

NAME _____ INDEX NUMBER _____

SCHOOL _____ DATE _____

NITROGEN AND ITS COMPOUNDS

1. 1990 Q30

(i) Explain how the following would affect the yield of ammonia. An increase in

(i). Pressure.

(2 marks)

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(ii) Temperature

(2 marks)

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2. 1991 Q 28b

(b) (i) Ammonia can be used to manufacture ammonium sulphate, $(\text{NH}_4)\text{SO}_4$ and ammonium phosphate, $(\text{NH}_4)_3\text{PO}_4$ fertilizers. Give one advantage that ammonium phosphate has over ammonium sulphate as a fertilizer.

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(ii) Give one disadvantage of using artificial fertilizers.

(1 mark)

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3. 1992 Q 25b-d

(b) Why is nitric acid stored in dark bottles?

(1 mark)

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(c) Explain why copper metal reacts with nitric acid but does not react with hydrochloric acid (4 marks)

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(d) Give one advantage ammonium phosphate, $(\text{NH}_4)_3\text{PO}_4$ has over urea, $\text{CO}(\text{NH}_2)_2$ as a fertilizer. (2 marks)

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4. 1993 P1A Question 21

State two observations that would be made when solid lead (II) nitrate is heated strongly.

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5. 1994 Q 2 P1B

In an experiment, ammonia gas was prepared by heating an ammonium salt with an alkali. After drying, 120cm^3 ammonia gas was collected at room temperature and pressure. All the ammonia gas was then reacted completely with 250cm^3 solution of phosphoric acid.

(a) What is meant by the term alkali?

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(b) Explain, using the physical properties of the gas, why ammonia is not collected.

(i) Over water

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(ii) By downward delivery

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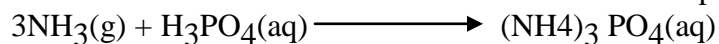
(c) Ammonia turns wet red litmus paper blue. Which ion is responsible for this reaction?

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(d) Calculate the number of moles of ammonia gas that were collected in the above experiment given that one mole of gas occupies a volume of 24000cm^3 at room temperature and pressure.

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(e) The equation below shows the reaction between ammonia and phosphoric acid.



(i) Explain how crystals of ammonium phosphate could be obtained in this experiment.

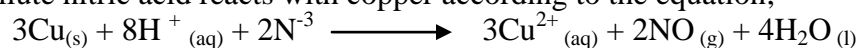
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(ii) Calculate the maximum mass of ammonium phosphate that could be obtained in this experiment (N=14.0, O=16.0, P=31.0, H=1.0)

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6. 1995 Q22 (P1)

Dilute nitric acid reacts with copper according to the equation;



a) What is the oxidation number of nitrogen in?

i) 2N^{-3}

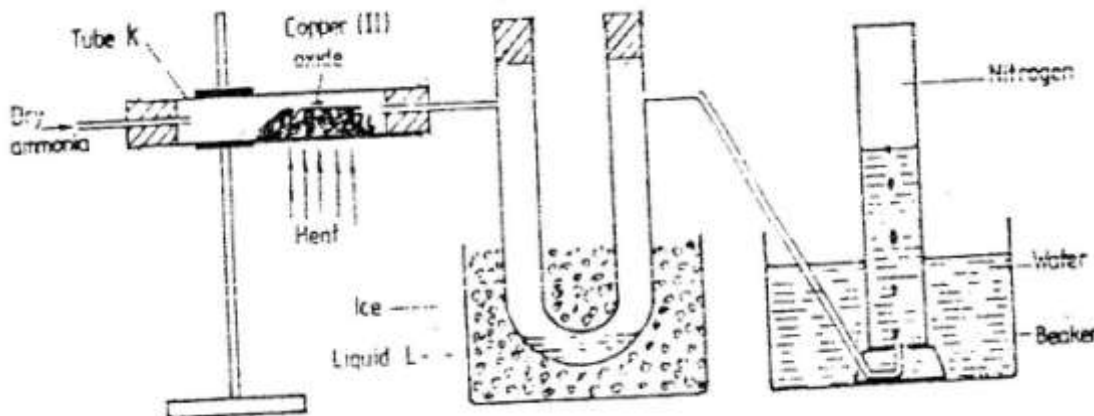
- ii) NO
- b) With respect to nitrogen, explain whether the above reaction is an oxidation or reduction process. (1mark)

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7. 1995 Q7 (P2)

(a) The diagram below shows a set-up that can be used to obtain nitrogen gas in an experiment.



- (i) Name liquid L (1mark)

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- (ii) What observation would be made in tube K after heating for some time? (1mark)

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- (iii) Write an equation for the reaction that took place in tube K. (1 mark)

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- (iv) If 320 cm^3 of ammonia gas reacted completely with the copper?

Calculate:

- I Volume of nitrogen gas produced. (1mark)

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- II the mass of copper oxide that reacted (3marks)

(Cu = 63.5, O=16.O, one mole of gas occupies 24 liters at room temperature and pressure)

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(v) At the end of experiment the PH of the water in the beaker was found to be about Explain (2marks)

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(b) In another experiment a gas jar containing ammonia was inverted over burning splint. What observation would be made? (1mark)

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(c) Why is it advisable to obtain nitrogen from air instead ammonia? (1mark)

