Nitrogen & Sulfur

Question Paper 4

Level	International A Level
Subject	Chemistry
Exam Board	CIE
Topic	Nitrogen & Sulfur
Sub-Topic	
Paper Type	Theory
Booklet	Question Paper 4

Time Allowed: 20 minutes

Score: /16

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	777.5%	70%	62.5%	57.5%	45%	<45%

1 Ammonia, NH_3, is a colourless, pungent-smelling gas which has been known to man from the beginning of recorded time. It is given off from urine such as that on a wet nappy from a baby.

The nitrogen-containing substance in urine is urea, $CO(NH_2)_2$, and this decomposes by hydrolysis into ammonia and another colourless gas.

(a) Construct an equation for the hydrolysis of aqueous urea.

....[2]

Ammonia was named after the shrine of Jupiter Ammon which was near the Egyptian-Libyan border. In ancient times ammonia was obtained by distilling camel dung.

(b) Now ammonia is synthesised from its elements in the Haber Process.

(i) Write an equation for this process.

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(ii) State the **three** usual operating conditions of the Haber Process.

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(iii) State **two** modern commercial uses of ammonia.

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....[4]

(c) 1.20 dm^3 of ammonia gas were dissolved in water to form 200 cm^3 of aqueous alkali at room temperature and pressure.

(i) Use the *Data Booklet* to calculate how many moles of $NH_3(g)$ were dissolved.

(ii) Write the equation for the neutralisation of aqueous ammonia by dilute sulphuric acid.

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(iii) Calculate the volume of $0.50\,mol\,dm^{-3}$ sulphuric acid that is required to neutralise the $200\,cm^3$ of aqueous ammonia.
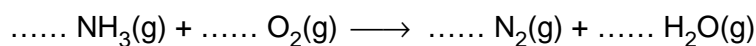
[3]

(d) In the boxes below, draw diagrams to show the shapes of an ammonia molecule and an ammonium ion. Clearly show the bond angles on your diagrams.

ammonia	ammonium ion

[4]

(e) Ammonia does not burn in air but will burn in pure oxygen.

(i) Balance the equation for this reaction:

…… $NH_3(g)$ + …… $O_2(g)$ $\longrightarrow$ …… $N_2(g)$ + …… $H_2O(g)$

(ii) Use oxidation numbers to explain why this is a redox reaction.

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....[3]

[Total : 16]