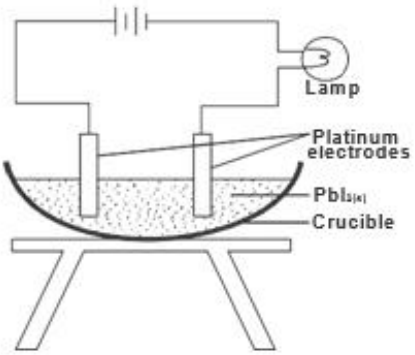
8. Dilute sulphuric (VI) acid was electrolysed using platinum electrodes. Name the product formed at the anode and give a reason for your answer.

9. a) The table below shows the observation made when an electric current was passed through two substances, A and B.

Substance	Observation
Molten A	conducts an electric current and a greyish substances is deposited at the cathode
Molten B	Conducts an electric current and is not decomposed.

i) Give the type of structure and bonding that is present in substances A and B. Substance A
Structure ..... (1 mark)
Bonding ..... (1 mark)
Substance B
Structure ..... (1 mark)
Bonding ..... (1 mark)
ii) Name the particles that are responsible for electrical conductivity in
Substance A ..... .(½ mark)
Substance B ..... (½ mark)
iii) Which of the two substances would not conduct electricity in its solid state? Explain. (2 marks)
iv) If one of the substances is metal bromide, state the observation you would expect to make at the anode (1 mark)
v) In what other state would you expect substance A to conduct electricity? Explain. (2 marks)

10. In an experiment to investigate the electrical conductivity of substances, a student used the set up shown below.



The student noted that the bulb did not light.

a) What had been omitted in the set up ? (1 mark)

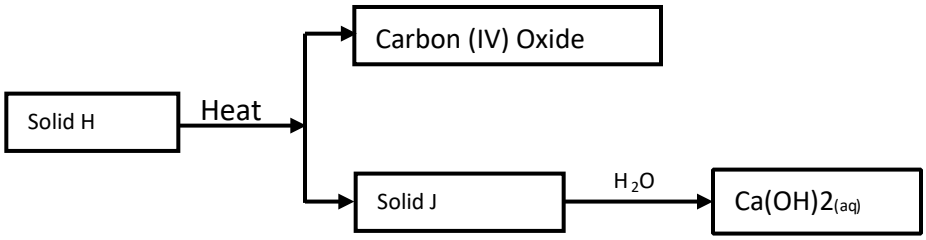
b) Explain why the bulb lights when the omission is corrected. (2 marks)

SALTS (16 LESSONS)

1. Starting with aluminium sulphate, describe how a solid sample of aluminium hydroxide could be prepared. (2 Marks)

2. Explain how you would separate a mixture of ammonium chloride and sodium chloride into its pure components. (1 mark)

3. Use the scheme below to answer the questions that follow.



a. Identify the solids; S and J (2 marks)

b. State one commercial use of solid J. (1 mark)

4. Describe how a pure sample of copper turnings can be obtained from mixture of copper turnings and zinc carbonate. (3mks)

5. Describe how a solid sample of lead (II) sulphate would be prepared using the following reagents: dilute nitric (V) acid, 9lead (II) carbonate solid sodium sulphate and distilled water. (3mks)

6. Using excess zinc powder and dilute sulphuric (VI) acid describe how a sample of dry zinc sulphate crystals can be 9 . prepared. (3 marks)

