Nitrogen	and	its	compoun	de
11111 02EH	anu	112	Compoun	us

- 1. (i)  $4HN_3$  (g) +  $5O_{2}$  (g)  $4NO_{(g)} + 6H_2O_{(g)}$ (ii) Act as catalyst (iii)  $Zn(NH_3)_4^{2+}$
- 2. a) Platinum/copper
  - b) Brown fumes

Hot rod m continues to glow red

- NO formed reacts with oxygen to form NO<sub>2</sub> (brown flames)
- Reaction highly exothermic
- 3. a) Calcium hydroxide
  - b)  $Ca(OH)_{2(g)} + 2NH_4CL_{(g)}$   $2NH_{3(g)} + CaCL_2 + 2H_2O_{(L)}$
- 4. (a) It neutralizes air to prevent violent combustion reaction from occurring.
  - (b) Its inert and have very low b.pt of -196°C

\*MAT

- 5. a) X is Nitrogen.  $\sqrt{1}$ 
  - b) It is less dense than air.  $\sqrt[4]{2}$
  - c) In preservation of semen in artificial insemination.  $\sqrt{1}$
- 6. a) (i) Solution A contains  $Pb^{2+}(aq)$  ions  $\sqrt[4]{2}$ 
  - (ii) Solution B contains  $Al^{3+}(aq)$  ions.  $\sqrt[4]{2}$
  - b) A colourless liquid at cooler parts  $\sqrt{1}$  of test-tube is formed.
    - A white reside remains in the test-tube.  $\sqrt{1}$
- a) to expel air that is in the combustion tube so that oxygen in it does not react with hot copper√1
   b)brown√½ copper metal will change to black√½

c)nitrogen  $\sqrt{1}$ 

- 8. (a) To increase the surface area over which the reaction occurs hence increased rate of reaction.
  - (b)  $NH_3$  is basic and reacts with some moles of the acid hence reduction in concentration
- 9. (a) (i) The solution changes from <u>green</u> √1 to <u>brown</u> √1 (1 mk) (ii) A brown √1 precipitate is formed. (1 mk)
  - (b)  $Fe^{3+}_{(aq)} + 3OH_{(aq)}$  Fe(OH)<sub>3(s)</sub>  $\sqrt{1}$
- (1 mk

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√

- 10. (a) Absorbs carbon (IV) oxide from  $\sqrt{1}$  the air. (1 mk)
  - (b)  $2 Cu_{(s)} + O_2 \longrightarrow 2CuO_{(s)} \sqrt{1}(1 \text{ mk})$ (c) Because it has the rare gases.  $\sqrt{1}$
- 11. (a) Anion  $CO_3$ Cation –  $Cu^{2+}$ (b)  $Cu^{2+} + 4NH_3 \longrightarrow \{CuNH_3\}_3\}^{2+}$
- 12. (a) (i)  $NH_4NO_{3 (s)} N_2O_{(g)} + 2H_2O_{(g)}$ 
  - (ii)  $NH_4NO_3$  should not be heated further if the quantity remaining is small because it may

explode

or A mixture of NH<sub>4</sub>Cl & KNO<sub>3</sub> can be used instead of NH<sub>4</sub>NO<sub>3</sub> leading to double decomposition taking place safely without explosion

- (iii) An hydrous calcium chloride in a u-tube
- (iv) Reacts with oxygen to form brown fumes of Nitrogen (IV) Oxide

$$2N_2O_{(g)} + O_{2(g)} = 2NO_{2(g)}$$

- (v) Has no colour
- Has a slight sweet smell
- Fairly soluble in water
- Denser than air
- (b) (i) Provides a large surface area for the absorption of ammonia gas by the water or prevent "bricking" back of water
  - (ii) Water would brick back into the hot preparation flask causing it to crack or break /an explosion can occur
  - (iii) Red litmus paper would turn to blue, blue litmus paper remains blue each
- 13. (a) B − ammonia gas \( \beta \) 1

C - nitrogen (II) oxide (NO) \ ₹1

E – water \ ₹1

F – unreacted gases  $\equiv 1$ 

- (b) The mixture of ammonia and air is passed through heated/catalyst where ammonia (II) is oxidized to nitrogen (II) oxide. 