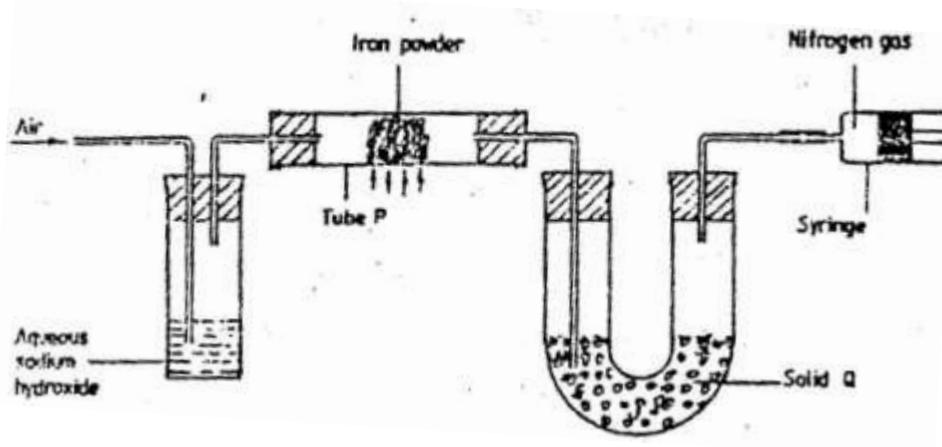
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8. 1996 Q16 (P1)

On strong heating, sodium nitrate oxygen gas. In the spaces provided below, draw a labelled diagram of a set-up that could be used for heating Sodium nitrate and collecting the oxygen gas liberated. (3marks)

9. 1997 Q6 (P2)

(a) The diagram below represents a set up that was used to obtain dry nitrogen from air. Study it and answer the questions that follow



(i) Name solid Q

(ii) What is the purpose of sodium hydroxide?

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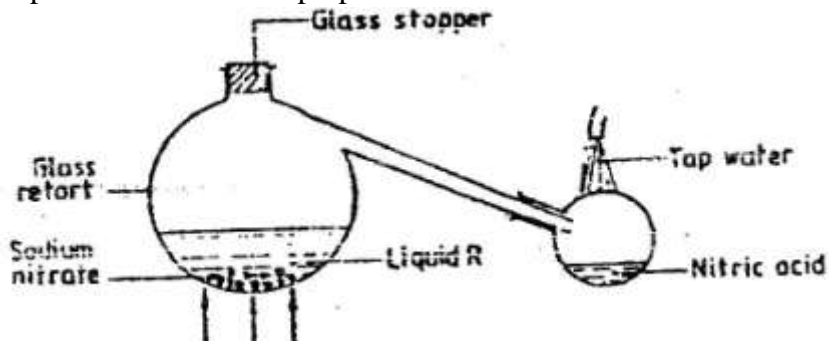
(iii) Write an equation for the reaction which took place in tube P. Give the name of one impurity present in the nitrogen gas obtained

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(iv) Give a reason why liquid nitrogen is used for storage of semen for artificial insemination

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(b) The set up below was used to prepare nitric acid



(i) Give the name of liquid R

(ii) Write an equation for the reaction which took place in the glass retort

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(iii) Explain the following

I. Nitric acid is stored in dark bottles

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II. The reaction between copper metal with 50% nitric acid (one volume of acid added to an equal volume of water) in an open test tube gives brown fumes.

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(c) A factory uses nitric acid and ammonia gas as the only reactants for the preparation of fertilizer. If the daily production of the fertilizer is 4800 kg calculate the mass of ammonia gas used daily.

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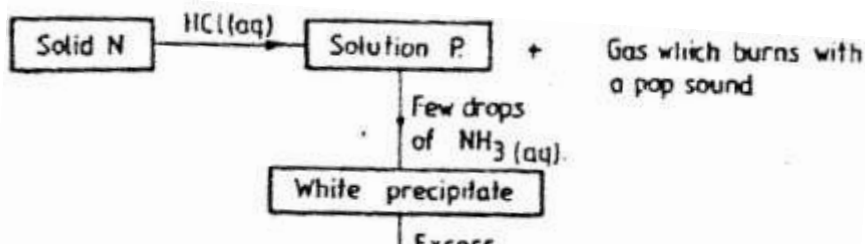
10. 1998 Q18

Urea, $(\text{NH}_2)_2\text{CO}$ is prepared by the reaction between ammonia and carbon dioxide.
 $2\text{NH}_3(\text{g}) + \text{CO}_2(\text{g}) \longrightarrow (\text{NH}_2)_2\text{CO}(\text{aq}) + \text{H}_2\text{O}(\text{l})$. 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

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11. 1998 Q22

The scheme below shows some reaction sequence starting with solid N.



a) Identify solid N

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b) Write the formula of the complex ion present in solution

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12. 1999 PP1A QUESTION 14

(a) A few drops of freshly prepared (II) sulphate solution were added to potassium nitrate solution in a test-tube. Concentrated Sulphuric acid was then carefully added to the mixture. State the observation that was made. (1 mark)

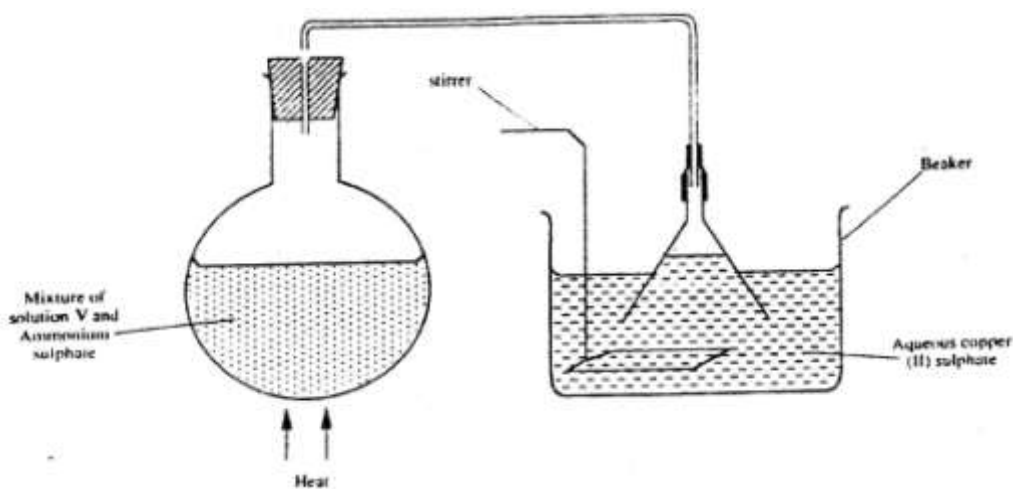
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(b) Write an equation for the reaction that occurs when solid potassium nitrate is strongly heated. (1 mark)