7. Describe how a solid sample of barium sulphate can be prepared starting with copper (II) oxide. (3mks)

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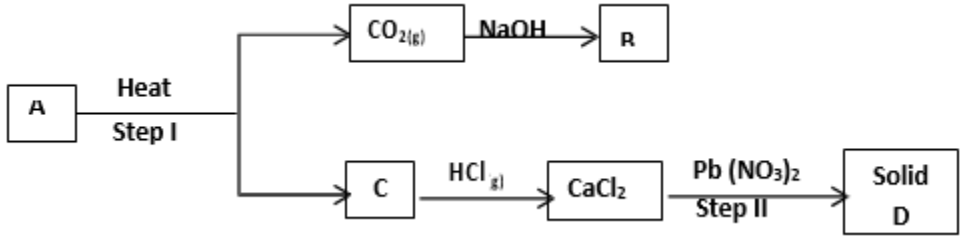
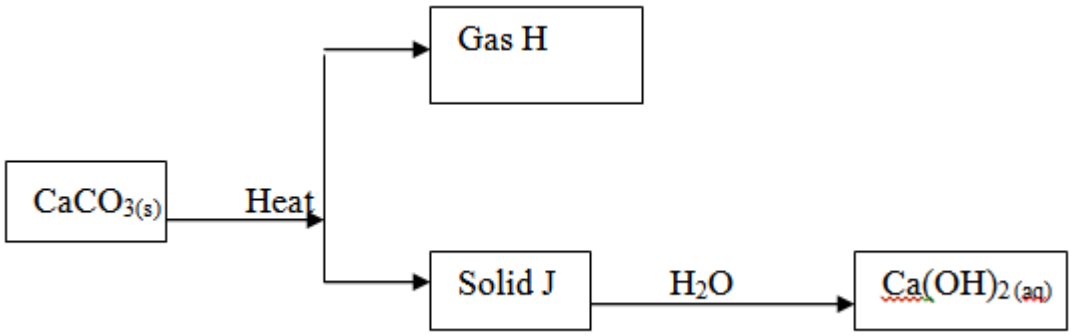
8. Study the reaction scheme below and answer the questions that follow.



(i) Identify substances. A ,B , C, D (2mks)
(ii) Write chemical equation for the reaction taking place in Step **(II)**. (1mk)

9. Describe how solid Aluminium chloride can be separated from a solid mixture of sodium chloride and ammonium chloride. (3 marks)

10. Use the scheme below to answer the questions that follow.



(a) Identify the substances H and J.
(b) State one commercial use of solid J. (1 mark)

11. (a) Describe how a solid mixture of Zinc sulphate and lead (ii) Sulphate can be separated into Solid samples.

(3marks)

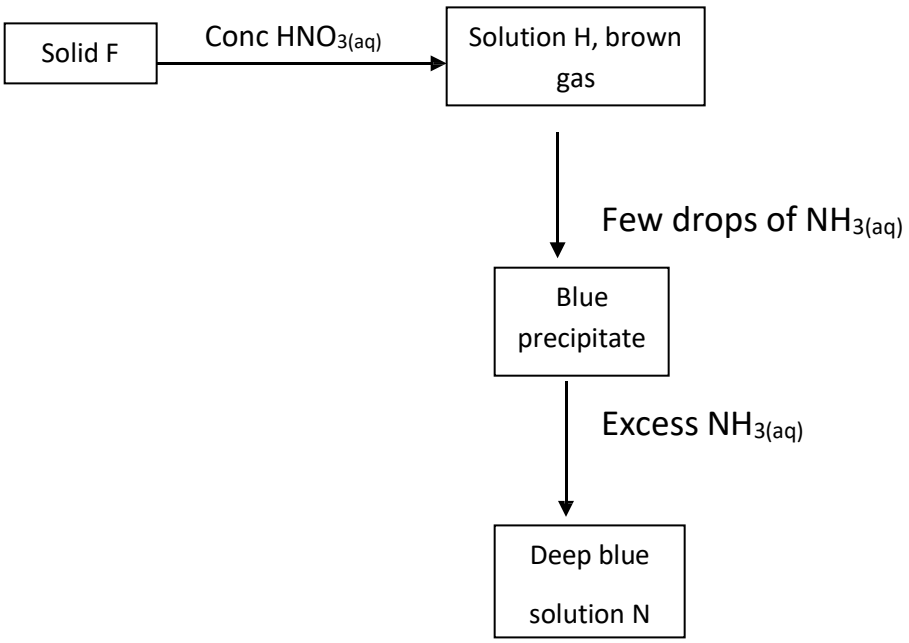
(b) The table below shows the tests that were carried out on three portions of a compound and the results obtained. Study it and answer the questions that follow.

	Test	Observation
1.	Addition of few drops of ammonium hydroxide to the first portion until in excess	White precipitate soluble in excess

2.	Addition of few drops of acidified barium nitrate to the second	White precipitate formed
3.	Addition of few drops of Lead (ii) nitrate to the third portion.	White precipitate formed.

(i) Identify the cation and anions present in the compound;
(ii) Write an ionic equation for the reaction in the third portion. (1mark)

(c) Consider the flow chart below; use it to answer the questions that follow.



