REPUBLIC OF SOMALILAND

Preface

Administration of Somaliland national examination and certification board (SLNECB) authorized the compilation, production and publication of Somaliland national chemistry examination books with simplified answers and solutions for secondary students. The production of these books came after a success through great and selfless effort, made by SLNECB and the teacher who compiled it. This was necessitated by the tremendous needs of the whole Somaliland secondary students in order that they get equal rights and experience in performing national examinations in particular and the international exanimations in general.

I hope all Somaliland students and teachers will enjoy using these valuable books.

Daud Ahmed Farah

Chairman of Somaliland national
examination and certification board

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Republic of Somaliland

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Chemistry Examinations
With simplified answers

First edition 2013

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Compiled by: Mohamed Samriye Husein (Samriye)

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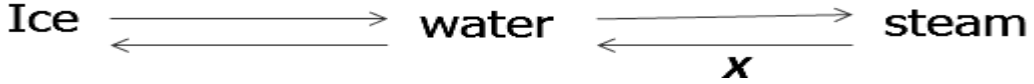
UNIT ONE:

MATTER AND ITS PROPERTIES.

1.1: Multiple choice questions

1. The diagram show the change of state of water:



(2002

What is the process represented by X?

A) Melting
B) Freezing
C) Condensing
D) Boiling

2. Which of following techniques could be used to separate the Dyes in ink? (2003)

A. chromatography
B. crystallisation
C. Distillation
D. Filtration

3. What stages occur in distillation?(2004)

A) Condensation then evaporation
B) condensation then filtration
C) evaporation then condensation
D) filtration then evaporation

4. All of the following are characteristic properties of gases except (2005)

a. They can expand without limit.
b. They can diffuse easily.
c. They are easily compressed.
d. They have high densities.

5. Identify the following experimental technique. (2009)

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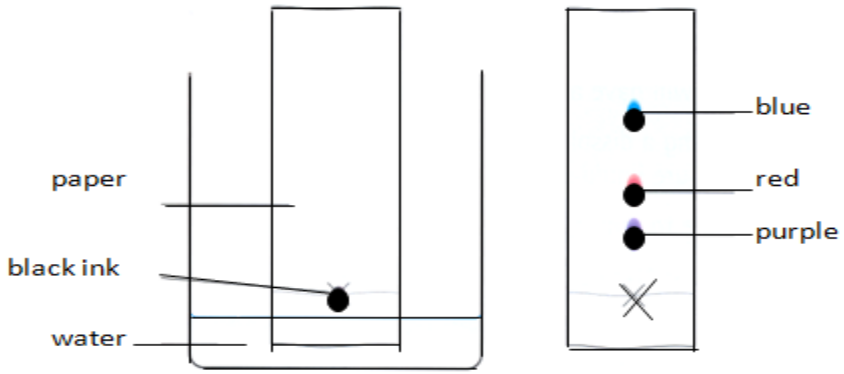

A Evaporation

B Chromatography

C Distillation

D Filtration

6. When salt is added to water, a solution is formed as shown in the diagram below.(2009)

What term is used to describe the water?

A Solid

B Solute

C Solvent

D Solution

7. Which formula represented a mixtures.(2011)

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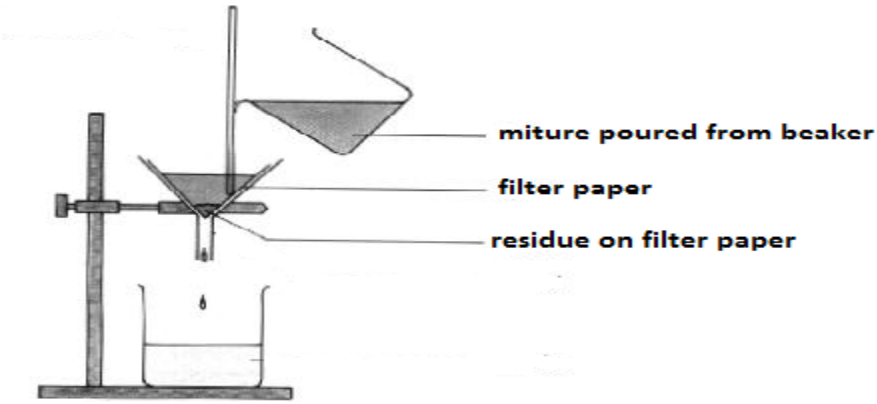
A. $C_6H_{12}O_{6(s)}$

B. $C_6H_{12}O_6$

C. LiCl(aq)

D. LiCl(s)

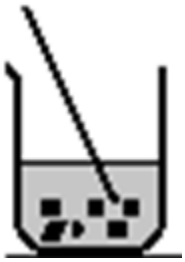
8. The diagram shows Q method for separating a mixture.(2012)



This method could be used to separate:

A) Sand from a mixture of sand and salt
B) Salt from a mixture of sand and salt
C) Sugar from a mixture of a chalk and sugar
D) Salt from sea water

9. The diagram shows the first step in separating sand and salt.(2012)



What is the next step?

A) Evaporate the water
B) Filter the mixture
C) Freeze the mixture
D) Make a chromatography

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10. A drop of coloured ink was added to water.

Which process caused the colour to spread?

A) Diffusion
B) Melting
C) Evaporation
D) Condensation

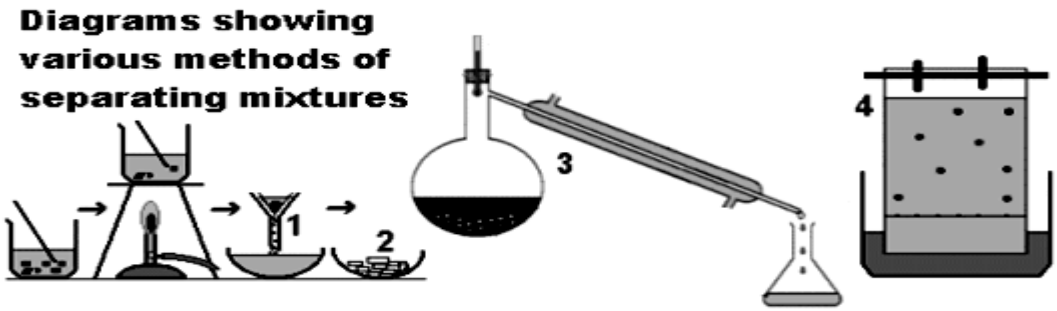
11. Which of the following processes can be used to decide whether chlorophyll is a single colour or a mixture?(2012)

A) Chromatography
B) Distillation
C) Filtration
D) Crystallization

12. The process of sublimation, the substance is transformed directly ;(2013)

A) from the solid to liquid state
B) From liquid state to vapour state.
C) From liquid state to solid state.
D) From solid state to gaseous state.

13.



Which method shown in the diagram is used to separate copper sulphate crystals from its solution in water?

A. method 1 B. method 3 C. method 4 D. method 2

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1.2. Structured questions

1. Name the method you would use to each of the following mixtures?(2002)

a) A miscible solution of ethanol and water.

……

b) A mixture of sand and water.

……

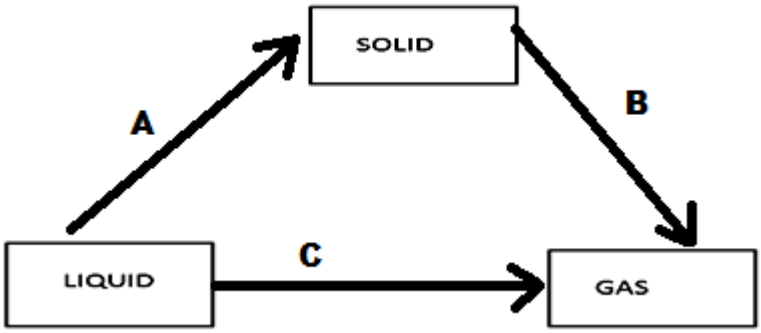
c) A salt solution.

……

d) An immiscible solution of oil and ethanol.

……

2. (a) the following diagram shows some changes in state(2003)



(i) Choose words from the box to identify A, B and C

Condensation, melting, saponification
Sublimation, vaporization

A. Is……
B. Is……
C. Is……

(ii) In which the process A, B and C is energy given out

……

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b. Air is mixture of gases including

Argon, carbon dioxide, nitrogen, oxygen

(i) Which of the above gases is in group 0 of the periodic table?

……

(ii) What is approximate ratio, by volume of nitrogen: oxygen in air?

……

c. Air dissolves in water but the proportions of the different gases Change because the solubility of the gases in water is different

In experiment 200cm^3 of air that has been dissolved in water Was passed over the hot copper wire several times .at end Of the experiment only 126 cm of gas was remaining

(i) What happens to the copper wire
……..

(ii) Write the balanced chemical equation for the reaction that occurred
……..

(iii) Use the information giving to calculate the percentage by volume of oxygen in air that is dissolved in water
……
……

3. a) (i) Name the three states of matter and give one example of a substance in each state. (2007)

……
……
……

(ii) Substance **X** is described as follows: it has no definite shape, it has a fixed volume, it flows easily and it has a high density. in what state is substance X?
……
……
……

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(iii) It is not easily to fill a container with a small opening with water. What does this tell you about matter? Explain.

……
……
……

a. State with reason whether the following are physical or chemical changes.

(i) Adding sugar to water

……
……

(ii) Striking a match stick

……
……

(iii) Souring milk

……
……

(iv) Rusting of a piece of iron

……
……

QUESTION 4.

The following list of apparatus were arranged to obtain water from a salt solution:

Round bottom flask

Thermometer

Liebig condenser

Small beaker

Two clamp stands

Bunsen burner

Pure water

Salt solution

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a) Draw a diagram to show the set – up. (6 mks)

……

……

……

b) What name is given to this separation technique? (1mk)

……

c) The water is in different states during this process. Name them in their right order.

……

d) Name the two processes involved . Name them in order in which they happen, (2 M)

……

QUESTION 5.(2008)

a) A sample of 2g of potassium chlorate crystals is put into a boiling tube and $4cm^3$ of water is added. The mixture is heated until all the crystals have dissolved. The solution is then allowed to cool slowly and the temperature at which crystals first appear is recorded. More water is added and the new mixture warmed to redissolve the salt. This solution is cooled and crystallized as before.

The table below shows results which were obtained with a Sample of 2g of potassium chlorate, adding $4cm^3$ of water each time.

Volume of water (cm^3)	4	8	12	16	20
Temperature which crystals appear (^{0}C)	92	63	48	35	27
Solubility (g/100g of water)					

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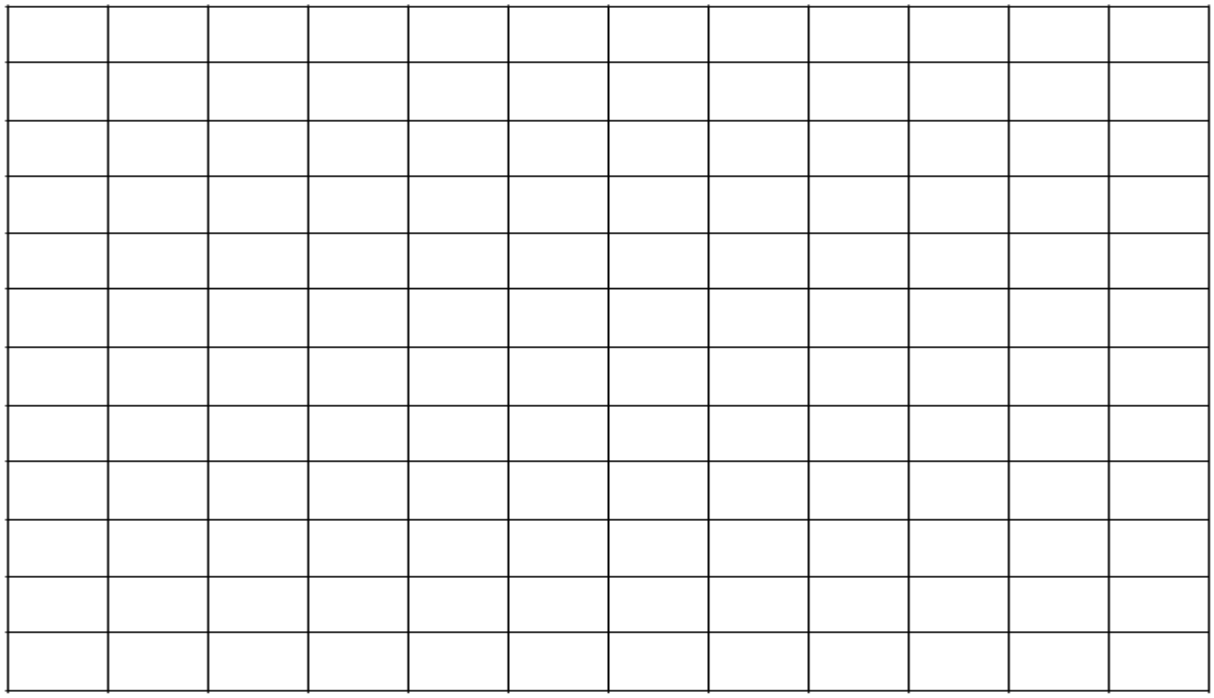
(i) Calculate the solubility values to complete the table. (2½ mks)

(ii) On the grid below, plot a graph of solubility (vertical axis) against temperature.



(iii) From your graph determine:

1. The temperature at which crystals will start to form when a solution of 30g of Potassium chlorate in 100g of water is cooled.

   ……

2. The mass of crystal that separates out when the solution in (iii) 1 above is cooled to 25 ^{0}C.

……

……

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b) State one use of solubility curves.

……

Question 6(2009)

Define Boyle's law

……

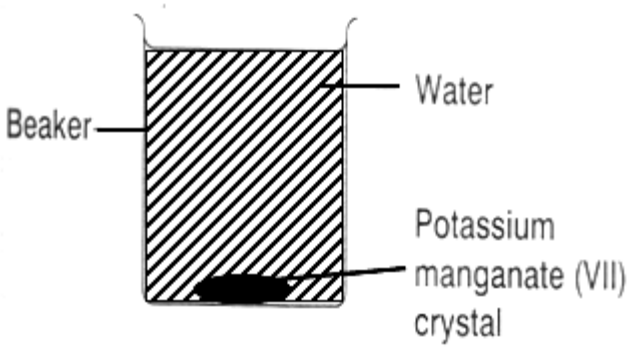
……

b) A certain gas occupies 5 dm^3 at 24 ^0C and 15 cm Hg. Calculate the pressure of the gas if the volume is halved and the temperature is raised to 200 ^{o} C.

……

……

c) A crystal of potassium manganate (VII) was carefully dropped into a beaker containing water, as shown below.



i. Explain what will be observed after ten (10) minutes.

……

……

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ii. Explain why the process above is faster in a vacuum than in air.

.....

.....

Question 7(2009)

a) Name the method you would use in each case to separate the following mixtures:

i. A solution of water and ethanol (1 mark)

.....

ii. Sugar solution (1 mark)

.....

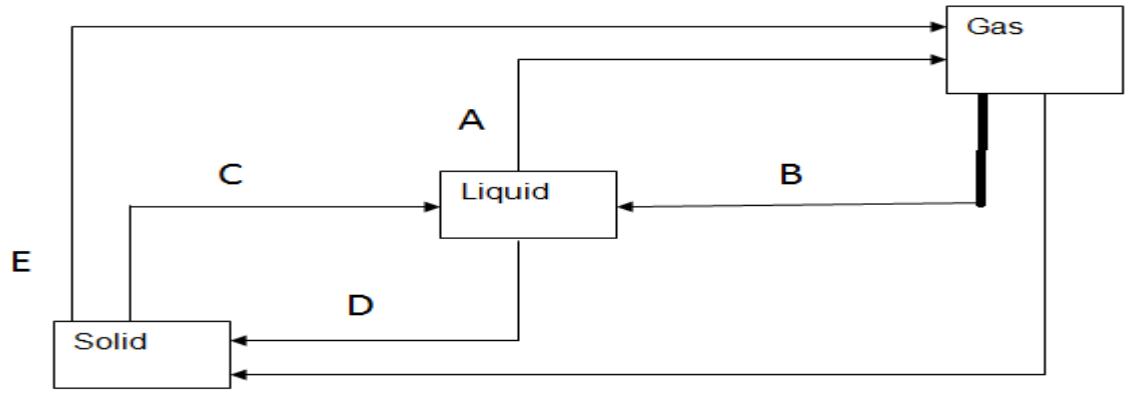
iii. An immiscible mixture of oil and ethanol (1 mark)

.....

iv. Mixture of sand and water (1 mark)

.....

b) The following diagram shows the effects of heat on the physical state of a substance.



i. Identify the processes represented by letters A, B, C, D and E. (5 marks)

A .....

B .....

C .....

D .....

E .....

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c) From the list below

Sodium, Potassium, Sulphur Dioxide, Ammonia

i. Name the elements

……

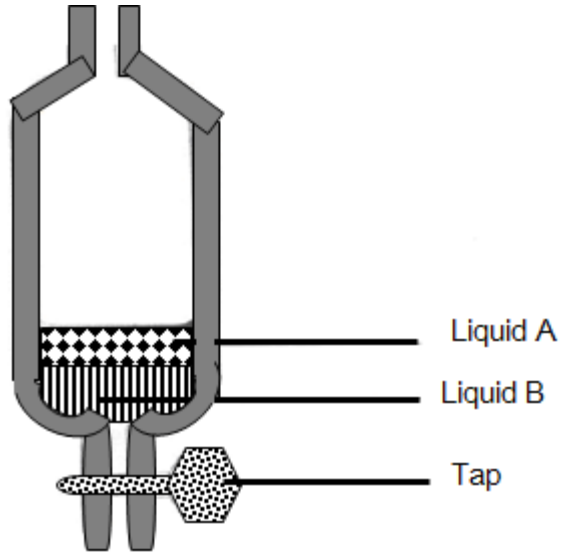
ii. Name the compounds

……

iii. Write the chemical formulae for one gas in the list

……

Question 8(2010)



a) Which liquid is denser in the separating funnel? Give a reason?

……
……
……..

b) Name two liquids that could be separated by this method

……

……

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c) A third liquid is added to the funnel it is insoluble in A but soluble in B describe what happens when the mixture is shaken?

.....

.....

.....

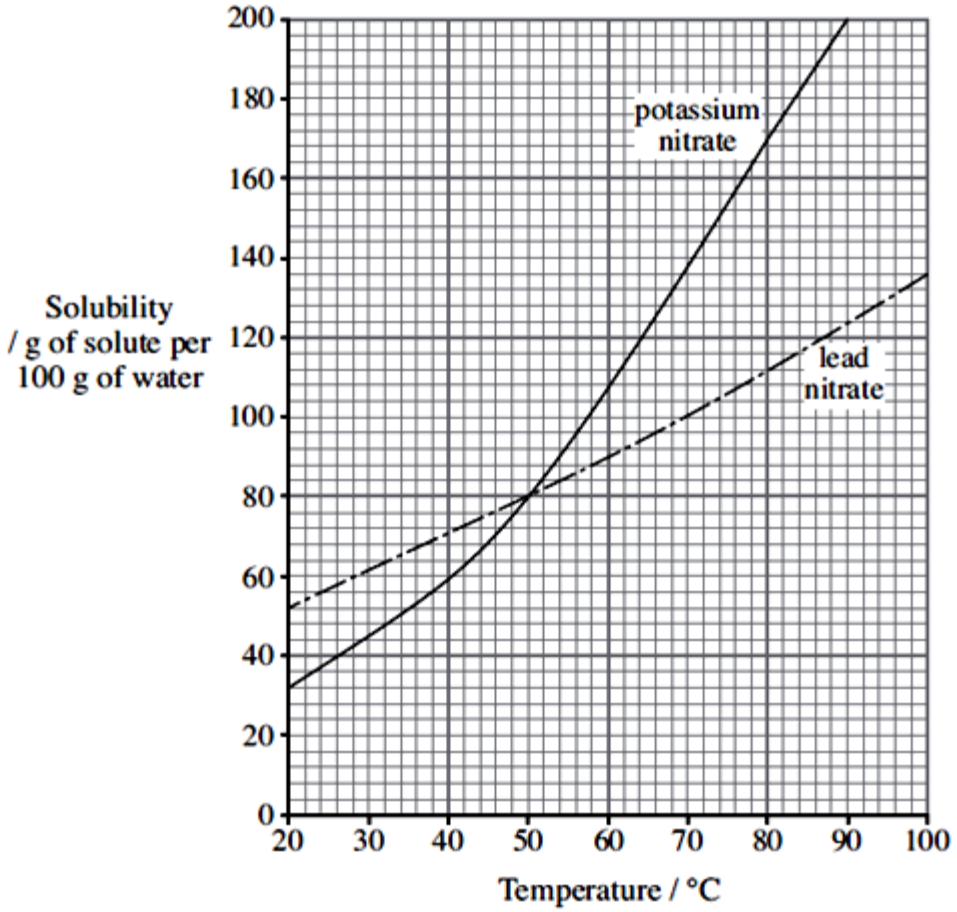
d) How else can you separate a liquid mixture?

.....

.....

Question 9

The following graph shows the solubility curves for potassium nitrate and lead nitrate.



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From the graph above give:

(i) the temperature at which the solubility is the same for both potassium nitrate and lead nitrate;

Temperature = ... °C

(ii) the difference between the solubilities of lead nitrate and potassium nitrate at 80°C;

Difference = ... g per 100 g of water

(iii) the mass of crystals that would form if a saturated solution of potassium nitrate in 100 g of water was cooled from 90°C to 30°C.

Mass of crystals formed = ... g

UNIT TWO.

ATOMIC STRUCTURE AND THE PERIODIC TABLE

2.1. Multiple choice questions

1. Which of the following has the same electronic arrangement as argon?(2002)

Argon = $^{40}_{18}Ar$

A) $^{37}_{17}Cl^{-}$
B) $^{39}_{19}K^{+}$
C) $^{39}_{19}K$
D) $^{39}_{17}Cl$

2. Which of following is correct atomic symbol for the element silicon?

A. Si
B. Si
B. sI
D. SI

3. the most common isotope of aluminium is $^{27}_{13}Al$. How many electrons does An atom is isotope contain?

A. 13 B. 14 C. 27 D. 40

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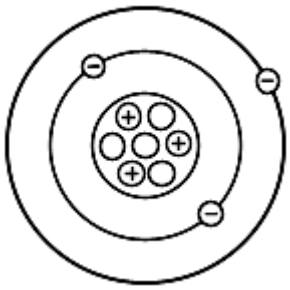
4. The following diagrams represents an atom of an element



Which of the following statements is true?

A) The atomic number of the element is 4
B) The mass number of the element is 10
C) The commonest ion of this element has a charge of +1
D) The commonest ion of this element has a charge of -1

5. in the periodic table, elements are arranged in order of increasing(2005)

A) Atomic numbers.
B) Number of valency electrons.
C) Atomic mass.
D) Electronegativity.

6. Which of the following elements has the lowest first ionization energy?(2005)

A) Li
B) Mg
C) Na
D) Al.

7. Chlorine is found in group vii of the periodic table. the group is known as the(2006)

A) halogens
B) alkali metals
C) Transitional metals.
D) Noble gases.

8. the following diagram represents an atom of lithium(2006)

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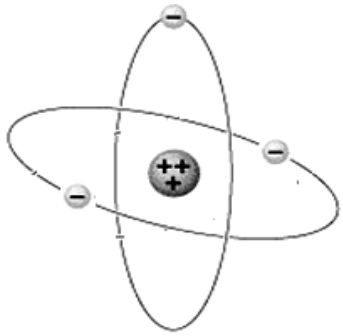

Which of the following statements is true?

A) a lithium atom has three neutrons
B) neutrons carry a charge of -1
C) the atomic number is 4
D) a lithium has 3 electrons

9. Which of following is the correct atomic symbol for the element of potassium?

A) k
B) Po
C) K
D) PO

10. Which one of the following sets represents a pair of isotopes?(2007)

A) $^{12}_{6}C$ and $^{14}_{7}N$
B) $^{32}_{16}S$ and
C) O_2 and O_3
D) $^{206}_{82}Pb$ and $^{208}_{82}Pb$

11. Which property increases with increasing atomic number in the alkali metals and halogens?(2007)

A) Ionization energy
B) Electronegativity
C) Melting point
D) Atomic radii

12. Which of the following is an alkaline earth metal?

A. Sodium
B. Calcium
C. Zinc
D. Aluminium

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13. Which of the following represents the electronic structure of three elements in the

Same group of the Periodic Table.(2008)

A.	2. 8. 1	2. 8. 3	2. 8. 4
B.	2. 7	2. 8	2. 8. 1
C.	2. 8	2. 8. 1	2. 8. 2
D.	2. 1	2. 8. 1	2. 8. 8. 1

14. An atom consist of(2008)

A) protons and electrons only

B) electron, protons and neutron

C) protons and neutrons only

D) protons only.

15. For an alkaline earth metal to attain a stable electronic configuration(2008)

A) it gains six electrons

B) it shares its electrons

C) it loses two electrons

D) it loses one electron.

16. Atoms can form ions with a single negative charge. To do this the atom must,(2009)

A) A gain a proton

B) B gain an electron

C) C loose a proton

D) D loose an electron.

17. Element P is in group one and period 3 of periodic table. What is its configuration?

A) 2 : 8 : 1

B) 2 : 8 : 8 : 1

C) 2 : 8 : 8 : 2

D) 2 : 1

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18. Which of the following is the odd one out?(2009)

A) Bromine
B) Chloride
C) Fluorine
D) Helium

19. A pure substance that cannot be chemically decomposed is called?(2009)

A) A compound
B) An isotope
C) An element
D) A mixture

20. What is an isotope?(2009)

A) Atoms of same element with same atomic number but different mass number
B) Element with the same mass number
C) Element existing in two or more different forms in the same physical state
D) Element with the different atomic number.

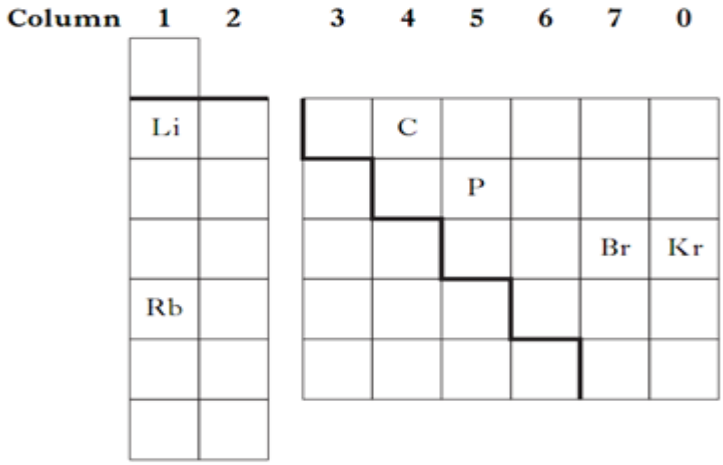
21. Which of the following gases is a noble gas?

A) Argon
B) Oxygen
C) Fluorine
D) Nitrogen

22. Isotopes of the same element have identical

A) nuclei
B) mass numbers
C) numbers of neutrons
D) numbers of protons

23. The diagram shows part of the periodic table.



Which TWO elements show similar chemical properties?

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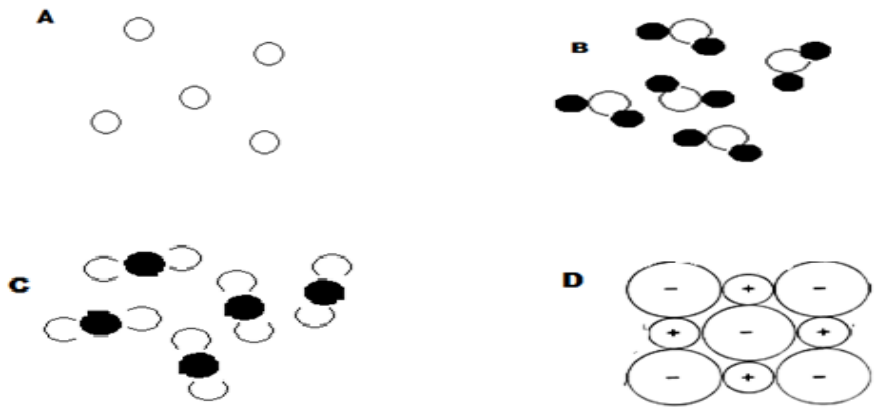
A. Li and C B. C and P C. Br and Kr D. Li and Rb

24. The structures of four substances can be represented by models. Which of the following models show an element?(2011)



25. Which of the following represents the electronic configuration of nitrogen in a ground state?(2011)

A) $1S^2\ 2S^2\ 2P^2$
B) $1S^2\ 2S^2\ 2P^3$
C) $1S^2\ 2S^2\ 2P^4$
D) $1S^2\ 2S^2\ 2P^5$

26. The proton numbers of four elements are shown. Which element is a metal?(2012)

Element	Proton Number
A	16
B	17
C	10
D	11

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27. Which row of symbols is correct for calcium, chlorine and copper?(2012)

Row	Calcium	Chlorine	Copper
A	Ca	Ch	Cu
B	Ca	CL	Co
C	Cu	Ca	CL
D	Ca	Cl	Cu

28. Which of the following is true about $^{63}_{29}Cu$? It has: (2012)

A) 63 protons
B) 29 protons
C) 29 neutrons
D) 63 neutrons

29. The chemical symbol of mercury is: (2013)

A) Ag
B) Au.
C) Hg
D) Mg

30. How many electrons of an ion chromium has $^{52}_{24}Cr$ **(2013)**

A) 24
B) 27
C) 21
D) 28

31. The maximum numbers of electrons that occupy in an S-orbital (sub shell) is: (2013)

A) 4
B) 3
C) 2
D) 1

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2.2 . Structured questions

Question 1(2002)

Part of the periodic table is given showing the position of six elements. All of these shown are present in the air either as elements or compounds (2002)

1								2
3	4			6_C	7_N	8_O	9_F	10_{Ne}
								18_{Ar}
								36_{Kr}

a) Some boxes in the periodic table above contain a number. What is this number called?