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13. 2000 Q12 P1

A student set up the apparatus shown below to prepare ammonia gas and react it with copper (II) sulphate solution.

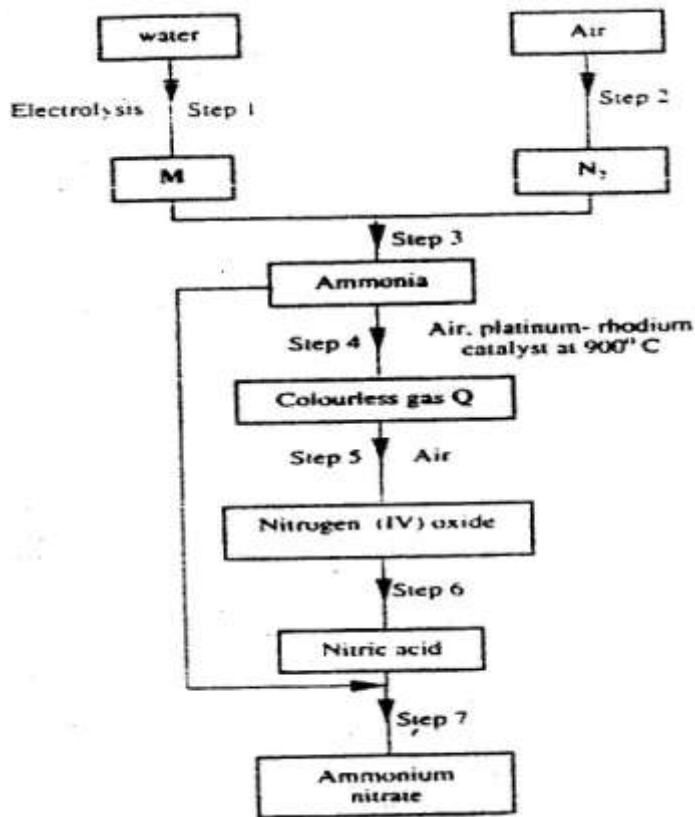


(a) Identify solution V

(b) State the observations which were made in the beaker

14. 2001 Q4b (P2)

b) Study the flow chart below and answer the questions that follow.



i) Name element M.

ii) Why is it necessary to use excess air in step 4?

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iii) Identify gas Q.

iv) Write an equation for the reaction in step 7

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v) Give one use of ammonia nitrate.

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c) State and explain the observations that would be made if a sampler of sulphur is heated with concentrated nitric acid.

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15. 2002 Q24 (P1)

(a) Give a reason why concentrated sulphuric acid is not used to dry ammonia gas

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(b) Name one suitable drying agent for ammonia gas

16. 2002 Q6 (P1)

When potassium nitrate is heated, it produces potassium nitrate and gas C₁

(a) Identify gas C₁

(b) Name the type of reaction undergone by the potassium nitrate

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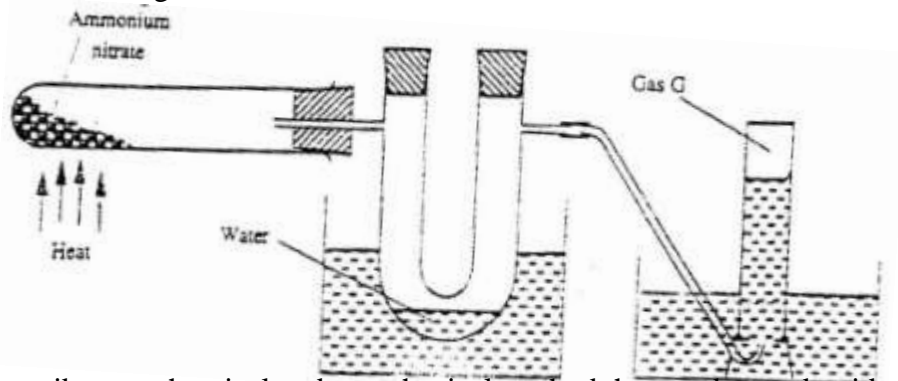
17. 2003 Q13 (P1)

Nitrogen (II) oxide and nitrogen (IV) oxide are some of the gases released from car exhaust pipes. State how these gases affect the environment

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18. 2003 Q17

Ammonium nitrate was gently heated and the products collected as shown in the diagram below.



Describe one chemical and one physical method that can be used to identify gas G.