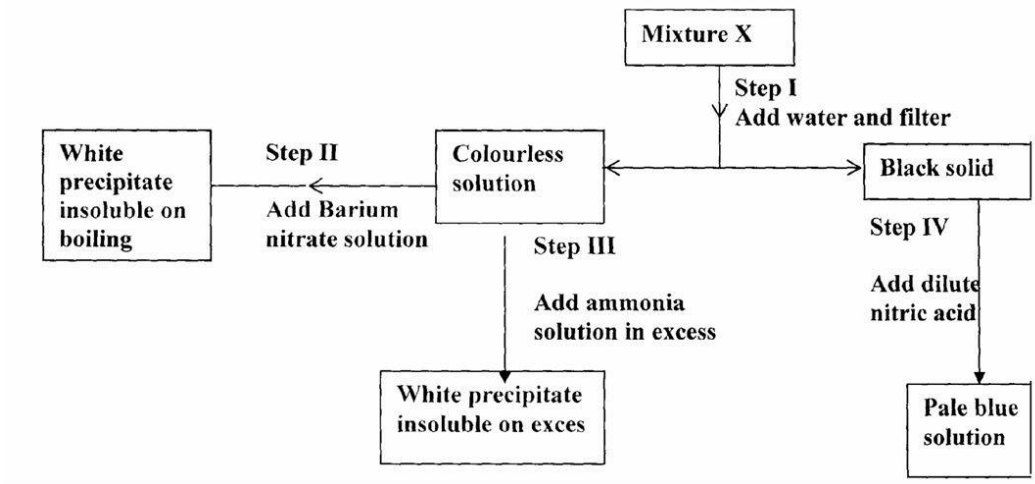
(i) State the most likely identity of solid F. (1mark)
(ii) Write the chemical equation for the reaction between solid F and concentrated nitric (v) acid. (1mk)
(iii) Name
(A) Solution N (1mark)
(B) Solution H (1mark)
(iv) Write the formula of solution N. (1mark)

12. Given the following reagents; solid sodium carbonate, solid lead (II) nitrate, water. Describe how a sample of lead (II) carbonate can be prepared in the laboratory. (3 marks)

13. a) Starting with lead (II) carbonate, describe how a solid sample of lead sulphate can be prepared. (3 marks)
b) Water Was added to lead (II) nitrate by a student. She divided the resulting solution into four, state the observation made after subjecting them to the following tests:
i) To the first portion she added sodium hydroxide dropwise until in excess. (1 mark)
ii) To the second portion she added ammonia solution dropwise until in excess. (1mark)
iii) the third portion she added hydrochloric acid and warm. (1 mark)
iv) To the last portion she added sodium iodide solution. (1 mark)
v) Write an ionic equation for the reaction in test (iv) above. (1 mark)
c) State two commercial uses of sodium carbonate obtained in Solvay process. (2 marks)

14. When Iron (III) chloride is exposed to the atmosphere, it forms a solution.
    (a) Name the process that takes place. (1 mark)
    (b) State one use of the process named in 1(a) above (1 mark)

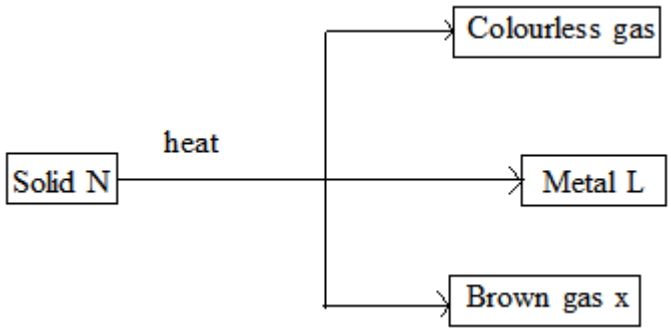
15. Study the chart below and answer the questions that follow.