.....

b)

i. Which of the elements shown are in the same group as Neon?

.....

ii. What is the name of this group of elements?

.....

iii. State one property showed all the members of this group?

.....

.....

iv. State one use for a named member of this group?

.....

c) The box in the periodic table which contains argon should also contain a second number. This number is 40. Give two pieces of information about the structure of an atom of Argon which can be deduced from this number?

.....

.....

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Question 2.(2003)

Explain the following terms?

(i) Atomic number……
……

(ii) Mass number ……
……

(iii) Ion ……
……

(b) (i) using the periodic table provided, complete the following table.

Name of element	atomic number	electronic configuration
……	25	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^5$
Sodium	11	……
chlorine	……	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$.

(ii) Which of the elements in the above table belongs to the

S- Block of the periodic table ……
P- Block of the periodic table ……

(c) Two different isotope of sodium may be represented by the symbols

$^{23}_{11}Na\ and\ ^{24}_{11}Na$

In terms of structure state how these two isotopes are

(i) Similar ……
……

(ii) Different ……
……

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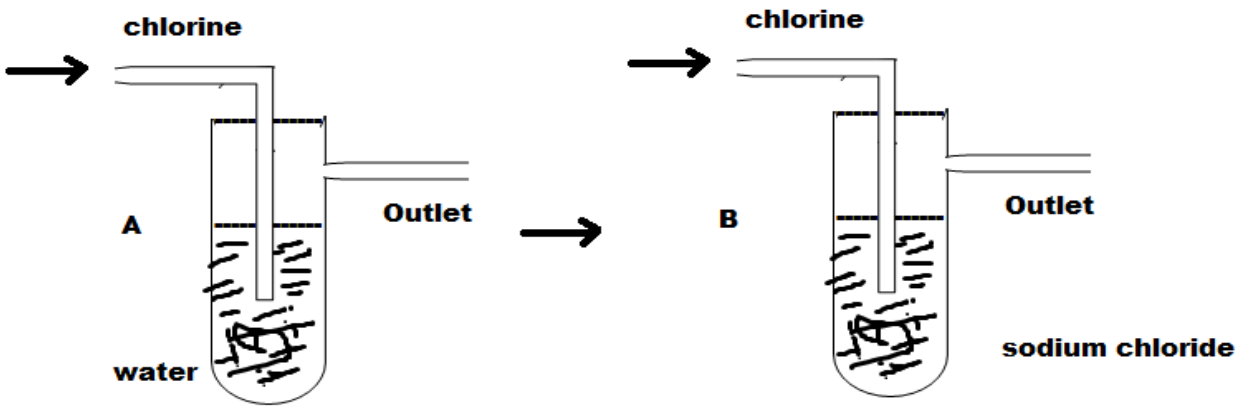
Question 3.(2004)

Chlorine gas is passed two solutions as shown below.(2004)



a) what chemicals are found in test-tubes

i) Test-tube A

……
……

ii) Test-tube B

……
……

b) Write the chemical equation in test-tube B?

……
……

c) Name the type of reaction that takes place in test-tube B?

……
……

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d) One of the test-tubes could form acidic solution after chlorine gas dissolve in it. Name the test tube?

……
……

e) in test-tube (A) after the reaction, if we put a coloured substance what will happen

Question 4.(2004)

a. This is about the actual representation of the periodic table of the elements. The letters shown in the table below are not the symbols of the elements. You will need to use these in some of your answers.(2004)

GROUP

PERIODS	I	II								III	IV	V	VI	VII	O
1															L
2	Q									E	G	J	Z	M	
3	R	D													
4	T														
5															

Each letter may be used once or more than once.

a) i) How many protons does an atom of element L contain?

……
……

ii) which element shown forms ions with single –ve charge?

……
……

iii) which metallic element is more reactive than R?

……
……

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b) i) Give the formula of the compound formed between elements D and M?

……
……

ii) Which element has its electrons arranged in four shells?

……
……

iii) How many neutrons are there in an atom of element D(Mass number 24)

……
……

c) How do the trends in the properties of atomic radius, reactivity, and metallic character of the first group (Q, R and T) exist?

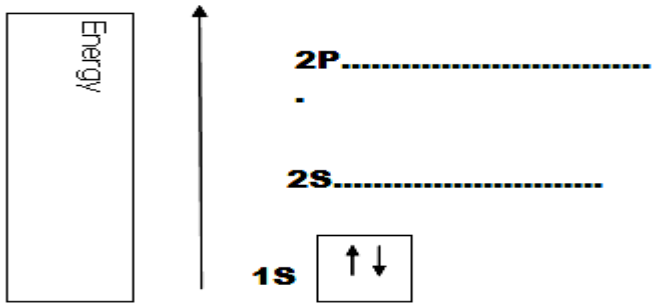
……
……

d) work out the electronic configuration in (S, P, D, and F) for the following atoms and ions

i) S……

ii) Cl^-……

e) Complete the following energy level diagram to show the electronic configuration of carbon.



Question 5.(2005)

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A. the table below shows atomic and ionic radius of some elements

Element	Atomic radius(nm)	Ionic radius(nm)
A	0.144	0.078
B	0.099	0.120
C	0.197	0.098

I. Two of the above elements are metals, which are they?

……

II. Which is the non-metallic element? how do you know from the above table?

……

III. The two metals belong to the same group in the periodic, which one is most reactive?

……

b. the table below gives some information relating to the elements in period 3 of the periodic table and their oxides.

Element	Na	Mg	Al	Si	P
Formula of oxide	Na_2O	MgO	Al_2O_3	SiO_2	P_2O_5
Atomic radius(nm	1.57	1.36	1.25	1.70	1.10

i) The atomic radius of the elements in the periodic table decreases from left to right. Explain why?.

ii) Suggest the relationship between the properties of oxides and their elements by referring to the above table?

Question 6(2006)

The electronic configuration of aluminum (atomic number 13) can be shown as:

a) Electronic structure 2, 8, 3 or

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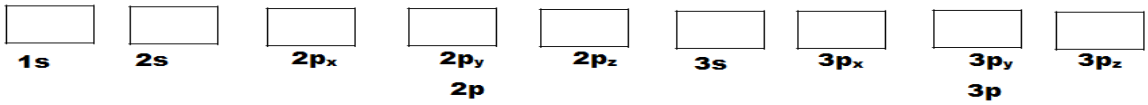
spdf form $1s^2 2s^2 2p^6 3s^2 3p^1$

Electrons in boxes notation



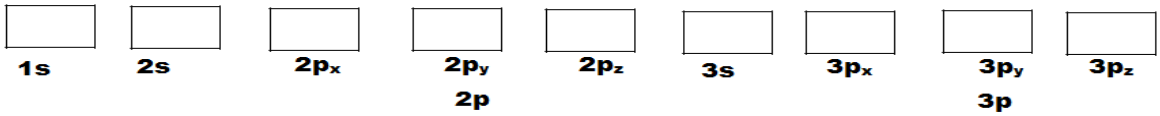
Give the electronic configuration in the form of s,p,d,f notation. and electrons in boxes notation to show the electronic configuration of the following elements.

b) Silicon (atomic number 14).

Electronic structure……

spdf notation……

Electrons in boxes notation

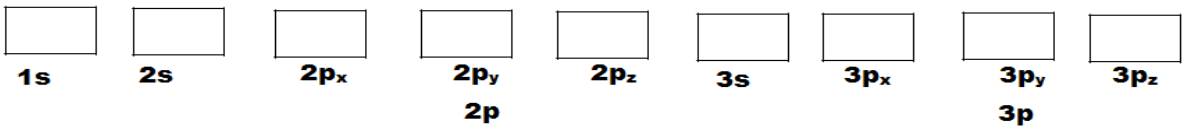


c) sulphur (atomic number 16)

electron structure……

spdf notation……

electrons in boxes……

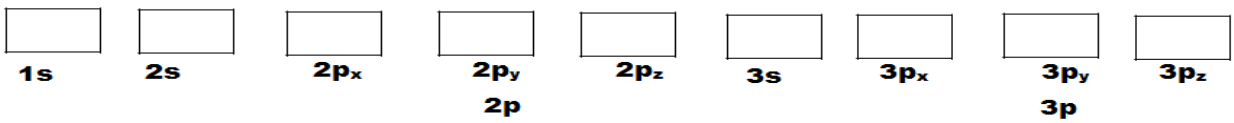


d) Sodium (atomic number 11)

Electron structure……

s,p,d and f
notation……

Electron in boxes notation……



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e) Fill in the table below to show equations for the 2nd, 3rd, & 4th ionization energies of aluminium.

Ionization energy	equation	Value in Kj/mol
1st	$Al(g) \rightarrow Al^{+}(g) + e^{-}$ 2, 8, 3 2, 8, 2.	578
2nd	$Al^{1+}(g) \rightarrow Al^{2+}(g) + e^{-}$ 2, 8, 2 2, 8, 1	1817
3rd	$Al^{2+}(g) \rightarrow Al^{3+}(g) + e^{-}$ 2, 8, 1 2, 8	2745
4th	$Al^{3+}(g) \rightarrow Al^{4+}(g) + e^{-}$ 2, 8 2, 7	11575

i) For each ion put the electronic structure in the table.

ii) In the table circle the electronic configurations that are the same as a noble gas.

iii the values from 1st, to 2nd to 3rd increases gradually, but there is huge increase from the 3rd to 4th. Explain why.

Question 7.(2006)

The table below shows part of the periodic table, including the symbols of some elements.

1																	2
3	4											5	6	7	8	9	$_{10}Ne$
$_{11}Na$	$_{12}Mg$											13	14	15	$_{16}S$	17	$_{18}Ar$
$_{19}K$	$_{20}Ca$	21	22	23	24	25	$_{26}Fe$	27	28	29	30	31	32	33	34	$_{35}Br$	36

Answer the question below using **ONLY** the symbol given.

a. Give the symbols of 2 elements that are the same period.

……

b. Give the symbol of 2 elements that are in the same group.

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……

c. Give the symbol of 2 elements that can show the +3 oxidation state.

……

d. Give the symbol of one element that can show more than one oxidation state.

……

e. Give the symbol of the most reactive elements shown.

……

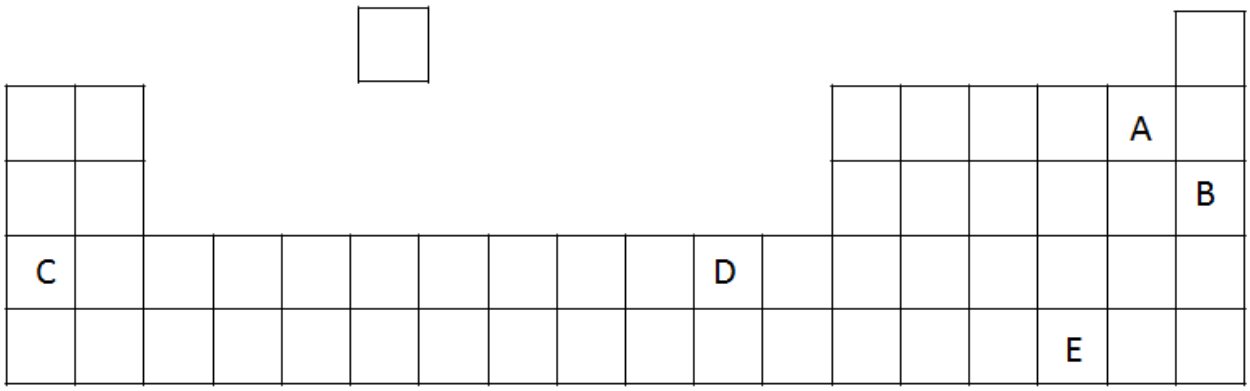
f. What type of bond would be shown between calcium and fluorine?

……

Question 8 (2008)

Questions (i) to (vi) concerns the position of elements, represented by the letters **A** to **E**, in a part of periodic table shown below. The letters in the table **do not** represent

Actual symbols of the elements.



Choose, from A to E, the element which is

(i) An alkali metal

……

(ii) In group 6

……

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(iii) A very unreactive gas

……

(iv) A transition metal

……

(v) A reactive non-metal

……

(vi) A Halogen

……

b) The following table shows atomic and ionic radii of elements A, B and C (not the actual symbols of the elements). Use it to answer the questions that follow.

Elements	Atomic radii (nm)	Ionic radii (nm)
A	0.113	0.096
B	0.085	0.109
C	0.172	0.171

(i) Explain why the atomic radius in A is larger than its ion radius.

……

……

(ii) Explain why element A has a very high melting point.

……

(iii) Which element is the strongest oxidizing agent?

……

c) Elements P and C react to form a white compound that conducts electric current. Explain.

……

……

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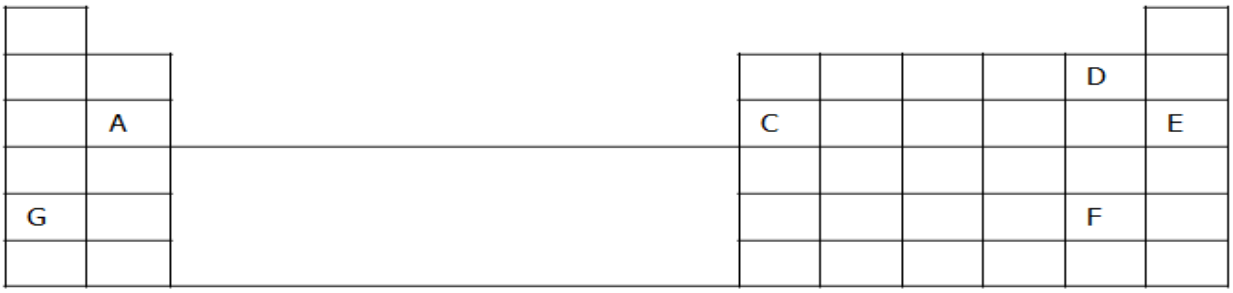
Question 9 (2009)

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



i. Which element belongs to the group of alkaline earth metals?

.....

ii. Which element is a noble gas

.....

iii. Element Q has atomic number 15. Mark its position on the grid.

iv. What is formed when elements D and F react with metals?

.....

v. Explain how the atomic radii of A and C compare.

.....

vi. Write down the formula of the compound formed between G and F.

.....

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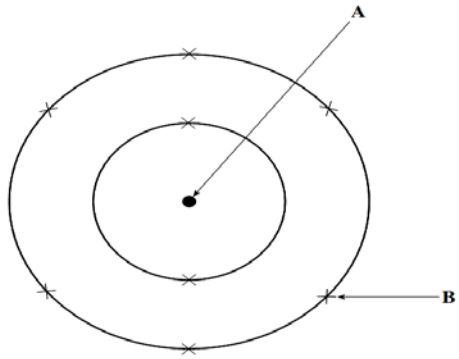
Question 10 (2010)

a) The diagram below shows an atom of oxygen.



Use the words in the box below to complete the structure of an atom.

electron	neutrons	nucleus	protons

i) The centre of the atom, labelled **A** is called .....

ii) The centre of the atom contains ..... and .....

iii) The particle labelled **B** is an .....

b) The chemical formula of sodium sulphate is Na_2SO_4.

i) State how many sulphur atoms are present in the formula, Na_2SO_4.

.....

ii) .Give the TOTAL number of atoms shown in the formula Na_2SO_4. Na_2SO_4

.....

c) Atoms contain particles called protons, neutrons and electrons. The nuclide notation of the sodium atom is shown.

$$^{24}_{11}Na$$

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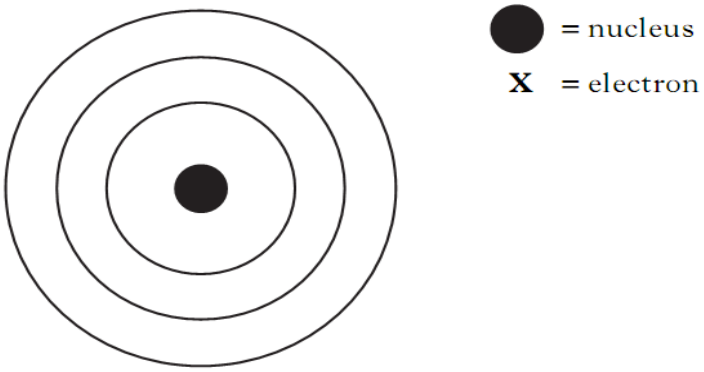
i). Complete the table to show the number of each type of particles in this sodium atom.

Particle	Number
Electron	11
Proton	
Neutron	

ii) Electrons are arranged in energy levels.

a) Complete the diagram to show how the electrons are arranged in a sodium atom.



b) Explain what holds the negatively charged electrons in place around the nucleus.

Question 11 (2010)

Eight particles (atoms or ions) have been listed with their subatomic composition,

Particle	protons	electrons	neutrons
H	11	10	12
I	12	12	12
J	13	13	14
K	14	14	14
L	15	15	16
M	18	18	19
N	17	17	18
O	17	16	20

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Indicate use the letters $H \rightarrow O$

a) Which particles are negative ions.

……

b) Which particle are positive ions

……

c) Which are neutral atoms

……

d) Which are isotopes

……

e) Which will form an amphoteric oxide? Give reason ?

……

f) Which will form an acidic oxide?

……

g) Which will form a basic oxide?

……

h) The electronic configuration of particles I is $1s^2\ 2s^2\ 2p^6\ 3s^2$

i) Write down the electronic configuration of particle **N**

a) in SPDF notation

……

……

B) in boxes notation

……

……

Question 12 (2010)

Atoms of elements **M, N** and **X** have 16, 17 and 19 electrons respectively. Atoms of neon have 18 electrons

a) Determine the formula of the compounds formed by the combination of atoms of The elements

i) M and X ……

ii) N and X ……

iii) M with itself ……

b) In each of the cases shown in a) (i)—(iii) above, Name the type of bond formed?

……

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c) Give two properties you would expect to be shown by the compound formed in (a)

……

……

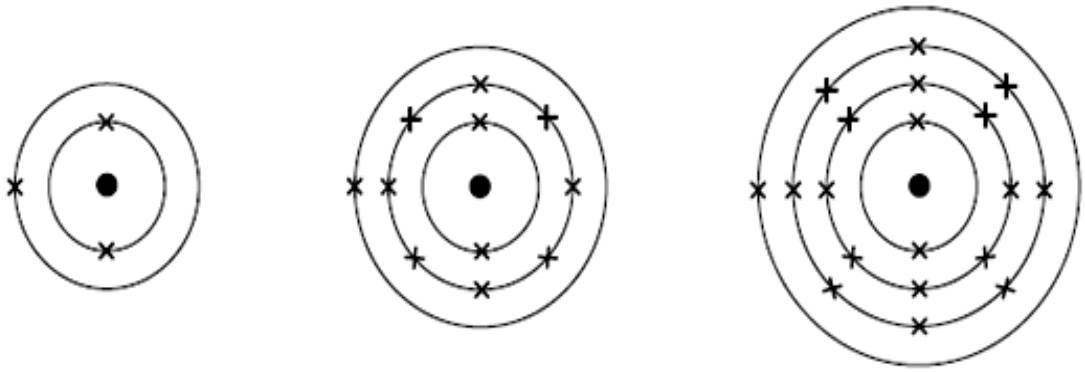
d) Define the term coordinate covalent bond and give one example of it

……

……

Question 13 (2011)

(a) The diagrams below show three different atoms labelled **A**, **B** and **C**.
These letters are **not** chemical symbols.



A **B** **C**

(i) **Use the information in the diagrams above to complete the following sentences.**

I. Atoms **A**, **B** and **C** can be found in Group ..... of the Periodic Table of Elements.

II. The atomic number of atom **A** is .....

III. The electronic structure of atom **B** is .....

IV. Atom **C** can be found in Period .....

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(ii) The box below shows particles found in atoms.

electrons	**neutrons**	**protons**

Choose a particle from the box above to complete the following sentence.

The particles shown in orbits (shells) of atoms **A**, **B** and **C** are called

.....

(b) The chemical formula of carbonic acid is H_2CO_3.

(i) State how many carbon atoms are present in the formula H_2CO_3. .....

(ii) Give the **total** number of atoms shown in the formula. .....

Question 14 (2012)

The table below gives information on four elements represented by letters **K, L, M** and **N** study it and answer the questions that follow:

Element	Electron arrangement	Atomic radius (nm)	Ionic radius (nm)
K	2, 8, 2	0.136	0.o65
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 element M

.....
.....

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c) Which element is a non- metal, explain

……
……

d) Which one of the element is the strongest reducing agent?

……
……

e) Explain why the ionic radius of L is larger than its atomic radius?

……
……
……

Question 15 (2013)

Atoms contain three different types of particles: these are electrons, protons, and neutrons.

A) i) Which one of the three particles has a neutral charge?

……

ii) Which two particles are found in the nucleus of the atom?

……
……

iii) Which one to the particles has a negative charge?

……
……

iv) Which one the three particles has the smallest mass?

……
……

B) Use the word in the box below to complete the sentences below. each made may be used once, more the once or not at all.

Protons	electrons	elements	molecules	neutrons

i) Atoms are neutral because they contain equal numbers of ……+……

ii) Isotopes are atoms with the same numbers of …….. But different numbers of …… in the nucleus.

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C) atoms of magnesium can be represented by the symbol $^{24}_{12}\mathbf{Mg}$
Use the numbers to complete these statements about the atom.
i. the atomic number of this atom is:……
ii. the mass number of this atom is……
iii. the electron configuration of this atom is ……

Question 16 (2013)

The table below gives information about some the halogen elements in group 7 of the periodic table.

elements	Atomic number	Melting point C^0	Boiling point C^0	Atomic radius(nm)	Colour	Electron configuration
Fluorine	9	-220	-188	0.071	Yellow	……
Chlorine	17	-101	-34	0.099	greenish	……
bromine	35	-7	58	0.114	Orange	2, 8, 18, 7
Iodine	53	114	183	0.133	Black	2, 8, 18, 18, 7

a. i) copy and complete the missing spaces in the above table (electronic configuration).

……

ii) Which halogen are gases at room temperature?

……

iii) Which halogen is solid at room temperature?

……

b. which is the most reactive element in group?

……

c. how the atomic radius change down the group?

……

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d. i) when chlorine is bubbled through an aqueous solution of potassium bromide, the solution turns orange. complete the chemical equation for the reaction.

$Cl_2(g)$ + ….KBr(aq) → ……+……..

ii) What is this type of reaction called?

……
……

2.3 extended questions.(2007)

Question 1

1. a) (i) define ionization energy?

……
……

ii) Study the following ionization energy values and answer the questions below.

Ionization	Ionization energy Kj/mol
$Na_{(g)}$ $Na^+_{(g)} + e$	500
$Na^+_{(g)}$ $Na^{2+}_{(g)} + e$	4600
$Na^{2+}_{(g)}$ $Na^{3+}_{(g)} + e$	6900
$Mg_{(g)}$ $Mg^+_{(g)} + e^-$	740
$Mg^+_{(g)}$ $Mg^{2+}_{(g)} + e^-$	1500
$Mg^{2+}_{(g)}$ $Mg^{3+}_{(g)} + e^-$	7700
$Mg^{3+}_{(g)}$ $Mg^{4+}_{(g)} + e^-$	10500

What do the values of energies of ionization suggested about:

(i) The first electron removed from sodium atom.

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……
……

ii) The first two electrons removed from magnesium atom. give a reason for your answer.

……
……

b) The elements magnesium, aluminium and sulphur belong to the same period of the periodic table.

	Magnesium	Aluminium	Sulphur
Atomic number	12	13	14
Atomic radius	0.134	0.102	0.089
Ionic radius	0.099	0.075	0.113

i) Why the atomic radius of magnesium greater than of aluminum?

……
……

ii) Why is the ionic radius of sulphur is greater than that of its atomic radius?

……
……

iii) The melting point of aluminium is greater than that of magnesium. Explain why?

……
……

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UNIT THREE:

CHEMICAL BONDING AND STRUCTURES.

3.1. Multiple choice questions

1. Which substance does not have the correct formula?(2005)
   A) Iron (II) sulphate $Fe_2(SO_4)_3$.
   B) Iron (I) oxide Fe_2O.
   C) Copper (I) sulphate Cu_2SO_4.
   D) copper(II) nitrate $Cu(NO_3)_2$
2. Which compound contains both covalent and ionic bonds? (2005)
   A) sodium carbonate Na_2CO_3
   B) Magnesium bromide. $MgBr_2$
   C) Dichloroethane. CH_2Cl_2
   D) Ethanoic acid. CH_3COOH
3. which pair of elements is most likely to form covalent bonds/(2005)
   A) Li and Cl
   B) P and O.
   C) Ca and S.
   D) Zn and Br.

4. Which of the following molecules is ionic?
   A) C_3H_8
   B) HBr
   C) $NaNO_3$
   D) SiO_3
5. What type of bond occurs when there is sharing of a pair of electrons? (2009)
   A) Ionic bond
   B) Metallic bond
   C) Hydrogen bond
   D) Covalent bond

6. An ionic bond is always formed with some covalent character, when (2009)

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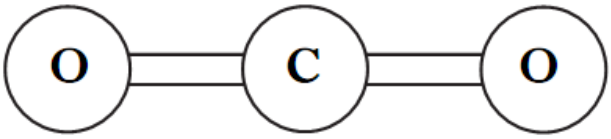
A) the electrons are not equally shared

B) there is a degree of electron transfer

C) the electron transfer is complete

D) there is a degree of electron sharing

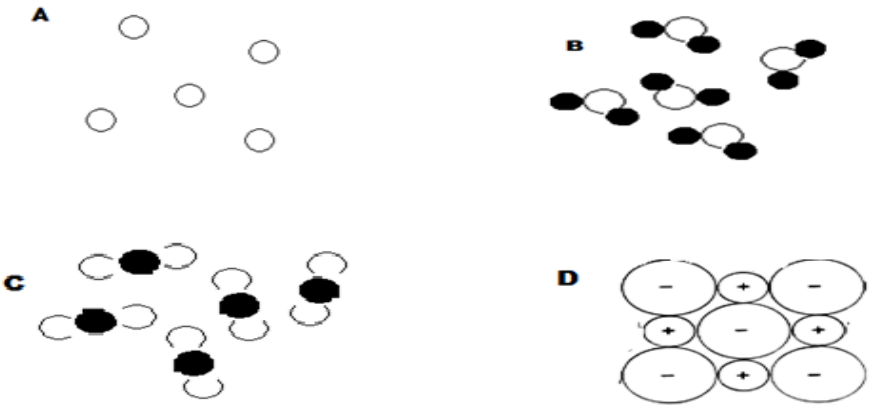
7. The diagram below shows a molecule of carbon dioxide. (2010)



Which line in the table is correct for this molecule?

	Particles joined together in the molecule	Strength of bonds inside the molecule
A	Atoms	Weak
B	Atoms	Strong
C	Ions	Weak
D	Ions	Strong

8. The structures of four substances can be represented by models. Which of the following models show an element? (2011)



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9. What is the total numbers of electrons shared in a double covalent bond? (2011)
   A) 1
   B) 2
   C) 3
   D) 4

10. Which of the following possesses a polar covalent bond? (2011)
   A) NaCl.
   B) O_2.
   C) HCl
   D) CH_4.

11. Hydrogen bond is a type of (2011)
   A) Strong covalent bond.
   B) Weak ionic bond.
   C) Strong intermolecular force
   D) Weak intermolecular force.

12. The number of valence shell electrons for nitrogen is (2012)
   A) 3
   B) 4
   C) 5
   D) 2

13. Which of the following properties is NOT common to both diamond and graphite?(2012)
   A) They are allotropes of carbon
   B) The bonding is covalent
   C) They are good conductors of electricity
   D) They do not react with strong acids

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3.2. Structured questions

Question one (2002)

Look at the table below. Use the information to answer the questions that follow the table:

Substance	Electrical conductivity			Melting point (°C)	Boiling point (°C)
	Solid	molten	In water		
T	good	good	Does not dissolve	1540	2760
U	poor	poor	Does not dissolve	115	444
V	good	good	Fizzes and the solution formed conducts	98	890
W	poor	poor	poor	0	100
X	poor	good	good	808	1465
Y	poor	poor	good	-114	-85

a) Choose one substance which at room temperature (20°C)?

i. A solid.....

ii. A liquid.....

iii. A gas.....

b)

i. Which substance is an ionic compound?

