

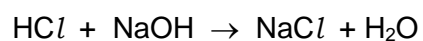


Oxford Cambridge and RSA

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 .



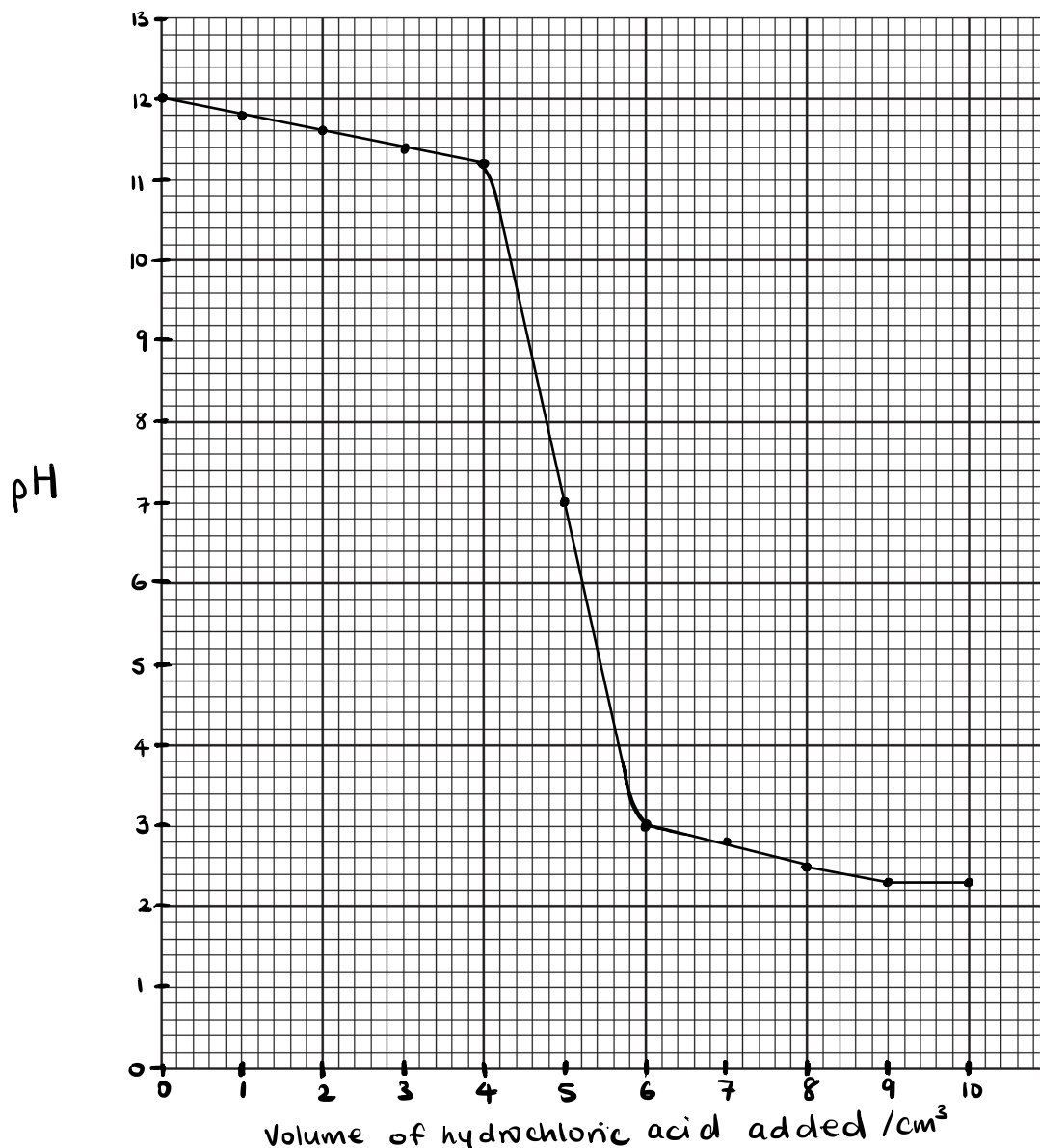
She slowly adds 1.0cm^3 portions of the hydrochloric acid to 20.0cm^3 of 1.0mol/dm^3 sodium hydroxide.

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 cm³ [1]

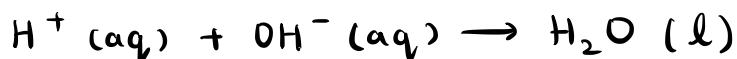
- (iii) What happens to the **concentration of hydroxide ions**, OH⁻, as the hydrochloric acid is added to the sodium hydroxide? [1]

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]



- (b) Hydrochloric acid, HCl (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.

$$100 = 10^2 \quad \text{pH} = \dots\dots\dots 4 \dots\dots\dots [2]$$

- (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]



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

Key
 atomic number
 Symbol
 name
 relative atomic mass

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