(a) Name:
    (i) Cations present in mixture X. (1mark)
    (ii) Anions present in the solution. (1mark)
(b) Write an equation to show how the white precipitate in step III is formed. (1mark)

14. The solubility of salt Y at 60^0C is 40g/100g of water and 48/100g of water at 100^0C.
    a) How much salt Y would saturate 190g of water at 100^0C. (1½ mark)
    b) 150g of a saturated solution of Y is 100^0C is cooled to 60^0C. Calculate the mass of Y that crystallizes. (2 ½ mks)

17. Study the flow chart below and answer the questions that follow.



a) Given that solid N burns in air with a red flame. Identify:-
i) Cation present in solid N (½ mark)
ii) Metal oxide L (½ mark)
iii) Gas X (½ mark)

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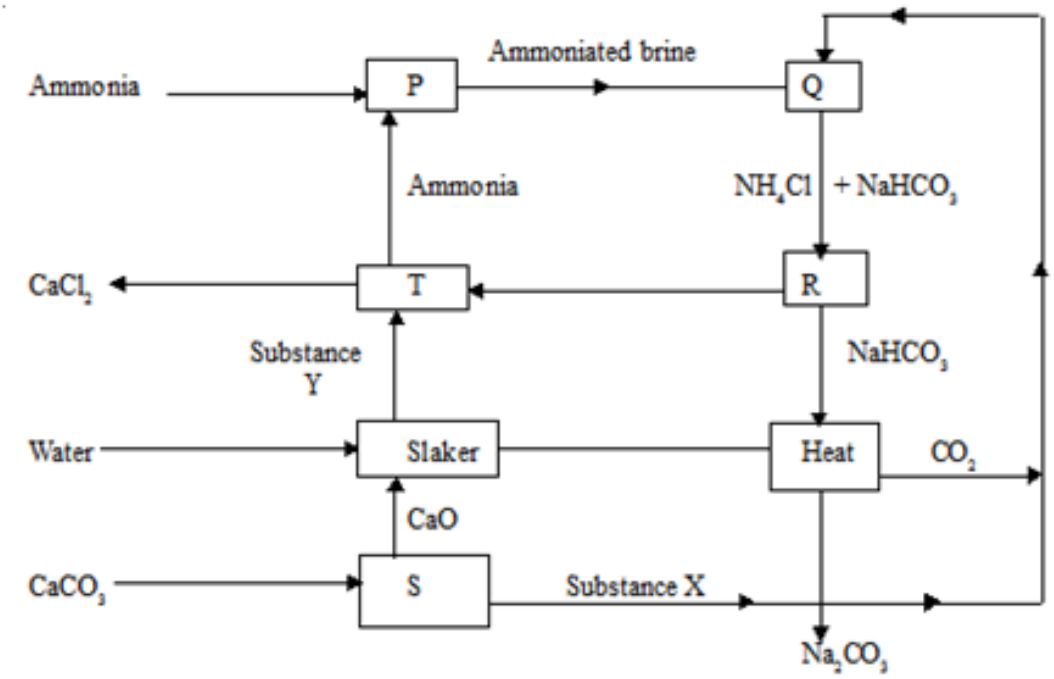
b) Write down the formula of the anion present in solid N. (½ mark)

18. Explain how you would obtain pure ammonium chloride from a mixture of lead sulphate and ammonium chloride? (2mks)

19. Use the flow chart below to answer the questions that follow.



a) Identify the substance labelled
X - (1mk)
Y - (1mk)

b) Name two substances being recycled in the process represented by the flow chart. (2mks)

c) Name the process that take place in
S- (1mk)
R - (1mk)

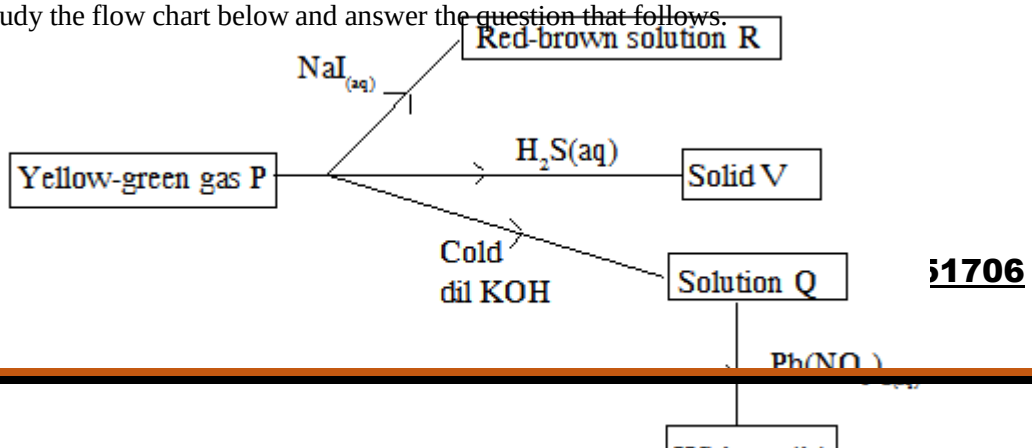
d) Give one uses of calcium chloride. (1mk)