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19. 2003 Q19b

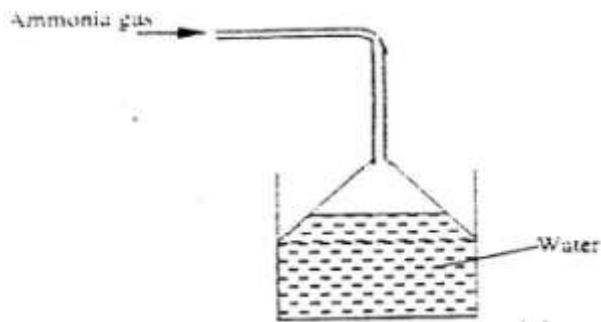
Give one use of ammonia

(1 mark)

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20. 2003 Q26

Ammonia gas was passed into water as shown below



a) When a red litmus paper was dropped into the resulting solution, it turns blue. Give a reason for the observations

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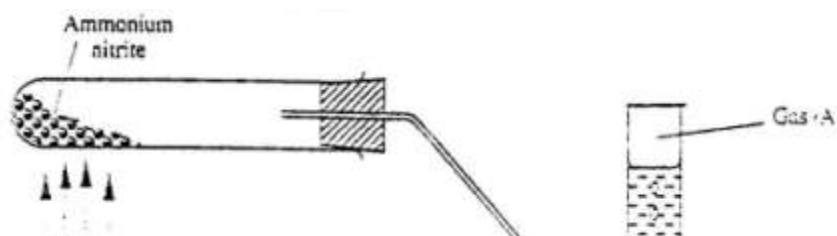
b) What is the function of the funnel?

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21. 2004 Q2

Ammonium nitrate was heated as shown in the set-up below

(2 marks)



- a) Identify gas A.
b) State and explain the precautions that must be taken before heating is dropped.

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22. 2004 Q7

Nitrogen forms many compounds in which its oxidation state varies.

- a) What is meant by oxidation state? (1mark)

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- b) What is the oxidation state of nitrogen in Mg_3N_2 (1mark)

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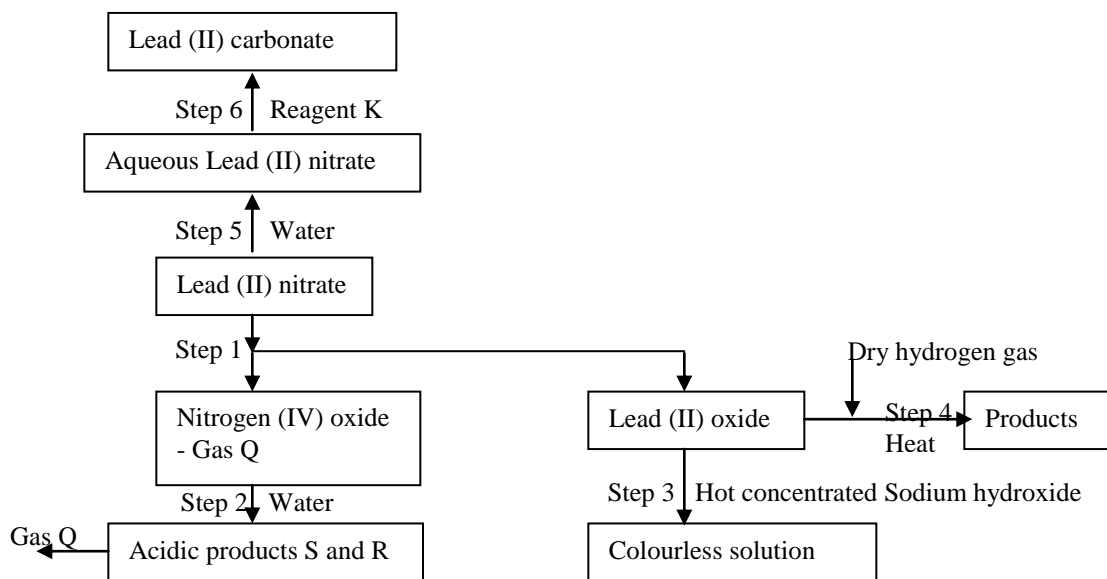
23. 2004 Q10

Explain why a high temperature is required for nitrogen to react with oxygen. (1mark)

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24. 2004 Q5 (P2)

The flow chart below shows some reactions starting with lead (II) nitrate.
Study it and answer the questions that follow.



(i) State the condition necessary in step 1.

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(ii) Identify:

I Reagent K

II Gas Q

III Acidic products S and R

(iii) Write:

I The formula of the complex ion formed in step 3. (1mark)

.....

II The equation of the reaction in step 4 (1 mark)

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b) The use of materials made of lead in roofing and in water pipes is being discouraged

State:

(i) Two reasons why these materials have been used in the past. (2marks)

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(ii) One reason why their use is being discouraged

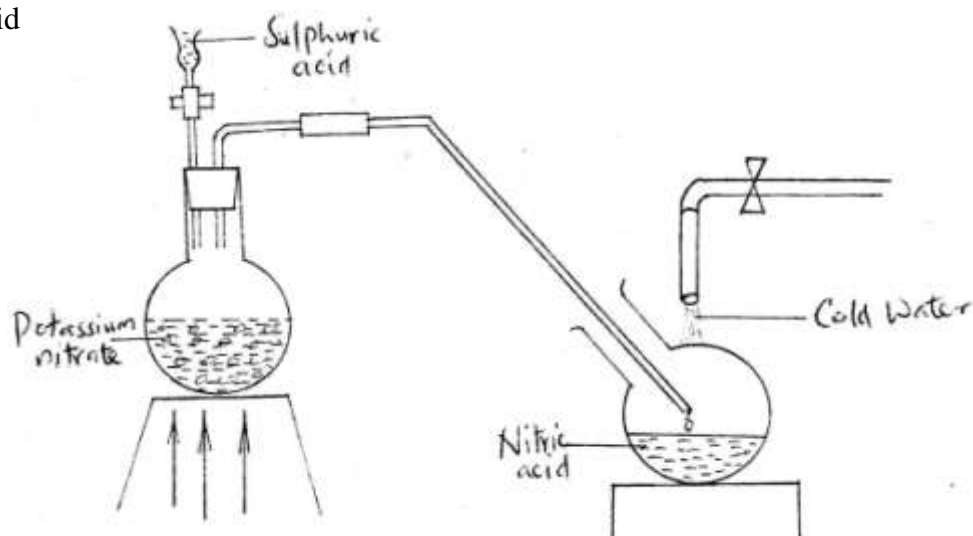
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c) (i) The reaction between lead (II) nitrate and concentrated sulphuric acid starts but stops immediately. Explain (2marks)

