

Nitrogen and Compounds – 2019 Nov IGCSE

1. 0620/31/O/N/19/No.6

This question is about ammonia.

- (a) When ammonia gas reacts with hydrogen chloride gas, white fumes of ammonium chloride are formed.



- (i) What type of chemical reaction is this?

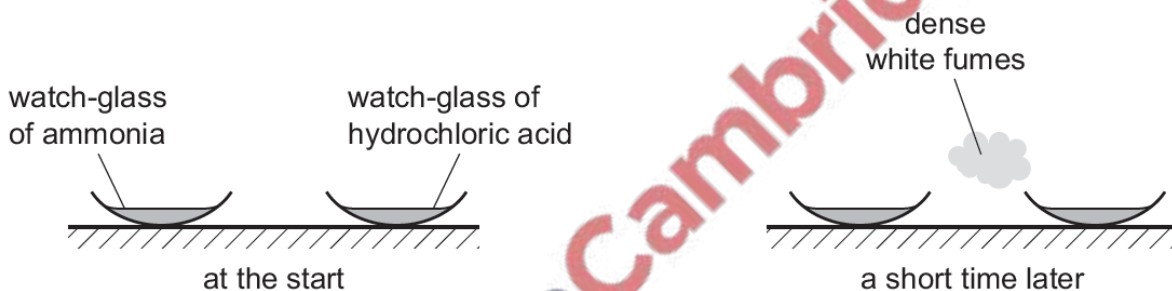
Draw a circle around the correct answer.

decomposition neutralisation oxidation reduction [1]

- (ii) Watch-glasses of aqueous ammonia and concentrated hydrochloric acid were placed near each other on a table.

At first no white fumes were seen.

After a short time, white fumes were seen between the watch-glasses.



Explain these observations using the kinetic particle model.

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..... [3]

- (b) Ammonia is used in the manufacture of fertilisers.

Name the **three** elements present in most fertilisers which improve plant growth.

1

2

3

[3]

(c) Aqueous ammonia can be used to test for aluminium ions and zinc ions.

Complete the table to show the expected observations.

ion	observation on adding a small volume of aqueous ammonia	observation on adding an excess of aqueous ammonia
aluminium (Al^{3+})		
zinc (Zn^{2+})		

[3]

[Total: 10]

2. 0620/32/O/N/19/No.6

This question is about compounds of nitrogen.

(a) Aqueous ammonia is alkaline.

(i) Which **one** of the following pH values could be the pH of aqueous ammonia?

Draw a circle around the correct answer.

pH 1 pH 5 pH 7 pH 9

[1]

(ii) Ammonia has a strong smell.

A beaker of aqueous ammonia was placed in front of a class of students. At first, the students at the back of the class could not smell the ammonia. After a few minutes they could smell the ammonia.

Explain these observations using the kinetic particle model.

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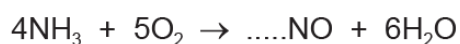
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[3]

(b) Ammonia is used in the manufacture of nitric acid.

(i) Balance the chemical equation for the first step in the process.



[1]

(ii) The reaction is exothermic.

What is meant by the term *exothermic*?

.....
..... [1]

(iii) The NO produced in the first step then reacts with oxygen to produce nitrogen dioxide, NO₂.



How does this equation show that NO is oxidised?

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..... [1]

(iv) Is nitrogen dioxide an acidic oxide or a basic oxide?
Give a reason for your answer.

.....
..... [1]

(c) Oxides of nitrogen are atmospheric pollutants.

State **one** adverse effect of oxides of nitrogen on health.

..... [1]

(d) Ammonia reacts with nitric acid to form a salt which is present in many fertilisers.

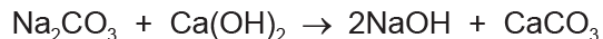
Name the salt formed when ammonia reacts with nitric acid.

..... [1]

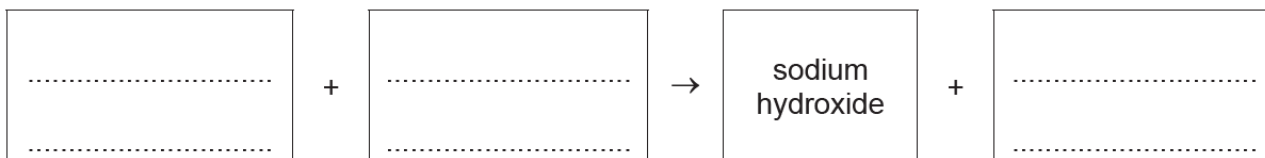
[Total: 10]

Sodium hydroxide and ammonia are both bases. They both turn red litmus blue.

