

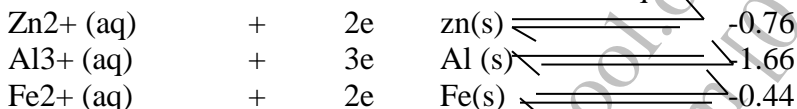
CHEMISTRY PAPER 233/ 1 K.C.S.E 1998
QUESTIONS

1. An isotope of Uranium $^{234}_{92}\text{U}$, decays by emission of an alpha particle to thorium
- Write the equation for the nuclear reaction undergone by isotope.
 - Explain why it is not safe to store radioactive substances in containers made from aluminium sheets.
2. Study the information in the table and answer the question below the table.

Substance	Solubility g /100g water
A	1.26×10^2
B	1.09×10^2

Describe how a solid sample of substance A could be obtained from a solid mixture of A and B.

- Give one advantage and one disadvantage of using petrol containing tetraethyl lead in motor vehicles.
- Use the information below to answer the questions that follow:



- Calculate the E value for the electrochemical cell represented bellow.



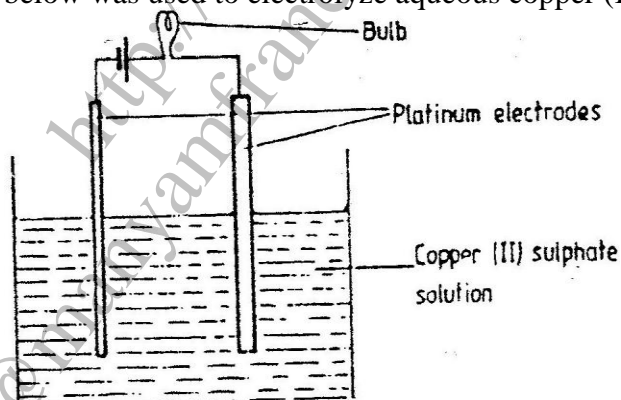
- Give a reason why aluminium metal would protect iron from rusting better than zinc metal.
5. The table below shows some properties of substances C,D and E. Study it and answer the questions that follow.

Substance	M.P (OC)	Solubility in water	Electrical solid state	Conductivity mo stated.
E	-39	Insoluble	Good	good
D	1610	Insoluble	Poor	poor
E	801	Soluble	Poor	good

Select substance

- Within a giant molecular structure
- That is not likely to be an element

6. On complete combustion of a sample of hydrocarbon, 3.52 gm of carbon dioxide and 1.44gm of water were formed. Determine the molecular formula of the hydrocarbon. (Relative molecular masses of hydrocarbon =56, carbon dioxide 44, water = 18 and relative atomic masses H = 1.0 and c=12.0)
7. A sample of water drawn from a river passing through an agricultural district was divided into two portions. The first portion gave a white precipitate when acidified barium chloride was added. The second portion when warmed with aqueous sodium hydroxide gave a colourless gas, which turned a moist red litmus paper blue.
- Identify the ions present in the river water.
 - Suggest the possible sources of the ions identified in (a) above.
8. The equation below represents a redox reaction. Identify the reducing agent. Give a reason. $2\text{FeCl}_2(\text{aq}) + \text{Cl}_2(\text{g}) \longrightarrow 2\text{FeCl}_3(\text{aq})$
9.
 - What is meant by dynamic equilibrium?
 - State and explain the observation that would be made if a few pellets of potassium hydroxide are added to the equilibrium mixture.
10. An ion of phosphorous can be represented as ${}_{15}^{31}\text{P}^{3-}$
- Draw a diagram to show the distribution of the electrons and the composition of the nucleus of the ion of phosphorous.
11. Diamond and graphite are allotropes of carbon. In terms of structure and bonding explain the following.
- Diamond is used in drilling through hard rocks
 - Graphite is used as a lubricant
12. Distinguished between a strong and a weak acid. Give examples.
13. The set-up below was used to electrolyze aqueous copper (II) sulphate



- Explain why the bulb light is brightly at the beginning of the experiment and becomes dim after sometime.
 - Write the ionic equation of the reaction that took place.
14. Draw the structural formula of:
- Ethanol
 - Propanoic
 - Give the name of the organic compound formed when ethanol and propanoic acid react in the presence of concentrated sulphuric acid.