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25. 2005 Q21

The diagram below shows a set-up that was used to prepare and collect a sample of nitric acid



a. Give a reason why it is possible to separate nitric acid from sulphuric acid in the set – up (1 mark)

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b. Name another substance that can be used instead of potassium nitrate

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c. Give one use of nitric acid (1 mark)

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26. 2005 Q25

When a few drops of aqueous ammonia were added to copper (II) nitrate solution, a light blue precipitate was formed. On addition of more aqueous ammonia, a deep blue solution was formed. Identify the substance responsible for the:

a. Light blue precipitate (1mark)

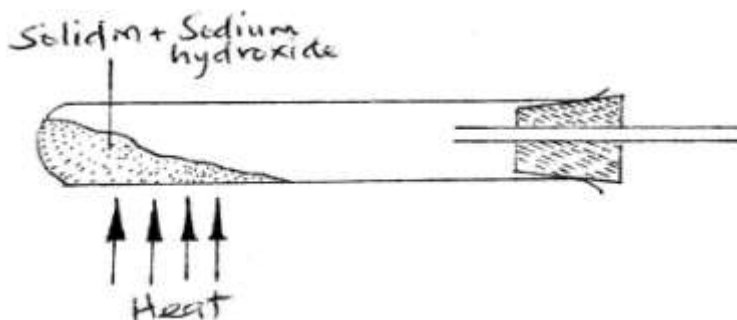
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b. Deep blue solution (1mark)

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27. 2005 Q2c (P2)

The diagram below shows an incomplete set-up used to prepare and collect ammonia gas



(i) Name solid M (1 mark)

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(ii) Complete the diagram to show how a dry sample of ammonia gas can be collected (3 marks)

28. 2006 Q17

The first step in the industrial manufacture of nitric acid is the catalytic oxidation of ammonia gas.

(a) What is the name of the catalyst used? (1 mark)

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(b) Write the equation for the catalytic oxidation of ammonia gas. (1mark)

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- (c) Nitric acid is used to make ammonium nitrate, state two uses of ammonium nitrate. (1 mark)
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29. 2006 Q7a (P2)

The table below shows the volumes of nitrogen dioxide gas produced when different volume of 1M nitric acid were each reacted with 2.07 g of lead at room temperature.

Volume of 1 M nitric acid (cm ³)	Volume of nitrogen dioxide gas (cm ³)
5	60
15	180
25	300
35	420
45	480
55	480

- a) Give a reason why nitric acid is not used to prepare hydrogen gas. (1mark)

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- b) Explain how the rate of the reaction between lead and nitric acid would be affected if the temperature of the reaction mixture was raised. (2marks)

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- c) On the grid provided below, plot a graph of the volume of the gas produced (Vertical axis) against volume of acid. (3 marks)

- d) Using the graph, determine the volume of:

i) Nitrogen dioxide produced when 30cm³ of 1 M nitric acid were reacted with 2.07 g of lead (1mark)

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ii) 1M nitric acid which would react completely with 2.07g of lead. (1mark)

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e) Using the answer in d(i) above, determine:

i) The volume of 1M nitric acid that would react completely with one mole of lead (Pb=207) (2marks)

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ii) The volume of nitrogen dioxide gas produced when one mole of lead reacts with excess 1 M nitric room temperature. (1mark)

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f) Calculate the number of moles of:

i) 1M nitric acid that reacted with one mole of lead (1mark)

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ii) Nitrogen dioxide produced when one mole of lead were reacted with excess nitric acid. (Molar gas volume of 2400cm³) (1mark)

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g) Using the answers obtained in f (i) and (ii) above, write the equation for

the reaction between lead and nitric acid given that one mole of lead nitrate and two moles of water were also produced. (1mark)

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30. 2007 Q13a (i)

a) Name the process that takes place when:

(i) Crystals of zinc nitrate change into solution when exposed to air (1mark)

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31. 2007 Q6a (p2)

(a) The elements nitrogen, phosphorous and potassium are essential for plant growth.

(i) Potassium in fertilizers may be in the form of potassium nitrate
Describe how a sample of a fertilizer may be tested to find out if it contained nitrate ions. (2marks)

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(ii) Calculate the mass of nitrogen present if a 25kg bag contained pure ammonium phosphate, $(\text{NH}_4)_2 \text{HPO}_4$. (N = 14.0, H=1.0, P = 31.0, O = 16.0) (2marks)

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(b) The table below shows the solubility of ammonium phosphate in water at different temperatures.