.....

ii. Give a reason for your choice.

.....

.....

.....

c)

i. Which two substances could be metals?

.....

ii. Explain the reason for your choice?

.....

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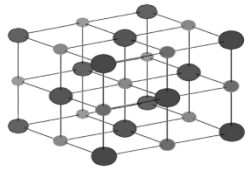
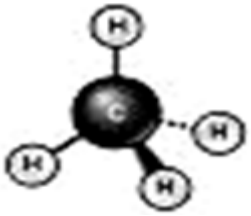
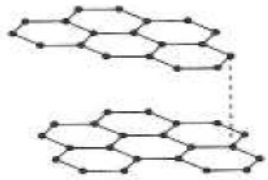
QUESTION TWO(2011)

The table below shows some properties of five substances each substance. Each substance is represented by a model of its structure. The models are not to scale.(2011)

Model of structure	Melting point/C^0	Boiling point/C^0	Electrical conductivity
	801	1413	Good when dissolved or molten
	-182	-161	Poor
	3550	4827	Poor
	Between 3652-3697	4200	Good
	0	100	poor

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Use the information in the table above to answer this question. Each name may be used once, more than once or not at all.

Give the name of the substance which:

I. Has the lowest melting point?

……

II. Is made up of ions?

……

III. Is an element?

……

IV. Is soluble in water?

……

V. The chemical formula for water is H_2O. Give the chemical formula of methane.

……

UNIT FOUR

ELECTROLYSIS AND ITS APPLICATION.

4.1. Multiple choice questions

1. Which of the following statements is true about oxidation? (2013)
   A) is gain of electrons
   B) loss of oxygen
   C) gain of hydrogen
   D) Loss of electrons.
2. one metal that is purified on a large scale by electrolysis is: (2013)
   A) iron
   B) gold
   C) copper
   D) Platinum.

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3. the oxidation number of nitrogen in HNO_3 is: (2013)
   A) 2
   B) 5
   C) 3
   D) 4
4. Aluminium is in group III of the periodic table. How many moles of aluminium would be formed by the passage of 9650 coulombs of electricity through molten aluminium Oxide? (2012)
   A) 0.003
   B) 0.03
   C) 0.3
   D) 3.0
5. Which of the following are the ions in a sodium sulphate solution? (2010)
   A) Na^{2+}, SO_4^{2-}, H^+, OH^-
   B) Na^+, SO_4^{2-}, H^+, HO^-
   C) NA^+, SO_4, H^+, O^{2-}
   D) Na^+, SO_4^{2-}, H^+, O^{2-}

6. The oxidation numbers of nitrogen in NH_3, HNO_3 and NO_2 are respectively (2007)
   A) -3, -5, +4
   B) -3, +5, -4
   C) +3, +5, +4
   D) -3, +5, +4

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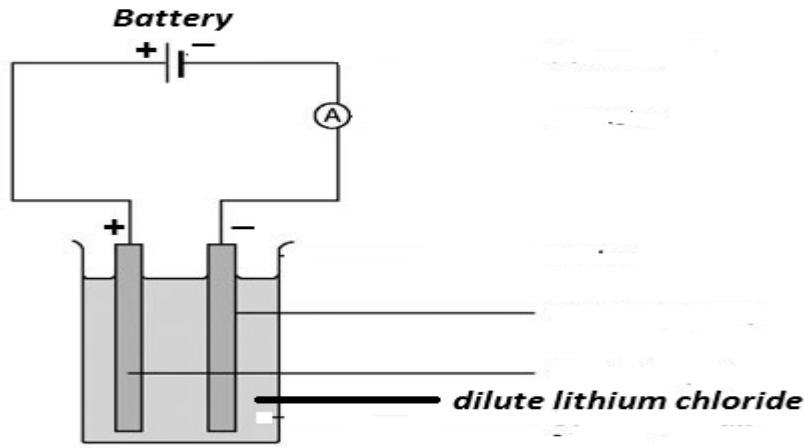
7. an electric current is passed through concentrated sodium chloride solution(brine) using inert electrodes, which gases are obtained at each electrode: (2004)

Negative electrode	Positive electrode
A) hydrogen	oxygen
B) hydrogen	Chlorine
C) sodium	chlorine
D) sodium	oxygen

4.2. Structured questions

Question 1.(2002)

The diagram below shows the electrolysis of a dilute solution of lithium chloride(2002)



a) On the diagram, label the anode and the cathode.

……
……

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b) Write the symbols of all the ions present in the solution.

……
……

c) Write a half equation for the reaction at each electrode.

……
……
……
……
……

d) At which electrode does oxidation takes place? Explain your answer

……
……
……

e) If a concentrated solution of lithium chloride is used instead of s dilute solution, what will the product at the anode? Explain your answer.

……
……
……
……

i. Equation for the reaction at the anode.

---

ii. Equation for the reaction at the cathode.

f. at which electrode does oxidation takes place? Explain your answer?

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g. if ac concentrated solution of lithium chloride is used instead of a dilute solution, what will e the product at anode? Explain your answer?

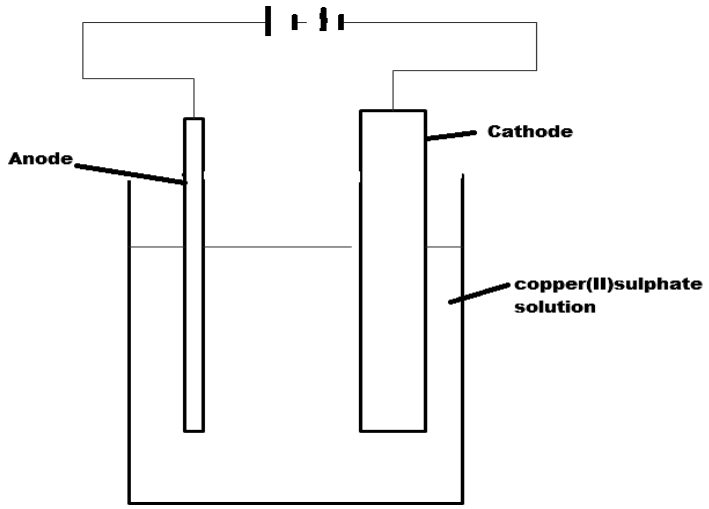
Product_____

Explanation_____
_____
_____

Question 2(2003)

This question is about how copper is purified

(a) The following diagram shows the purification of copper by electrolysis



(i) Name the particles that carry the electric current through the copper (II) sulphate solution.

……

i. Explain why no electric current would flow if the copper sulphate was present as a solid and not in aqueous solution.

……

ii. What changes would you see at the electrodes during electrolysis?

At the anode (positive electrode)……
……

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iii. complete the ionic equations for the reaction at each electrode

Anode Cu ……. +2e

Cathode Cu + ……. Cu

b. a current of 8 A was passed through the electrolyte for 15 minutes

(i) What was the total charge passed coulombs?
……
……

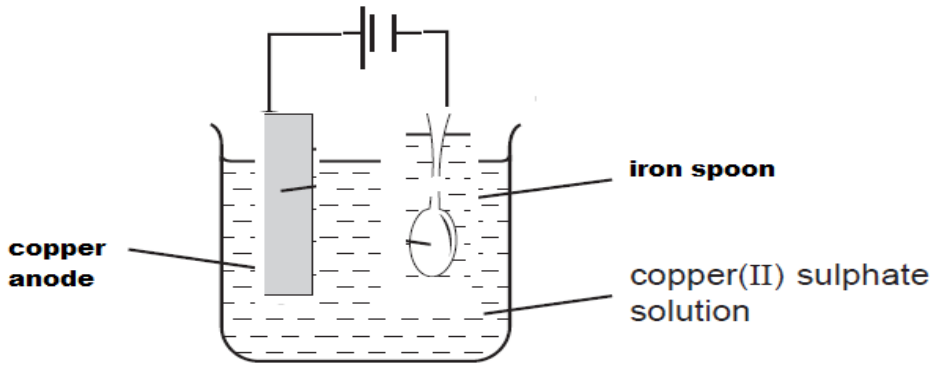
(ii) What mass of copper in grams, was deposited at the cathode?
(one mole of copper is deposited by a charge of 193 000)

……
……
……
……

b. (ii) draw the display formula of one possible product and give the Systematic name

Question 3.(2007)

a. The diagram below show is an arrangement that was used to copperplate a spoon. Study the diagram and use it to answer the questions below:



(i) What is observed at the electrodes?
……
……
……

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(ii) Explain the observation.

……
……
……

(iii) Show the direction of electron movement on the diagram

(iv) What would be the observation if a carbon anode were to be used?

……
……
……
……

b. State what you understand by the terms

(i) Electrolyte……

……

(ii) Inert electrode……

……

c. Explain why solid sodium chloride is a non – conductor or electricity, whereas molten sodium chloride and sodium chloride solution are conductors of electricity.

……
……

Question 4(2008)

a) Define the following terms:

(i) Electrolyte

……
……
……

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(ii) Cathode

……

……

(iii) Anode

……

……

b) Electroplating is an important industrial process.

(i) State what is meant by electroplating.

……

……

(ii) Give two reasons for electroplating.

……

……

(Iii) State what happens at the anode during electroplating.

……

……

……

c) Calculate the mass of copper deposited when a current of 4.0 A was passed through a solution of copper sulphate for 30 minutes (Cu = 64, 1F = 96500 C)

……

……

……

……

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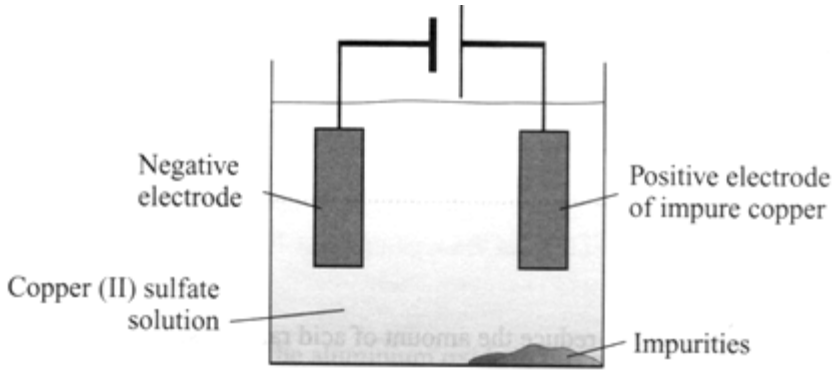
Question 5

a) Copper can be purified using electricity as follows;



i. By what process is copper normally extracted from its ore? (1 mark)

……

ii. What is the name given to the electrical process by which copper is purified? (1mark)

……

iii. State two other applications of the process in (ii) above. (2 marks)

iv. Give one advantage of using purified copper instead of impure copper. (1mark)

……

b) Magnesium sulphate solution was electrolyzed using platinum electrodes. Give the products at the cathode and anode. (2 marks)

……
……

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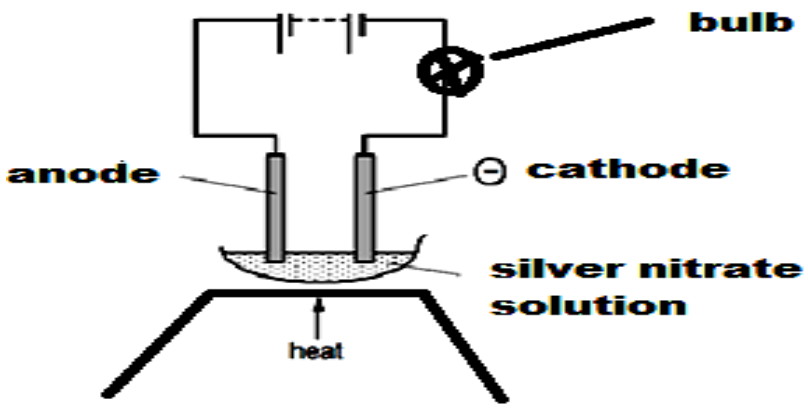
Question 6(2013)

1) The diagram below shows the electrolysis of silver nitrate solution using inert electrodes.



a. i) state the ions present in silver nitrate solution.

……
……

ii) Which ions will migrate to the negative electrode?

……
……

iii) Which ions will migrate to the positive electrode?

……
……

b. i) what term is used for the negative electrode.

……

ii) What term used for the positive electrode.

c. i) identify the substance formed at both electrodes.
-Ve electrode……
+Ve electrode……

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ii) Which electrodes does oxidation takes place?

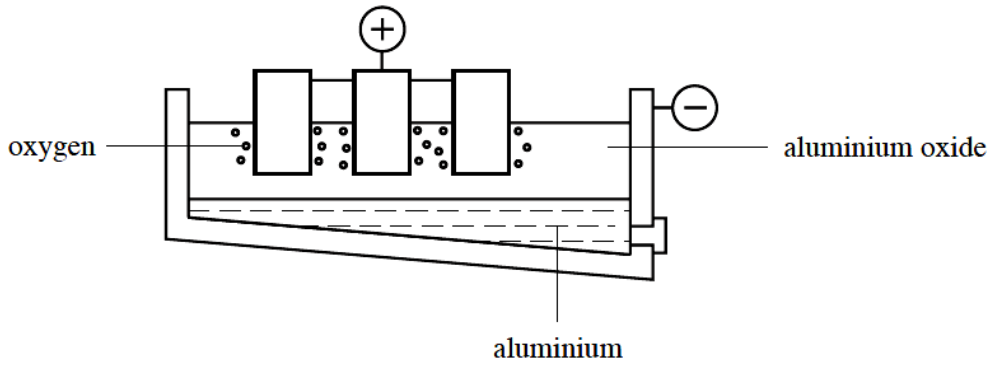
……

……

Question 7(2012)

Question 7

(i) The diagram below shows the industrial extraction of aluminium from molten aluminium oxide.



anode	**aluminium**	**aluminium oxide**	**bauxite**	**oxygen**
electricity	**electrolysis**	**cathode**	**reduction**	

Use the information in the box above to answer the following questions.

Give the name of the

I. process used to break down a compound using an electric current,

……

II. electrolyte used in the process,

……

III. term used for the removal of oxygen from a metal oxide,

IV. product formed at the anode,

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(ii) Some properties and uses of aluminium are given below.
Draw a line from each property to the box with a use which relies on this property.
One line has been drawn for you.

Property	Use
low density	overhead power cables
thermal conductor	aircraft
corrosion resistant	saucepans
electrical conductor	greenhouse frames

UNIT FIVE.

ACIDS, BASES AND SALTS.

5.1. Multiple choice questions

1. Which of the following statements is not true for both dilute hydrochloric acid and dilute sulphuric acid (2002)
   A) Both react with magnesium
   B) Both have pH of less than 7
   C) Both conduct electricity
   D) Both have a concentration of H^+ ions in solution equal to the concentration of OH^- ions in solution

2. Which of the following is property of all acids? (2003)

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A) Turns red litmus blue
B) Reacts with a salt to form abase
C) Reacts with an ammonium salt to produce ammonia gas
D) Reacts with a carbonates to produce carbon dioxide

3. Sodium hydroxide is neutralized by sulphuric acid according to the following equation

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

What volume of sulphuric acid of concentration 0.2 mol/dm is needed to Neutralize $20cm^3$ of sodium hydroxide solution of concentration 0.1mol/dm

A. 5cm B. 10cm C. 20cm D. 40cm

4. $AgNO_3(aq) + KI(aq) \rightarrow AgI(s) + KNO_3(aq)$ (2004)
The above equation represents a reaction which could be classified as:
A) acid-base
B) decomposition
C) precipitation
D) Neutralization

5. Which of the following is not a property of a base? (2004)
A) Soapy to touch
B) Their solutions turn litmus red.
C) they have a PH greater than 7
D) They react with acids to form salt and water.

6. the PH of a weak alkali is between: (2006)

A) 0 and 4
B) 7 and 10.
C) 4 and 7.
D) 11 and 14.

7. $Ba(OH)_2(aq) + H_2SO_{4(aq)} \longrightarrow BaSO_{4(aq)} + 2H_2O_{(l)}$. the equation represents a reaction which could be classified as: (2007)
A) Acid – base B) neutralization
C) precipitation *D)* synthesis

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8. An acid reacts with alkali to give (2008)
   A) hydrogen and water
   B) hydrogen and a salt
   C) a salt only
   D) salt and water
9. Hydrogen gas is evolved when an acid reacts with (2008)
   A) another acid.
   B) an alkali.
   C) a non-metal.
   D) a metal.
10. What are the products of the following reaction? (2009)

    $NaOH_{(aq)} + HNO_{3\,(aq)}$

    A) Salt and water.
    B) Hydrogen and salt.
    C) Water only.
    D) Hydrogen, water and salt.
11. Which of the following INCREASES when hydrochloric acid is diluted with water?(2010)
    A) Rate of reaction with magnesium
    B) Concentration of H^+ ions
    C) Electrical conductivity
    D) pH
12. Neutral solutions have a pH of (2010)
    A. 2 B. 7 C. 0 D. 14
13. A solution of PH 8 is (2011)
    A) Slightly basic
    B) Slightly acidic.
    C) Strongly basic

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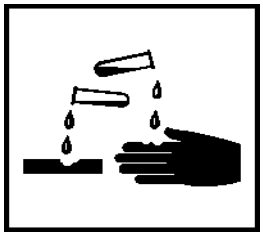
D) Strongly acidic

14. Which of the following hazard symbols below would you expect to see on a bottle of concentrated sulphuric acid in the laboratory?(2011)



A. B. C. D

15. A word equation is shown below.(2012)

Hydrochloric acid + Magnesium →magnesium chloride + hydrogen

What is the symbol equation for the reaction?

A) HCl (aq) + Mg (s) → $MgCl_2$ (aq) + H (g)
B) HCl (aq) + Mg (s) → $MgCl_2$ (s) + H_2 (g)
C) HCl (aq) + Mg (s) → $MgCl_2$ (aq) + H_2 (g)
D) HCl (aq) + Mg (s) → $MgCl_2$ (s) + H_2 (g)

16. The following table shows the preferred as soil pH conditions for different vegetables. Which vegetable grows over the largest pH range?(2012)

vegetable	Soil pH
A	4.5 - 6.0
B	5.5 – 6.5
C	5.5 – 7.5
D	6.0 – 7.5

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17. which of the following is NOT characteristics of an acid: (2013)
    A) an acid changes the colour of indicator:
    B) an acid has bitter taste
    C) An acid ionizes in water.
    D) An acid produces hydrogen ions.

5.2 Structured questions.

Question 1.

This question is about acids and base

a)
   i. Give a definition of an acid ----------

   ---
   ii. Give a definition of base.----------

Question 2 (2004)

The diagram below shows some of dilute sulphuric acid. Use it to answer the questions that flow:

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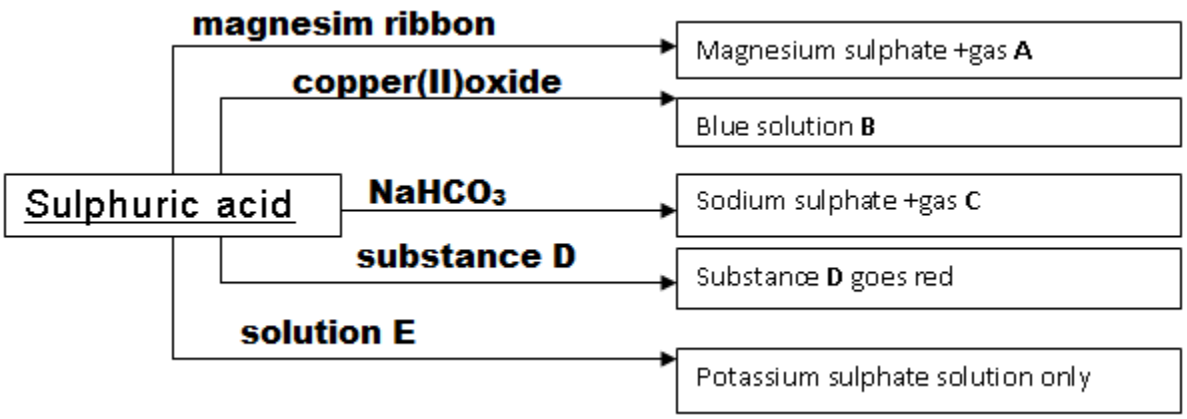

a) Name or give the formula of each of the following:

i) Gas **A**.

---

ii) Solution **B**.

---

iii) Gas **C.**

---

iv) Substance **D**.

---

v) Solution **E**.

---

b) How would you test for

i) Gas A

……

……

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ii) Gas C?

……
……

c) Complete the word equations

i) Iron + hydrochloric acid → ……+……

ii) Sodium hydroxide +nitric acid → ……+……

iii) Magnesium carbonate + hydrochloric acid→ ……+……

Question 3(2005)

a. Jama tested some solutions with universal indicator paper. he wrote down their PHs.

But he for get to write the names of the solutions. can you help him by matching the PHs to the correct solutions. 1, 5, 7, 14.

Solutions tested	PH
Distilled water	
Sulphuric acid	
Sodium hydroxide	
Vinegar	

b. Oxides are classified as **acidic, amphoteric** or **basic.** Copy and classify the following.
Magnesium oxide……
Aluminum oxide……
Silicon (IV) oxide……

a) Name a reagent that reacts with an amphoteric oxide but not a basic one.

……

b) Name a reagent that reacts with an basic oxide and with an amphoteric oxide.

……
……

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Question 4(2007)

Five solutions were tested using a universal indicator. their PH values were recorded as below:

Solution	PH
P	**13.0**
Q	**1.0**
R	**6.0**
S	**7.0**
T	**12.0**
U	**8.0**

a. Which solution is
   (i) the most acidic?.....
   (ii) the most basic?.....
   (iii) Likely to be distilled water?.....
   (iv) Likely to be ethanoic acid?.....
   (v) Likely to be ammonia solution?.....
   (Vi) Likely to be a toothpaste?.....

b. Explain why it is not advisable to use **R** when a patient has indigestion?
   .....
   .....
   .....

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c. The following properties describe acids and bases. Show which property describes an acid which describes a base.

Number	Property	Write Base or Acid
1	Have pH of less than 7	
2	Have a bitter taste	
3	Contain H^+ ions when dissociated with water	
4	Have a pH greater than 7	
5	React with carbonate and hydrogen carbonate to produce carbon dioxide	
6	When dissociated in water produces hydroxide ions	

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Question 5(2009)

Solutions A, B, C and D have the pH values, shown in the table below.

Solutions	A	B	C	D
PH	3	7	6	13

a) Which solution is likely to be;

i. Rain water collected from an industrial area. (1 mark)

…….

ii. Potassium chloride solution. (1 mark)

…….

b) Identify the solution which, when concentrated, should not be heated in glass tube. (1 mark)

……

c) A few drops of a solution of potassium iodide were added to a solution of lead nitrate.

State the observation made. (1 mark)

……

……

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d) The equilibrium reaction of phenolphthalein indictor in water may be represented as:

$$HPh_{(aq)} + H_2O_{(l)} \longrightarrow H_3O^+_{(aq)} + Ph^-_{(aq)}$$

(Colourless) (Red)

State what happens to the equilibrium position when:

(i) Excess acid is added. (1.5 marks)

……

(ii) Excess base is added. (1.5 marks)

……
……

Question 6(2010)

Complete the table which covers the different methods of preparing salts

Method of preparation	**Name of salts prepared**	**Two substrates used in preparation**
acid + alkali	Sodium sulphate	…… and ……
Acid + metal	……	……and hydrochloric acid
Acid + insoluble base	Copper (II) sulphate	……and……
Acid + carbonate	Magnesium	……and……
Precipitate	Barium sulphate	……and……

b) Write word equation and balanced equation for the equations, in the above table.

i) Acid + insoluble base

……

……

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ii) Acid + carbonate

……

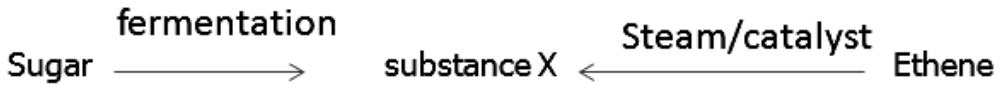
……

UNIT SIX

ORGANIC CHEMISTRY.

6.1. Multiple choice questions

1. The diagram below shows two ways of preparing substance X (2003)



Substance **X**

A. Carbon dioxide B. Ethanol
C. glucose D. methane

2. Which of the following molecules are produced when ethene (C_2H_4) is hydrated with concentrated sulphuric acid. (2004)
   A) C_2H_6
   B) C_2H_5OH
   C) CH_4
   D) CO_2
3. Which of the following compounds in an ester? (2005)
   A) CH_3COOH.
   B) $C_2H_5CH_3$.
   C) $CH_3OC_2H_5$.
   D) $HCOOCH_3$
4. How many different isomers of pentane exist? (2005)
   A) 1
   B) 2
   C) 3
   D) 4

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5. Organic molecules with the same molecular formula but different structural formulas are called. (2006)
   A) allotropes
   B) isomers
   C) isotopes
   D) polymers
6. The diagram shows two ways of obtaining a substance X. (2007)

$$\textit{Sugar} \xrightarrow{\textit{fermentation}} X \xleftarrow{\textit{steam}} \textit{Ethene}$$ **identify X,**

A) Carbon
B) carbon dioxide
C) Ethane
D) Ethanol

7. . Which one of the following is not a hydrocarbon? (2008)
   A) Methane
   B) Ethane
   C) Ethanol
   D) Ethyl
8. Hydrocarbon compounds burn in oxygen to give:
   A) water and carbon dioxide
   B) water only
   C) hydrogen and carbon dioxide
   D) hydrogen only
9. Which one of the following is a secondary alcohol? (2008)
   A) 3 – 3 – Dimethyl butanol
   B) Butanol
   C) 2 – Methylpropan – 2 – ol
   D) Pentan – 2 – ol
10. . Which of the following is **NOT** a natural polymer*?* (2009)
   A) Protein
   B) Cellulose
   C) Rubber

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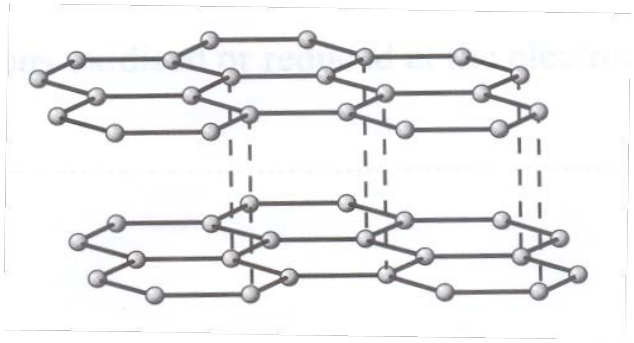
D) Nylon

11. The diagram below shows one of the main allotropes of carbon. Identify it. (2009)



A) Graphite

B) Diamond

C) Sulphur

D) Copper

12. Methane (CH_4) gas diffuses through air because the molecules are (2010)

A) moving randomly
B) dissolving quickly
C) traveling slowly
D) expanding steadily

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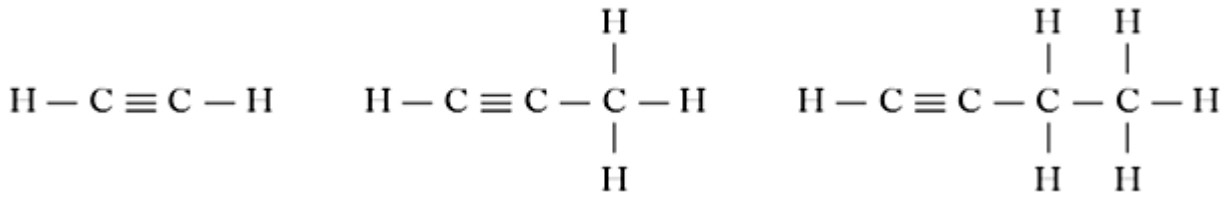
13. The first three members of the alkyne homologous series are: (2010)



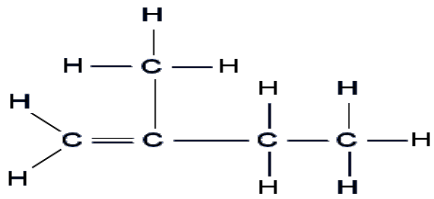
What is the general formula of for this homologous series?

A	C_nH_n
B	C_nH_{n+1}
C	C_nH_{n+2}
D	C_nH_{2n-2}

14. The number of isomers having the molecular formula (C_4H_{10}) is (2010)

A. 1 B. 2 C. 3 D. 4

15. Given the formula representing a hydrocarbon. (2011)



The molecular formula and the empirical formula for this hydrocarbon is:

A) C_5H_{10} and CH_2
B) C_5H_{10} and CH_3
C) C_4H_{10} and CH_3
D) C_4H_8 and CH_3

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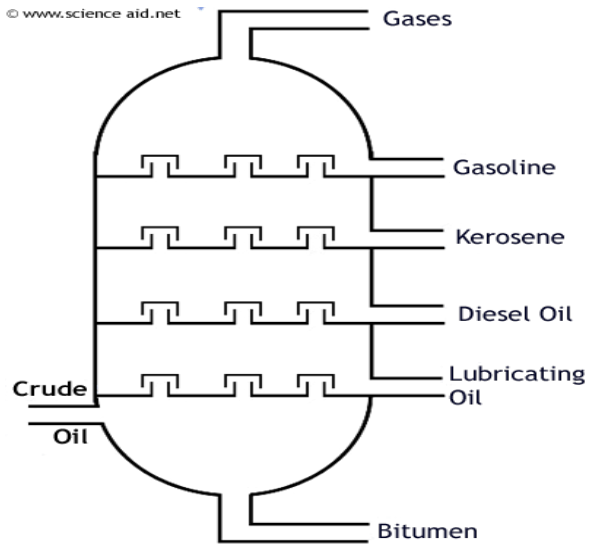
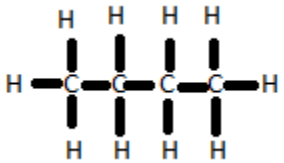
16. Gasoline is produced by the fractional distillation of crude oil. It has a low viscosity.