e) Write down balanced chemical equations for the reactions that takes place in chambers Q - (1mk)
T - (1mk)

f) Using ionic equations, explain how sodium carbonate can be used to soften hard water. (2mks)

g) Other than softening of hard water, give one other use of sodium carbonate. (1mk)

20. Study the flow chart below and answer the question that follows.



Identify
i) Solid V (1mk)
ii) Solution R (1mk)
iii) Solution Q (1mk)

STRUCTURE AND BONDING (20 LESSONS)

1. The table below gives atomic numbers of elements represented by the letters A, B, C and D.

Element	A	B	C	D
Atomic number	15	16	17	20

Use the information to answer the questions that follow.

(a) Name the type of bonding that exists in the compound formed when A and D react. (1 mark)
(b) Select the letter which represents the best oxidizing agent. Give a reason for your answer. (1 mark)
(c) Give a reason why phosphorous is stored under water. (1 mark)

4. Using dots (•) and crosses (x), show bonding in:
   d. The compound formed when nitrogen reacts with fluorine (atomic numbers F = 9, N = 7). (2mks)
   e. Sodium oxide (atomic numbers Na = 11, O = 8). (2mks)

3. The boiling points of some compounds of hydrogen and some elements in group (IV) and (VI) of the periodic table are given below.

Compound	Boiling point (°C)	Compound	Boiling point (°C)
CH_4	-174.0	H_2O	100
SiH_4	-112.0	H_2S	-61

(a) Which of the compounds CH_4 and SiH_4 has stronger intermolecular forces. Give a reason. (1 mark)
(b) Explain why the boiling points of H_2O and H_2S show different trends from that of CH_4 and SiH_4. (4 marks)

4. Illustrate bonding in carbon (II) oxide using dot (•) and cross (x) (C – 6, O – 8). (2 marks)

5. The table below gives some physical properties of substances A, B and C. Study it and answr the questions that follow.

Substance	Colour	M.P (^{0}C)	Solubility in water	Electrical conductivity	
				Solid	Liqud
A	Black	114	Insoluble	Non conductor	Liquid
B	Black	1326	Soluble	Non conductor	Conducts
C	Black	3730	Insoluble	Conducts	Conducts

Identify the substance that is:
(i) Giant atomic structure (1mk)
(ii) Ionic structure (1mk)

6. In terms of structure and bonding, explain the following.
   ii) Graphite is used as a lubricant. (1 mark
   iii) Alluminium is better conductor of electricity then magnesium. 1 mark)
   iv) Water is a liquid at room temperature while hydrogen sulphide is a gas. (1 mark)

7. Elements P and Q have the following atomic numbers 19 and 8 respectively.
   f. Using dot and cross draw a diagram to show how the elements form bonds. (1 mark)

8. The melting point of phosphorous trichloride is -91°C while that of sodium chloride is 801°C. In terms of structure and bonding explain the difference in the melting point. (3mks)

9. (a) Using electrons in the outermost energy level, draw (•) and cross (x) diagram for H_3O^+ and C_2H_4 (H = 1, C = 6, O = 16)
   (i) C_2H_4 (1mk)
   (ii) H_3O^+ (1mk)
   (b) What would be the effect of dipping litmus paper in aqueous solution of H_3O^+? (1mk)

10. The table below shows properties of some chlorides. Study it and answer the questions that follow.

Chloride	Mp(°C)	BP (°C)	Electrical conductivity in aqueous	PH of solution
Al	-	183	Good	3
Na	860	1420	Good	7
P	32	75	Good	3
H	-146	-29	Good	1

   a) Explain the high melting and boiling points of sodium chloride. (1mark)
   b) Write an equation for the reaction between PC15 and water. (1mark)
   c) Draw the dot (•) and cross (x) diagram to show bonding in NaCl. (1 mark)