Temperature (C ⁰)	Solubility of ammonium phosphate in g/100g water
10	63.0
20	69.0
30	75.0
40	82.0
50	89.0
60	97.0

(i) On the grid provided, draw the solubility curve of ammonium phosphate (Temperature on x – axis) (3 marks)

(ii) Using the graph, determine the solubility of ammonium phosphate at 25⁰C (1 mark)

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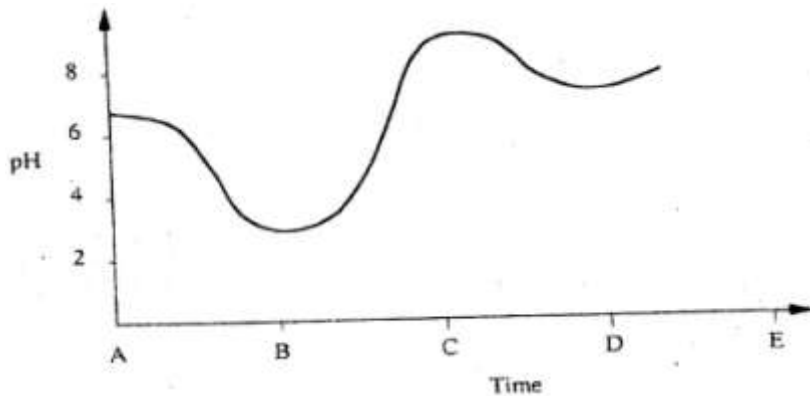
(iii) 100g of a saturated solution of ammonium phosphate was prepared at 25⁰C
I what is meant by a saturated solution? (1 mark)

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II Calculate the mass of ammonium phosphate which was used to prepare the saturated solution (2 marks)

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(c) The graph below shows how the PH value of soil in a farm changed over a period of time



(i) Describe how the pH of the soil can be determined (2 marks)

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(ii) State one factor that may have been responsible for the change in the soil pH in the time interval AB (1 mark)

32. 2008 Q3 (P2)

(a) Describe the process by which Nitrogen is obtained from air on a large scale. (4 marks)

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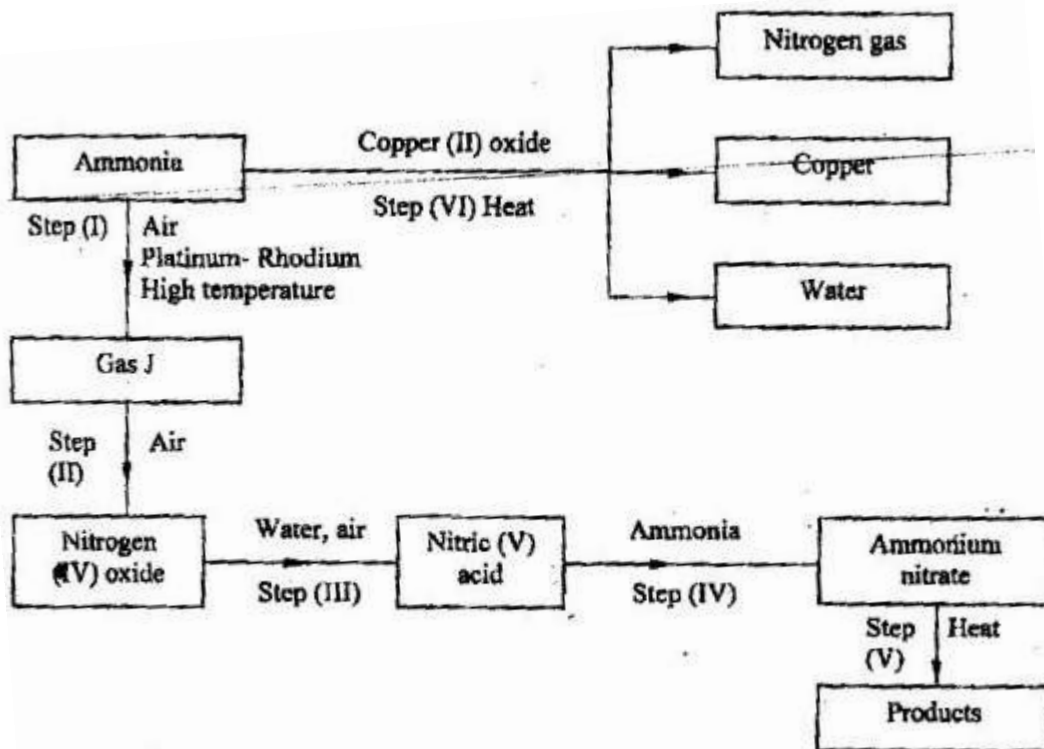
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(b) Study the flow chart below and answer the questions that follow.



(i) Identify gas J. (1 mark)

(ii) Using oxidation numbers, show that ammonia is the reducing agent in step (VI) (2marks)

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(iii) Write the equation for the reaction that occurs in step (V). (1mark)

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(iv) Give one use of ammonium nitrate. (1mark)

c) The table below shows the observations made when aqueous ammonia was added to cations of elements F₂F and G until in excess.

Cation of	Addition of a few drops of Aqueous ammonia.	Addition of excess aqueous ammonia.
E	White precipitate	Insoluble
F	No precipitate	No precipitate
G	White precipitate	Dissolves

(i) Select the cation that is likely to be Zn²⁺ (1mark)

.....
(ii) Given that the formula of the cation of element E is E²⁺, write the ionic equation for the reaction between E²⁺_(aq) and aqueous ammonia. (1mark)

33. 2009 Q13

When 8.53g of sodium nitrate were heated in an open tube the mass of oxygen was produced was 0.83g. Given the equation of the reaction as