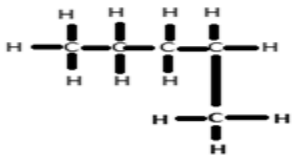
Which of the following properties also applies to gasoline.

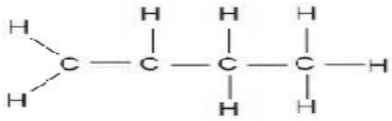
A) High boiling point and high flammability.
B) Low boiling point and high flammability.
C) High boiling point and low flammability.
D) Low boiling point and low flammability.

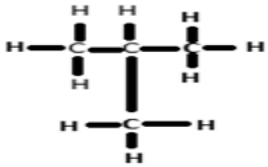
17. Butane has the structure shown. (2012)

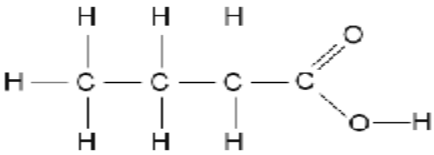


Which compound is an isomer of butane?

A 

B 

C 

D 

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18. One general characteristics of a homologous series is that the compounds all have the same: (2012)

A) Molecular formula
B) Empirical formula
C) Structural formula
D) General formula

19. The general formula for alcohols is (2013)

A) C_nH_{2n}
B) C_nH_{2n+1}
C) $C_nH_{2n+1}OH$
D) C_nH_{2n-2}

20. the most common reaction that alkenes undergo is: (2013)

A) Elimination.
B) Substitution.
C) addition
D) Decomposition.

21. Octane is typical alkane. Which two words complete these statements correctly?

Octane is generally .....(1) (2013)
Octane.....(2) be used as a fuel

	1	2
A	unreactive	Can not
B	unreactive	Can
C	reactive	Can not
D	reactive	Can

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6.2 structured questions.

Questions 1 (2002)

The hydrocarbons methane, ethane and propane are members of the same homologous series.

a)

i. Explain what is meant by the term 'hydrocarbon'

……
……
……

ii. Name a raw material rich in hydrocarbons

……
……

b)

i. State two general properties of any homologous series.

……
……

ii. Name the homologous series that methane, ethane and propane belongs.

……
……

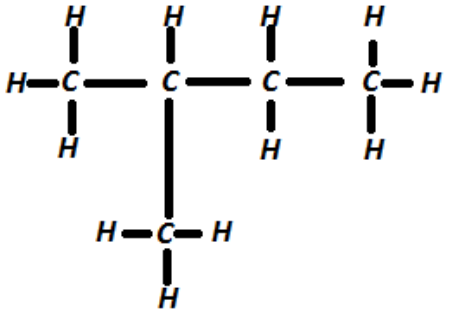
c) Write the structural formula of the following

i. Ethene

ii. Octane

d) Name the following compounds

i.



Name ……

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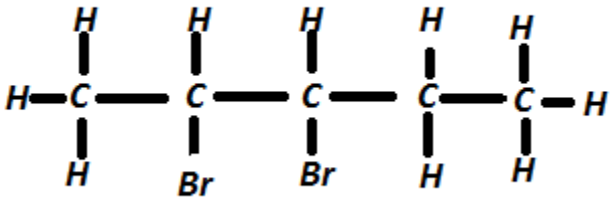
ii.



Name ……

a) Explain why it is possible to distinguish between ethane and ethene using bromine water?

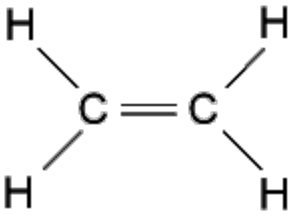
……
……
……

a) i) hydrocarbon means compounds that contain only carbon and hydrogen,
ii) Crude oil.
b) i) homologous series have these properties in common,

- They have the same general formula.
- Same functional group.
- Undergo gradual physical and chemical changes.

ii) Alkanes.

c) i)



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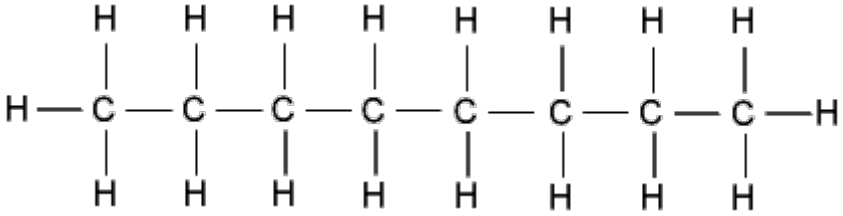

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d) i) 2-methyl butane.
ii) 2,3- dimethyl pentane

e) Bromine water is used to test the presence of the double and triple bonds.
It decolorizes with the double or triple bonds but it will remain orange when added to a saturated hydrocarbons.

Question 2 (2003)

Ethanoic acids is a carboxylic acid and has the structural formula CH_3COOH

(a) Give the name and the structural formula of carboxylic acid that has Three carbon atoms in its molecule.

(i) Name ……..

(ii) Structural formula ……

(b) Write an equation to show how ethanoic acid dissociates with water.
……

(c) Explain why ethanoic acid described as a week acid where as Hydrochloric acid is strong acid.

……
……..
……
……..
……

(d) Ethanoic acid reacts with methanol to form a ester.

(i) What conditions are necessary for this reaction to occur?

……
……..
(ii) Suggest how the ester might be separated from any unreacted ethanoic acid
……
……

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(iii) What observations would indicate that an ester had been formed?

……

(iv) Give the systematic name of this ester?

……

(v) Write the formula of this ester?

……

Question 3 (2004)

Alcohols are members of homologous series.

a. i) State three characteristics of homologous series?

……

……

……

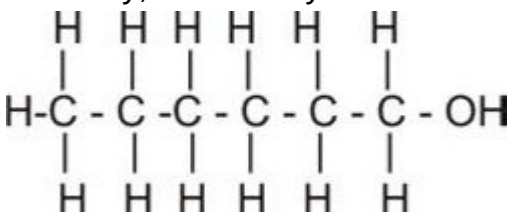
ii) Write down the general formula of alcohols?

……

……

iii) Name the following compounds and then decide whether they are primary, secondary, and tertiary alcohols.

1.



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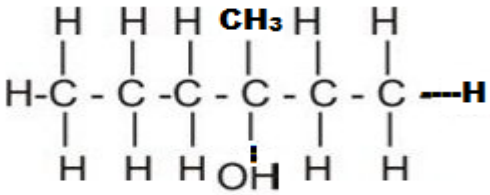
2.



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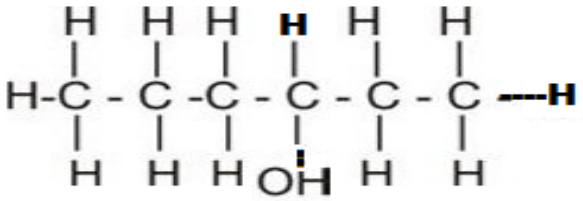
3.



……

b). write an equation for the combustion of

i) Ethanol

……

ii) Methane

……

c) i) What is the name given to the process by which grape juice is turned into vinegar?

……

ii) What is added to the grape juice for the process to occur?

……

Question 4(2005)

Alkanes can be converted into substances which are used as solvents. Alkanes can react with halogens such as chlorine in the presence of ultraviolet light.

a. write a balanced equation for the reaction between methane and chlorine?

……

ii. Name the type of the reaction above.

……

iii. Highly reactive chlorine atoms are produced in the presence of the ultraviolet light. What are they called?……

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b. explains why decane does not react with bromine water?

……
……

c. i) alkanes burn in excess air producing two substances. Name the two substances formed by this reaction?

……
……

ii. Explain the meaning of the following terms

Homologous series……

Saturated hydrocarbon……

Question 5(2005)

.1-dichloroethene $CCl_2=CH_2$. Readily undergoes additional polymerization.

a) i) what does the term additional polymerization mean?

……

ii) What is the systematic name of this polymer?

……

iii) Name the main two types of polymerization?

……
……

b) For each of the following compounds say whether you would expect them to show geometric (Cis- trans) isomerism.

i)

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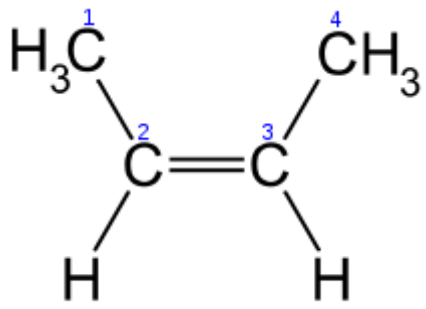

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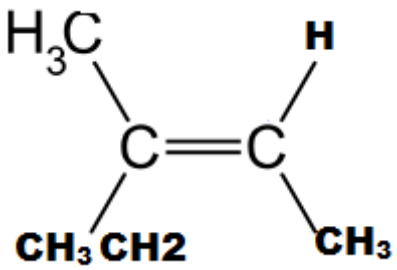
ii) . 

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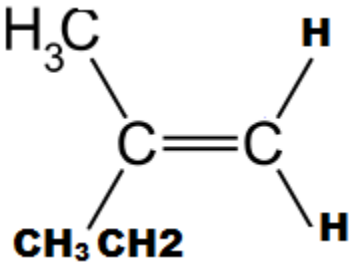
iii) 

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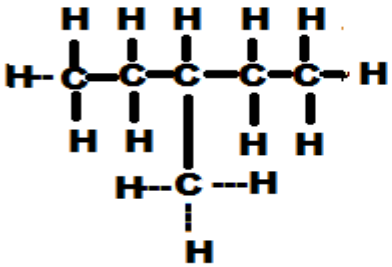
Question 6(2006)

a. Draw the displayed structure of hexane.

b. name the two isomers of hexane given below

A



A……

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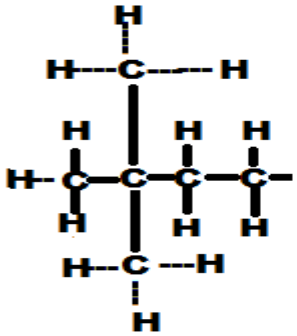
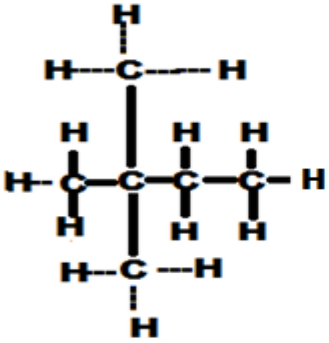
B



B .....

B



B 2,2 di-methyl butane

c. Complete the table below for each of the given hydrocarbons.

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Compound	ethane	ethene	ethyne
Homologous series	Alkane		
Molecular formula			
Structural formula			
Type of covalent bonding		Single and double	
Is the carbon bond to carbon bonding saturated or unsaturated	Saturated		unsaturated

d. the following reaction show the first stage on the formation of a polyester in which an alcohol and a carboxylic acid group combine to form an ester with the loss of water.

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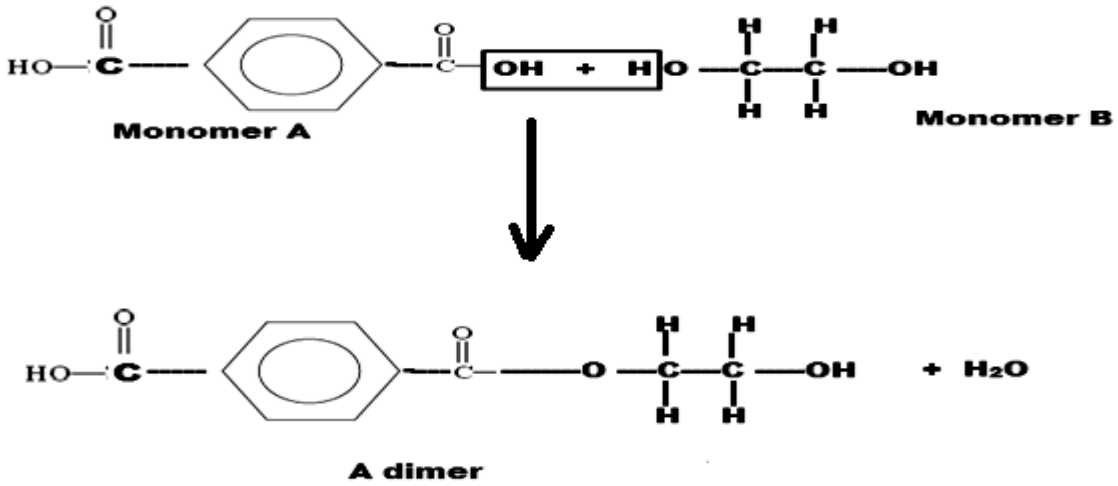

i) Which monomer is the alcohol?(A or B).

……

ii) Which monomer is the carboxylic acid(A or B).

……

iii) What is the repeating unit of the resulting polymer?

……

iv) What type of polymerization is taking place?

……

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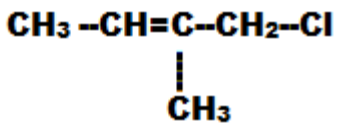
Question 7(2007)

a. Name the organic compounds whose structural formulas are given below:

i) 

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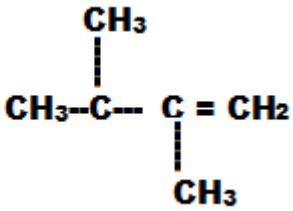
ii) 

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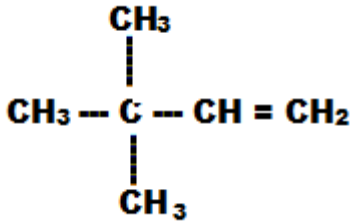
iii) 

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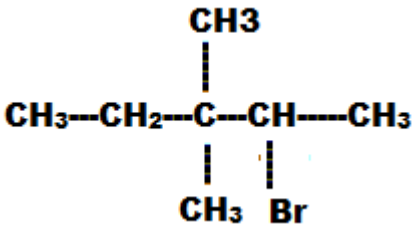
iv) 

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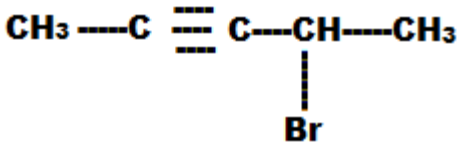
v) 

---

a. Propene and chlorine react as shown below:

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$CH_3CH_2CH_3 + Cl_2 \longrightarrow CH_3CH_2CH_2Cl + HCl$

i) What type of reaction is this?

……

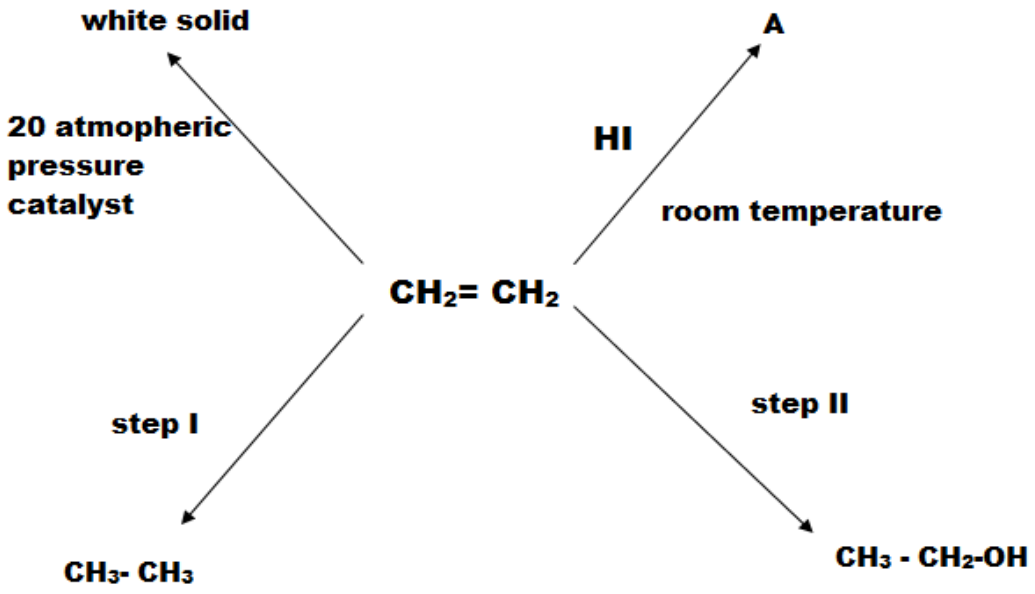
……

ii) State the conditions under which this reaction takes place.

……

……

iii) The scheme below shows some reactions starting with ethene. Study it and answer that follow.



a) Name product A.

……(1mark)

b) State the conditions and write the chemical equations in Step I and Step II.

……

……

……

……

……

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c) Name the white solid.

……(1mark)

Question 8.(2007)

The list below gives the formula of some organic compounds. Use it to answer the questions that follow.

i) $CH_3\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}OH$

ii) $CH_3\text{-}CH_2\text{-}CH_3$

iii) $CH_3\text{-}CH_2\text{—}COOH$

iv) $CH_3\text{-}\ CH_2\text{-}CH{=}CH_2$

V) $CH_3\text{-}CH_2\text{-}CH_2\text{-}CH_3$

a) Select two compounds that:

i) Are not hydrocarbons.

---

ii) Belong to the same homologous series.

……

b) Identify the compound that is likely to undergo polymerization. Give a reason for your answer.

……
……

c) Under certain conditions ethanoic acid and ethanol reacts to form a sweet smelling compound.

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i) What is the general name of the compounds to which the sweet smelling compounds belong?

……
……

ii) Write the formula of the sweet smelling compound?

……
……

Question 9(2008)

The table below shows the formula of some organic compounds and their boiling points.

Compound	Boiling point (K)
C_3H_6	225
C_4H_8	266
C_6H_{12}	336

(i) State the homologous series of which the compounds belong.

……

(ii) Give the molecular formula of the first member of the homologous series.

……
……

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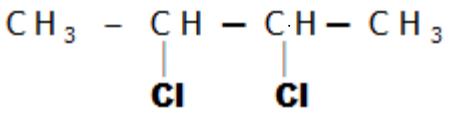
(iii) What would be observed if a few drops of acidified potassium manganate (VII) are added to C_3H_6?

.....

.....

b) Compound **P** reacted with chlorine to form compound **Q**. The structural formula of compound **Q** is shown below:



i) Name and give the structural formula of compound P.

.....

.....

.....

.....

.....

.....

ii) Give the name of compound Q.

.....

.....

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Question 10(2009)

Alkenes are an important series of hydrocarbons

a) Write the general formula of alkenes

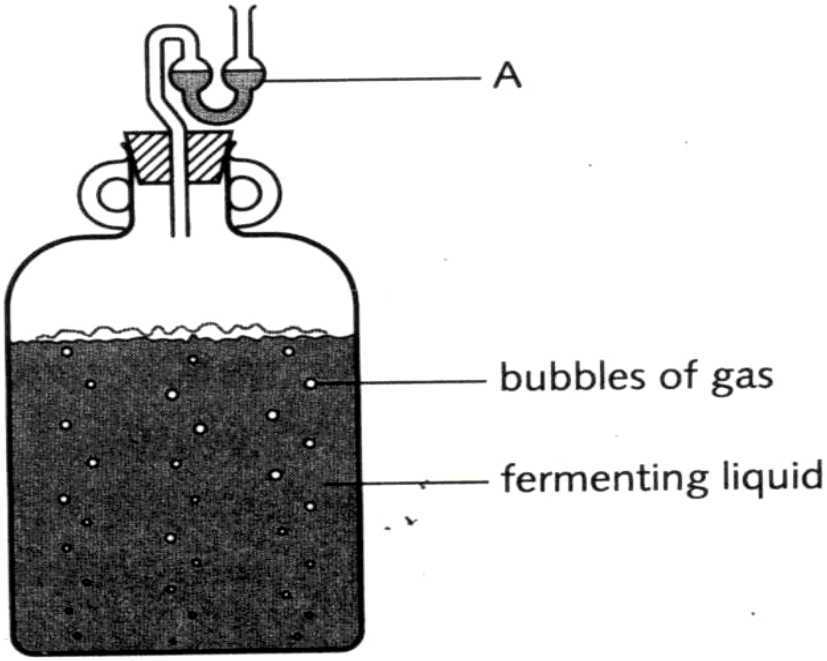
……

b) Give a simple test that could be used to show the presence of an alkene in a mixture with an alkane?

……
……

c) Ethanol can be made by addition of water to ethene. Ethanol can also made by

fermentation



i) Name the gas produced during fermentation

……
……

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ii) What must be added to sugar solution to make it fermented?

……
……

III) At about what temperature does fermentation take place at its fastest rate?

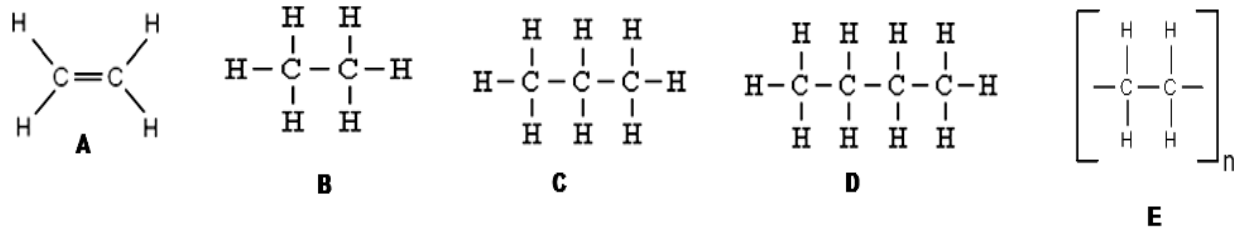
……
……

d) Write a balanced chemical equation for the combustion of ethanol in air.

……
……

Question 11(2011)

The structural formulae of five hydrocarbons are shown below.



use the information above to answer parts i) , ii) and iii).

i) Give the molecular formula of hydrocarbon B?

……

ii) Give the letter of unsaturated hydrocarbon?

……

iii) Explain your answer in part (ii)?

……

iv) Explain what is meant by the letter n' in hydrocarbon E?

……
……

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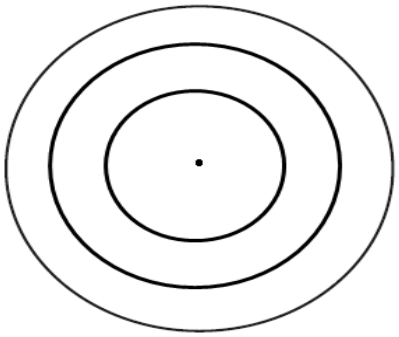
Question 12(2011)

a) i) carbon is in group iv of the periodic table. Draw a diagram to show how the electrons are arranged in an atom of carbon.



ii) To which period does carbon belongs in the periodic table?

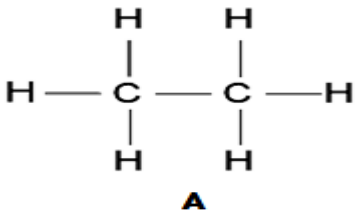
……

b) Organic compounds contain carbon and hydrogen.

i) State the name given to this organic compound?

……

ii) To which homologous series does the compound A belongs?



iii) State the name of compound A ……

iv) What is the meaning of the term homologous series?

……

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c) Some perfumes contain smelly chemicals called esters. esters can be made by reacting two types of chemicals together.

i) Complete this word equation making esters.

Alcohol + ……→ ester + ……

ii) Write the general formula for the following organic compounds.

Alcohol……

Alkane ……..

Question 13.(2012)

When a solution of glucose was mixed with yeast and allowed to stand for about three days, fermentation occurred producing two products.

a)

i. Write an equation for the reaction of glucose mixed with yeast and name the products

……
……
……

ii. State the homologous series in which the organic product belongs.

……
……

iii. What is the role of yeast?

……
……

b) When ethanol is heated with concentrated sulphuric acid at 170°C, a substance X is formed.

i. Name substance X

……
……

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ii. Write the structural formula of substance X

……
……
……

iii. Name the reagent that can be used to identify substance X

……
……
……

c)

i. Substance X is reacted with hydrogen at a very high temperature in the presence of a catalyst to form product Y which can burn. Write the equations that are involved.

……
……
……
……

ii. Draw the structural formula of:

- 2,3 – dimethyl butane

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d)

i. CFCs are present in Aerosols. Explain how they are hazard to the atmosphere and give their systemic names.

……
……
……
……
……

ii. Define the terms polymers and polymerization.

……
……
……
……
……

Question 12(2013)

The table below shows the boiling point of firs four members of the alkane homologous series. It also shows the enthalpy changes when these alkanes undergo complete combustion.

Alkane	Boiling point	Enthalpy change of combustion Kj/mol
Methane	-161	-890
ethane	-88	-1560
propane	-42	-2219
butane	0	-2877

a. i) state two characteristics of homologous series?

……
……
……

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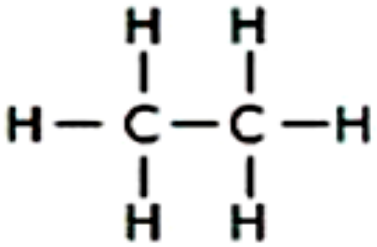
The displayed structure of ethane is:



ii) Draw the displayed structure of pentane/

.....
.....
.....

iii) Give the general formula of alkanes/

.....
.....

b .i) what information if the table tells you that there is a gradual change of physical property as the number of carbon atoms increase?

.....
.....

ii) What information in the table tells you the combustion of alkanes is exothermic?

.....
.....

iii) Copy and complete the complete combustion of propane?

$C_3H_8(g) + O_2(g) \rightarrow$ .....+.....

c. i) ethene C_2H_4 is manufactured by cracking crude oil. Complete the equation of the cracking of dodecane.

$C_{12}H_{26}(l) \rightarrow C_2H_4$ +.....

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ii) Ethene is an unsaturated hydrocarbon. What do you understand the terms

- Saturated……..
- Hydrocarbon……

d. i) ethene is used to make ethanol. Which of these reactions is used to make ethanol from ethene?

Catalytic addition of steam. ☐

Fermentation. ☐

Oxidation using oxygen ☐

Reduction using hydrogen. ☐

ii) Haloalkanes are classified as primary, secondary and tertiary. draw the displayed structure for primary, secondary and tertiary haloalkanes.

……
……
……
……
……
……
……

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UNIT SEVEN

METALS AND REACTIVITY SERIES+ EXTRACTIONS.

7.1. Multiple choice questions

1. Which of the following metals would displace zinc from a solution of zinc sulphate?(2002)
   A) Iron
   B) Copper
   C) Magnesium
   D) Lead

2. Which of the following elements burn in air to produces acidic oxide? (2003)
   A. Alumunium B. magnesium C. sodium D. Sulphur

3. which of the following metals would displace copper from a solution of copper(II)sulphate(2003)
   A) Silver
   B) lead
   C) gold
   D) mercury

4. Which of the following methods **CANNOT be used to** prevent rusting?
   A) Electroplating
   B) Oxidizing in the presence of moisture
   C) Galvanizing
   D) Painting

5. metals conduct electricity, this is because metals posses:
   A) All electrons held in a fixed position.
   B) Freely moving ions.
   C) delocalized electrons
   D) All have both free electrons and free ions.

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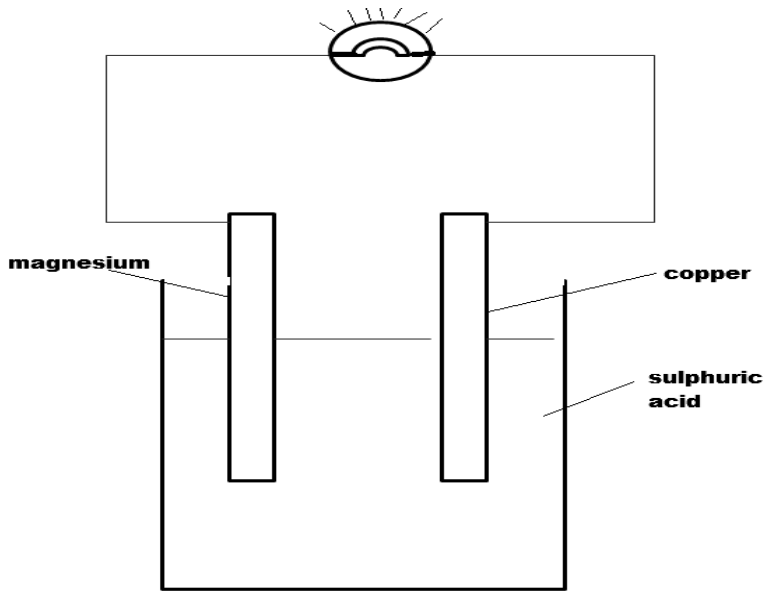
7.2. Structured questions

Question 1(2003)

. Strips of copper and magnesium were cleaned with sandpaper and then Connected to form a sample cell



(a) Why was necessary to clean the metal strips with sand paper?

