JUNE 2004

GCE A AND AS LEVEL

MARK SCHEME

MAXIMUM MARK: 60

SYLLABUS/COMPONENT: 9701/02

CHEMISTRY
Theory 1 (Structured Questions)

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1 (a) The volume of the gas molecules / atoms / particles is insignificant compared with the volume of the vessel.
There are no forces of attraction between the gas molecules.
All collisions by the gas molecules are perfectly elastics. Any <u>two</u>. [2]

(b) (i) The pressure of / exerted <u>by the gas</u>. [1]
Pa / Nm^{-2} [1]

(ii) The volume of the containing vessel [1]
m^3 / dm^3 / cm^3 [1]

(iii) The absolute temperature [1]
In K <u>or</u> 273 + °C [1]

(c) (i) $pV \approx w/m \times RT$

$m = (0.103 \times 8.31 \times 297) / (99.5 \times 10^3 \times 63.8 \times 10^{-6})$ [1]
$= 40.0$ [1]

The gas is argon [1]

(ii) The hydrogen bonds between ammonia molecules (1)
are stronger than the Van De Waals' forces between N_2 and Ar molecules (1)

Ammonia is polar / has a dipole (1)

(Any two) [2]

Total = [13]

2 (a) $1s^2$ $2s^2\,2p^6$ $3s^2\,3p^3$ [1]

(b) 5 or V [1]

(c) (i) $3NaOH + H_3PO_4 \longrightarrow Na_3PO_4 + 3H_2O$ [1]

(ii) (50 x 0.5) / 1000 = 0.025 (moles) [1]

(iii) conseq. on **(i)** 3 x .025 = 0.075 (moles) [1]

(d) (i) $P_4S_3 + 8O_2 \longrightarrow P_4O_{10} + 3SO_2$ (or $2P_2O_5$) balanced = 2 marks

OR $+ 6O_2 \longrightarrow P_4O_6 + 3SO_2$ (or $2P_2O_3$) unbalanced = 1 mark

[2]

(ii) $P_4O_{10} + 6H_2O \longrightarrow 4H_3PO_4$ [1]

OR $P_4O_6 + 6H_2O \longrightarrow 4H_3PO_3$

$SO_2 + H_2O \longrightarrow H_2SO_3$ [1]

(if SO_3 then e.c.f.) **Total = [9]**

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3 (a) $CO(NH_2)_2 + H_2O \longrightarrow 2NH_3 + CO_2$ balanced equation (1)
(1) colourless gas
[2]

(b) (i) $N_2 + 3H_2 \leftrightarrow 2NH_3$

(ii) 100 ATMs or over
400 - 500°C
iron catalyst

(iii) Fertiliser, making nitric acid, explosives etc. 1 mark for each
[4]

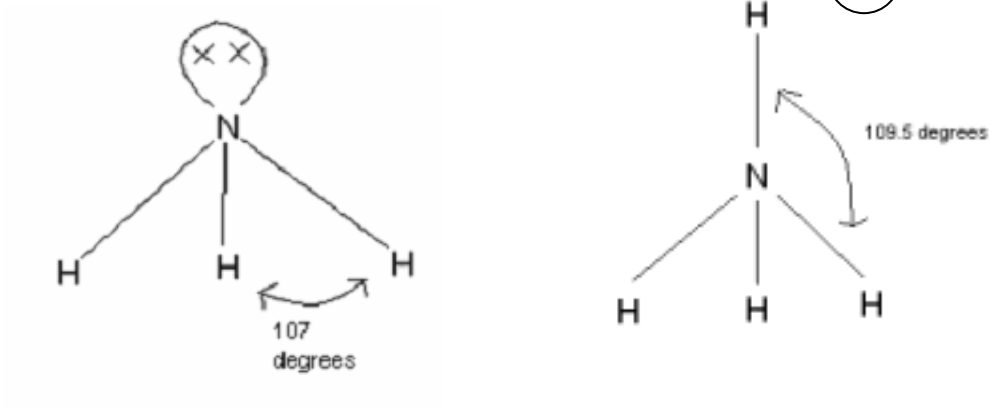
(c) (i) (1.2) / (2.4) = 1/20 or 0.05 moles [1]

(ii) $2NH_3 + H_2SO_4 \longrightarrow (NH_4)_2SO_4$ or equivalent [1]

(iii) 0.025 mols of H_2SO_4 are required

Vol. of 0.50 mol dm^{-3} H_2SO_4 required = (0.025 x 1000) / 0.5 = $50cm^3$ [1]

(d)



1 mark for each diagram, 1 mark for each correct bond angle
If not 3-dimensional diagram – 1 penalty.
[4]

(e) $4NH_3 + 3O_2 \longrightarrow 2N_2 + 6H_2O$ [1]

N goes from -3 to 0 ⟶ oxidation [1]
O goes from 0 to -2 ⟶ reduction [1]

Total = [16]

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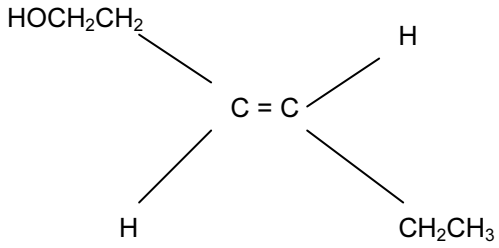
4 (a) (i) Acid or base, heating / reflux / warm [1]

(ii) $CH_3(CH_2)_2CO_2CH_3 + H_2O \longrightarrow CH_3(CH_2)_2CO_2H + CH_3OH$ [1]

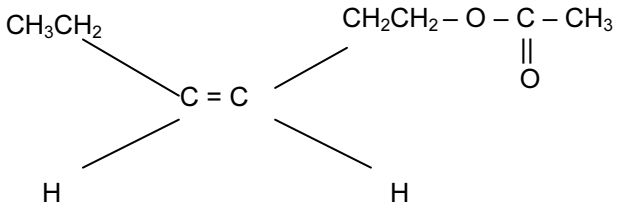
(iii) Solvents (polyesters not in AS syllabus, but allow as plastics, textiles) [1]

(b) (i)



1 mark for this diagram

(ii)



1 mark for ester link, 1 mark for rest of molecule

[3]

(c) (i) $C_6H_{12}O$ 72 + 12 + 16 $M_r = 100$ [1]

$CH_2 = CH – CH = CH – CH_2CH_3$ [1]

dehydration / elimination [1]

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(d) A test for an alcohol (both alcohol and the product are alkenes)

e.g. sodium bubbles of gas
PCl_5 misty fumes
$H^+/ Cr_2O_7^{2-}$ orange turned green
conc. H_2SO_4 + carbonylic acid ester smell

NOT Br_2 or H^+/MnO_4^- as it tests positive for both

1 mark for specified test
1 mark for the relevant observation

[2]

Total = [11]

5 (a) Example (1) reason (1) MUST BE ORGANIC

e.g.
PVC (1) used in food packaging (& needs to be inert) (1)
Teflon / PTFE (1) used in non-stick kitchenware (1)
Freons (1) used as deoderants, anaesthetics etc. (1)
CCl_4 etc (1) solvent (1)

3 x 2 [6]

(b) (i) U.V. radiation [1]
Breaks C-Cl bond OR giving Cl free radicals [1]
These react with ozone [1]

(ii) e.g polypropene for PVC
alkanes e.g. butane for aerosols

OR equivalent answers need not be organic
e.g. N_2O as anaesthetic

[2]

Total = [11]

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