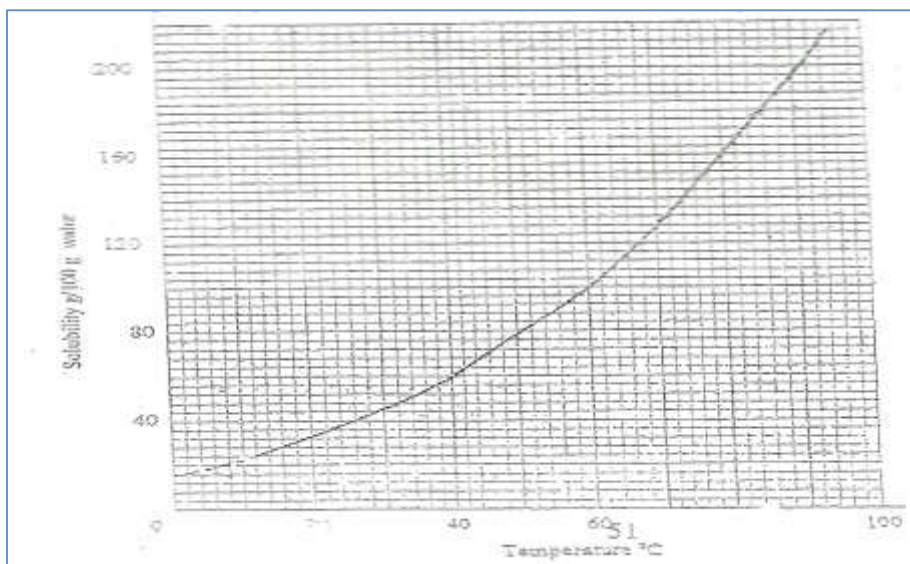
Calculate the percentage of sodium nitrate that was converted to sodium nitrite

(Na= 23.0 , N = 14.0 , O = 16.0)

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34. 2009 Q16

The solubility curve of potassium nitrate is shown below.



(a)

Determine the solubility of potassium nitrate at 50°C.

(K = 39.0, O = 16.0, N = 14.0, and density of water 1 g/cm³).

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35. 2010 Q16

A sample of fertilizer is suspected to be calcium ammonium nitrate.

Describe chemical tests for each of the following ions in the sample:

a) Calcium ions;

(2 marks)

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b) Ammonium ions.

(1 mark)

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36. 2010 Q20

In an experiment to prepare nitrogen (I) oxide, ammonium nitrate was gently heated

in a flask.

a) Write the equation for the reaction that took place in the flask. (1 mark)

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b) State and explain how the gas was collected. (1 mark)

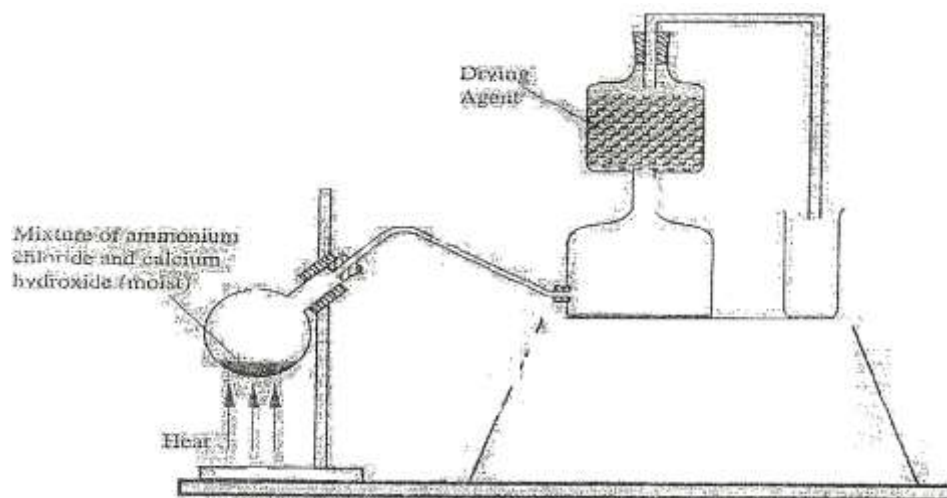
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c) A sample of the gas was tested with damp blue and red litmus papers.
What observations were made?

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37. 2010 Q5 (P2)

A student set up the apparatus as shown in the diagram below to prepare and collect dry ammonia gas.



i) Identify **two** mistakes in the set up and give a reason for each mistake. (3 marks)

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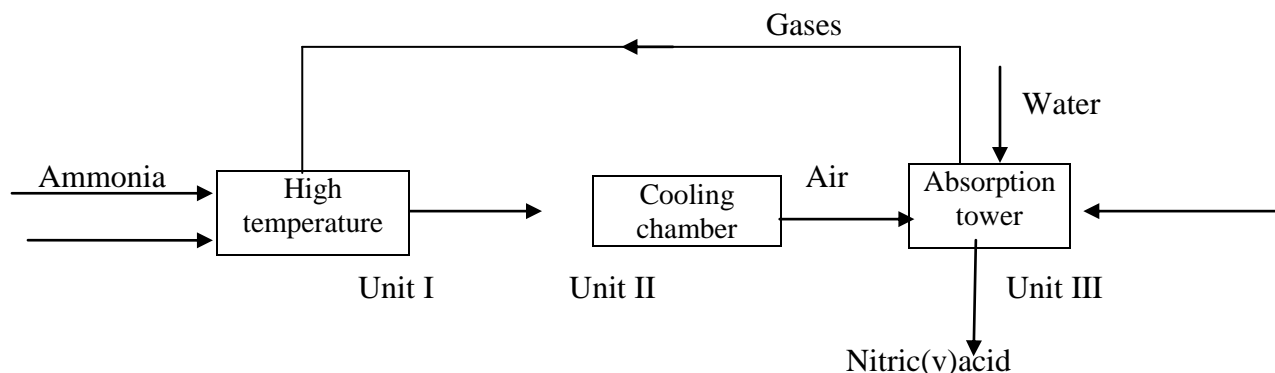
ii) Name a suitable drying agent for ammonia (1 mark)

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iii) Write an equation for the reaction that occurred when a mixture of ammonium chloride and calcium hydrogen was heated. (1 mark)