11. (a) Using electrons in the outermost energy level, draw a dot (.) and cross (X) diagram for the ion of PH_4^+ and compound B_2O_3. (P=15, H=1, B=5, O= 16)

   (i) $PH4^+$ (1 mark)
   (ii) B2O3 (1 mark)
   (b) The formula of the compound formed when Aluminum and chlorine react is Al2Cl6. Name the types of bonds that exist in the compound. (1mark)

12. A piece of burning magnesium ribbon was placed in a gas jar full of nitrogen gas. The product Q formed was then reacted with water.
    (a) Write the chemical formula for the product Q. (1mk)
    (b) Write the equation for the reaction between product Q and water. (1mk)
    (c) Using dot (•) and cross (X) diagrams to represent electrons, draw the structure to show bonding in a nitrogen molecule. (N = 14 (1mk)

13. The diagram below represents the structure of aluminium chloride.Identify the bonds:
    M (½ mark)
    N (½ mark)
    What is the difference between bonds M and N? (1mk)

14. The table below shows the electrical conductivity of substances A, B and C.

Substance	Solid State	Molten state	Aqueous solution
A	Conducts	Conducts	Not soluble
B	Doesn't conduct	Conducts	Conducts
C	Doesn't conduct	Doesn't conduct	Not soluble

    a) Give the type of structure and bonding that is present in substance A. (1mk)
    c) Which substance is likely to be sodium chloride. Explain. (2mks)

15. a) What type of bond is formed when Beryllium and oxygen react. (1mk)
    b) Explain why water fetched in rocky areas tend to boil at higher temperature than distilled water. (2mks)

16. Using dots (•) and cross (X) to represent electrons, show the bonding in the folloing compounds.
    i) OH^- (O = 8, H = 1) (1mk)
    i) Li_2O (Li = 3, O = 8) (1mk)

17. With reference to chlorine, distinguish between covalent bonds and van der Waals forces. (2 marks)

17. a) The table below shows some elements of the periodic table and their atomic numbers (The letters do not represent the actual symbols of the elements). Study it and answer the questions that follow.

Element	A	B	C	D	E	F	G	H	I	J
Atomic number	1	7	8	19	15	2	9	6	16	20
Electronic configuration										

    a) Complete the table by filling the electronic configuration for each element. (5 marks)
    b) Which letter represents:

    I. The most powerful reducing agent.
    Explain 1 mark)

    II. The most powerful oxidizing agent
    Explain. (1 mark)

    c) Select two elements with oxidation state of -2.(1 mark)

d) Which element has the highest first ionization energy? Explain. (1 mark)

e) Select two elements which when reacted form a compound that conducts electricity both in molten and aqueous state. (1 mark)

f) Which two elements when reacted form a compound that dissolves in water to form an acidic solution? (1 mark)

g) Using dots (•) and cross (×) to represent electrons, show the bonding in a compound formed when A combines with B.

(2 marks)

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

Formula of chloride	NaCl	$MgCl_2$	$AlCl_3$	$SiCl_4$	PCl_3
Melting point (°C)	801	714	-	-	-
Formula of oxide	Na_2O	MgO	Al_2O_3	SiO_2	P_2O_5
Melting point (°C)	1190	3080	2050	1730	560

a. Using dots (•) and crosses (x) to represent electrons in the outermost energy level, show the bonding in the following compounds.
   i. PCl_3 (1 mark)
   ii. $MgCl_2$ (1 mark)

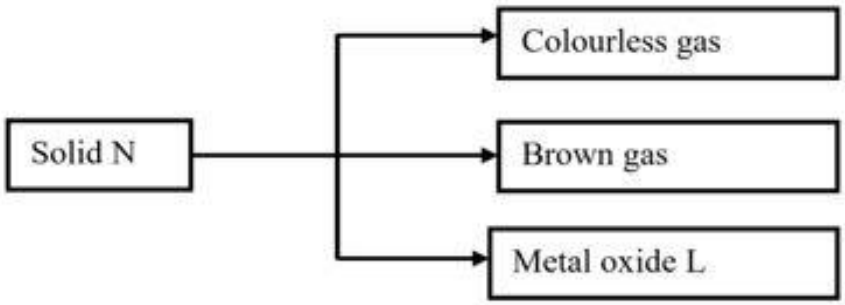
b. Why is the melting point of $AlCl_3$ not indicated in the table above ? (1 mark)

c. Explain the large difference in the melting points of MgO and P_2O_5. (2 marks)

STRUCTURE OF THE ATOM AND THE PERIODIC TABLE (24 LESSONS)

1.