(a) The chemical equation shows a reaction that produces sodium hydroxide.



Complete the word equation for this reaction.



[2]

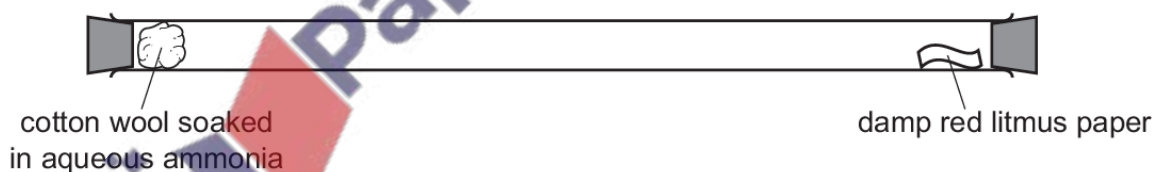
(b) Aqueous sodium hydroxide can be used to test for chromium(III) ions and iron(II) ions.

Complete the table to show the expected observations.

ion	observation on adding a small volume of aqueous sodium hydroxide	observation on adding an excess of aqueous sodium hydroxide
chromium(III) (Cr^{3+})		
iron(II) (Fe^{2+})		

[3]

(c) A student set up a long glass tube as shown.



At first, the litmus paper remained red.

After a short time the litmus paper was completely blue.

Explain these observations using the kinetic particle model.

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[3]

(d) Oxides of nitrogen are formed when ammonia is heated with oxygen in the presence of a catalyst.

(i) Suggest why a catalyst is used.

..... [1]

(ii) State **one** other process which puts oxides of nitrogen into the atmosphere.

..... [1]

(iii) State **one** adverse effect of oxides of nitrogen on health.

..... [1]

(e) Ammonium nitrate is present in many fertilisers.

Which **one** of these compounds is also present in many fertilisers?

Tick **one** box.

barium hydroxide

potassium phosphate

sodium chloride

tin(II) sulfate

[1]

(f) When ammonium chloride dissolves in water, the temperature of the solution decreases.

What is the name for a reaction where the temperature of the solution decreases?

..... [1]

[Total: 13]

Ammonia is an important chemical.

(a) Ammonia is manufactured by the Haber process. The reaction is reversible.

(i) What is the sign for a reversible reaction?

..... [1]

(ii) State the essential conditions for the manufacture of ammonia by the Haber process starting from hydrogen and nitrogen. Include a chemical equation to show the reaction which occurs.

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.....
..... [5]

(iii) Name **one** raw material which is a source of the hydrogen used in the Haber process.

..... [1]

(b) Ammonia is a base and reacts with sulfuric acid to form the salt, ammonium sulfate.

(i) What is meant by the term *base*?

..... [1]

(ii) Name **the** industrial process used to manufacture sulfuric acid.

..... [1]

(iii) Write a chemical equation for the reaction between ammonia and sulfuric acid.

..... [2]

(c) When aqueous ammonia is added to aqueous iron(II) sulfate a green precipitate is seen. This green precipitate turns red-brown at the surface.

(i) Name the green precipitate.

..... [1]

(ii) Suggest why the green precipitate turns red-brown at the surface.

.....
 [2]

(iii) State what happens when an excess of aqueous ammonia is added to the green precipitate.

..... [1]

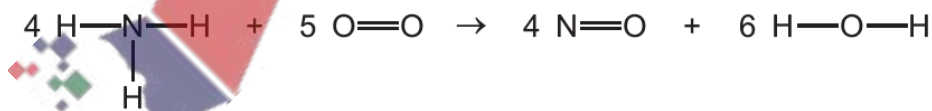
(d) Ammonia reacts with oxygen as shown.



(i) Calculate the volume of oxygen at room temperature and pressure, in dm^3 , that reacts with 4.80 dm^3 of ammonia.

volume = dm^3 [3]

(ii) The chemical equation for the reaction can be represented as shown.



Use the bond energies in the table to calculate the energy change, in kJ/mol , which occurs when **one** mole of NH_3 reacts.

bond	N–H	O=O	N=O	O–H
bond energy in kJ/mol	391	498	587	464

- Energy needed to break bonds.

..... kJ

- Energy released when bonds are formed.

..... kJ

- Energy change when **one** mole of NH_3 reacts.

energy change = kJ/mol
[4]

[Total: 22]