……

(b) Explain why the bulb lit up.

……

C (i) which of the two metals is the more reactive?

……

(ii) Which metal releases the electron into the circuit?

……

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The following table shows the results of an experiment in which four metals
Were places in solutions of other metal sulphates?

Metal Sulphate	Colour	Metals added			
		Chromium	Cobalt	Copper	Magnesium
Chromium sulphate	Green		No reaction	No reaction	Colorless soln. Grey solid
Cobalt sulphate	Pink	Green soln. grey solid		No reaction	Colorless soln. Grey solid
Copper sulphate	Blue	Green soln. grey solid	Pink soln. grey solid		Colorless soln. Grey solid
Magnesium magnesium	Colorless	No reaction	No reaction	No reaction	

(i) Place these metals in order of their reactivity starting with the most reactive
……

(ii) Explain how you deduced the order of reactivity.

……
……
……

(iii) Iron is below magnesium in the reactivity series. Write in **IONIC** equation for
The reaction that occurs when magnesium metal is placed in solution
Of iron (II) sulphate.
……

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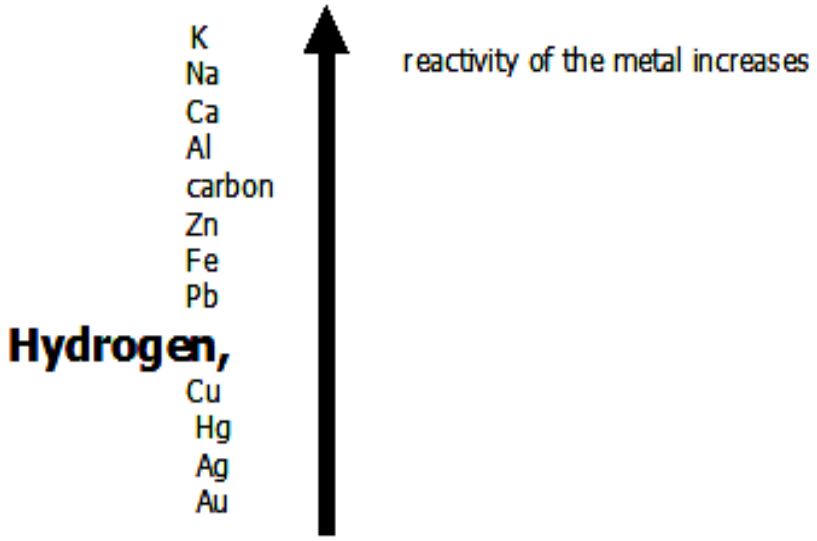
Question 2(2005)

Metals can be extracted from their ores in two ways.

1 heating the oxide of the metal with coke(carbon)
2 Electrolysis of a molten compound of the metal.



a. i) name three metals which are extracted by this method(1) above?

.....

ii) Explain why this method is used for extraction of these metals named above?

.....

iii) State why the method (1)is not used for the extraction of these metals?

.....

b. i) name three metals which are extracted by method (2).

.....

ii) Explain why this method (2) is used for the extraction of these metals?

.....

iii) State also why method (1) above is not used for the extraction of these metals?

.....

.....

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Question 3(2006)

1. A strip of zinc is placed in a beaker containing copper (II) sulphate solution. its left for a day.
    a) What colour is the solution before the reaction has taken place?

……

    b) What is the colour of the solution after the reaction has taken place?

……

    c) What is the colour of the metal strip before the reaction has taken place?

……

    d) What colour is the metal strip after the reaction has taken place?

……

    e) write a half equation to show what has happened to the copper(II) ions)

……

    f) Write half equation to show what happened to zinc atoms?

……

    g) Which half equation shows a reduction?

……
……

    h) Which half equation shows oxidation?

……
……

    i) How has the oxidation number of the copper changed?

……
……

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j) How has the oxidation of the zinc changed?

……
……

k) Which ions were spectator ions during the reaction?

……
……

Question 2(2008)

a) A group of students carried out experiments on the reaction of metal sulphate solution with different metals. They used the same concentration and always added an

Excess of the metal. Their observations are given in the table below:

Metal Sulphate	Color of Sulphate Soln.	Metals			
		Chromium	Cobalt	Copper	Magnesium
Chromium	Green		No reaction	No reaction	Colorless soln. Grey solid
Cobalt	Pink	Green soln. grey solid		No reaction	Colorless soln. Grey solid
Copper	Blue	Green soln. grey solid	Pink soln. grey solid		Colorless soln. Grey solid
Magnesium	Colorless	No reaction	No reaction	No reaction	

(i) Which metal reacted with all the other metal sulphate solutions? (1 mk)

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……

(ii) Which metal did not react with any of the other metal sulphate solutions?

……

(iii) Put the metals in their order of reactivity with the most reactive first.

……

(iv) Iron is slightly more reactive than cobalt. Which other metal sulphate solution will it React with?

……

b) (i) Choose one metal from the above that will react with steam water.

……

(ii) Name the salt formed when your chosen metal in (b) (i) reacts with sulphuric acid.

……

(iii) Write the chemical equation for the (b) (ii) reaction above.

……

……

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Question 3(2012)

The table below gives some properties of elements

Substance	Reaction with water
J	Reacts with steam, but no reaction with cold water
K	Reacts with cold water producing a flame
L	Reacts with cold water producing bubbles and fizzing sound

a) Arrange the elements in increasing order of reactivity.

……

b) Write the equation for the reaction between K and cold water.

……

……

c)

i. Name the element that could make hissing sound when react with cold water.

……

ii. Write the equation for the reaction in C (i) and balance it.

……

d) Name any group that its elements could react with cold water (in the periodic table).

……

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UNIT EIGHT

NON-METALS.

8.1. Multiple choice questions

1. Which of the following is an allotrope of sulphur? (2008)
   A) Monoclinic
   B) Graphite
   C) Sulphuric acid
   D) Sulphur dioxide.
2. In which of the following is hydrogen **NOT** used?(2009)
   A) Manufacture of ammonia
   B) Manufacture of hydrochloric acid
   C) Coolant and heat exchanger in different manufacturing processes
   D) Manufacture of margarine
3. Which of the following compounds would NOT be used as a fertilizer?
   A. NH_4NO_3
   B. KNO_3
   C. $NaCl$
   D. K_3PO_4
4. The formula for dinitrogen monoxide is
   A NO
   B NO_2
   C N_2O
   D N_2O_4.

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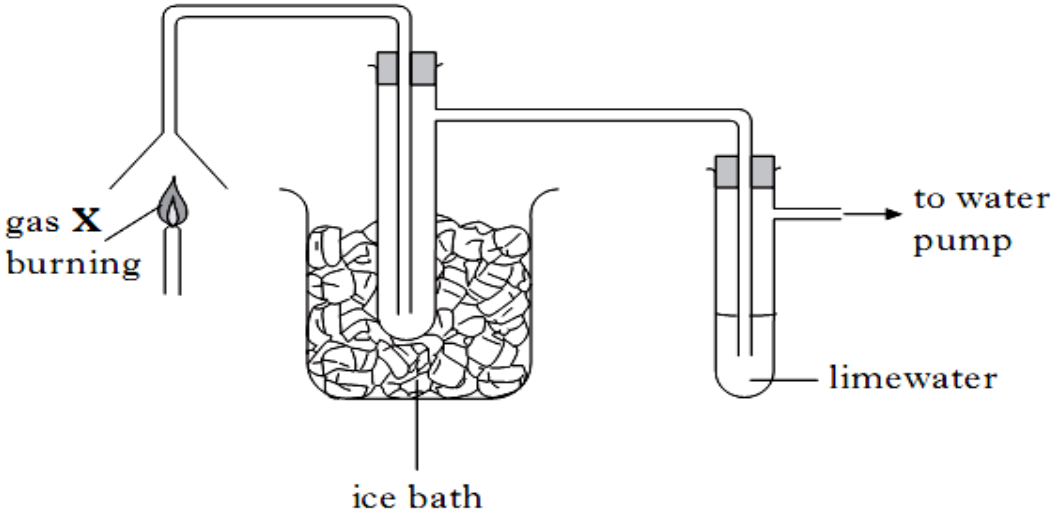
5. The apparatus shown can be used to identify what is produced when a gas is burned.



When gas **X** was burned, a colourless liquid collected in the cooled test tube but there was no change in the limewater. Gas X could be

A. Methane B. Carbon monoxide C. Hydrogen D. Ethene

6. the chemical formula of ammonium phosphate is:
   A) NH_4SO_4
   B) NH_4SO_3
   C) $(NH_4)_3PO_4$
   D) $(NH_4)_2SO_4$
7. the only non-metal that is liquid at room temperature and pressure is:
   A) chlorine
   B) argon
   C) bromine
   D) sodium
8. Which of the following elements posses' allotropes?
   A) nitrogen
   B) argon
   C) chlorine
   D) sulphur

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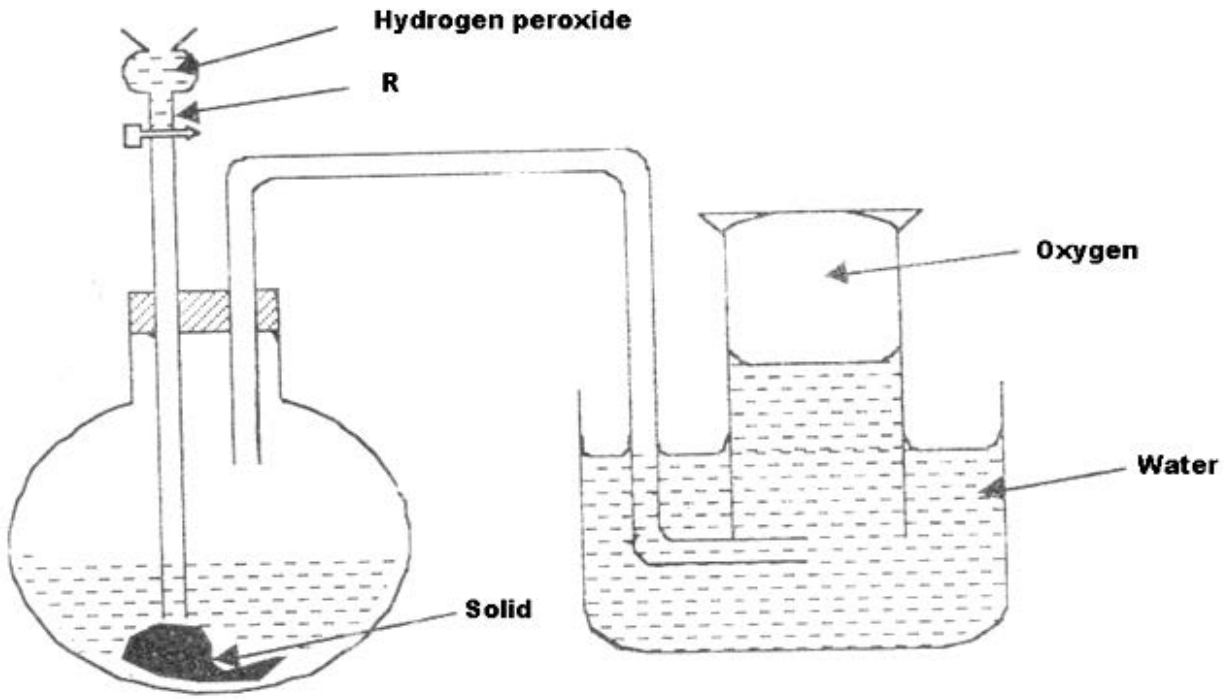
8.2 STRUCTURED QUESTIONS.

Question 1.

The set up below was used to prepare and collect oxygen.



a) Name and state the purpose of the solid .

……
……

b) Write an equation for the reaction that take place in the round flask

……
……
……

c) When zinc metal is burnt in oxygen, the compound formed reacts with both dilute hydrochloric acid and sodium hydroxide ,what property make it possible for the compound to react with both solutions.

……
……

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d) Describe a chemical test to identify oxygen gas.

……
……

Question 2.(2005)

Consider the reactions to produce ammonia by Haber process:

$$N_2\,(g) + 3H_2\,(g) \rightleftharpoons 2NH_{3(g)} \quad \Delta H = -92kj/mol$$

a. What does the sign ⇌ tell about the reaction?
……

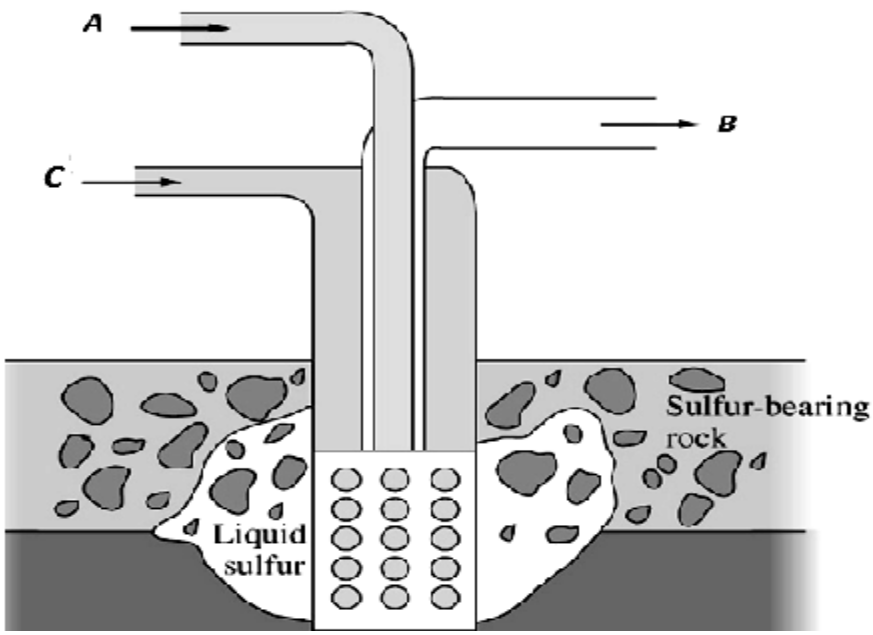
b. Is the reaction exothermic or endothermic?
……

c. What temperature is used in industry for the reaction to make ammonia?

……

Question 4(2012)

The diagram below illustrates how Sulphur is extracted from the ground using three concentric pipes



©SLNECB

a)

i. Give the name of this process of extraction……

Which of the pips A, B, C CONTAIN?

ii. Super-heated water……

iii. Hot compressed air……

b)

i. Name two allotropes of Sulphur

……
……

ii. What is the transition temperature for these allotropes?

……
……

c) The contact process for the manufacture of sulphuric acid is represented as follows:

$$2SO_2\,(g) + O_2\,(g) \rightleftharpoons 2SO_3\,(g) \quad \Delta H = -197 kj/mol$$

i. What does the symbol $\rightleftharpoons$ represents?

……
……
……
……

ii. Name the catalyst used in this reaction.

……
……
……
……

d)

i. Describe how sulphur (VI) oxide (SO_3) is converted to sulphuric acid during the process.

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……
……
……

ii. State two disadvantages of having Sulphur dioxide (SO_2) in the environment.

……
……
……
……

QUESTION 4 (2006)

Consider the reactions to produce ammonia by Haber process:

N_2 (g) + $3H_2$ (g) $\rightleftharpoons 2NH_{3(g)}$ ΔH = -92kj/mol

a. What does the sign $\rightleftharpoons$ tell about the reaction?

……

b. Is the reaction exothermic or endothermic?

……

c. What temperature is used in industry for the reaction to make ammonia?

……

8.3 EXTENDED QUESTIONS.

Question 1

In the Haber process, nitrogen and hydrogen are reacted over iron oxide catalyst to give ammonia gas.

a) Explain how the hydrogen gas used in the process is obtained.

……
……
……
……

b) Write an equation for the formation of ammonia gas from the raw materials.

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……
……

c) Explain how the following factors would affect the yield of ammonia.

1. High pressure

……
……

2. Low temperature

……
……

d) Write an equation for the reaction between ammonia and copper II oxide.

……
……

e) Explain the effect of the iron oxide catalyst on the yield of ammonia in the Haber process.

……
……

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UNIT NINE

RATES OF CHEMICAL REACTIONS AND EQUILIBRIA.

9.1. Multiple choice questions

1. Which of the following statements best describes the action of a catalyst in a reaction?(2003)

   A) It lowers the energy of the reactant
   B) It lowers the energy of the reactant
   C) It lowers the activation energy of the reaction
   D) It lowers the rate of the reaction

2. Which statement is TRUE about chemical reactions at equilibrium?(2007)

   A) The forward and backward reactions proceed at equal rate.
   B) The forward and backward reactions have stooped.
   C) The concentration of the reactants and products are equal
   D) The forward reaction is exothermic.

3. . A substance which increases the rate of reaction without itself being changed chemically is(2008)

   A) an enzyme
   B) a catalyst
   C) an isotope
   D) an allotrope.

4. Some collisions between reactant molecules do not form products. This is most likely because;

   A) The molecules do not combine in the proper ratio.

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B) The molecules do not have enough energy.
C) The concentration is too low.
D) The reaction is at equilibrium.

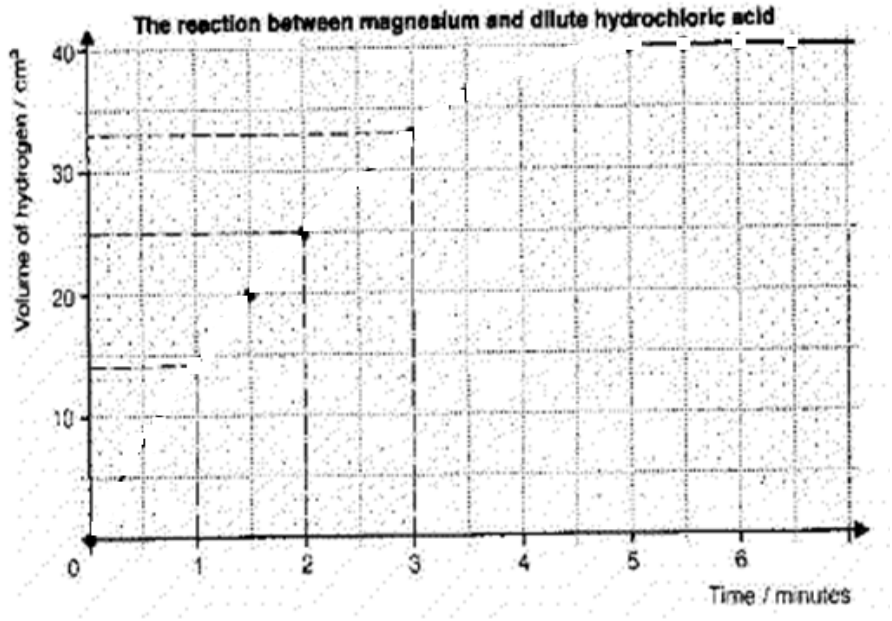
9.2 Structured questions

Questions1 (2011)

Magnesium reacts with dilute hydrochloric acid to produce hydrogen gas. a piece of magnesium ribbon was placed in excess dilute hydrochloric acid. the volume of hydrogen gas produced was recorded every minute. The experiment was carried out at room temperature. the results obtained are shown in the table below.

Time/minutes	0	1	2	3	4	5	6
Volume of hydrogen/cm^3	0	20	30	36	39	40	40

i) Plot the results from the table on the grid below and draw a smooth curve through the points. The pointed has been plotted for you.



ii) Give the volume of hydrogen given off during the first 3.5minutes/

iii) Circle the correct answer.

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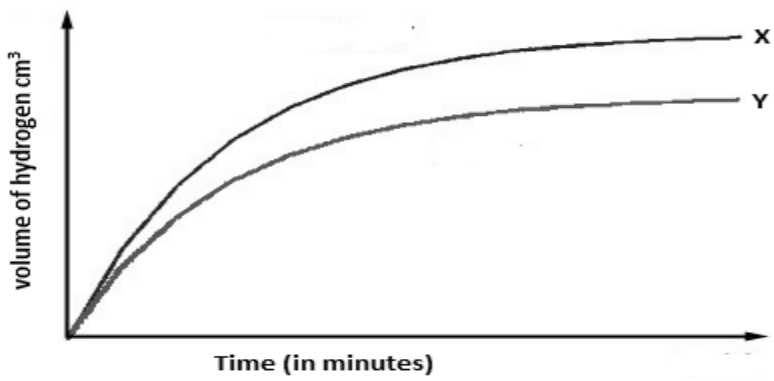
The reaction proceeding as at its fastest rate between

A - 0 –1 minute. B- 3—4 minutes, 5—6 minutes

iv) The reaction has been repeated using the same amount of magnesium ribbon but twice the volume of the original acid, give the final volume of hydrogen you would expect to be produced and explain your answer?

Question 2(2012)

The curve X and Y were obtained when 6.0 grams of magnesium ribbon and the same mass of powdered magnesium was reacted with 2M hydrochloric acid at 25°C and a 1 atm pressure respectively.



Give their names

a)

i. Which curve was obtained by reacting hydrochloric acid and magnesium ribbon?

……
……

ii. Which curve was obtained by reacting hydrochloric acid and powder magnesium? Give a reason.

……
……
……

b) How many mole of magnesium were used in the reaction?

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……
……
……

c)

i. What would happen to the reaction if 4M hydrochloric acid was used?

……
……
……

ii. Give a reason to your answer.

……
……
……

d) Name three factors that affect the rate of reaction.

……
……
……

Question 3.

Sodium thiosulphate solution reacts with dilute hydrochloric acid according to the following equation:

$$Na_2S_2O_{2\,(aq)} + 2HCl_{(aq)} \longrightarrow 2NaCl_{(aq)} + SO_{2\,(g)} + S_{(s)} + H_2O_{(l)}$$

In an experiment to study how the rate of reaction varies with concentration, $10cm^3$ of 0.4M Sodium thiosulphate was mixed with $10cm^3$ of 2M Hydrochloric acid in the flask was then placed on a white paper marked with a cross (**x**).

The time taken for the cross to disappear when viewed from above was noted and recorded in the table below. The experiment was repeated three times at the same temperature using the volumes in the table and the results recorded are shown in the table below.

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Experiment	Volume of 0.4m thiosulphate	Volume of water	Volume of HCl acid	Time
1	10	0	10	16
2	7.5	2.5	10	23
3	5.0	57.0	10	32
4	2.5	7.5	10	72

a) i. On the graph paper provided, plot a graph of the volume of thiosulphate (Vertical column) against time taken for the cross to disappear.

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ii. From the graph, determine how long it took for the cross to disappear in experiment

……

b) From the graph in a (i), what conclusion can be drawn on the relationship between concentration and rate of a reaction? (2 marks)

……

c) i. State four the factors that influence the rate of a reaction. (2 marks)

……
……
……

ii. Explain why the time taken for the cross to disappear becomes longer in experiment 4.

……
……

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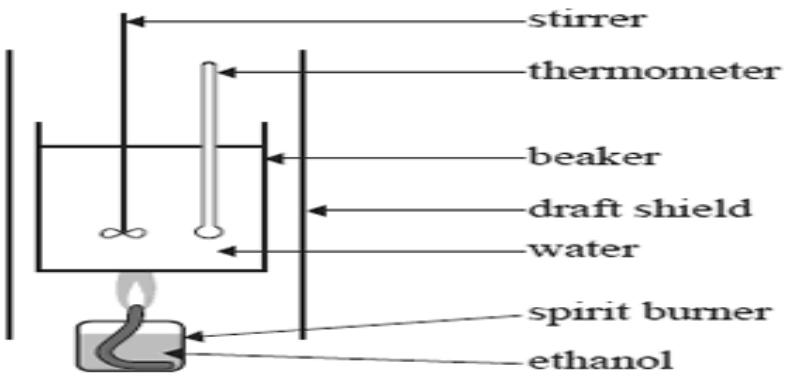
UNIT TEN

ENERGY IN CHEMISTRY(ENTHALPY CHANGES)

10.1 Multiple choice questions

1. In which process does an endothermic change take place? (2011)
   A) Combustion
   B) neutralization
   C) Evaporation.
   D) filtration

2. The apparatus shown is used in a first-hand investigation to determine and compare the heat of combustion of three different liquid alkanols.(2011)



Which is the independent variable

A) The type the alkanols used
B) Amount of water used
C) Amount of alkanol used
D) Temperature change in water.

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3. The equation for the over all in photosynthesis is

$$\text{Energy} + 6CO_{2(g)} + 6H_20(l) \rightarrow C_6H_{12}O_{6(aq)} + O_{2(g)}$$

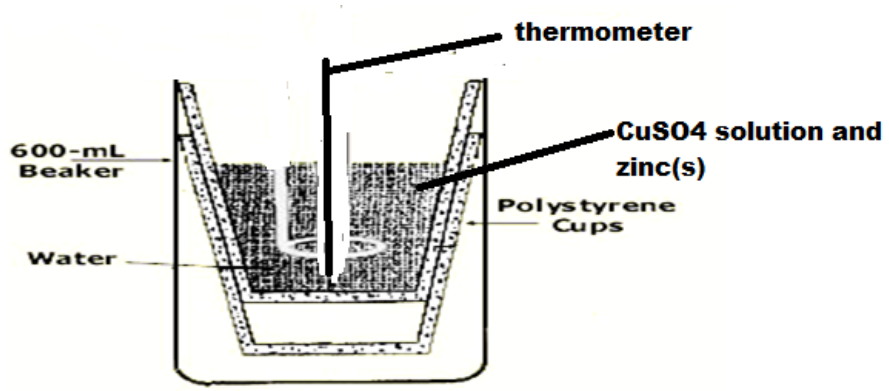
Photosynthesis is:

A) An endothermic process.
B) An exothermic process.
C) A combustion reaction.
D) An acid base reaction.

10.2. Structured questions

Question 1(2005)

A pupil measured the enthalpy change for the following reactions using this apparatus.



$$CuSO_4\,(aq) + Zn(s) \rightarrow ZnSO_4(aq) + Cu(s)$$

He added 1.0gram of zinc powder to 50cm^3 of 0,2M of copper sulphate solution and stirred the mixture gently. The initial temperature was 21C^0 and the final temperature was 28C^0.

a) Why is polystyrene used instead of a glass container?

b) How many moles of copper (ii) sulphate are present initially?

c) Calculate the enthalpy change of the reaction using the formula ($Q = MC\Delta T$)

(specific heat capacity = 4.2J.

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……
……
……
……

d) Draw an enthalpy diagram to show whether the reaction is exothermic or endothermic?

……
……
……

Question 2(2006)

Ethane burns in air according the following equation:

$C_2H_6 + O_2 \rightarrow CO_2 + H_2O \quad \Delta H = \text{--ve}$

a. What name is given to represent in which ΔH is negative?

……

b. The following tables show the energy changes that take place when bonds are broken and formed.

Energy used (taken in) to break bonds:

bond	Number of the bonds	Bond dissociation Energy Kj/mol	Energy needed in Kj
C—H	12	413	
C—C	2	330	
O=O		497	3479
		Total energy used(taken in)	

Energy given out when new bonds are formed.

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bond	Number of the bonds	Bond dissociation Energy Kj/mol	Energy needed in Kj
C=O	8	740	
H-O	**10**	463	
		Total energy used(taken in)	

I) complete the table to find the total energy taken in and the total energy given out.

II) Use your answer to calculate the energy given out by the complete combustion of 1 mole ethane.

.....

Questions 3(2007)

(10 marks) this question is about endothermic and exothermic reactions.

(a) Explain the meaning of the terms endothermic and exothermic.

