GCSE Chemistry A (Gateway Science)

J248/03 C1-C3 and C7 Higher (Higher Tier)

Question Set 8

1 A teacher investigates neutralisation. She uses hydrochloric acid, HCl, and sodium hydroxide, NaOH.

$$HCl + NaOH \rightarrow NaCl + H_2O$$

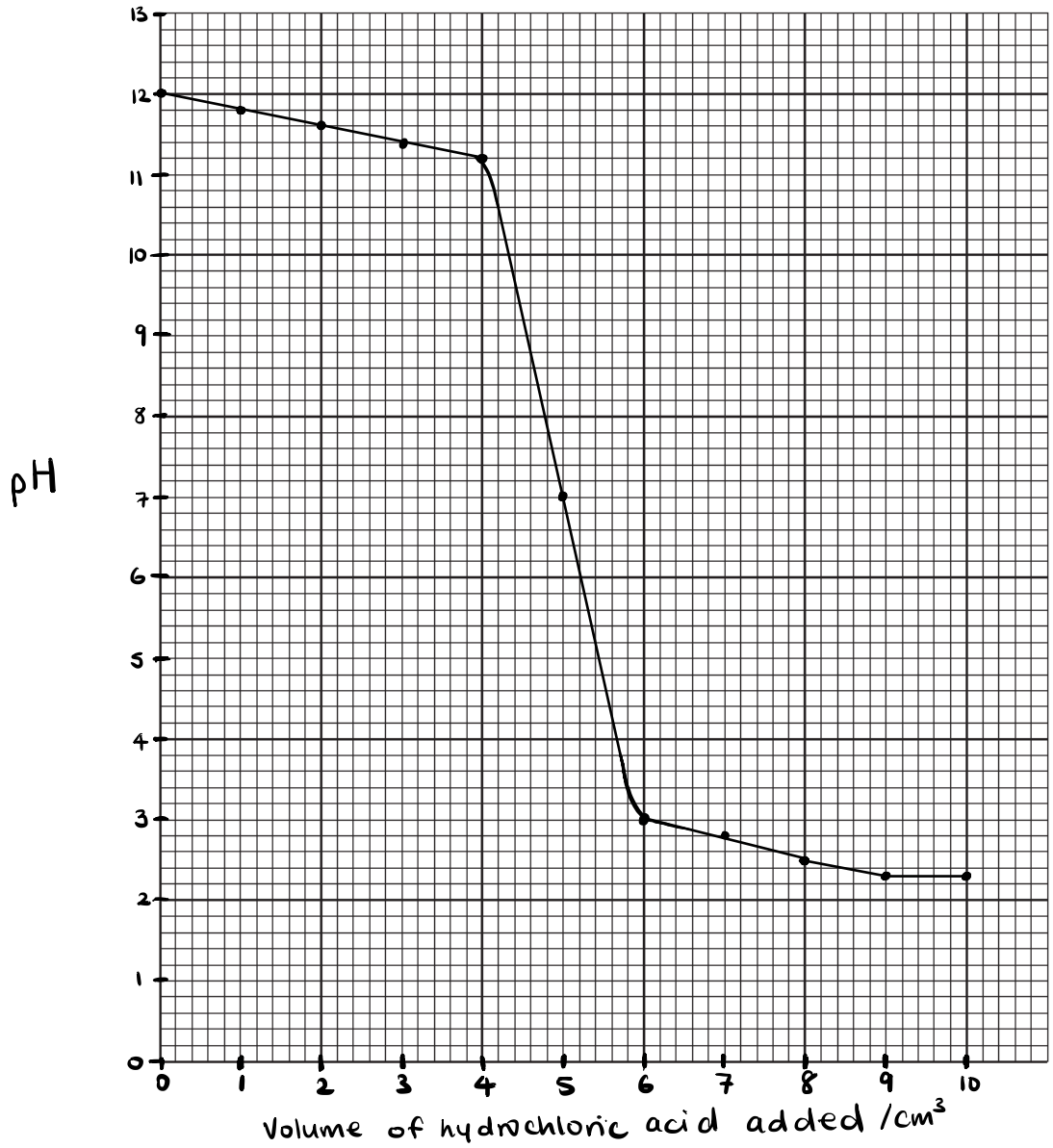
She slowly adds 1.0 cm^3 portions of the hydrochloric acid to 20.0 cm^3 of 1.0 mol/dm^3 sodium hydroxide.

She records the pH until she has added an excess of acid.

Look at her results.

Volume of hydrochloric acid added (cm^3)	**pH**
0	12.0
1	11.8
2	11.6
3	11.4
4	11.2
5	7.0
6	3.0
7	2.8
8	2.5
9	2.3
10	2.3

(a) **(i)** Plot a graph of the pH value against the amount of hydrochloric acid added and draw a line of best fit.



[3]

(ii) Use your graph to estimate the **volume of hydrochloric acid** when the pH is 10.

Volume of hydrochloric acid = ... 4.3 ..... cm^3 **[1]**

(iii) What happens to the **concentration of hydroxide ions**, OH^-, as the hydrochloric acid is added to the sodium hydroxide? **[1]**

The OH^- concentration decreased

(iv) Acidic solutions contain hydrogen ions, H^+. Alkaline solutions contain hydroxide ions, OH^-.

Write the **balanced ionic** equation for neutralisation. **[1]**

$$H^+(aq) + OH^-(aq) \longrightarrow H_2O(l)$$

(b) Hydrochloric acid, HC*l* (aq), is a strong acid. Ethanoic acid, CH_3COOH (aq), is a weak acid.

Explain the difference between a strong and a weak acid. **[2]**

Strong acid is acid that fully ionises / dissociates in water
Weak acid is acid that partially ionises / dissociates in water

(c) **(i)** Nitric acid, HNO_3, is another strong acid.

Nitric acid has a pH of 2.

The teacher adds enough water to reduce the concentration of the nitric acid by a factor of 100.

Calculate the new pH of the nitric acid.

$100 = 10^2$

pH = ... 4 ..... **[2]**

(ii) Nitric acid, HNO_3, can also neutralise sodium hydroxide, NaOH.

Sodium nitrate, $NaNO_3$, and water are made.

Write a **balanced symbol** equation for this reaction. **[1]**

$HNO_3 + NaOH \rightarrow NaNO_3 + H_2O$

(iii) Describe how dry sodium nitrate crystals can be made using this reaction. **[2]**

Heat the salt solution slowly to evaporate the water off. Then leave it to cool and dry to form dry sodium nitrate crystals.

Total Marks for Question Set 8: 13

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