15. The grid below shows part of a periodic table. The letters do not represent the actual symbols of the elements

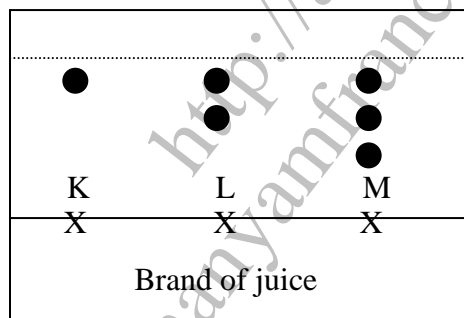
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- a) Select the:
- element which has the largest atomic radius
 - Most reactive non-metal
- b) Show on the grid the position of the element J which forms J^{2+} ions with electronic configuration 2, 8, 8.
16. Study the information in the table below and answer the questions below the table.

Bond	Bond energy (kJmol ⁻¹)
C-H	414
Cl-Cl	244
C-Cl	326
H-Cl	431

Calculate the enthalpy change of the reaction:
 $\text{CH}_4(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow \text{CH}_3\text{Cl}(\text{g}) + \text{HCl}(\text{g})$

17. The diagram below represents a paper chromatogram for three brands of juices suspected to contain banned food colorings.

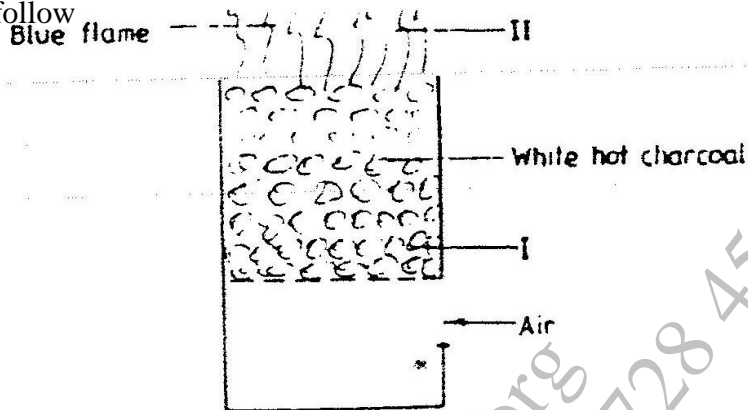


The results showed the presence of banned food colorings in L and M only. On the same diagram:

- Circle the spots which show the banned food colorings
 - Show solvent front.
18. Urea, $(\text{NH}_2)_2\text{CO}$ is prepared by the reaction between ammonia and carbon dioxide.
 $2\text{NH}_3(\text{g}) + \text{CO}_2(\text{g}) \rightarrow (\text{NH}_2)_2\text{CO}(\text{aq}) + \text{H}_2\text{O}(\text{l})$
 In one process, 680 kg of ammonia were reacted with excess carbon dioxide.
 Calculate the mass of urea that was formed. (H = 1.0, C = 12.0, N = 14.0, O = 16.0 and relative molecular mass of ammonia = 17)

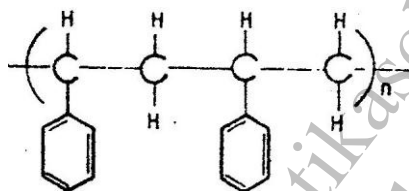
Calculate the mass of Urea that was formed

19. Describe how a solid sample of lead (II) Chloride can be prepared using the following reagents, dilute nitric acid, dilute hydrochloric acid and lead carbonate.
20. The diagram below represents a charcoal burner. Study it and answer the questions that follow

