No Brain Too Small

Level 1 Science Practice Exam 1

90944 Demonstrate understanding of aspects of acids and bases

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of aspects of acids and bases.	Demonstrate in-depth understanding of aspects of acids and bases.	Demonstrate comprehensive understanding of aspects of acids and bases

You should attempt all the questions in this booklet.

A table of ions (page 2) and periodic table (page 14) are included.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Table of ions

+1	+2	+3	–3	–2	–1
NH_4^+	Ca^{2+}	Al^{3+}		O^{2-}	OH^-
Na^+	Mg^{2+}	Fe^{3+}		S^{2-}	Cl^-
K^+	Cu^{2+}			CO_3^{2-}	NO_3^-
Ag^+	Pb^{2+}			SO_4^{2-}	HCO_3^-
H^+	Fe^{2+}				
Li^+	Ba^{2+}				
	Zn^{2+}				

Question One: Atoms, Ions and Formulae.

(a) Explain why magnesium (Mg) is in Group 2 and Period 3 of the Periodic table.

(b) Explain why a magnesium atom has no overall charge.

(c) Complete the table below for the ions formed by aluminium, sodium and oxygen. Use the Periodic Table in the Resource Booklet to help you.

Atom	Atomic number	Electron arrangement of atom	Electron arrangement of ion	Charge on ion
Al				
Na				
O				

(d) The formula for aluminium oxide is Al_2O_3. The formula for sodium oxide is Na_2O. Explain why the two formulae are different.

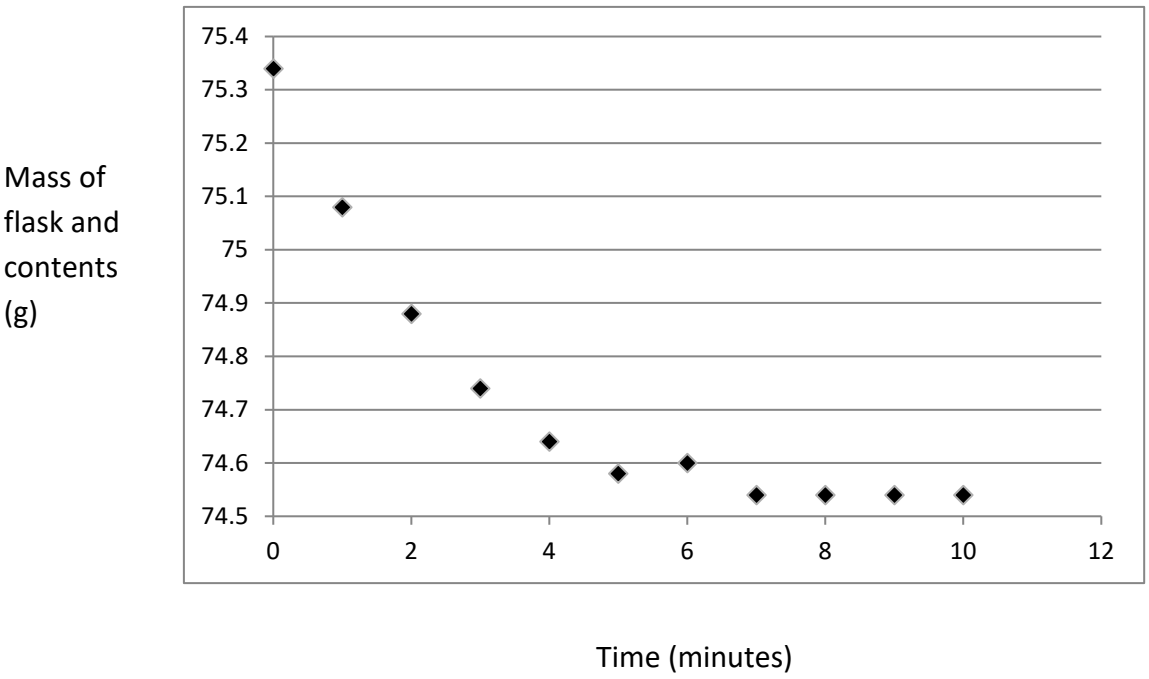
In your answer:

- consider the ratio of ions in each formula and explain how the ratio is related to the charge on the ions
- relate the ion ratio in the ionic formula to the number of electrons lost or gained by each atom.

Question Two: Reaction Rates

Calcium carbonate reacts with dilute hydrochloric acid to produce the gas carbon dioxide.

The graph below shows the results from a reaction when 40 mL of dilute hydrochloric acid was added to one marble chip (calcium carbonate) at room temperature of 20°C. The calcium carbonate was in excess.