.....
.....
.....
.....(2 marks)

(b) (i) Draw an energy level diagram for the reaction:

$$NaOH_{(aq)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)} : \Delta H = -57kjmol^{-1}$$

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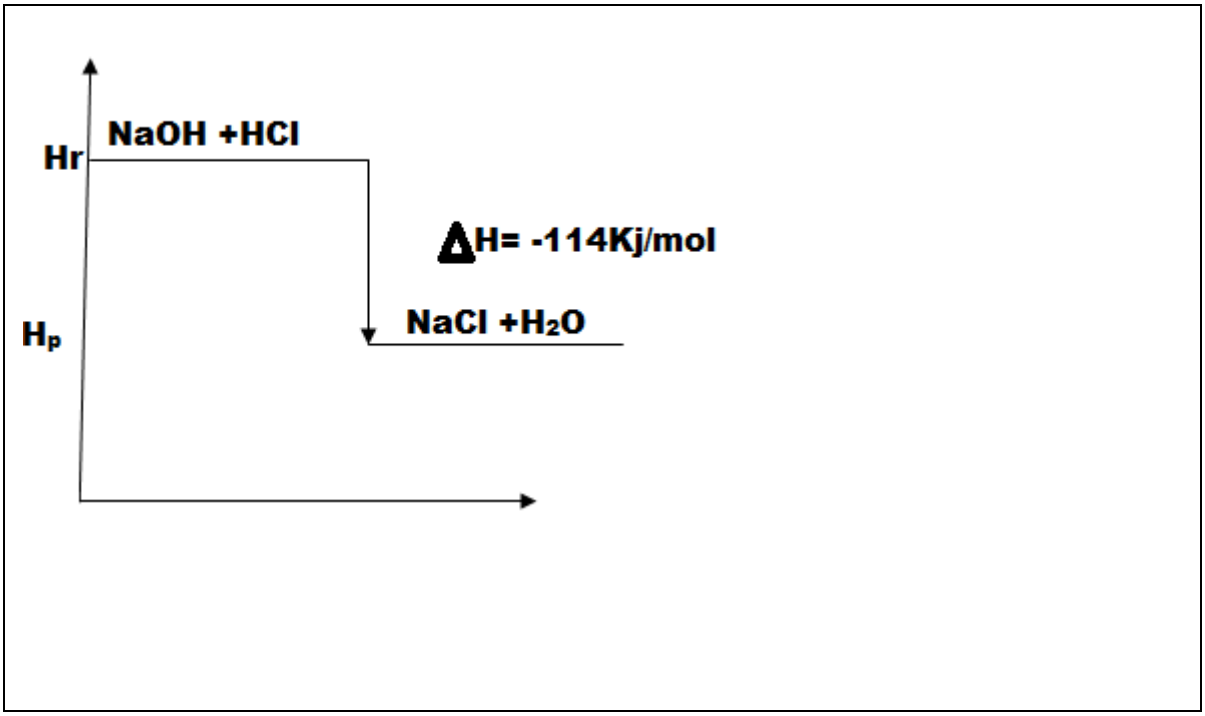

(ii) Is this reaction endothermic or exothermic?

……(1 mark)

(iii) Calculate the energy change associated with this reaction if 2 moles of sodium hydroxide were neutralized by excess hydrochloric acid.

……
……

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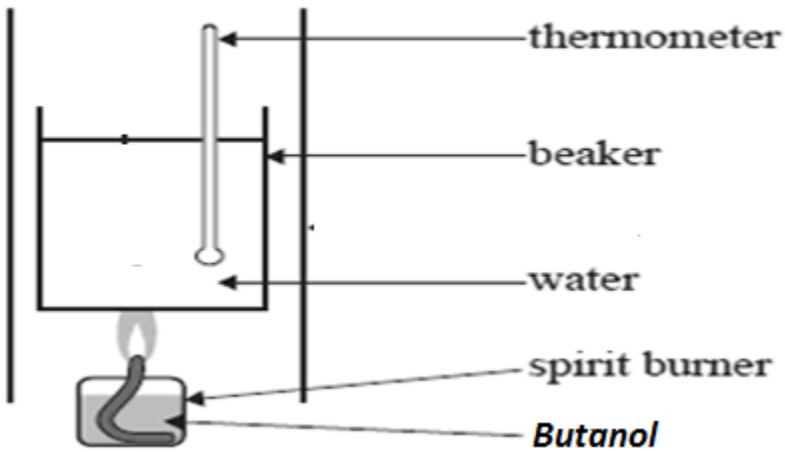
Question 4(2012)

The experiment shown below shows the determination of the heat of combustion of butanol. (**$CH_3CH_2CH_2CH_2OH$**), a student obtained the following set of data. Use the data to answer the question that follow:



Volume of water = 400 cm^3
Initial temperature of water = 24.5°C
Final temperature of water = 33.5°C
Initial mass of lamb and butanol = 36.65°C
Final mass of lamb = 36.65°C
(Specific heat capacity of water = 4.2j/gk)

a)

i. Write an equation for the combustion of butanol

……
……
……
……

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ii. Calculate the number of moles of butanol burnt
(C = 12, O = 16, H = 1)

……
……
……
……
……

iii. Calculate the heat change in this experiment

……
……
……
……

b)

i. Calculate the heat of combustion per mole of butanol

……
……
……

ii. Explain why the value of the heat of combustion for butanol obtained in this experiment is different from the theoretical value?

……
……
……

c)

i. Study energy level diagram below, state whether the reaction represented by the diagram is exothermic or endothermic.

……
……
……

ii. Give a reason to your answer

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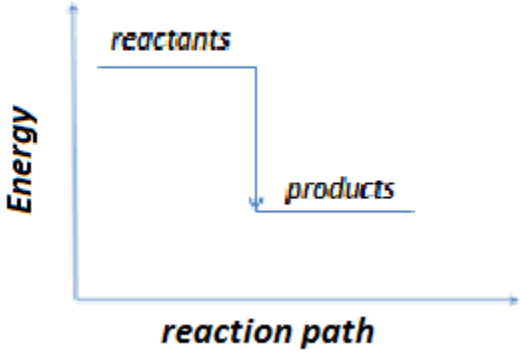

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10.3 EXTENDED QUESTIONS.

Question (2008)

During an experiment to determine the molar heat of neutralization of hydrochloric acid and sodium hydroxide, 25 cm^3 of 0.3 M HCL was reacted with 25 cm^3 of 0.3 M of sodium hydroxide. The following results were obtained.

Mass of copper container	=	45.0 g
Initial temperature of acid	=	24.0 ^oC
Initial temperature of alkali	=	24.0 ^oC
Mass of container and the acid – alkali mixture	=	95.0 g
Final temperature of the acid – alkali mixture	=	27.0 ^oC
Density of water	=	*1 g cm^{-3};*
Specific heat capacity of water	=	*4.2 kj kg^{-1} K^{-1}*

a) (i) Why should the copper container be lagged?

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……

(ii) Calculate the heat evolved in the reaction. (2 mks)

……

……

……

(iii) Determine the molar enthalpy of neutralization for the reaction.

……

……

……

……

(iv) Draw and label a diagram that shows the energy – level for the reaction.

……

……

……

……

b) The molar heat of neutralization of a strong base and a weak acid is less

Than the molar heat of neutralization of a strong base and a strong acid. Explain why this is so.

……

……

Question 2(2009)

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. Ammonia gas is produced for commercial purposes in industry by the Haber process; see the equation.

$$N_{2\,(g)} + 3H_{2\,(g)} \longrightarrow 2NH_{3\,(g)}$$

The following two tables show the enthalpy change for reaction of making ammonia in the Industry.

Enthalpy change from bond breaks in the reactants;

Bonds	Bond enthalpy (Kj mol)	Number of bonds broken	Total enthalpy input (Kj mol)
N N	945	_____	945
H H	436	3	_____
			2253

Enthalpy change from bond formed in the products;

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Bonds	Bond enthalpy (Kj mol)	Number of bonds broken	Total enthalpy input (Kj mol)
N H	391	_____	2346

a) i) calculate the missing values and fill in the table.

ii. Use the information in the above tables to calculate the total enthalpy change (Kj/mol) of the reaction of formation of ammonia.

.....

.....

.....

.....

iii. Is the reaction of making ammonia in industry exothermic or endothermic? (1 mark)

.....

b) i. Why is concentrated sulphuric (VI) acid a weaker acid than dilute sulphuric (VI) acid?

.....

.....

ii. What is the catalyst used in the conversion of sulphur (IV) oxide to sulphur (VI) oxide in the Contact Process? (1 mark)

.....

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UNIT ELEVEN

MOLES AND CHEMICAL CALCULATIONS

11.1. Multiple choice questions

1. The equation for burning of butane is shown below:(2002)

$$2C_4H_{10} + 13O_2 \longrightarrow 8CO_2 + 10H_2O$$

How many molecules of water are formed when one molecule of butane urns completely?

A) 4
B) 5
C) 8
D) 10

2. The percentage of water in copper(II) sulphate crystals $CuSO_4.5H_2O$ is(atomic masses (Cu = 63.5, S =32, O =16, H= 1)(2006)

A) 64%
B) 10%
C) 36%
D) 58%

3. The equation for the reaction of magnesium with hydrochloric acid is shown below:

$$Mg + 2HCl \longrightarrow MgCl_2 + H_2$$

What mass of magnesium is needed to produce 2g of hydrogen?

A) 12g B) 22g
C) 24g D) 36g

4. What is the volume of one mole of an ideal gas at S.T.P.?(2008)

A. 24.0 dm^3 B. 24.0 cm^3

C. 22.4 cm^3 D. 22.4 dm^3

5. Calculate the R.M.M of NaOH given Na = 23, O = 16, H = 1.(2008)

A) 18

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B) 23

C) 40

D) 39

6. How many grams are there in 5 moles of carbon atom?(2008)

A) 12g

B) 6g

C) 60g

D) 5g

7. Calculate the number of moles of carbon atom contained in 6 grams. **(C=12)(2009**

A 0.5

B 72

C 5.0

D 120.0

8. What are the major products of the following reaction? $Cl_{2\,(g)} + H_2O_{(l)}$*(2009)*

A) $HCl_{(aq)}$ + Dye + Oxygen

B) $HCl_{(aq)}$ acid only

C) $HCl_{(aq)}$ + $HOCl_{(aq)}$

D) HOCl+ H_2O

9. Standard temperature and pressure(STP) are defined as

A) 0 C and 1.0 atmospheric pressure

B) 0 C and 273 mm Hg pressure

C) 0 K and 1.0 atmospheric pressure

D) 0 K and 760 mm Hg pressure

10. What mass of sodium hydroxide is required to prepare $1dm^3$ of a 1 mol dm^{-3} solution

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A. 0.04 B. 0.4 C. 4g D. 40g

11.2. Structured questions

Question 1(2002)

Marble is naturally occurring form of calcium carbonate. When heated marble beaks down to form quicklime.

a)

i. Give the chemical name of quicklime?

……

ii. If water is added to quicklime, slaked lime is produced. Write the word chemical equation to show this reaction.

Word equation……

Chemical equation……

b) Apart from marble chips, name another naturally occurring form of calcium carbonate

……

c)

i. Calculate the molecular mass of calcium carbonate ($CaCO_3$) and calcium oxide (CaO) (RAM: Ca = 40, C = 12, O = 16)

……
……
……
……
……
……

ii. Calculate the mass of calcium carbonate needed to make 2.8g of calcium oxide.

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……
……
……

d) What substance in the air will react with calcium hydroxide to form calcium carbonate?

……
……

Question 2(2005)

The chemical equation of the decomposition of limestone is:

Calcium carbonate → calcium oxide + carbon dioxide

$CaCO_3 \rightarrow CaO + CO_2$.

a. State whether the reaction is exothermic or endothermic.

……

b. What is the mass of one mole calcium carbonate?

(RAM C = 12 O =16 Ca = 40)

……
……

c. Why do farmers spread powdered limestone in their fields?

……

d. Give one use of quicklime?

……

e. Suggest why carbon dioxide may pollute the atmosphere?

……
……

Question 3(2005)

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a) i) calculate the empirical formula of an organic liquid containing 50.17% of carbon, 13% hydrogen and the rest is oxygen.

.....
.....
.....

ii) The molecular mass of the liquid is 92. what is its molecular formula?

b) Calculate the volume occupied by the following gases at (rtp).

(One mole of any gas occupies a volume of $24dm^3$ at (rtp)

i) 12.5 moles of oxygen gas.

.....

ii) 0.15 moles of carbon dioxide.

.....

c) Calculate how many faradays of electricity must be passed to deposit 2.16g of silver.

(RAM Ag = 108)

.....
.....
.....

Question 4(2006)

2. Given the relative atomic masses of(Na =23, O= 16, C= 12.)
   a) how many moles of sodium carbonate are contained in

   i) $500cm^3$ of 1M solution?

.....
.....

   ii) $1500cm^3$ of 0.25M?

.....
.....
.....

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b) how many moles of sodium carbonate are contained in:

i) 1060g of the solid?

……
……

ii) 1000cm^3 of 1M solution?

……
……

iii) 1000cm^3 of 0.55M solution?

……
……

iv) 285cm^3 of 0.55M Solution?

……
……
……

Question 5(2006)

3. a) Write the molecular equation to show magnesium ribbon burning in oxygen to form magnesium oxide?

……
……

b) i) name the product of the following complete hydrocarbon combustion reaction?

Propane + oxygen → ……

ii) Complete and balance the molecular equation

$C_3H_8(g)$ + $O_2(g)$ → ……

c) i) complete and balance the molecular equation of the following precipitation reaction.

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$Pb(NO_3)_2(aq) + NaI(aq) \rightarrow$ …….

ii) Write an ionic equation for this reaction?(No need to show spectator ions)

……
……

Question 6(2007)

a) Calculate the number of moles in:

(i) 4g of hydrogen gas

……
……
……
……(2 marks)

(ii) 1.15g sodium atoms

……
……
……
……(2 marks)

(iii) 1.2046×10^{25} molecules of hydrogen gas

……
……
……
……(2 marks)

(iv) 2g of iron atoms

……
……
……
……(2 marks)

b) Calculate the mass of the following:

(i) 0.25 moles of carbon

……
……
……
……(2 marks)

(ii) 1.2046×10^{25} molecules of hydrogen gas

……
……

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……
……(2 marks)

(iii) 0.15 moles of $CaCl_2$

……
……
……
……

Question 7(2008)

A hydrocarbon contains 88.88 % carbon by mass.

(i) Calculate the empirical formula of the compound.

(5 mks)

……
……
……

b) Calculate the number of moles present in:

(i) $40cm^3$ of a 4M solution

(3 mks)

……
……
……
……

Question 8(2010)

How many moles are present in20 g of magnesium oxide ,MgO-

[Ar = 7, Mg = 24, O = 16]

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……
……
……
……

b) A compound has the following composition by mass of carbon 40% , hydrogen 6.7% and oxygen 53.3%. The relative molecular mass of the compound is180

I) Determine the empirical formula of the compound.

……
……

II) Determine the molecular formula of the compound

……

……

III) Name the compound formed in the molecular formula

……
……

Question 9 (2011)

a. Ammonia and ammonium nitrate are both fertilizers.

I. Calculate the percentage of nitrogen in each ammonia and ammonium nitrate fertilizers.

……
……
……

II. Why ammonium nitrate fertilizer sometimes mixed with chalk. $CaCO_3$

……
……
……

b. An organic compound P contains 64.9% carbon, 13.5% hydrogen, 21.6% oxygen.

I. Determine the empirical formula of P?

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……
……

II. Determine the molecular formula of P?

……
……

c. A solution of magnesium chloride was made by dissolving 4.75g of salt to make 25ocm^3 of solution. calculate the:

I. Molarity of the solution

……
……

II. The number of moles of chloride ion in 250cm^3 of the solution?

……
……

UNIT TWELVE

EARTH AND WATER

12.1 Multiple choice Questions

1 Which of the following methods is **NOT** used to remove water hardness? (2009)

A) Boiling.

B) Distillation.

C) Filtration.

D) Addition of washing soda.

2 Water is an example of (2010)

A. a mixture of hydrogen and oxygen B. a giant compound

C. a compound of hydrogen and oxygen D. non-polar liquid.

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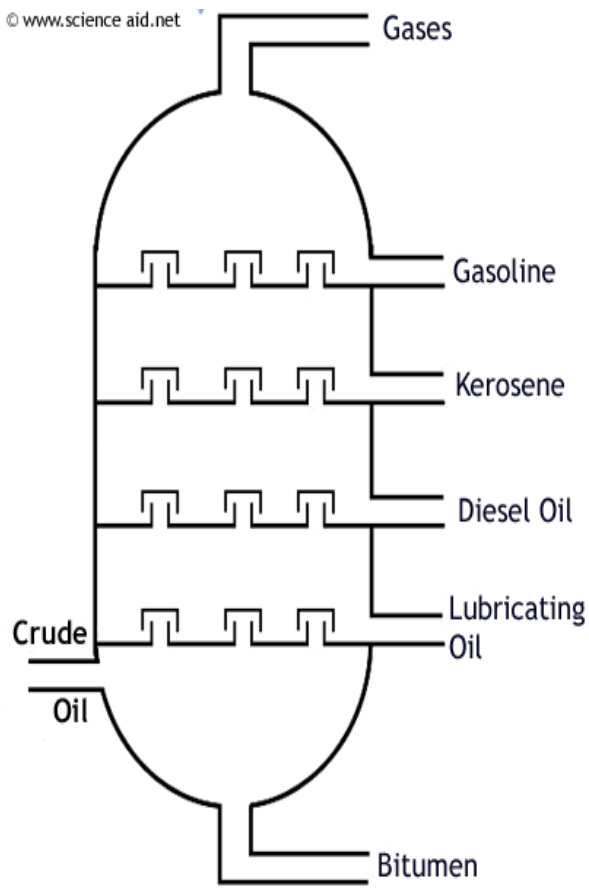
3 Which of the following shows the approximate percentage of three major gases in inhaled air? (2011)

A) 50% nitrogen, 49% oxygen, 1% carbon dioxide.
B) 79% nitrogen, 21% oxygen, 0.04% carbon dioxide.
C) 79% nitrogen, 14% oxygen, 6% carbon dioxide.
D) 59% nitrogen, 41% oxygen, 0.04% carbon dioxide.

4 Gasoline is produced by the fractional distillation of crude oil. It has a low viscosity. (2011)



Which of the following properties also applies to gasoline.

A) High boiling point and high flammability.
B) Low boiling point and high flammability.

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C) High boiling point and low flammability.
D) Low boiling point and low flammability.

12.2. Structured questions

Question 1 (2003)

(a) Jama tested the hardness of four samples of water A, B and D in each he test used 25 cm^3 of water He added soap solution to the water 1cm^3 at a time, to the water and shock it for 10 sec .he stopped adding soap solution when there was a layer of lather at least 2 cm deep on the top of the water. Jama repeated each test.

Sample of water	Volume of soap solution added in cm^3	
	First test	Second test
A	4	4
B	12	11
C	1	2
D	23	21

i. Which sample of water was the hardness? Explain why.
……
……

ii. State TWO things that Jama did to make it a fair test.
1……
……
2……
……

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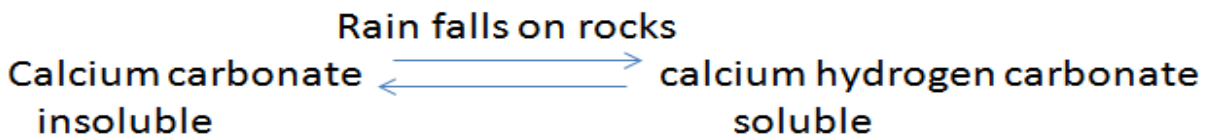
(b) When carbon dioxide dissolves in rain water it forms A weak acid called carbonic acid

$$H_2O + CO_2 \rightleftharpoons H_2CO_3$$

(i) What does the symbol $\rightleftharpoons$ indicate in the above equations?

(j) What is likely PH for rain water?

c. the following diagram contains information about water hardness



Use information given and your knowledge of carbonate chemistry to explain why hard water causes scale in kettles in areas where the water is hard.

……
……
……
……
……

Question 2(2009)

) The table below shows the composition of the mixture of the gases coming from a typical car exhaust.

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Gas	% of the gas in the exhaust fume
Carbon dioxide.	9
Carbon monoxide	5
Oxygen	4
Hydrogen	2
Hydrocarbons	0.2
Nitrogen oxide	0.2
Sulphur dioxide	Less than 0.008
Gas X	79.6

i. State the name of the gas X

……

ii. Complete the word equation for the complete combustion of Octane.

Octane + Oxygen ⟶ ……

iii. Which two chemical elements are present in hydrocarbons?

……

iv. To which homologous series of hydrocarbons does octane belong?

……

b) Compound **W** is a saturated hydrocarbon. Its composition by mass is known to be: **C= 85.72** and **H =14.28**. Calculate the empirical formula of compound W.

Question 3(2009)

a) i. Why is chlorine added in water purification?

……

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ii. After chlorination, the water is acidic. A small amount of slaked lime is added to the acidic water. Explain why slaked lime is added.

……

……

iii. Write down the chemical formula and the chemical name of slaked lime.

Chemical formula ……..

Chemical name …….

b) (I) State the boiling point of water ……

(ii) Describe a chemical test for water

……

……

(iii) State one use of water in the home

……

c) Potassium reacts violently with water. Write a balanced chemical reaction of this reaction.

……

……

12.3 extended questions (2007)

. A bottle of mineral water has this information on the labeled.

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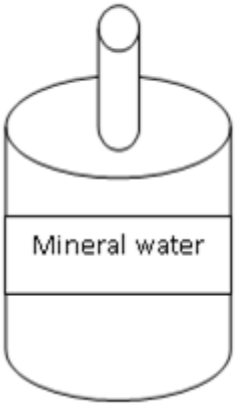

Ions	Concentration in mg/l
Calcium	73
Magnesium	8
Potassium	1
Sodium	18
Chloride	28
Hydrogen carbonate	5
Sulphate	338

a) A sample of this water was evaporated and a solid left behind.

i) What is evaporation?

.....
.....

ii) Name the chemical compound which would make up most of the solid left behind?

.....

b) This mineral water is hard.

i) What is mean by hard water?

.....

ii) Explain why hard water should not be used in hot systems?

.....
.....

iii) Give one advantage and disadvantage of hard water?

a) Advantage.....

b) Disadvantage.....

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c) Name two methods of removing hardness from hard water?

i)……

ii)……

UNIT THIRTEEN

ANSWERS

UNIT ONE:

MATTER AND ITS PROPERTIES.

ANSWERS:

1.1: M.C.Q

1. C
2. A
3. C
4. D
5. B
6. C
7. C
8. A
9. B
10. A
11. A
12. D
13. D

ANSWERS

1.2: STRUCTURED QUESTIONS.

QUESTION 1.(2002)

a. fractional distillation
b. filtration
c. simple distillation
d. separating funnel

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QUESTION 2

ANS:

a. i) A = freezing
B = sublimation
C = evaporation
ii) A

b. i) argon
ii) 2: 1

c. i) It reacts with oxygen in air and its oxidized to copper(II)oxide .
ii) $2Cu + O_2 \rightarrow 2CuO$.
iii) The percentage of oxygen that dissolves in water is:
$\frac{200.126}{200} x100 = \frac{74}{200} x100 = 37\% \ IS \ oxygen$

QUESTION 3

: question 3.

a.

i. solid ice
Liquid/ water
Gas /steam

ii. X is liquid state

iii. It is a gaseous state of matter, because only gases can occupy an empty container.

b) i) physical because it can be reversed easily.

ii) Chemical because it can't be reversed easily.

iii) Chemical because it's irreversible.

iiii) chemical it's also irreversible.

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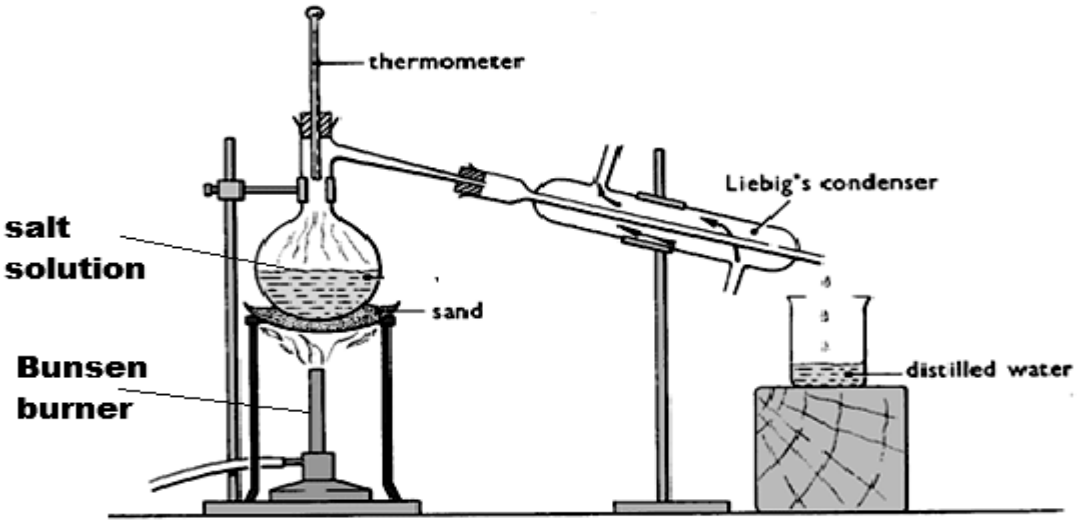
QUESTION 4



a.
b. distillation
c. liquid--------gas------liquid.

QUESTION 5(2008)

1. 2g of potassium chlorate is crystals is put in a boiling tube 4cm^3 of water is added.

a) i) calculating the solubility by completing the table.

Volume of water (cm^3)	4	8	12	16	20
Temperature which crystals appear (^{0}C)	92	63	48	35	27
Solubility (g/100g of water)	50	25	16.66	12.5	10

ii) Potting a graph of solubility (vertical axis) against temperature on x-axis

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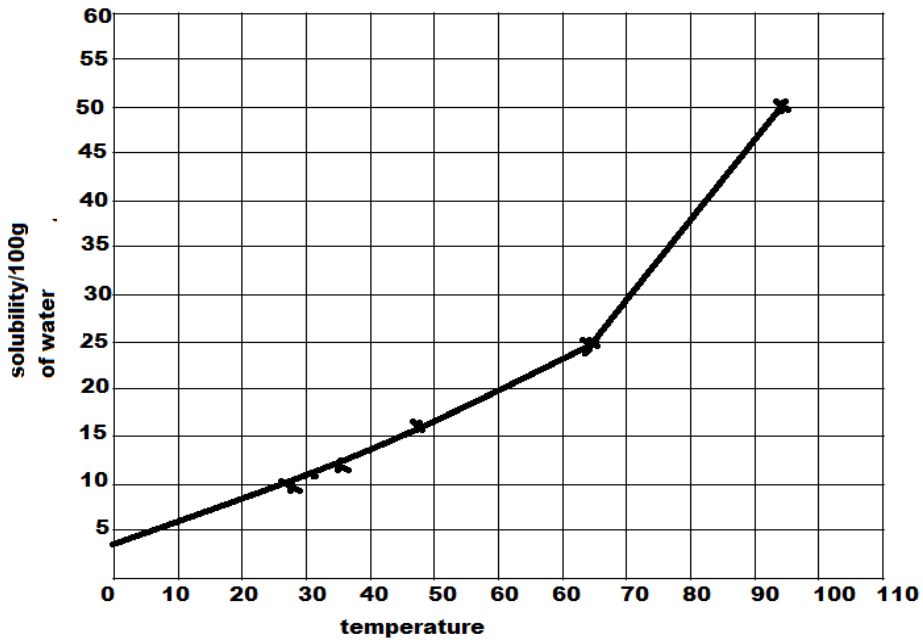

iii) Determining the temperature at which crystals will start to form when a solution of 30g of potassium chlorate in 100g of water is $70C^0$.

iv) The mass of crystals that will form at $25C^0$ is 9g of potassium chlorate.

b) One use of the solubility curves is that to compare the solubility of different salts.

QUESTION 6

a) Boyles law states that: for a fixed mass of a gas whether its pure or mixture its volume is inversely proportional to its pressure as the temperature remains constant.

b) The final pressure of the gas is: $P_2 = \frac{P1xV1xT2}{V2xT1} = \frac{15X5X473}{2.5X297} = \frac{35475}{742.5} = 47.5\text{mmHg}$.

c) i) after ten minutes the particles of potassiumpermangate will dissolves completely in water.

ii) The process of diffusion is faster in vacuum than in air this is because there are no particles colliding with these particles in a vacuum space.

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QUESTION 7

a.
   i. . Distillation.
   ii. . evaporation
   iii. . Separation formula.
   iv. Filtration.

b.
   a. boiling
   b. Condensation.
   c. melting
   d. Freezing.
   e. Sublimation.

c.
   i. the elements are sodium and potassium
   ii. NH_3/SO_2.

QUESTION 8

a. Liquid B is denser than liquid A because it floats on the surface of liquid B.
b. OIL and water can be separated by this method
c. The third liquid will produce cloudy substances.
d. It can be separated by fractional distillation.

QUESTION 9

I. The temperature is $50C^0$
II. at $80C^0$ the difference in solubility between potassium nitrate and lead nitrate is 168-112 = 56g
III. the mass of potassium nitrate crystals that will form from $90C^0$ to $30C^0$ is 200 – 44 = 156g.

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UNIT TWO:

ATOMIC STRUCTURE AND THE PERIODIC TABLE.

ANSWERS

2.1: M.CQ

1. A
2. B
3. A
4. C
5. A
6. C
7. A
8. D
9. C
10. D
11. D
12. B
13. D
14. B
15. C
16. B
17. A
18. D
19. C
20. A
21. A
22. D
23. D
24. A
25. B
26. D
27. D
28. B
29. C
30. C
31. C

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2.2: STRUCTURED QUESTIONS.

ANSWERS:

QUESTION 1

a) atomic number.
b) i) Neon, Argon , and Krypton
ii) Noble gases
iii) They are unreactive elements.
iv) Neon is used in advertizing sings in light bulbs.