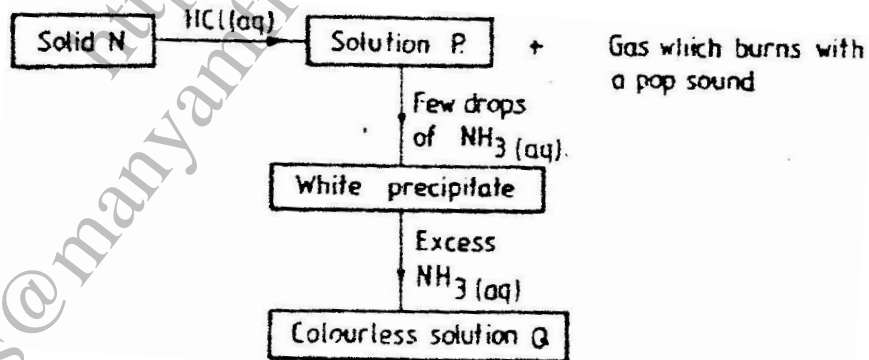


Write equations for the reactions taking place at I and I and II

21. The formula given below represents a portion of a polymer Give:

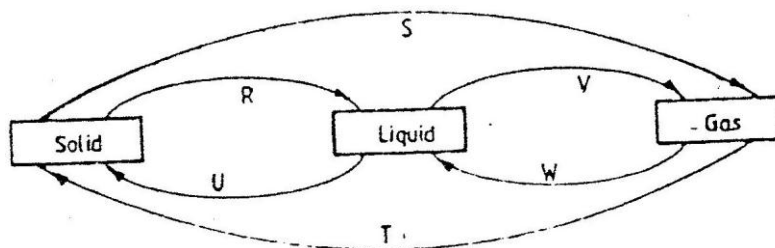


- a) The name of the polymer.
- b) One disadvantage of continued use of this polymer.
22. The scheme below shows some reaction sequence starting with solid N.



- a) Identify solid N
- b) Write the formula of the complex ion present in solution
23. A sealed glass tube containing air at s.t.p was immersed in water at 100°C. Assuming that there was no increase in the volume of the glass tube due to the expansion of the glass, calculate the pressure of the inside tube. (standard pressure = 760mmHg,)

24. A beekeeper found that when stung by a bee, application of a little solution of hydrogen carbonate helped to relieve the irritation from the affected area. Explain.
25. The diagram below shows the physical state of matter. Study it and answer the questions that follow.



Identify the processes R, V, w and U

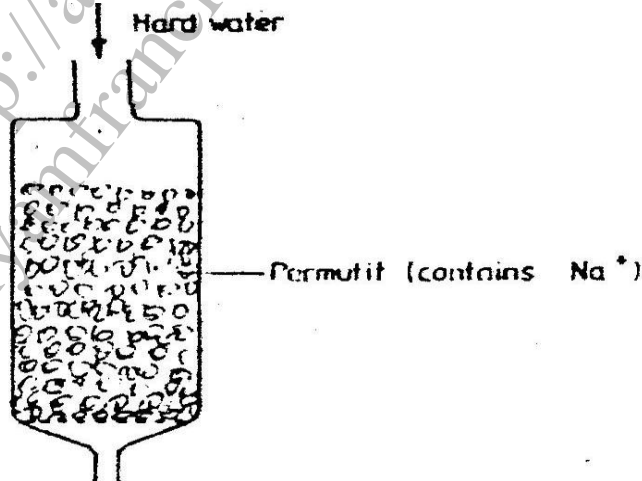
(c) Name one substance which can undergo the process represented by S and T.

26. The table below gives the energy required to remove the outermost electron for some group I elements.

Element	I	II	III	IV
Energy kJmol ⁻¹	494	418	519	376

Arrange the elements in order of their reactivity starting with the most reactive.

27. A hydrocarbon slowly decolorizes bromine gas in the presence of sunlight but does not decolourise acidified potassium permanganate
Name and draw the structural formula of the fourth member of the series to which the hydrocarbon belongs.
28. The column below was used do soften hard water

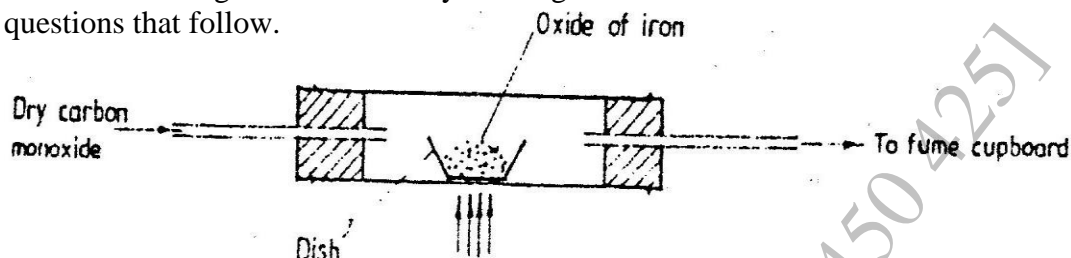


- (i) Explain how the hard water was softened as it passed through the column
- (ii) After some time the material in the column is not able to soften hard water
How can the material be activated?
- (iii) Give one advantage of using hard water for domestic purposes.
29. What is the oxidation number of chlorine in CO₄

