

1

90944



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

SUPERVISOR'S USE ONLY

Level 1 Science, 2016

90944 Demonstrate understanding of aspects of acids and bases

9.30 a.m. Monday 14 November 2016
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.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

Pull out Resource Booklet 90944R from the centre of this booklet.

If you need more room for any answer, use the extra space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–8 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Achievement

TOTAL

12

ASSESSOR'S USE ONLY

Annotated Exemplar Template

Achieved exemplar 2016

Subject:	Science	Standard:	90944	Total score:	09
Q	Grade score	Annotation			
1	A4	Correctly gives the electron arrangement for atoms and ions of F, S, and Ca. Correctly gives the formulae for two ionic compounds of silver fluoride and calcium nitrate. States clearly that when forming ions sodium loses one electron and oxygen gains 2.			
2	A3	Identifies surface area as the factor which is affecting the rate of reaction. Identifies that calcium carbonate chips have a smaller surface area when compared against the powdered form.			
3	N2	Identifies that a neutralisation reaction occurs between a base and an acid.			

QUESTION ONE

(a) Complete the table below.

Element	Atomic number	Electron arrangement of atom	Electron arrangement of ion
F	9	<u>2,7</u>	<u>2,8</u>
S	16	<u>2,8,6</u>	<u>2,8,8</u>
Ca	20	<u>2,8,8,2</u>	<u>2,8,8</u>

(b) Write the formulae for the following ionic compounds.

Use the table of ions in your resource booklet to help you.

(i) Silver fluoride AgF(ii) Potassium sulfate K₂SO₄(iii) Calcium nitrate Ca(NO₃)₂(c) Sodium burns in oxygen gas, O₂, to form sodium oxide, Na₂O.(i) Explain how the Na and O atoms form Na⁺ and O²⁻ ions, in terms of their groups in the periodic table, electron arrangement, AND number of protons.

The group that sodium is in is Group 1 with the electron arrangement of 2,8,1 and has 11 protons. The reason sodium forms a 1⁺ ion is because it loses 1 electron.

The group that oxygen is in is Group 16. It's electron arrangement is 2,6 and has 8 protons. The reason oxygen forms a 2⁻ ion is it gains 2 electrons.

- (ii) Justify the ratio of Na^+ and O^{2-} ions in the formula Na_2O , in terms of the **electrons** lost or gained, and the **charge** on each ion.

Include an explanation of the **type of bonding** between the Na^+ and O^{2-} ions.

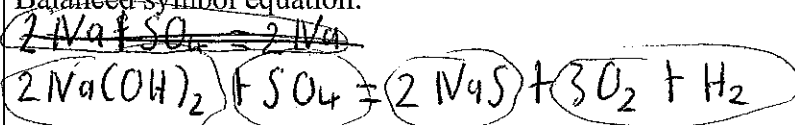
The ratio of sodium to oxygen is 2:1, that is because sodium loses an electron and oxygen gains 2, so to make the charge balanced the sodium needs 1 electron and oxygen wants to lose 2. ||

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

Word equation:

sodium hydroxide + sulfuric acid = sodium sulphide + hydrogen + hydrogen

Balanced symbol equation:



A4

QUESTION TWO

ASSESSOR'S
USE ONLY

A sample of calcium carbonate is added to dilute hydrochloric acid in an open conical flask. The total mass of the flask and contents is measured over time.

Three experiments are carried out at 25°C using the same mass of calcium carbonate, and the same volume of acid:

	Calcium carbonate pieces	pH of acid
Experiment 1	Chips	1
Experiment 2	Powdered	1
Experiment 3	Powdered	5



- (a) For each of the experiments reacting calcium carbonate and dilute acid together, the mass of the flask and its contents decreases over time.

Describe why this happens.

∩ The calcium carbonate is slowly dissolving so it is vanishing. ∩

- (b) (i) Identify the factor affecting the reaction rate being investigated in **Experiments 1 and 2**.

Surface area ∩

- (ii) Explain how this factor affects the rate of reaction in the two flasks, with reference to particle collisions.

Explain any observations, including changes in mass, over the course of **Experiments 1 and 2** until the reactions are finished.

∩ In the first experiment the chip will take longer to dissolve so the reaction will go slower because there is a smaller surface area. ∩

In experiment 2 the reaction will go quicker because the powder has a larger surface area. ∩

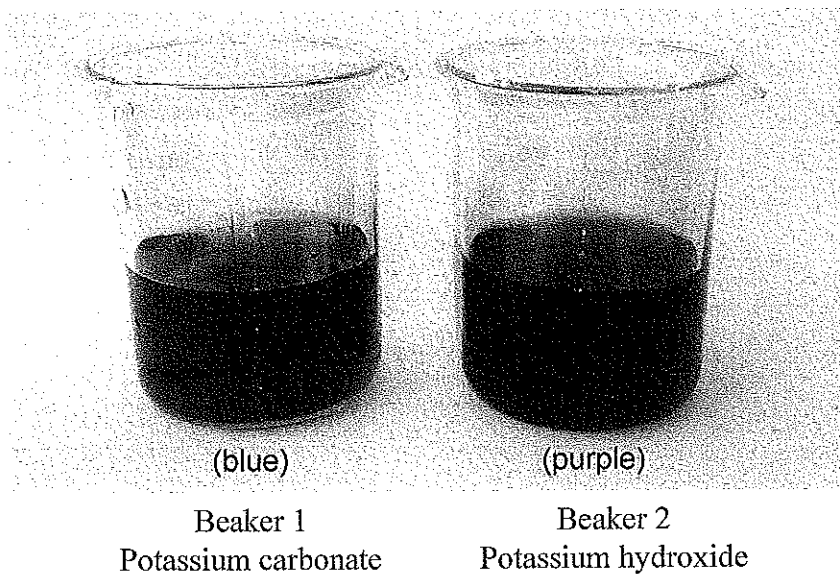
- (c) Compare and contrast the rate of reaction of **Experiments 2 and 3**, with reference to particle collisions and the concentration of hydrogen ions in the solution.

The rate of reaction in experiment 2 will be slower because there are less hydrogen ions to react with in the solution. Experiment 3 will go a lot quicker because the concentration of hydrogen ions is a lot bigger than experiment 2.

A3

QUESTION THREE

A student added universal indicator to the solutions in two beakers as shown below.



- (a) Explain why the solutions are different colours.

The solution in beaker 1 has a lower pH than the solution in beaker 2. ↓

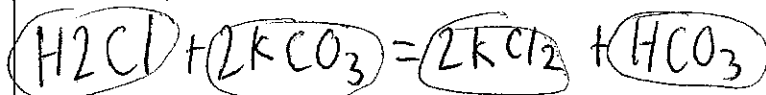
The student then adds hydrochloric acid to each of the beakers until there are no more changes in colour.

- (b) Write a word equation AND a balanced symbol equation for the reaction between **hydrochloric acid** and **potassium carbonate** in Beaker 1.

Word equation:

hydrochloric acid + potassium carbonate = potassium chloride + hydrocarbonate

Balanced symbol equation:



- (c) Explain what will happen to the indicator colour in **Beaker 2 (potassium hydroxide)** as the hydrochloric acid is added.

Relate this to the changing pH, the ions present in the beaker, and the type of reaction occurring.

The change in the pH goes from being an acid through to a neutral and to a base. The ions that are present in the beaker are ~~water~~ oxygen, hydrogen and potassium and the type of reaction is a neutralising reaction. The colour of beaker 2 would go from being a purple colour to a red colour depending on how much hydrochloric acid is added.

ASSESSOR'S
USE ONLY

N2