Study the flowchart below and answer the questions that follow.



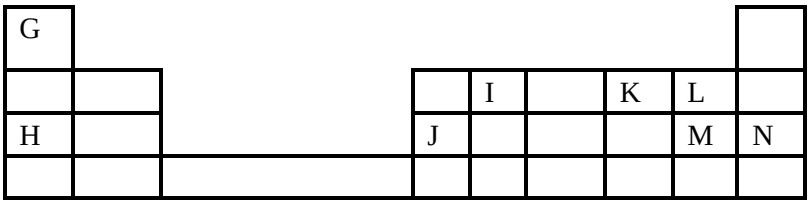
(a) Write the formula of the anion present in solid N. (1 mark)

(b) Solid N in the flow chart above burns in air with a red flame. Identify the

(c) Cation present in solid N (1mark)

(d) Metal oxide L

2. (a) The grid below is part of the periodic table. Letters are not actual symbols. Study it and answer the questions that follow.



g. Give the letters representing atoms that can form a singly-charged anion. (1 mark)
h. Identify the most electromagnetic element in the grid. Explain. (1 mark)
i. Identify the strongest reducing agent. (1 mark)
j. Write the formula of the most stable compound formed when **J** and **K** react (1 mark)
k. Give the name of the type of bond in the compound formed in (iv) above. (½ mark)
l. Give the chemical family name of **L** and **M**. (½ mark)

3. Natural Gallium consists of two isotopes ^{68}Ga and ^{71}Ga in the ratio 3:2 respectively. Given that the atomic number of gallium is 31.

ii) Calculate the number of neutrons in the isotope ^{68}Ga. (½ mark)

iii) Calculate the relative atomic mass of gallium (1½ mark)

(viii) Write the ionic equation for the reaction in which gas **L** is bubbled through a solution with ions of M. (1 mark)

(ix) Element P is alkaline earth metal and belongs to period 2. Indicate its position on the grid. (1 mark)

(b) Use the information in the table below to answer the questions that follow.

Element	**Atomic number**	**Melting point ^0C**
Q	11	98
R	12	650
S	14	1410
T	17	-102
U	18	-189
V	19	64

Give a reason why the melting point of:

i Q is higher than of V. (1 mark)
ii R is higher than of Q. (1 mark)
iii S is the highest. (1 mark)

4. Two elements A and B have electronic configurations 2.8.3 and 2.6 respectively.
m. To which group and period does element B belong? (1mk)
n. If the two react, what is the formula of the compound they form? (1mk)

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

Ion	X^{3+}	Y^{2-}
Electron arrangement	2,8	2,8,8

(a) Write the electronic arrangement of elements. X and Y

(b) Write the formula of the compound that would be formed between X and Y.

6. Determine the oxidation number of:

(i) Manganese in $KMnO_4$. (1mk)

(ii) Chromium in $Cr_2O_7^{2-}$ (1mk)

7. An element X is atomic number 3, relative atomic mass 6.94 and consists of two isotopes of mass numbers 6 and 7 respectively.

o. What is the mass number of the more abundant isotope of X? (1mk)

p. Calculate the relative abundance of each of the isotopes. (2mks)

8. The table below shows atomic numbers of four elements **W**, **X**, **Y** and **Z**.

Element	W	X	Y	Z
Atomic number	20	17	19	9

(a) Write electron arrangement of the ion of **Z**. (1 mark)

(b) (i) Write the formula of the compound formed between **W** and **X**. (1 mark)

(ii) Name the bond(s) and structure of the compound in (i) above. (1 mark)

9. Element X is found in period 3 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. (3 marks)

10. Two elements A and B have electronic configurations 2.8.3 and 2.6 respectively.

(a) To which group and period does element B belong? (1mk)

(b) If the two react, what is the formula of the compound they form? (1mk)