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QUESTIONS

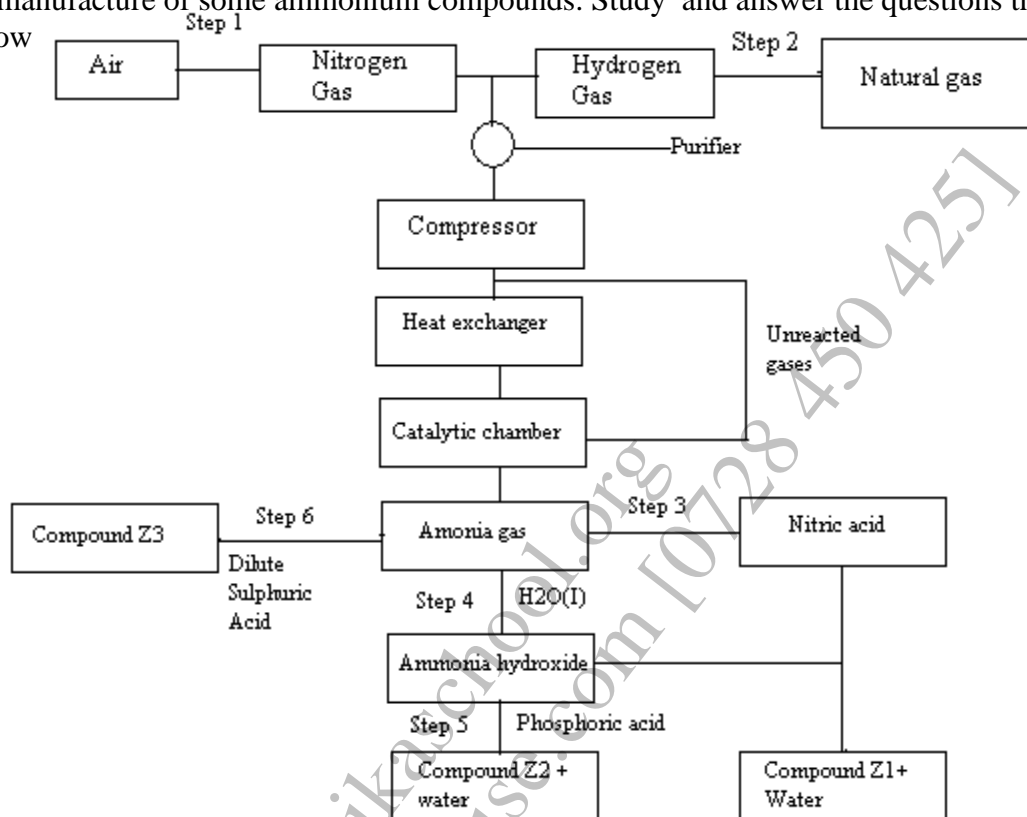
1. (a). An ore is suspected to contain mainly iron. Describe a method that can be used to confirm the presence of iron in the ore
- (b) Excess carbon monoxide gas was passed over a heated sample of an oxide of iron as shown in the diagram below. Study the diagram and the data below it to answer the questions that follow.



Mass of empty dish	=	10.98g
Mass of empty dish + oxide of iron	=	13.30g
Mass of empty dish + residue	=	12.66g