QUESTION 2

ANS: Question 2.

a. i) Atomic number is the number of protons in the nucleus of an atom.
ii) Mass number is the sum of protons and neutrons in the nucleus of an atom.
iii) An ion is a charged particle.
b. i)
ii) Sodium S-block element
Chlorine P-block element
c. i) They have the same atomic number.
ii) They have different masses

QUESTIONS 3

ANS: **Question 3**

a) i) Test tube A: hydrochloric acid and hypochlorous acid are formed

ii) Test tube B: sodium chloride and Iodine is formed

b) The chemical equation is: $2NaI_{(aq)} + Cl_{2(g)} \longrightarrow 2NaCl_{(aq)} + I_{2(s)}$

c) Displacement reaction

d) Test tube A

e) If we put a coloured substance in test tube A, it bleaches its colour, because hypochlorous acid acts as a bleaching agent.

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QUESTION 4

ANS: Question 4.

a) i) 2 protons

ii) Element M

iii) T is more reactive than R

b) i) The formula is DM_2

ii) Element T

iii) It has 24 – 12 = 12 neutrons

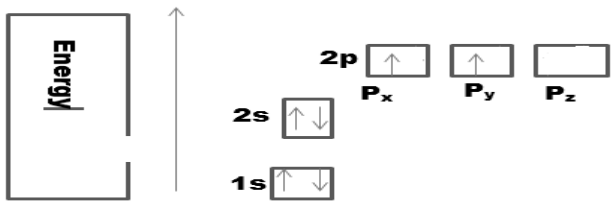
c) In the elements Q, R and T

- their atomic radius increases down the group
- Their metallic character decreases down the group
- Their reactivity also increases down the group, but they all have giant metallic characters.

d) i) S = $1s^2 2s^2 2p^6 3s^2 3p^4$

ii) Cl^- = $1s^2 2s^2 2p^6 3s^2 3p^6$

e)



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QUESTION 5

ANS: **Question 5**.

a) i) the two metals are (A) and (C)

ii) B is non-metals because its ionic radius is greater than that of its atomic radius.

iii) (C) is more reactive than A.

b) i) this is due to the increase of the nuclear across the period.

ii) The relationship is that the first two oxides are basic, next one is amphoteric the last oxides are acid in nature.

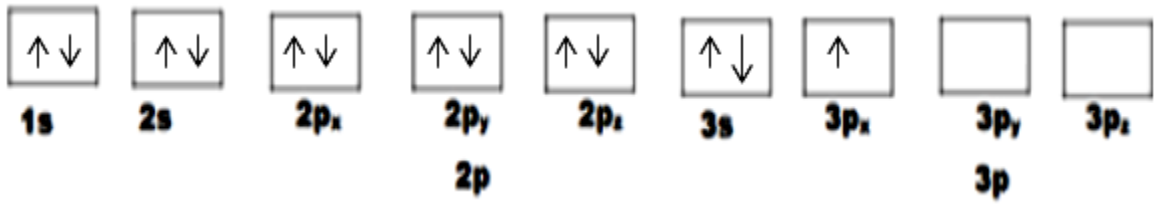
Question 6

ANS: Question 6

2, 8, 3.

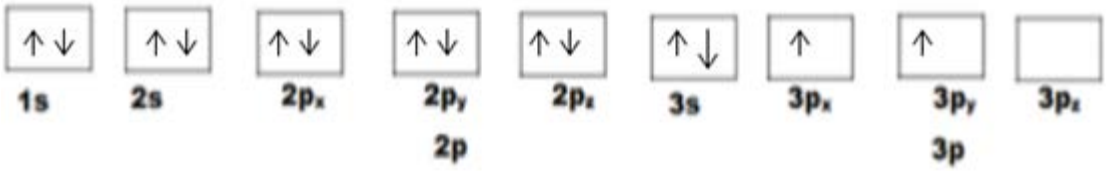
$1s^2 2s^2 2p^6 3s^2 3p^1$

a)



b) 2, 8, 4.

$1s^2 2s^2 2p^6 3s^2 3p^2$



c) 2, 8, 6

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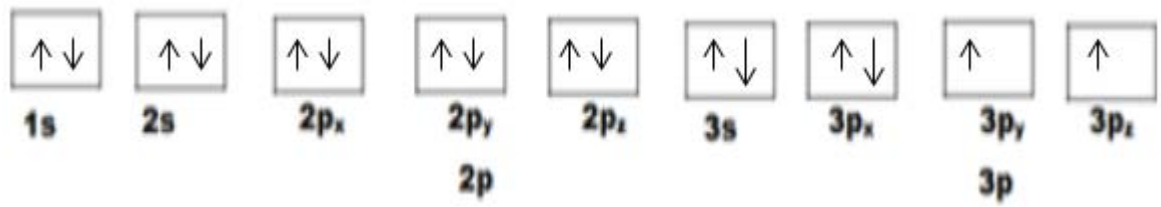
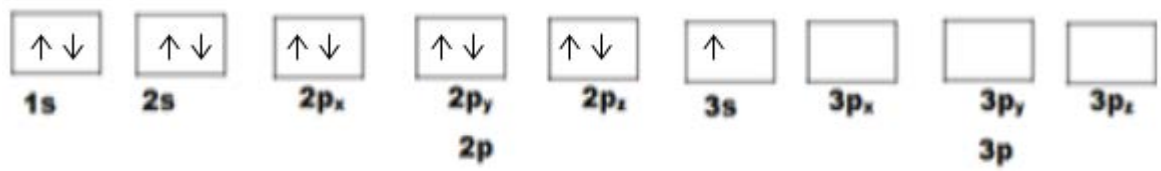
$1s^2 2s^2 2p^6 3s^2 3p^4$



d) 2, 8, 1

$1s^2 2s^2 2p^6 3s^1$



e)

i)

Ionization energy	equation	Value in Kj/mol
1st	$Al(g) \rightarrow Al^{+}(g) + e^{-}$ 2, 8, 3 2, 8, 2.	578
2nd	$Al^{1+}(g) \rightarrow Al^{2+}(g) + e^{-}$ 2, 8, 2 2, 8, 1	1817
3rd	$Al^{2+}(g) \rightarrow Al^{3+}(g) + e^{-}$ 2, 8, 1 2, 8	2745
4th	$Al^{3+}(g) \rightarrow Al^{4+}(g) + e^{-}$ 2, 8 2, 7	11575

ii) The 3rd has noble gas electron structure.

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iii) there is a large increase in ionization energy from the 3rd and 4th this is because as we cross from one shell to the next the force of attraction between the remaining electrons and the nucleus increases very rapidly this will increase the ionization energy.

Question 7.

ANS: Question 7

A) H and He
B) B and Al.
C) Al and Ga.
D) Cu
E) F
F) ionic bond

QUESTION 8

ANS:

a) i) C

ii) E

iii) B

iv) D

v) A

IV) A

b) i) the atomic radius of A is greater than that of its ionic radius because it's a metal and metal form positive ions. This will decrease the size of the atom.

ii) A has high very high melting because of the metallic bonding that hold its atoms together.

iii) Element B is the strongest oxidizing agent.

c) Element B and C reacts to form a white compound that conducts electric current this is because when it's melted or dissolved in its ions can carry electricity

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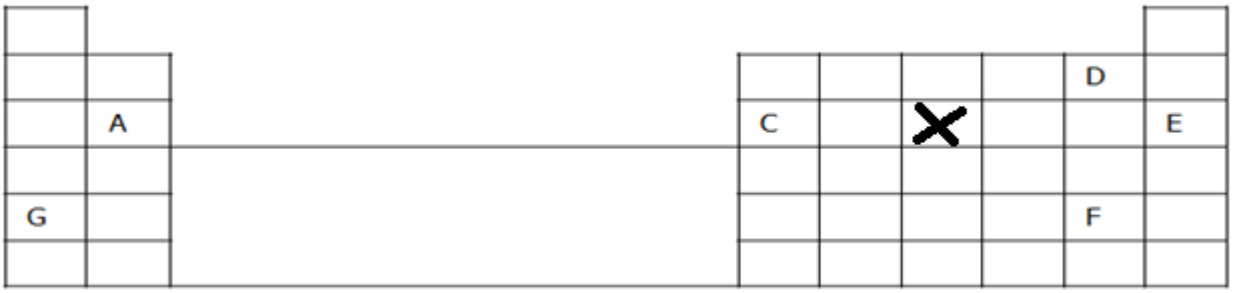
Question 9

ANS: Question 9

i. A
ii. E
iii. Mark position (X) in the grid.



iv. salts
v. The atomic radius of A is greater than that of C because the radius decreases as the size positive nuclear charge increases across the period from left to right.
vi. the formula of a compound G and F is (GF)

Question 10

ANS: Question 10

A.
  i. A- nucleus
  ii. protons and neutrons
  iii. B—is an electron.
B.
  i. One sulfur atom.
  ii. Total number of atoms present in the 14-atoms.
C. i.

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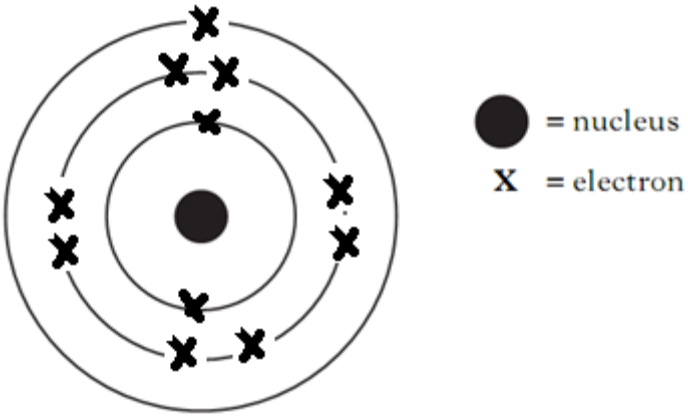
Particle	Number
Electron	11
Proton	**11**
Neutron	**12**

iii. a.



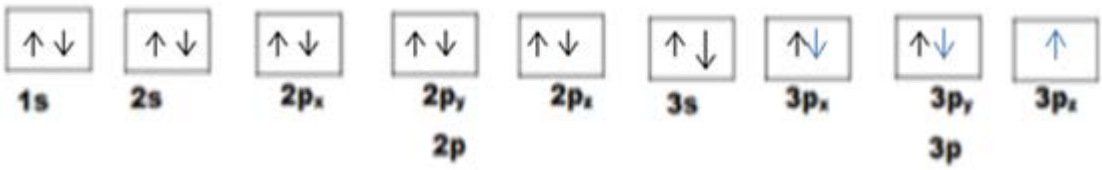
B. the force that holds the electrons in position around the nucleus is positive charge from the nucleus.

Question 11

ANS: Question 11

a) nil
b) H and O are positive.
c) I,J,K,L,M, and N are neutral.
d) N and O are isotopes
e) J and K
f) L will form acidic oxide
g) H and I form basic oxides
h) i) . $1S^2\ 2S^2\ 2p^6\ 3S^2\ 3P^5$

ii)



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Question 12

ANS: Question 12

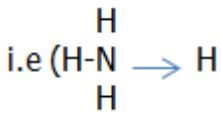
a.
   i. X_2 M

i. XN

b.
   I. ionic
   II. Ionic.
   III. covalent

c. It has higher melting point and boiling point.
   - It is soluble in water.

d. When both shared electrons come from one side between the bounded atoms this type of bonding is called coordinate covalent bond.



Coordinate covalent bond

Question 13

ANS: Question 13

I) ONE

II) 3.

III) 2, 8, 1.

IV) Period 4.

ii) Electrons.

b) i) one carbon atom.

ii) 6 atoms.

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Question 14

a) elements K and N
b) M_2O
c) Element L, because it needs to gain only one electron to gain full outer shell. Non – metals always gain electrons.
d) Element M
e) Because it gains one electron

Question 15

ANS:

1. a) i) neutrons
   ii) Protons and neutrons.
   iii) Electrons
   iv) Electrons

   b) i) protons and electrons

   ii) protons and neutrons

   c) i) 12

   ii) 24

   iii) 2, 8, 2.

Question 16

ANS:

a) i)

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elements	Atomic number	Melting point C^0	Boiling point C^0	Atomic radius(nm)	colour	Electron configuration
fluorine	9	-220	-188	0.071	Yellow	2, 7
Chlorine	17	-101	-34	0.099	greenish	2, 8, 7
bromine	35	-7	58	0.114	Orange	2, 8, 18, 7
iodine	53	114	183	0.133	black	2, 8, 18, 18, 7

ii) Fluorine and chlorine.

iii) Iodine

b) Fluorine

c) It increases.

d) i) $Cl_2(g) + \cdots 2KBr(aq) \rightarrow 2KCl(aq) + Br_2$

2.3 extended questions.

ANS: extended Question 1(2007)

1.
   A. i. ionization: is the energy required to remove a mole of electrons from a mole of atoms in a gaseous state.
   B.
      i. The values of the ionization energies show that there is a large increase rise when the first electron is removed from the sodium atom.
      ii. When the first two electrons are removed from magnesium atom there is also a large increase in ionization energy, because the third electron will get this need and more energy than the second.

a.
   i. The atomic radius of magnesium is greater than that of aluminium because aluminium has greater positive nuclear charge than magnesium.

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ii. The atomic radius of sulphur is greater than its atomic radius because the negative charge of sulphide ion has greater size than the neutral atom of sulphur.

iii. The M.P of aluminum is greater than that of magnesium because it has greater size of positive nuclear charge.

UNIT THREE:

CHEMICAL BONDING AND STRUCTURES.

3.1 M.C.Q

1. B
2. B
3. B
4. C
5. D
6. A
7. A
8. A
9. D
10. C
11. D
12. C
13. C

3.2 STRUCTURED QUESSTIONS

Question one

a.
   I. T
   II. w
   III. y

b.
   I. x
   II. because the ionic compounds are good conductors when they are molten and solution

c.
   I. T and V
   II. metals are good conductors when they are solids

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d.

I. V

II. It is a metal, conducts when solid and reacts water very quickly to form a solution which is conductor, these are the properties of group 1 metals.

QUESTION TWO

I. Methane.
II. Sodium chloride.
III. carbon
IV. Sodium chloride.
V. CH_4

UNIT FOUR

ELECTROLYSIS AND ITS APPLICATION.

4.1 M.C.Q.

1. D
2. C
3. B
4. B
5. B
6. D
7. B

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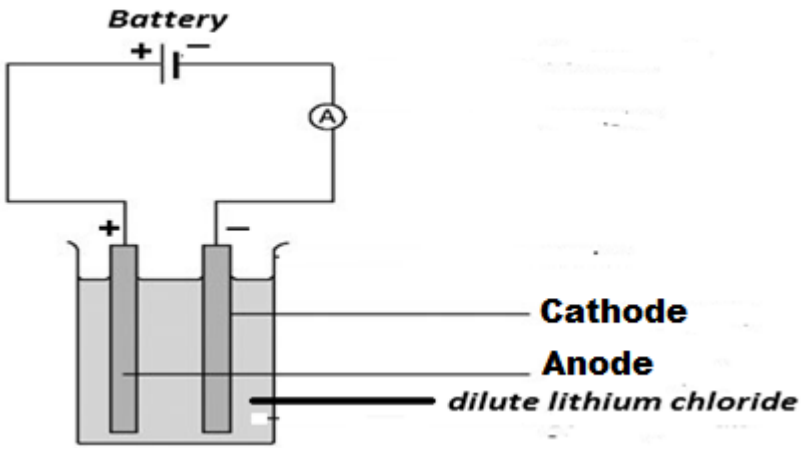
4.2 STRUCTURED QUESTIONS

Question 1.

a.



b. Li^+, Cl^-, H^+ and OH^-
c. hydrogen gas
d. oxygen gas
e. Anode: $4OH^- \longrightarrow 2H_2O + O_2 + 4e^-$
Cathode: $2H^+ + 2e^- \longrightarrow H_2$

f. At the anode, because electrons are lost to the anode.
g. Chlorine, because the Cl^- ions will give up electrons more readily than the OH ions.

Question 2

ANS:

a. i) ions
ii) If copper(II) sulphate is present as a solid there will no free electrons that can carry electricity.
iii) The anode dissolves and disappears while the cathode will become thicker and thicker.
iv) At the anode.
$Cu^{2+} \rightarrow Cu + 2e$.
At the cathode

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$Cu^{2+} + 2e \rightarrow Cu$.

b. i) the total charge carried is

$$Q = Ixt = 8Ax15x60 = 7200C$$

ii) $M = \frac{IxtxAr}{ZxF} = \frac{8Ax15x60x64}{2x96500} = \frac{460800}{19300} = 2.38g \text{ of copper.}$

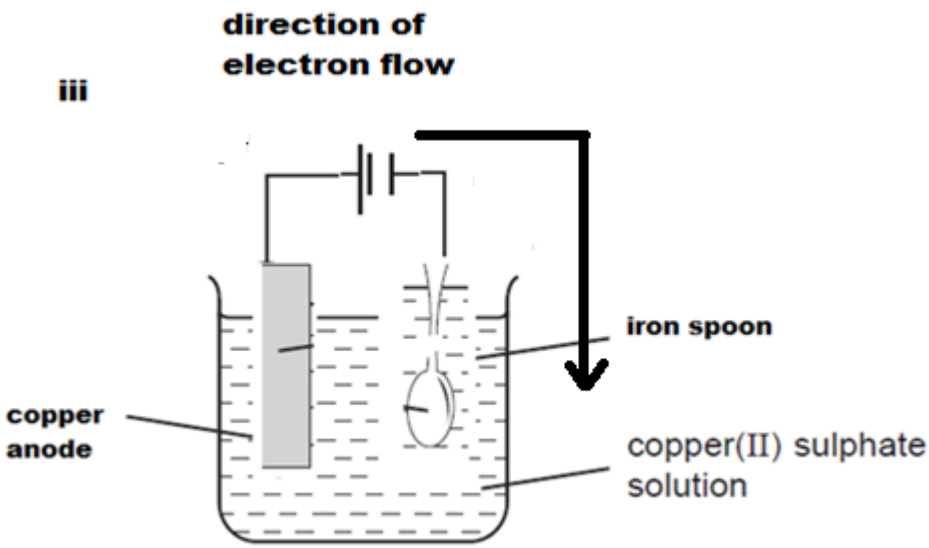
Question 3

ANS:

a) i) the anode dissolves or disappears, while the cathode becomes thicker.

ii) Copper anode releases electrons to become ions and it moves towards the iron spoon where it gains electron and coats on it. So the cathode will become thicker.

iii



iv) Copper ions from copper(II)sulphate solution electrolyte will coat on the iron spoon, so the copper ions within the electrolyte will decrease.

b) i) an electrolyte the liquid that decomposes and allows electricity to pass through them.

ii) An inert electrode: is an electrode that does not affect the product of electrolysis.

c) Solid sodium chloride has no free ions while molten sodium chloride has free ions that can carry electricity within the electrolyte.

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Question 4

ANS:

a)

i) Electrolyte: liquid that decomposes and allows electricity to pass through them.

ii) Cathode: is the negative electrode.

iii) Anode: is the positive electrode.

b) i) an electroplating is the process of coating one metal to another metal or non-metal.

ii) The reason using electroplating are:

- To prevent the metals from corrosion.
- To make metal surface shiny.

iii) During electroplating the anode dissolves or disappears.

c) calculating the mass of copper that will deposit can be calculated by using the equations.

$$M = \frac{IxTxAr}{ZxF} = \frac{4Ax30x60x64}{2x96500} = \frac{460800}{193000} = 2.38g \text{ of copper}$$

Question 5

ANS:

i. It's extracted by roasting in the air.
ii. Electrolysis.
iii. Extraction of reactive metals.
. Electroplating of metals.
iv. Pure copper has the advantage because it has low resistance.
B. <u>cathode</u>
$2H^+ + 2e \rightarrow H_2(g)$
<u>Anode</u>
$4OH \rightarrow 2H_2O + O_2$ (g)

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Question 6

ANS:

a) i) the ions are:

Ag^{+} $NO-_{3}$ H^{+} and OH^{-}

ii) Silver ions will migrate to the negative electrodes.

iii) Hydroxide ions.

b) i) cathode

ii) Anode

c) i) –ve electrode silver atoms

+ve electrode oxygen gas

ii) Oxidation takes place at the anode.

Question 7

ANS: Question 7

a) i) electrolysis

ii) Graphite

iii) The other compound present in the cell is cryolite.

iv) The function this compound is that it reduces the melting point of the alumina.

b) High cost of electricity.

c)

cathode $Al^{3+} \rightarrow Al + 3e$

anode = $2O^{-2} \rightarrow O_2$

d) i) oxygen

ii) It burns the anode and it has to be replaced weakly.

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UNIT FIVE
ACIDS, BASES AND SALTS

5.1 M.C.Q

1 D
2 D
3 A
4 C
5 B
6 C
7 B
8 A
9 D
10 A
11 B
12 B
13 A
14 B
15 C
16 C
17 B

5.2 STRUCTURED QUESTIONS

Question 1

ANS:

a) i) an acid is a substance that dissolves in water and produces hydrogen ions in aqueous solutions.
ii) A base is a substance that dissolves in water and produces hydroxide ion in aqueous solutions.
iii) Acids

- Have a PH which is less than 7.
- Acids are good electrolytes.
- They have a sour taste.

Bases:

- Have a PH greater than 7.
- Contains hydroxide ions.
- Have bitter taste.

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Question 2

ANS:

a) i) gas(A) is hydrogen.

ii) Solution (B) is Copper (II) sulphate solution.

iii) Gas(C) is carbon dioxide.

iv) Substance (D) is litmus paper

v) Solution (E) potassium hydroxide.

b) i) gas(A) can be tested by splint light.

ii) Gas(C) can be tested by using lime water.

c) Completing the equations.

i) Iron + hydrochloric acid→ iron chloride + hydrogen.

ii) Sodium hydroxide + nitric acid→ sodium nitrate + water.

iii) Magnesium carbonate + hydrochloric acid → magnesium chloride + water + carbon dioxide.

Question 3

ANS: Question 3

a. completing the table

Solutions tested	PH
Distilled water	7
Sulphuric acid	1
Sodium hydroxide	14
Vinegar	5

b. Magnesium oxide- = basic oxide
c. basic Aluminum oxide- = amphoteric oxide

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d. silicon (iv) oxide = acidic oxide

A) a reagent that will react with amphoteric oxide but basic oxide is Na_2O.

B) A reagent that will react with both basic oxide and amphoteric oxide

Is silicon (iv) oxide.

Question 4

ANS:

a) i) Q

ii) P

iii) S

iv) R

V) T

VI) U.

b) Because it's acidic solution and will increase the acidity in the stomach.

c)

Number	Property	Write Base or Acid
1	Have pH of less than 7	Acid
2	Have a bitter taste	Base
3	Contain H^+ ions when dissociated with water	Acid
4	Have a pH greater than 7	Base
5	React with carbonate and hydrogen carbonate to produce carbon dioxide	Acid
6	When dissociated in water produces hydroxide ions	Base

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Question 5

ANS:

a.

i. PH=C

ii. B

b. solution D

C. the observation that can be made is that a yellow precipitate of a lead iodide is formed.

D) .

i. addition excess acid the equation will shift towards the products

ii. Excess base will shift towards the reactants.

Question 6

ANS:

a. complete the table

- NaOH and H_2SO_4
- magnesium chloride
- magnesium.
- copper oxide and sulphuric acid
- $MgCO_3$ and H_2SO_4
- $MgSO_4$
- BCl_2+ $NaSO_4$ → BaSO4.+ NaCl

b.

i. copper(ii) oxide + sulphuric acid → copper(ii)sulphate + water.

$CuO(s) + H_2SO_4(aq) \rightarrow CuSO_4(aq) + H_2O$

ii. magnesium carbonate+ sulphuric acid

→magnesium sulphate + water + carbon dioxide.

$MgCO_3 + H_2SO_4 \rightarrow MgSO_4 + H_2O + CO_2$

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UNIT SIX

ORGANIC CHEMISTRY.

6.1 M.C.Q

1 B
2 B
3 D
4 C
5 B
6 D
7 C
8 A
9 D
10 D
11 A
12 A
13 D
14 B
15 A
16 B
17 C
18 D
19 C
20 C
21 B

6.2 STRUCTURED QUESTIONS

Questions 1

ANS

a) i) hydrocarbon means compounds that contain only carbon and hydrogen,
ii) Crude oil.
b) i) homologous series have these properties in common,

- They have the same general formula.
- Same functional group.
- Undergo gradual physical and chemical changes.

ii) Alkanes.

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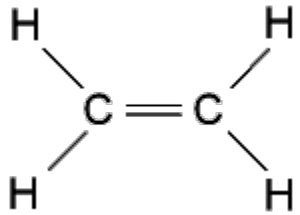
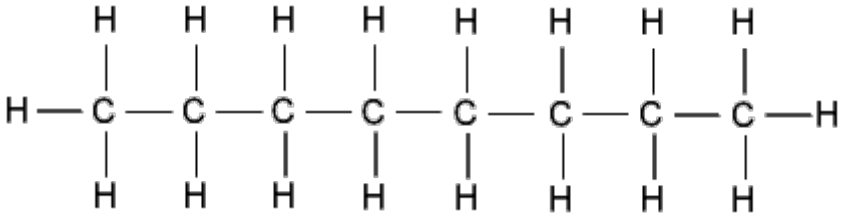
c) i)



ii)



d) i) 2-methyl butane.
ii) 2,3- dimethyl pentane

e) Bromine water is used to test the presence of the double and triple bonds.
It decolorizes with the double or triple bonds but it will remain orange when added to a saturated hydrocarbons.

Question 2

ANS:

a. i) propanoic acid.
   ii) CH_3—CH_2—COOH.

b. CH_3—CH_2—COOH $+H_2O \rightleftharpoons CH_3$—$CH_2$—$COO^-$ H_3O^+

c. It is a weak acid because it partially ionizes in water, where as hydrochloric acid completely ionizes in water.

d. i) heat and catalyst
   ii) By fractional distillation.
   iii) It has pleasant smell.
   iv) Methyl ethanoate
   v) CH_3—$COOCH_3$

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Question 3

ANS:

a.

1 here are the characteristics of the homologous serious

- have the same general formula
- same functional
- Undergoes gradual physical and chemical change.

2 the general formula for alcohols $C_nH_{2n+1}OH$

b.

i. $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$

ii. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

c.

i. Fermentation process.

ii. Yeast.

Question 4

ANS:

a.

i. CH_4 (g) + CI_2 (g) $\rightarrow$ CH_3CI + HCI.

ii. substitution reaction

iii. they are free radicals

b. Because substitution reaction cannot take place.

c.

i. the two substance are carbon dioxide and water

ii. Homologous series are members of the same family which different the number of carbon atoms in the chain.

Question 5

ANS:

a) i) addition polymerization: means that small units called monomers join to make a large molecule called a polymer.

ii) The systematic name of this polymer is called poly vinyl chloride(PVC).

b) I) CIs – isomer.

ii) trans- isomer.

iii) 2-methyl but-1-ene.

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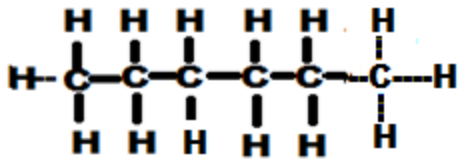
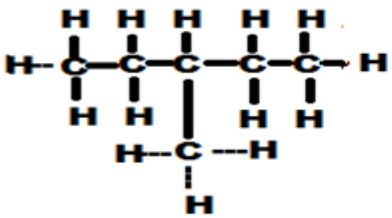
Question 6

ANS:

a) The displayed structure of hexane is



A



A **3- methyl pentane**

c)

Compound	ethane	ethene	ethyne
Homologous series	Alkane	**alkene**	**alkyne**
Molecular formula	C_2H_6	C_2H_4	C_2H_2
Structural formula	CH_3--CH_3	CH_2=CH_2	H--C ≡ C---H
Type of covalent bonding	**single**	Single and double	**double bond**
Is the carbon bond to carbon bonding saturated or unsaturated	Saturated	**unsaturated**	unsaturated

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d) i) monomer (B)

ii) Monomer (A)

iii) Carboxylic acid and alcohol.

iv) Condensation polymerization.

Question 7(2007)
ANS:

Naming organic compound

a.
   i. 1-chloro 2-methly-but2-ene
   ii. 2,3-dimethly but-1-ene
   iii. 3,3-dimethly but-1-ene
   iv. 2,bromo, 3,3- dimethyl, pentene
   v. 3,bromo, but-2-yne

b.
   i. substitution reaction
   ii. by using ultraviolet radiation
   iii.
      a. iodine
      b. step i

         <u>conditions</u>

         - heat and
         - catalyst of N:

step ii

<u>conditions</u>

- heat and
- catalyst of H_3PO_4

c. the white solid is polyethene

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Question 8

ANS:

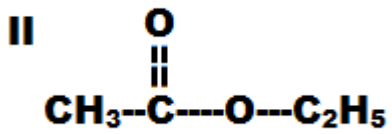
a.

i. compound(I) and (iii) are not hydrocarbons.

ii. compound (ii) and (V) belongs to the same homologous series.

b. Compound (iv) will undergo addition polymerization because it contains carbon-carbon double bond

c. i) . esters



Ethyl ethanoate

Question 9

ANS:

a) i) these compound belong to an alkene homologous series.

ii) The molecular formula of this series is $\mathbf{C_2H_4}$

iii) If few drops of potassium permanganate is added its colour will disappear.

b) i) name of compound P is: but-2-ene

Its structural formula is: …….CH_3-CH=CH-CH_3

ii) The name of compound Q is: 2,3-dichlorobutane

Question 10

ANS:

a. C_nH_{2n}
b. Bromine water
c.
I. carbon dioxide.
II. sodium hydrogen carbonate(yeast)
III. (20—30C^0)

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d. $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$.