(a) Draw a smooth curve through the reliable points and label it A.

(b) Sketch on the grid the graph that would be obtained if the same reaction was carried out at 40°C. Label it B.

(c) Explain your answer to (b) in terms of particle collisions.

(d) Write a word equation AND a balanced symbol equation for the reaction between calcium carbonate and hydrochloric acid.

Word equation:

Balanced symbol equation:

Question Three: Salts

Epsom salts was a favourite medicine of our grandparents.

Its chemical name is magnesium sulfate.

(a) Write down the chemical formula of magnesium sulfate.

_____

Salts can be made in a number of ways.

I. adding excess metal to an acid
II. adding excess carbonate to an acid
III. adding excess hydroxide to an acid

(b) For each of the methods above, give the correct **chemical formulae** of two substances which could be mixed to make magnesium sulfate.

method I.

method II.

method III.

(c) In each case the magnesium sulfate is formed as a solution in water. A little unreacted metal, carbonate or hydroxide also remains in the mixture.

What would you need to do to produce a pure sample of solid magnesium sulfate?

A student is asked to neutralise 10 mL of nitric acid solution. They add 3 drops of universal indicator solution. They are given some dilute sodium hydroxide solution which they add, drop by drop.

(d) Write a word equation AND a balanced symbol equation for the reaction between nitric acid and sodium hydroxide.

Word equation:

Balanced symbol equation:

(e) Discuss what occurs during neutralisation of the nitric acid.

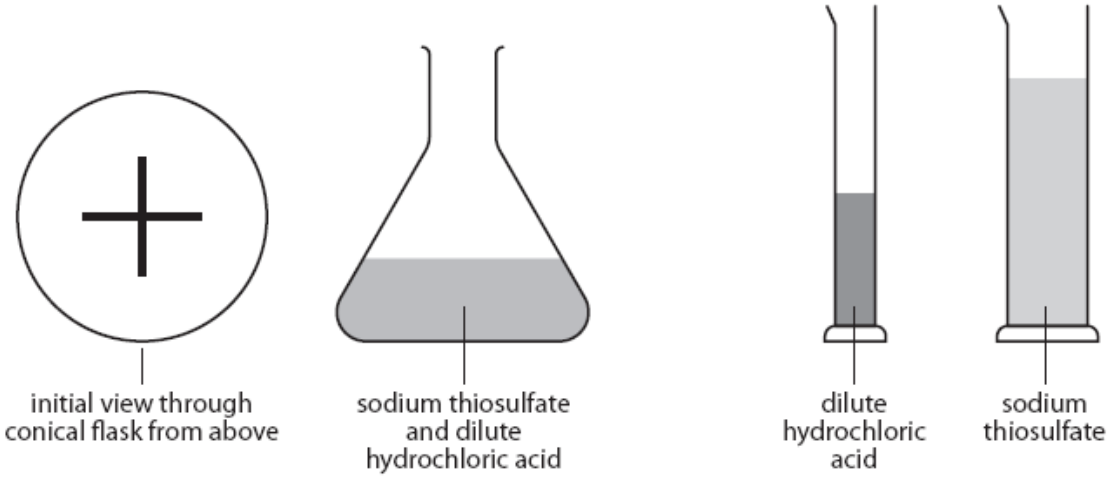
In your answer you should:

- discuss the observations you would expect to make during the neutralisation
- explain the relationship between the changing pH of the solution and the amount of hydrogen and hydroxide ions as the sodium hydroxide is added to the beaker.

Question Four: Rates

When sodium thiosulfate solution, $Na_2S_2O_3(aq)$, is added to hydrochloric acid, yellow sulfur is formed.

When viewed from above the **+** disappears from view, as more and more sulfur is formed.



The following results table was obtained by mixing various amounts of sodium thiosulfate solution, water and 1 mol L^{-1} hydrochloric acid.

Volume (mL)	$Na_2S_2O_3$	50	40	30	20	10
	H_2O	0	10	20	30	40
	HCl	6	6	6	6	6
Reaction time (s)		7	15	29	58	182

Discuss this experiment.

In your answer you should:

- identify which variable is being altered
- explain why the volume of acid needs to be kept the same
- describe what was measured during the reaction to get the data above
- write a conclusion for this experiment which refers to particle collisions.

EXTRA PAPER

PERIODIC TABLE OF THE ELEMENTS

1	2											13	14	15	16	17	18
																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	3	4	5	6	7	8	9	10	11	12	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg							

Atomic Number