  ☐ 1
- (c) Gases are cooled and air passed through heated/catalyst where ammonia is further oxidized to nitrogen(IV) oxide. *₹* 1
- (d) Fractional distillation, \$\leq \frac{1}{2}\$ Water with a lower boiling point \$\leq \frac{1}{2}\$ than nitric (V) acid, distills left leaving the concentrates acid.
- 14. a)i) Fractional distillation

ii) Argon

- b) A Sulphur
  - B Ammonia gas
  - C Oteum
  - D Amonium sulphate
- c) i) Finely divided iron
  - ii) Vanadium (v) Oxide
- d) Speeds up the rate of reaction by lowering the activation energy

e) 
$$2NH_{3(g)} + H_2SO_{4(aq)}$$
 (NH<sub>4</sub>)  $2SO_{4(aq)}$   
f) R.M.M of (NH<sub>4</sub>) = 132  
Mass of N = 28  
% N =  ${}^{28}/_{132}x$  100 = 21.212%

g) Used as a fertilizer

- *15.* (a) (i) Fused calcium chloride /Cao (quick lime) (ii) To remove carbon (IV) Oxide (iii)  $4Fe^{+}_{(s)} + 3O_{2(g)}$  —— $3Fe_2O_{\S(s)}$   $OR \ 3Fe_{(s)} + 2O_{2(g)}$  —— $Fe_3O_{4(s)}$ (iv) Argon/Helium/Neon/Krepton (v) Provide very low temperature so that the semen does not decompose /is not destroyed (b) (i) Concentrated sulphurið acid (ii)  $NaNO_{3(s)} + H_2SO_{4(l)}$   $Na_2HSO_{4(aq)} + HNO_{3(aq)}$   $Na_2SO_4 + 2HNO_3$ (reject unbalanced chemical equation) (b) Copper reacts with 50% nitric acid to give nitrogen II Oxide which is colourless. Air oxidize's Nitrogen II oxide to Nitrogen IV oxide which is brown.  $2NO_{(g)} + O_2 - 2NO_{2(g)}$ colourless *16.* (a) (i) Nitrogen – Fractional distillation of liquid air –( ½ mk) Hydrogen - Cracking of alkanes -Electrolysis of acidified water (ii) Temperature  $-400^{\circ}C - 500^{\circ}C$ Pressure - 400atm - 500atm Catalyst – kinely divided iron (iii) Catalyst P – Nickel Gas M – Nitrogen IV oxide (iv) (a)  $2NO_{(g)} + O_{2(g)}$  2 $NO_{2(g)}$  (b)  $NO_{2(g)} + H_2O_{(l)}$  H $NO_{2(aq)} + HNO_{3(aq)}$ (v) To a small portion of the nitrate liquid in a test tube add equal amount o freshly prepared iron (II) sulphate followed by some drops of conc.  $H_2SO_4$  slowly on the sides. If a brown ring forms on the boundary of the two solutions, a nitrate is confirmed. (vii) – Manufacture of nitrogenous fertilizers - Manufacture of synthetic fibres e.g nylon - Manufacture of explosives e.g TNT - Manufacture of textile dyes - Manufacture of other acids e.g. phosphoric acid *17*. (a) (i) Nitrogen (I) Oxides. Rej. Dinitrogen oxides.
  - (ii)  $NH_4 NO_{3(s)}$   $\longrightarrow$   $N_2O_{(g)} + 2H_2O_{(g)}$
  - (iii) The gas is soluble in cold water.
  - (iv) An irritating choking smell of a gas.
  - (b) (i) Platinum wire. (ii)  $4NH_{3(g)} + 5O_{2(g)} - 4NO_{(g)} + 6H_2O_{(g)}$   $2NO_{(g)} + O_2 - 2NO_{2(g)}$ 
    - (iii) Nitrogen (I) Oxide Nitrogen (IV) Oxide.