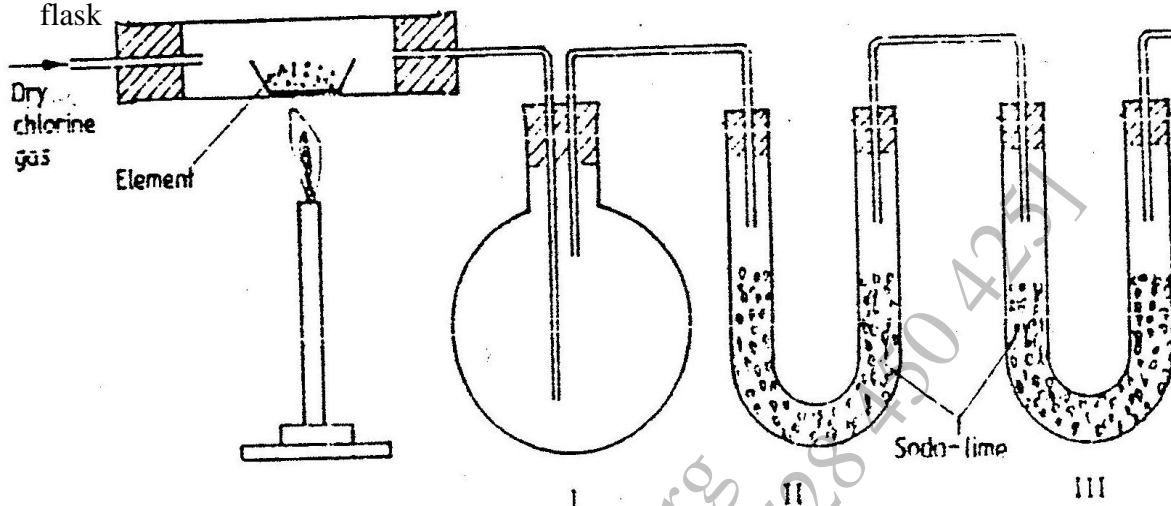
- (i) Determine the formula of the oxide of iron. (relative formula mass of oxide iron = 232, Fe = 56.0, O = 16.0)
- (ii) Write an equation for the reaction which took place in the dish
- (c) Corrosion is a destructive process in which iron which is converted into hydrated iron (III) oxide
- State:
- (i) two conditions necessary for rusting to occur
- (ii) One method used to protect iron from rusting
- (d) Explain why it is not advisable to wash vehicles using seawater
2. (a) The following equations represent two different types of reactions
- (i) $n\text{C}_4\text{H}_8(\text{g}) \rightarrow (\text{C}_4\text{H}_8)_n(\text{s})$
- (ii) $\text{C}_2\text{H}_6(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow \text{C}_2\text{H}_5\text{Cl}(\text{l}) + \text{HCl}(\text{g})$
- State the type of reaction represented by:
- (i)
- (ii)
- (b) The fermentation of glucose produces ethanol as shown in the equation below
- $$\text{C}_6\text{H}_{12}\text{O}_6(\text{aq}) \rightarrow 2\text{C}_2\text{H}_5\text{OH}(\text{aq}) + 2\text{CO}_2(\text{g})$$
- (i) State how the concentration of ethanol produced could be increased
- (ii) State and explain the observation that would be made when a piece of sodium metal is added to a sample of ethanol contained in a beaker
- (iii) Give two commercial uses of ethanol other than in the manufacture of alcoholic drinks
- (c) The molecular formula of a hydrocarbon is C_6H_{14} . The hydrocarbon can be converted into two other hydrocarbons as shown by the equation below
- (i) Name and draw the possible structural formula of X
- Name
- Structural formula
- (ii) State and explain the observation that would be made if a few drops of bromine water were added to a sample of X.

- (iii) Write an equation for the complete combustion of C_3H_8
3. The flow chart below shows the industrial preparation of ammonia and the process used in the manufacture of some ammonium compounds. Study and answer the questions that follow



- (a) Give the name of the
- Process in step 1
 - Reaction that takes place in step 5
- (b) State one other source of hydrogen gas apart from natural gas
- (c) Explain why it is necessary to compress nitrogen and hydrogen in this process
- (d) Write an equation for the reaction which takes place in step 6
- (e) Name the catalyst and the reagents used in step 3
- Catalyst
- Reagent
- (f) Name compound Z1
- (g) Give one commercial use of compound Z2

4. The set – up below was used to prepare anhydrous chlorides of a number of elements in a laboratory where no fine cupboard was available. The chlorides were to be collected in flask

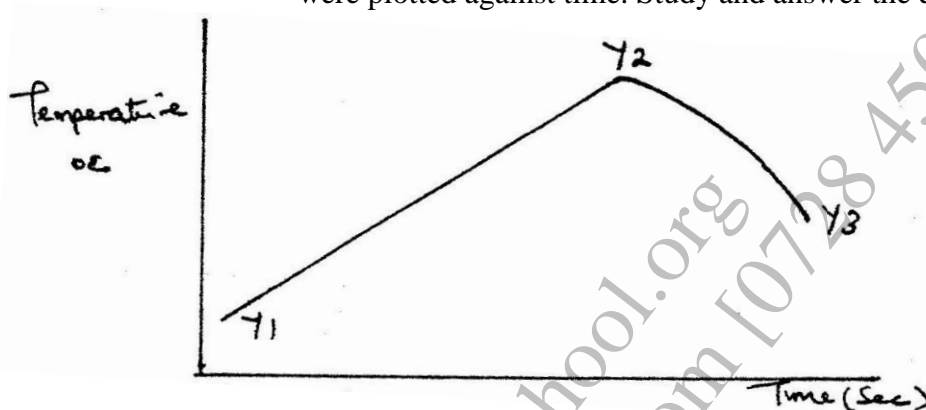


The following table shows the melting and boiling points of the chlorides that were prepared.