11. (a) Calculate the oxidation state of chromium in the ion Cr_2O^{2-}. (1 mark)

(b) Using oxidation numbers, determine from the equation below the species which undergoes oxidation and reduction. $2FeCl_{2(aq)} \longrightarrow Cl_{2(g)} + 2FeCl_{3(aq)}$

Oxidation - (1 mark)

Reduction - (1 mark)

12. (a) An element O has two isotopes O containing 90% and Isotope O.

a. What are isotopes? (1 mark)

b. Find the R.A.M of O. (2 marks)

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

						S	U	V
P	R					T	X	W

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Q								

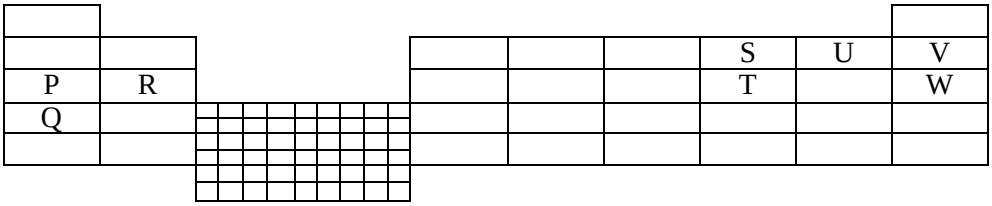
(a) Which of the elements has the highest atomic radius? Explain. (2 marks)
(b) Identify the most reactive Oxidizing agent. Explain. (2 marks)
(c) Compare the atomic radius of P and R. Explain (2 marks)
(d) Give the formula of one stable ion with an electron arrangement of 2.8 which is:
(i) A Negatively charged divalent ion. (2marks)
(ii) A Positively charged monovalent.
(e) Given that the mass number of W is 40. Write down the composition of its nucleus (2 marks)
(f) Write the formula of the compounds formed between.
(i) Element R and X. (1 mark)
(ii) Give one property of the structure formed when R and X bond. (1 mark)

14. Sulphur (IV) oxide and nitrogen (IV) oxide reacts as shown in the equation below.

$$SO_2 + NO_2 \rightarrow SO_{3(g)} + NO_{(g)}$$

(a) Using oxidation numbers show that this is a redox reaction.
(b) Identify the reducing agent.

15. The grid below shows part of the periodic table. Use it to answer questions that follow. The letters do not represent the actual symbols of the elements.



(a) (i) Which of the element has the lowest ionization energy? (1mk)

(ii) Explain your answer in a(i) above. (1mk)

(b) (i) Identify the most reactive non-metal. (1mk)

(ii) Explain your answer in b(i) above. (1mk)

(c) Give the electronic configuration of element.

(i) **S** …….. (½mk

(ii) **Q** …….. (½mk

(d) Compare the atomic radius of **P** and **R**. Explain. (2mks

(e) The mass number of W is 40. Write down the composition of its nucleus. (1mk)

(f) Write formula of oxides of P. (1mk)

(g) (i) What is the name given to elements found in the shaded region. (1mk)

(ii) Which elements can be used to provide an inert environment? (1mk)

16. (a) Distinguish between ionization energy and electron Affinity (2 marks)

(b) The atomic number of Q and R are 9 and 17 respectively. Compare the electron affinity of Q and. Explain. (1 mark)

17. The relative atomic mass of an element is 10.28, it has two isotopes $^{10}_{5}R$ and $^{11}_{5}R$.

Calculate the relative percentage abundance of each isotope. (3 marks)

18. a) The electronic configuration of an ion P^{2-} is 2.8.8.

b) Draw the structure of the atom just above element P in the periodic table. (2 marks)

19. The grid below is part of periodic table. Use it to answer the questions that follow. (The letters do not represent the actual symbols of the elements)

						R	S	
N	Q						T	U
P								

a) Indicate in the grid the position of an element represented by letter V, whose atomic number is 14.(1mk)
b) Select a letter which represents a mono atomic gas(1 mark)
c) Write an equation for the reaction between Q and T.(1 mark)

20. 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 <u>two</u> elements have similar properties? Explain. (2marks)
b) What is the most likely formula of the oxide of L? (1mark)
c) Which element is a non – metal? Explain. (1mark)