Colourless.	Reddish brown.		
Relights a glowing splint.	Extinguishes a glowing splint.		
Has a sweet smell.	Irritating pungent smell.		
Fairly soluble in water.	Readily soluble in water.		
1 uniy soluble in water.	(Accept any 1 correct comparative)		
(c) (i) It corrodes/reacts with rubber a	` 1 '		
(ii) I) Oxidized: Sulphur/S			
<u>Reduced:</u> Nitric (V) acid / H	$NO_{(aq)}$		
II) It decomposes by heat into	$NO_2$ which dissolves in the acid.		
it through conc. Sodium Hydroxide	ve dust particles by electrostatic precipitation. Then pass to absorb CO2. Then through condensers at 25C to coled to liquefy it. The liquefied air is then en at – 183C		
b) i) X – Ammonia// NH <sub>3</sub> Y- Air			
ii) $4NO_{2(g)} + 2H_2O_{(s)} + O_{2(g)}$	4HNO <sub>3(aq)</sub>		
$2NO_{2(g)} + H_2O_{(l)}$	$HNO_{2(qq)} + HNO_{2(qq)}$		
$2HNO_{2(aq)} + O_{2(g)}$	$= \frac{2HNO_{3(aq)}}{2HNO_{3(aq)}}$		
iii) Through fractional distillat	tion		
iv) $HNO_{3(aq)} + NH_{3(g)}$	$NH4ND_{3(aq)}$		
$RMM of NH_3 = 17$	$RFM of NH_4NO_3 = 80$		
If $80g\ NH_4NO_3$	17 g		
960000_	$\frac{960000}{80 \times 1000} \times 17 = 2040 \text{kg}$		
(a) Potassium hydroxide solution			
(b) To remove dust particles			
(c) Water vapour Moisture			
$(d) -183^{\circ}C$			
(e) Fractional distillation of liquid air			
distils out first and liquid oxygen w	O		
(g) Nitrogen in liquid form is used as a - Used as a raw material in H	a refrigerant e.g. in storing semen for artificial insemination aber process e.t.c		
II. Air is a mixture because:			
It contains gases which are not chemi-	cally combined		
- The gases are not in fixed ratios.			
$HOCL_{(aq)} + Dye$ $HCL_{(aq)}$	+[Dye+O]		
Coloured	Colourless		
$H_2SO_{3(aq)} + [Dye + O] $ H <sub>2</sub> SO	$D_{4(qq)} + Dye$		
Coloured	Colourless		

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21.	a) Drying agent $\sqrt{-\frac{1}{2}}$ which must be CaO  Method of collection $\sqrt{-}$ upward delivery  Workabillity $\sqrt{-\frac{1}{2}}$		
	b) $2NH_4CL_{(g)} + Ca(OH)_{2(g)}$ $CaCL_{2(g)} + H_2O_{(l)} + 2NH_{3(g)} $		
<i>22</i> .	a) Heat		
	b) $Cu_{(g)} + N_2O_{(g)}$ $CuO_{(g)} + N2_{(g)}$		
	c) - Manufacture of ammonia		
	- In light bulbs		
	- As a refrigerant		
<i>23</i> .	- At 113°C consists of S <sub>8</sub> rings that flow easily;		
	- Darkens due to breaking of $S_8$ rings and forming long chains consisting of thousands of atoms.		
	The chains also entangle;		
	- The long chains consisting of thousands of atoms. The chains also entangle;		
	- The long chains break near b.p. to form shorter one;		
24.	Difference is at the cathode electrode where in concentrated sodium chloride sodium		
	is deposited while in dilute sodium chloride, hydrogen is liberated, because		
<i>25</i> .	(i) $2N_2O_{(g)} + C_{(s)} - Co_{2(g)} + 2N_{2(g)}$		
20.	(ii) Ammonium chloride and sodium nitrate		
	(iii)The hydroxide ions √1 (Ammonia dissolves forming ammonia hydroxide.(1 mk)		
<i>26</i> .	(a) E - Ammonium chloride (½ mk)		
	F – Aluminium hydroxide (½ mk)		
	(b) $Al_3++3OH_{(aq)}  AL(OH)_{3(s)}$		
27.			
27.	a) Zinc hydroxide		
	b) [Zn (NH3)4] 2+		
	c) $Zn^{2+}_{(aq)} + 2OH_{(aq)}$ $Zn(OH) 2_{(s)}$		
<i>28</i> .	a) Plantinum/platinum Rhodium 🖷 1		
	b) $4NH_3(g) + 5O_2(g) - 4NO(g) = 1 + 6H_2O(l)$		
	c) – Fertilizers 🚔 1		
	- Preparation of Nitrogen (I) oxide. - Explosives		
29.	Blue ppt \$\mathbb{a}\$ 1 is formed which dissolves in excess to form a deep blue \$\mathbb{a}\$1 solution due to		
	formation of tetra amine Copper (II) ions		
<i>30</i> .	(a) - Finely divided iron impregnated by alumina $(Al_2O_3)$		
<i>.</i>	- 200 atmosphere pressure		
	- Temperature of 450°C 1/2		
	b) - CuO is reduced to Copper metal		
	of the information copper menu		

-  $NH_3$  is oxidized to water and nitrogen

*31*. (a) Colour of copper (II) Oxide changes from black to brown

(b) (i) Nitrogen  $/N_{2(g)}$ (ii) Water/ $H_2O_{(l)}$