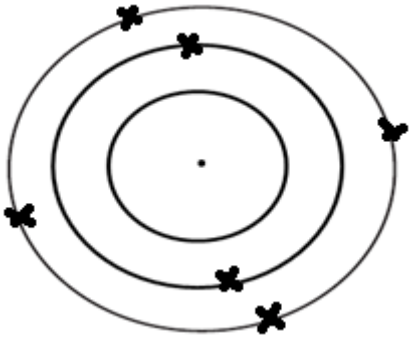
Question 11(2011)

ANS:

I. C_2H_6
II. A
III. Because it contains carbon-carbon double bonds.
IV. (n) Represents the number of monomer in the polymer chain.

Question 12

ANS:



)

ii) Carbon is in period 2.

b) i) hydrocarbons.

ii) Alkanes.

iii) Ethane

iv) Homologous series are organic compound having the same general formula, but differ the number of carbon atoms in the chain.

c) i) alcohol + carboxylic acid → ester + water.

ii) The general formula for the

: Alcohol…….$C_nH_{2n+1}OH$.

: Alkane…….. C_nH_{2n+2}

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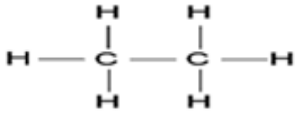
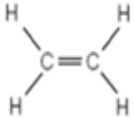
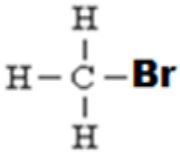
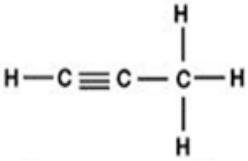
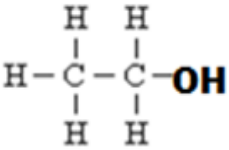
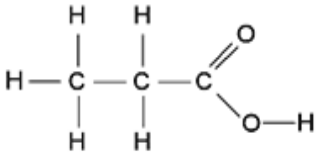
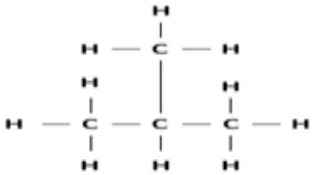
d) Matching column A to column B.

A	B	C
		
D	E	F
		
G	H	
		

Column A(insert letter)	Column B- Name
G	Propanoic acid
F	ethanol
D	Bromomethane
A	ethane
E	Prop-1-yne
H	2-methyl propane

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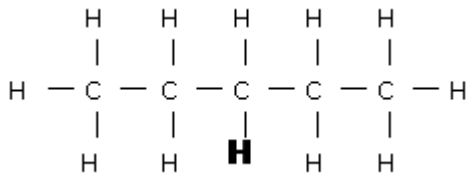
Question 13

ANS:

2. a) i) members of homologous series have the same
   - general formula
   - functional group

ii)



ii) the general formula for alkanes is $\mathbf{C_nH_{2n+2}}$.

b) i) the melting and boiling point increases as the number of carbon atoms increase.

ii) the negative sing shows that the process is exothermic.

iii) $C_3H_8 + O_2 \rightarrow 3CO_2 + 4\ H_2O$ =energy

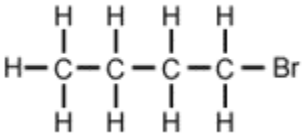
c) i) $C_{12}H2_6 \rightarrow C_2H_4 + C_{10}H_{22}$

ii) The meaning of the following terms

- Saturated means they contain carbon- carbon single bonds.
- Hydrocarbons: compounds that contain only carbon and hydrogen.

d) i) catalytic addition of steam

ii) primary, secondary and tertiary of haloalkanes



primary

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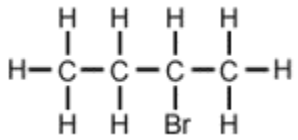
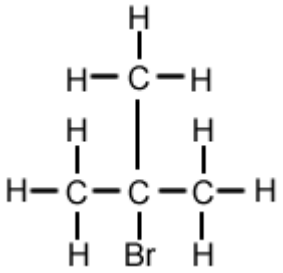


secondary



tertiary

UNIT SEVEN

METALS AND REACTIVITY SERIES+ EXTRACTIONS.

7.1 M.C.Q

1	c
2	d
3	b
4	b
5	d

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7.2 STRUCTURED QUESTIONS.

Question 1

ANS:

a. This is because magnesium is a very reactive metal and reacts with oxygen from the air to form a layer of magnesium oxide.
b. Because electricity is being produced.

c. i) magnesium
   ii) Magnesium

d. i) Magnesium>chromium>cobalt>copper.

e. $Mg + Fe^{2+} \rightarrow Mg^{2+} + Fe$

Question 2

ANS:

a) i) the three metals are zinc, iron, and lead.

ii) Because they are less reactive metals.

iii) Because carbon is more reactive than these metals and displace from their compounds when heated strongly.

b) i) the metals are sodium, potassium and aluminium.

ii) Because they are very reactive metals and cannot be separated easily.

iii) Because it's more difficult do extract form their stable compounds.

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Question 3

ANS:

a) The colour of the solution was blue before the reaction has taken place.

b) The solution becomes colourless.

c) The colour of the metal strip was white shiny metal.

d) After the reaction the metal is coated by a reddish or brown colour.

e) $Cu^{+2} + 2e \rightarrow Cu(s)$

f) $Zn \rightarrow Zn^{+2} + 2e$.

g) The copper half equation shows reduction.

h) The zinc half equation shows oxidation.

i) The oxidation number of copper decreases.

j) The oxidation number of zinc increases.

k) The sulphate ions (SO_4^{-2}) are the spectator ions.

Question 2

ANS:

A)

i. Magnesium
ii. Copper
iii. Mg>Cr>Co> cu
iv. Copper sulphate solution

B)

i. Magnesium
ii. Magnesium sulphate
iii. $Mg + H_2SO_4) \rightarrow MgSO_4) + H_2(g)$

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Question 3

ANS:

a) J > K > M
b) K + cold water →metal hydroxide + hydrogen
c)
i. Calcium
ii. $Ca\ (s) + 2H_2O(l) \rightarrow Ca(OH)_2\ (aq) + H_2(g)$
iii. Group II

UNIT EIGHT

NON-METALS.

8.1 M.C.Q

1 A
2 C
3 C
4 C
5 C
6 C
7 C
8 D

8.2 STRUCTURED QUESTIONS.

Question 1.

ANS:

a. The name of the solid manganese oxide purpose for the solid acts as catalyst.

b. $$2H_2O_2 \xrightarrow{MnO_2} 2H_2O + O_2$$

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c. it is an amphoteric substance
d. it can be tested by using splint light it relight.

Question 2.

ANS:

a) The symbol shows that the reaction is reversible.

b) Exothermic reaction.

c) $450C^0$

d) Because this is the temperature in which the catalyst can work best.

e) 200atm.

f) To increase the yield of ammonia.

g) Iron beds are used as a catalyst.

h) To increase the surface area of the reactants.

Question 3

ANS:

a)
i. Frasch process
ii. C
iii. A

b)
i. Monoclinic Sulphur and rhombic Sulphur
ii. the transition temperature is $96C^0$

c)
i. Reversible reaction
ii. vanadium pentoxide is used as a catalyst

d)
i. By adding with water and concentrated sulphuric acid
ii. Air pollution and

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QUESTION 4

a) The symbol shows that the reaction is reversible.

b) Exothermic reaction.

c) $450C^0$

d) Because this is the temperature in which the catalyst can work best.

e) 200atm.

f) To increase the yield of ammonia.

g) Iron beds are used as a catalyst.

h) To increase the surface area of the reactants.

8.3 EXTENDED QUESTIONS.

Question 1

ANS:

A) Hydrogen is obtained from natural gas methane
B) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

1- High pressure will increase the yield of **Questions1**

C) ammonia It also increase the speed of collision between the particles
2- Low temperature will farour the catalyst to work best
D) $CuO + NH_3 \rightarrow Cu(s) + H_2O + N_2(g)$
E) It increase the speed of a chemical reaction but it has no effect on the equilibrium mixture

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UNIT NINE

RATES OF CHEMICAL REACTIONS AND EQUILIBRIA.

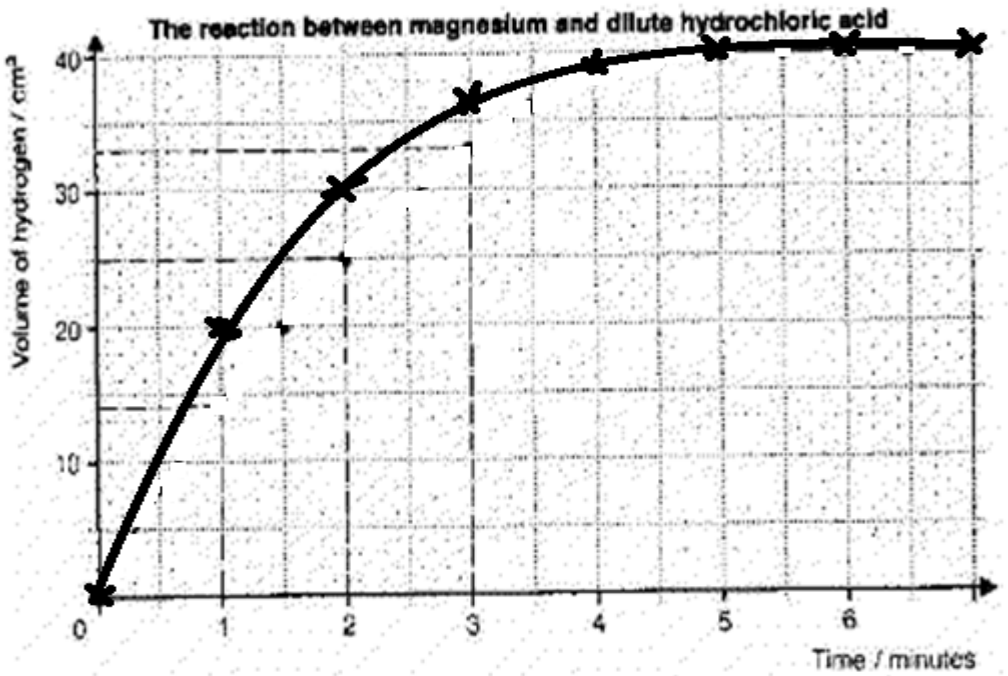
9.1 M.C.Q

1. C
2. A
3. B
4. B

9.2 **STRUCTURED QUESTIONS**.

ANS:

i)



ii) The volume of hydrogen produced in 3.5minutes is 37.5cm^3

iii) The reaction is at fastest A) 0—1

IV) The final volume of hydrogen produced when the volume of the acid is doubled is 32cm^3 of hydrogen gas.

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Question 2

ANS:

a)

i. Curve Y
ii. Curve X, the reaction between hydrochloric acid and magnesium powder is faster than the reaction between hydrochloric acid and magnesium ribbon, so curve X is steeper than curve Y.

b) $$\text{no of moles} = \frac{\text{mass}}{\text{molar mass}}$$

$$\frac{6.0\text{g}}{12\text{g/mol}} = 0.5 \text{ mol}$$

c)

i. The rate of reaction will increases
ii. Because if you increase the concentration, the rate of reaction increases

d)

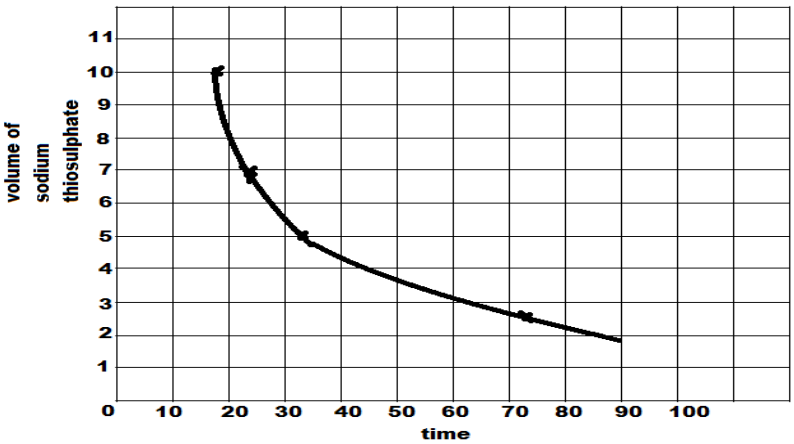
- Surface area
- Concentration
- Catalyst

9.3 EXTENDED QUESTIONS.

Question 1.

Question 2.

i)



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ii) In experiment 4 it will take 16 minutes for the cross to disappear.

b) as the concentration of the reactants increases the time for the cross to disappear decreases, this shows that the reaction can go faster since more particles have the chance to collide.

c) i) these factors include:

- Surface area of the reactants.
- Concentration of the reactants.
- Temperature at which the reaction is carried out.
- By using a catalyst.

UNIT TEN

ENERGY IN CHEMISTRY(ENTHALPY CHANGES)

10.1 M.C.Q

1. C
2. D
3. A

10.2 STRUCTURED QUESTIONS.

Question 1

ANS:

a) Because polystyrene reduces heat loss to the surroundings.

b) $M = \frac{n}{v}$

$n = M \times V$

$n = 0.2\ mol/dm^3 \times 0.05\ dm^3$

n = 0.01 mole of copper sulphate

C) Enthalpy change = $M \times C \times \Delta t$

$50 \times 4.2 \times 7 = 1470J.$

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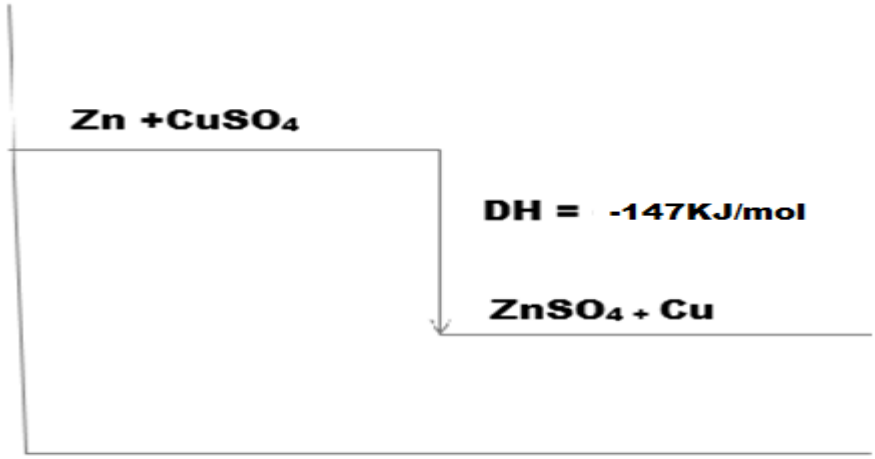
d)



Question 2

ANS:

a. Exothermic reaction.
b. i)completing the table
c.

bond	Number of the bonds	Bond dissociation Energy Kj/mol	Energy needed in Kj
C—H	12	413	**4956**
C—C	2	330	**660**
O=O	**7**	497	3479
		Total energy used(taken in)	**9095**

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bond	Number of the bonds	Bond dissociation Energy Kj/mol	Energy needed in Kj
C=O	8	740	5920
H-O	10	463	4630
		Total energy used(taken in)	10550

ii) The energy given out is energy in – energy out
9095-10550 = -1455kj/mol.

Questions 3

ANS:

b. endothermic : chemical reactions or physical processes that absorbs heat energy from their surrounding
Exothermic; chemical reactions or physical process that releases heat energy to their surrounding

c.
i. $NaOH_{(aq)} + HCl_{aq} \rightarrow NaCl(_{aq} + H_2O(l)$
ii. the process is exothermic
iii. 1 mole NAOH _____57kg/mol
2molNAOH _____> x
X : 2X –(57) = -114kg/mol

Question 4

ANS:

a)
i. C_4H_9OH (g) + $6O_2$ (g) $\longrightarrow$ $4CO_2$ (g) + $5H_2O$ (l) + Energy

ii. No of moles $= \frac{\text{mass}}{\text{molar mass}} = \frac{2.8\text{g}}{74\text{g/mol}}$ = 0.037moles of butanol

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iii. Enthalpy change = mcΔt
= (2.8g)(4.2j/g°c)(9°C)
=105.85j of energy

b)

i. 2.8 g of C_4H_9OH ⟶ 105.85j

74 g 0f C_4H_9OH ⟶ X

$X = \frac{(74\ g)(105.85\ j)}{2.8\ g}$ = -2797.2 j of heat

ii. Because there is a heat loss to the environment

c)

i. Exothermic reaction
ii. Because the reactants have more energy than the products

10.3 EXTENDED QUESTIONS.

Question 1

ANS:

A)

i. Copper container is lagged to reduce heat loss from the system to the surroundings.
ii. Energy evolved the reaction= Q = MxCxΔt.
= 50gx4.2x3 = 630j.
Calculating the numbers of moles of HCl.
n = MxV. = 0.3mol/dm^3 x 0.025dm3
= 0.0075mole of HCl.
0.0075mole→ 630j

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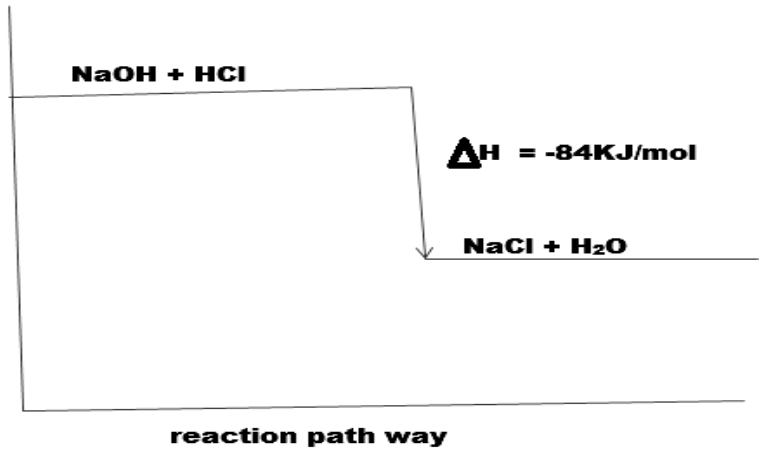
1mol→ = X

X = 84000J

ΔH = -84KJ/mol.

iv)



b) Because strong bases and strong acids completely ionizes, while weak acid and strong base partially ionizes. This reduces the heat evolved from the system.

Question 2

ANS:

1- a) i) completing the table. The missing values.

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Bonds	Bond enthalpy (Kj mol)	Number of bonds broken	Total enthalpy input (Kj mol)
N N	945	___3___	945
H H	436	3	___1308____
			2253

Bonds	Bond enthalpy (Kj mol)	Number of bonds broken	Total enthalpy input (Kj mol)
N H	391	__6_____	2346

ii) Calculating the enthalpy for the formation of ammonia.

ΔH = energy in – energy out

2253-2346 = -93kj/mol.

iii) The reaction is exothermic reaction.

b) i) this is because dilute sulphuric acid has more free hydrogen ion than concentrated suphuric acid.

ii) Vanadium pentoxide is used as a catalyst.

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UNIT ELEVEN

MOLES AND CHEMICAL CALCULATIONS

11.1 M.C.Q

1. D
2. C
3. C
4. A
5. C
6. C
7. A
8. C
9. A
10. D

11.2 STRUCTURED QUESTIONS.

Question 1

ANS:

a) i) calcium oxide,
ii) Calcium oxide + water→ calcium hydroxide,
$CaO + H_2O \rightarrow Ca(OH)_2$
b) i) limestone
c) i) $CaCO_3$
1 Ca = 1x40 = 40
1C = 1X12 =12
3O 3X16 = 48

Formula mass of $CaCO_3$ = 100g/mol.

CaO 1Ca = 1x40 =40
1 O = 1X16 = 16
the formula mass is 56g/mol.

ii) $CaCO_3 \rightarrow CaO + CO_2$

100g $CaCO_3 \longrightarrow$ 56g CaO

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X ← 2.8g CaO

$$\frac{100}{56}X2.8 = 5g \text{ fo CaO}$$

d) Carbon dioxide.

Question 2

ANS:

a. Endothermic reaction.
b. The mass of 1 mole of $CaCO_3$ is =(40+12+48= 100g).
c. Farmers spread lime powdered limestone to reduce acidity in the soil.
d. quicklime is used for the purification of ion in the blast furnaces
e. Carbon dioxide can pollute the atmosphere because it is one that green house gases that traps. Heat to the earth which cause global warming.

Question 3

ANS:

1. a) i) the empirical formula

Carbon	Hydrogen	Oxygen
$\frac{5o.17}{12}$ =4.18 $\frac{4.18}{2.30}$ =1.6 2	$\frac{13}{1}$ =13 $\frac{13}{2.30}$ =5.6 6	$\frac{36.83}{16}$ = 2.30 $\frac{2.30}{2.30}$ =1 1

The empirical formula is **C_2H_6O**

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ii) The molecular formula is

$\frac{92}{46} = 2(\mathbf{C_2H_6O}) = \mathbf{C_4H_{12}O_4}$

The molecular formula is $\mathbf{C_4H_{12}O_4}$

b) i) The volume occupied by the **12.5 moles** of oxygen gas is:

V = moles x $24dm^3$/moles

V = 12.5 moles x $24dm^3$/moles

V = $300dm^3$

ii) The volume occupied by the **0.15 moles** of carbon dioxide is:

V = moles x $24dm^3$/moles

V = 0.15 moles x $24dm^3$/moles

V = $3.6dm^3$

C) The number of moles of faradays of electricity must be passed to deposit 2.16g of silver (Ag = 108) is:

1mole of F → 108g

X ← 2.16g

108g X = (1mole of F) (2.16g)

$\frac{108g\ x}{108g} = \frac{2.16g}{108g}$

X = 0.02 moles of faradays

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Question 4

ANS:

a) Calculating the numbers of grams in sodium carbonate (Na_2CO_3)

i) 500cm^3 of 1M.

$n = MxV$ = 1mol/dm^{3}x0.5dm^3

0.5moles of Na_2CO_3

mass = nxM_r = 0.5molx106g/mol = 53g of Na_2CO_3

ii) 1500cm^3 of 0.25M.

$n = MxV$ = 0.25mol/dm^{3}x 1.5dm^3

0.375mol of Na_2CO_3

mass = nxM_r = 0.375mol x 106g/mol

= 39.75g of Na_2CO_3

b) i) calculating the numbers of moles in

1060g of Na_2CO_3

$$n = \frac{M}{Mr} = \frac{1060\,g}{106\,g/mol} = 10\text{moles of } Na_2CO_3$$

ii) 1000cm^3 of 1M

$$n = MxV = \frac{1mol}{dm\,3}\ x\ 1dm3 = 1mol$$

iii) 1000cm^3 of 0.55M

$$n = MxV = \frac{0.55mol}{dm3}\ x1dm3$$

0.55 moles of Na_2CO_3

iv) 285cm^3 of 0.55M.

$$n = MxV = \frac{0.55mol}{dm3}\ x.285m3$$

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0.15675moles of Na_2CO_3

Question 5

ANS:

a) $Mg + O_2 \rightarrow MgO$.

b) i) propane + oxygen → carbon dioxide + water.

ii) $C_3H_8 + O_2 \rightarrow 3CO_2 + 4H_2O$

c) i) $Pb(NO_3)_2 + NaI(aq) \rightarrow PbI_{2(s)} + Na\ NO_{3(aq)}$

ii) $Pb^{2+} + 2I \rightarrow PbI_{2(S)}$

Question 6(2007)

ANS:

a) Calculating the numbers of moles

i) 4g of hydrogen gas

$n = \frac{M}{Mr} = \frac{4g}{\frac{2g}{mol}} =$ 2mols of hydrogen gas.

ii) 1.15g of sodium atoms.

$$n = \frac{M}{Mr} = \frac{1.15g}{\frac{23g}{mol}} = 0.05\text{moles of sodium atoms.}$$

iii) $1.2046X10^{25}$ Molecules of hydrogen gas.

1mole of H_2 = $6.02X10^{23}$ molecules

X = $1.2046X10^{25}$ Molecules

$X = \frac{1.2046X1025}{6.02X1023}$ = 2O moles of hydrogen gas

iv) 2g of iron atoms

$$n = \frac{M}{Ar} = \frac{2g}{\frac{56g}{mol}} = 0.036\text{moles of iron atoms.}$$

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b) Calculating the masses.

i) 0.25moles of carbon dioxide.

$$m = nXMr = 0.25MOLX\frac{12g}{mol} = 3mols \text{ of carbon atoms.}$$

ii) $1.2046X10^{25}$ molecules of hydrogen gas.

$6.02X10^{23}$ molecules = 2g

$1.2046X10^{25}$ == X

= $6.02X10^{23}$ X = $2.4092X10^{25}$

$$= \frac{2.4092X10^{25}}{6.02X1010^{23}} = 40g \text{ of hydrogen gas}$$

iii) 0.15 moles of $CaCl_2$

$$m = nXMr = \frac{0.15molX111g}{mol} = 16.7g \text{ of calcium chloride}$$

Question 7

ANS:

a) i) calculating the empirical formula.

Carbon	Hydrogen
$\frac{88.88}{12} = 7.40 = \frac{7.40}{7.40} = 1$	$\frac{11.12}{1} = 11.12 = \frac{11.12}{7.40} = 1.5$
The empirical formula is CH_2	

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b) Calculating the numbers of moles in

i) 40cm^3 of a 4M solution.

$$n = MxV = \frac{0.04\,dm\,3x4mol}{dm\,3} = 0.16mol.$$

Question 8

ANS:

a) $n = \frac{M}{Mr} = \frac{20}{40} = 0.5moles$

b) i) calculating the molecular formula.

carbon	Hydrogen	Oxygen
$\frac{40}{12} = 3.33 = \frac{3.33}{3.33} = 1$	$\frac{6.7}{1} = 6.7 = \frac{6.7}{3.33} = 2$	$\frac{53.3}{16} = 3.33 = \frac{3.33}{3.33} = -1$
Therefore the empirical formula of the compound is CH_2O		
II) The molecular formula of the compound is $\frac{180}{30} = 6$		

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The molecular formula is $C_6H_{12}O_6$

III) The name of the compound is glucose.

Question 9

ANS:

a) i) the percentage of nitrogen in ammonia and ammonium nitrate is

The percentage of N in ammonia is

$$\frac{14}{17}\text{x}100 = 82.35\% \text{ of nitrogen}$$

The percentage of nitrogen in ammonium nitrate is

$$\frac{28}{80}\text{x}100 = 35\% \text{ of nitrogen}$$

ii) Ammonium nitrate is sometimes mixed with chalk to reduce acidity in the soil.

b) i) determining the empirical formula of compound P is

Carbon	Hydrogen	Oxygen
$\frac{64.9}{12} = 5.4$ $= \frac{5.3}{1.35} =$ 4	$\frac{13.5}{1} = 13.5 = \frac{13.5}{1.35} =$ 10	$\frac{21.6}{16} = 1.35 = \frac{1.35}{1.35} =$ 1
The empirical formula of P is $C_4H_{10}O$		

ii) The molecular formula of butane is the same as its empirical formula

$C_4H_{10}O$

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UNIT 12

EARTH AND WATER

12.1 M.C.Q

1. C
2. C
3. B
4. C

12.2 structured questions

Question 1 (2003)

ANS:

a. i) D because it uses more soap solution.
   ii)
   1. If the sample is water it turns white anhydrous copper (II) sulphate into blue
   2. it will boil at $100C^0$ at sea level.
b. i) ⇌ the symbol shows that the reaction is reversible.
   ii) The PH is likely to between 5—6..

c. i) Hard water causes scales in kettles because when water is heated in the kettle the heat removes calcium carbonate from water and it may form sediments which form as scales in the kettle.

Question 2

ANS:

i. Name of the gas (X) is nitrogen.
ii. Octane oxygen = carbon dioxide + water.
iii. Carbon and hydrogen.
iv. It belongs the alkane homologous series.
b) the empirical formula of compound (w) is

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Carbon	hydrogen
85.72	14.28
12	1
7.14	14.28
7.14	7.14
1	2

Empirical formula {CH_2}

Question 3

ANS:

a.

i. Chlorine is added to water to kill germs or other bacteria.

ii. Chemical formula= $Ca(OH)_2$ (s).

Chemical name --calcium hydroxide

b.

i. boiling point 100C^o

ii. Chemical test = addition copper(ii) sulphate solution. For water

iii. For cooking food.

C. K+ H_2O (l) -→ KOH+ H_2.

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12.3 extended questions

ANS:

A.

i. Evaporation is the charge state from liquid to gas.

ii. Calcium carbonate or calcium hydrogen carbonate

B.

i. hard water means water that contain more magnesium and calcium ion than sodium ions

ii. hard water, should not be used in hot boiler this is because hard water may produce scales that can block in the pipes.

iii. Advantage of hard water

- It reduces heart attack

Disadvantage

- It prevent soap to make lather

C.

i. Distillation

ii. Ion exchange.

THE END

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