- Explain why it is necessary to pass dry chlorine through the apparatus before heating each element
 - Give two reasons why tubes II and III were filled with Soda lime (solid mixture of sodium hydroxide and calcium hydroxide)
 - Explain why it would not be possible to collect any sodium chloride in flask I
 - Name one other substance that can be used in tubes II and III
 - Write an equation for the reaction that forms phosphorous (III) chloride
 - Describe how you would separate a mixture of sodium chloride and aluminium chloride
1. (a) The table below gives the solubilities of hydrated copper (II) sulphate in mol dm³ at different temperatures
- On the grid provided, plot a graph of solubility of copper (II) sulphate (vertical axis) against temperature.
 - From the graph, determine the mass of copper (II) sulphate deposited when solution is cooled from 70^o C to 40^o C.
(Molar mass of hydrated copper (II) sulphate = 250g)
- (b) In an experiment to determine the solubility of sodium chloride, 5.0cm³ of a saturated solution of sodium chloride weighing 5.35g were placed volumetric and diluted to a total volume of 250cm³
- 25.0cm³ of the dilute solution completely reacted with 24cm³ of 0.1M silver nitrate solution.
- $$\text{AgNO}_3(\text{aq}) + \text{NaCl}(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{NaNO}_3(\text{aq})$$
- Calculate:
- Moles of silver nitrate in 24cm³ of solution
 - Moles of sodium chloride in 25.0cm³ of solution
 - Moles of sodium chloride in 250cm³ of solution
 - Mass of sodium chloride in 5.0cm³ of saturated sodium chloride solution (Na = 23.0, Cl = 35.5)
 - Mass of water in 5.0cm³ of saturated solution of sodium chloride
 - The solubility of sodium chloride in g/100 water

5. In order to determine the molar of neutralization of sodium hydroxide, 100cm^3 of 1M sodium hydroxide and 100cm^3 of 1 M hydrochloric acid both at the same initial temperature were mixed and stirred continuously with a thermometer. The thermometer of the resulting solution was recorded after every 30 seconds until the highest temperature of the solution was attained. Thereafter the temperature of the solution was recorded for a further two minutes

- (a) (i) Why was it necessary to stir the mixture of the two minutes
(ii) Write an ionic equation for the reaction which took place
(iii) The sketch below was obtained when the temperature of the mixture were plotted against time. Study and answer the questions that follow.



- I. What is the significance of point Y2?
II. Explain why there is a temperature change between points Y1 and Y2
Y3 and Y4

- (iv) In the initial temperature for both solutions was 24.5°C and the highest temperature attained by the mixture was 30.9°C

Calculate the:

- I. heat change for the reaction
(specific heat capacity of the solution = $4.2\text{Jg}^{-1}\text{K}^{-1}$ and the density of the solution = 1.0g/cm^3)
II. Molar heat of neutralization of sodium hydroxide

- (v) Explain how the value of the molar heat of neutralization obtained in this experiment would compare with the one that would be obtained if the experiment was repeated using 100cm^3 of 1 Methanoic acid instead of hydrochloric acid.

- (b) On the grid provided below, draw an energy level diagram for the reaction between hydrochloric acid and sodium hydroxide

6. Study the information given in the table below and answer the questions that follow. The letters do not represents the actual symbols of the elements

Element	Atomic number	Boiling point
S	3	1603
T	13	2743
U	16	718
V	18	87
W	19	1047

- (a) Select the elements which belong to the same

- (i) Group
- (ii) Period
- (b) Which element
 - (i) Is in gaseous state at room temperature? Explain
(Take room temperature to be 298K)
 - (ii) Does not form an oxide?
- (c) Write the
 - (i) Formula of the nitrate of element
 - (ii) Equation for the reaction between elements S and U
- (d) What type of bond would exist in the compound formed when U and T react?
Give a reason for your answer
- (e) The aqueous sulphate of element W was electrolyzed using inert electrodes Name the products formed at the:
 - (i) Cathode
 - (ii) Anode

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