GCSE Chemistry A (Gateway Science)

J248/04 Chemistry A C4-C6 and C7 (Higher Tier)

Question Set 10

1 (a) In an experiment, a mixture of ammonium chloride and calcium hydroxide is heated.

Ammonia gas, NH_3, is made.

$2NH_4Cl + Ca(OH)_2 \rightarrow CaCl_2 + 2NH_3 + 2H_2O$

A student adds 5.00 g of ammonium chloride to an excess of calcium hydroxide.

Calculate the maximum **volume of ammonia gas** that could be made at room temperature and pressure.

One mole of a gas occupies 24 dm^3 at room temperature and pressure.

Mr of $NH_4Cl = 14 + 4 + 35.5 = 53.5$

mass = Mr x mol mol $NH_4Cl = \frac{mass}{Mr} = \frac{5}{53.5} = 0.093$ mol

molar ratio = 2:2 ∴ 0.093 mol ammonia

1 mol = 24 dm^3 x 0.093

0.093 = 2.24 dm^3

Volume of ammonia gas = 2.24 dm^3 **[2]**

(b) In another experiment a student reacts sodium hydroxide solution with dilute hydrochloric acid.

$NaOH + HCl \rightarrow NaCl + H_2O$

(i) 35.0 cm^3 of 0.075 mol/dm^3 hydrochloric acid, HCl, are added to 25.0 cm^3 of 0.100 mol/dm^3 sodium hydroxide solution, NaOH.

Use the information to determine which reactant is **in excess**. (see end of paper) **[3]**

(ii) To find the exact amount of dilute hydrochloric acid that reacts with 25.0 cm^3 of the sodium hydroxide solution, the student does a titration.

Look at the student's results. The rough titration is **not** shown.

	Titration 1	Titration 2	Titration 3	Titration 4
Final burette reading (cm^3)	36.30	38.60	39.25	38.30
Initial burette reading (cm^3)	0.00	2.80	4.05	2.10
Volume of acid used (cm^3)	36.30	35.80	35.20	36.20

Use the student's **concordant** results to calculate the mean volume of hydrochloric acid required.

$\frac{36.3 + 36.2}{2} = 36.25$

Mean volume = 36.25 cm^3 **[2]**

(c) In another titration 25.0 cm^3 of potassium hydroxide solution, KOH, are titrated with 0.200 mol/dm^3 sulfuric acid, H_2SO_4.

$2KOH + H_2SO_4 \rightarrow K_2SO_4 + 2H_2O$

$C = \frac{m}{V}$

24.80 cm^3 of sulfuric acid are needed to neutralise 25.0 cm^3 of the potassium hydroxide solution.

Calculate the concentration of the potassium hydroxide solution in mol/dm^3.

	$2KOH$	$+ H_2SO_4$
C	$= 0.00992 \div \frac{25}{1000}$ $= 0.3968$ ③	0.2 m
m	0.00496 $\times 2$ $= 9.92 \times 10^{-3}$ ②	$= 0.2 \times \frac{24.8}{1000} = 0.00496$ ①
V	$\frac{25}{1000}$	$\frac{24.8}{1000}$

*note molar ratios

Concentration = ... 0.3968 ..... mol/dm^3 **[4]**

Total Marks for Question Set 10: 11

bi) $C = \frac{m}{V}$ $\therefore m = CV$

mol of $HCl = 0.075 \times \frac{35}{1000} = 0.002625$

mol of $NaOH = 0.1 \times \frac{25}{1000} = 0.0025$

molar ratio is 1:1

so, HCl is in excess as $0.002625 > 0.0025$

The Periodic Table of the Elements

(1)	(2)											(3)	(4)	(5)	(6)	(7)	(0)
1																	18
1 **H** hydrogen 1.0	2											13	14	15	16	17	2 **He** helium 4.0
3 **Li** lithium 6.9	4 **Be** beryllium 9.0											5 **B** boron 10.8	6 **C** carbon 12.0	7 **N** nitrogen 14.0	8 **O** oxygen 16.0	9 **F** fluorine 19.0	10 **Ne** neon 20.2
11 **Na** sodium 23.0	12 **Mg** magnesium 24.3	3	4	5	6	7	8	9	10	11	12	13 **Al** aluminium 27.0	14 **Si** silicon 28.1	15 **P** phosphorus 31.0	16 **S** sulfur 32.1	17 **Cl** chlorine 35.5	18 **Ar** argon 39.9
19 **K** potassium 39.1	20 **Ca** calcium 40.1	21 **Sc** scandium 45.0	22 **Ti** titanium 47.9	23 **V** vanadium 50.9	24 **Cr** chromium 52.0	25 **Mn** manganese 54.9	26 **Fe** iron 55.8	27 **Co** cobalt 58.9	28 **Ni** nickel 58.7	29 **Cu** copper 63.5	30 **Zn** zinc 65.4	31 **Ga** gallium 69.7	32 **Ge** germanium 72.6	33 **As** arsenic 74.9	34 **Se** selenium 79.0	35 **Br** bromine 79.9	36 **Kr** krypton 83.8
37 **Rb** rubidium 85.5	38 **Sr** strontium 87.6	39 **Y** yttrium 88.9	40 **Zr** zirconium 91.2	41 **Nb** niobium 92.9	42 **Mo** molybdenum 95.9	43 **Tc** technetium	44 **Ru** ruthenium 101.1	45 **Rh** rhodium 102.9	46 **Pd** palladium 106.4	47 **Ag** silver 107.9	48 **Cd** cadmium 112.4	49 **In** indium 114.8	50 **Sn** tin 118.7	51 **Sb** antimony 121.8	52 **Te** tellurium 127.6	53 **I** iodine 126.9	54 **Xe** xenon 131.3
55 **Cs** caesium 132.9	56 **Ba** barium 137.3	● 57–71 lanthanoids	72 **Hf** hafnium 178.5	73 **Ta** tantalum 180.9	74 **W** tungsten 183.8	75 **Re** rhenium 186.2	76 **Os** osmium 190.2	77 **Ir** iridium 192.2	78 **Pt** platinum 195.1	79 **Au** gold 197.0	80 **Hg** mercury 200.6	81 **Tl** thallium 204.4	82 **Pb** lead 207.2	83 **Bi** bismuth 209.0	84 **Po** polonium	85 **At** astatine	86 **Rn** radon
87 **Fr** francium	88 **Ra** radium	● 89–103 actinoids	104 **Rf** rutherfordium	105 **Db** dubnium	106 **Sg** seaborgium	107 **Bh** bohrium	108 **Hs** hassium	109 **Mt** meitnerium	110 **Ds** darmstadtium	111 **Rg** roentgenium	112 **Cn** copernicium		114 **Fl** flerovium		116 **Lv** livermorium		

Key
atomic number
Symbol
name
relative atomic mass