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iv) Describe **one** chemical test for ammonia gas (1 mark)

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b) Ammonia gas is used to manufacture nitric (V) acid, as shown below.



i) This process requires the use of a catalyst. In which unit is the catalyst used? (1 mark)

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ii) Identify compound **A** and **B** (1 mark)

A

B.....

iii) Using oxidation number, explain why the conversion of ammonia to nitric(V) acid is called catalytic oxidation of ammonia (2 marks)

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iv) Ammonia and nitric (V) acid are used in the manufacture of ammonium nitrate fertilizer. Calculate the amount of nitric (V) acid required to manufacture 1000kg ammonium nitrate using excess ammonia. (3 marks)

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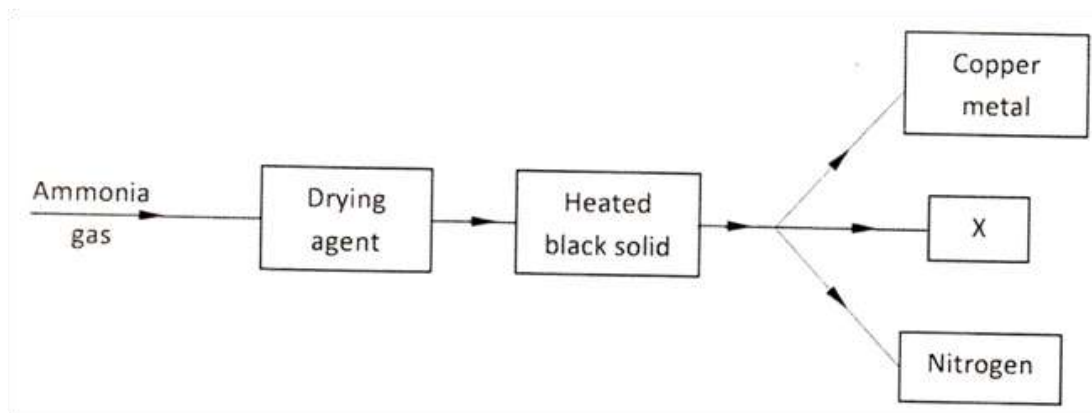
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38. 2011 Q4b Nitrogen is inert. State one use of the gas based on this property (1mark)

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39. 2012 Q12 P1 Study the flow chart below and answer the questions that follow.



(a) Name a suitable drying agent for ammonia. (1 mark)

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(b) Describe one chemical test for ammonia (1 mark)

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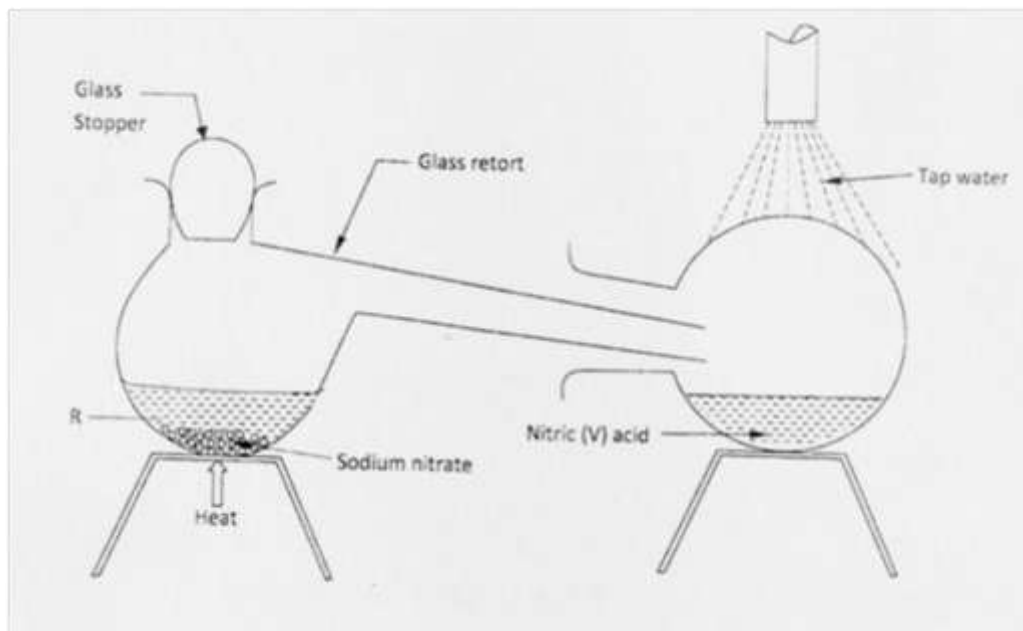
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(c) Name X (1 mark)

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40. 2012 Q3 P2

In the laboratory, small quantities of nitric (V) acid can be generated using the following set up. Study it and answer the questions that follow.



(a) (i) Give the name of substance R (1 mark)

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(ii) Name one other substance that can be used in place of sodium nitrate. (1 mark)

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(iii) What is the purpose of using tap water in the set up above? (1 mark)

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(b) Explain the following

(i) It is **not** advisable to use a stopper made of rubber in the set-up (1 mark)

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(ii) The reaction between copper metal with 50% nitric (V) acid in an open test-tube produces brown fumes. (1 mark)

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(c) (i) Nitrogen is one of the reactants used in the production of ammonia, name two sources of the other reactant.

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(ii) A factory uses nitric (V) acid and ammonia gas in the preparation of a fertilizer. If the daily production of the fertilizer is 4800kg; calculate the mass of ammonia gas used in kg. (N = 14.0; O = 16.0; H=1.0) (3 marks)

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(iii) State **two** other uses of nitric (V) acid other than the production of fertilizers (2 marks)

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