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NZQA

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Level 1 Science 2021

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.

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.

Check that this booklet has pages 2–11 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (//). This area may be cut off when the booklet is marked.

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

QUESTION ONE

Lithium and aluminium are metals. Oxygen is a non-metal.

(a) Write the electron arrangement for each of the atoms.

Lithium: _____

Aluminium: _____

Oxygen: _____

(b) (i) Aluminium and oxygen atoms both form ions with the same electron arrangement.

Write the electron arrangement of the two ions.

Aluminium ion, Al^{3+}: _____

Oxide ion, O^{2-}: _____

(ii) Explain how each ion, Al^{3+} and O^{2-}, is formed.

In your answer you should:

- explain why these elements form ions
- explain the charges on both ions in terms of electron arrangement of atoms and ions, number of protons and number of electrons, and charge.

(c) The Tiwai Point factory, near Invercargill, removes aluminium from its ore, bauxite.

Bauxite is a rock that contains aluminium oxide, Al_2O_3.

Explain the ratio of aluminium ions to oxide ions in Al_2O_3.

In your answer you should explain:

- how the ratio is related to the charge on the ions
- the number of electrons gained or lost by each atom as it forms the ionic compound.

www nzherald.co nz/the-country/news/covid-19-coronavirus-tiwai-point-reduces-production-in-response-to-virus/E3PCHSVWFOLHFMZW2TM6U4NRH4/

QUESTION TWO

Indigestion can be caused by excess hydrochloric acid, HCl, in the stomach. It can be treated with indigestion tablets made of magnesium carbonate, $MgCO_3$.

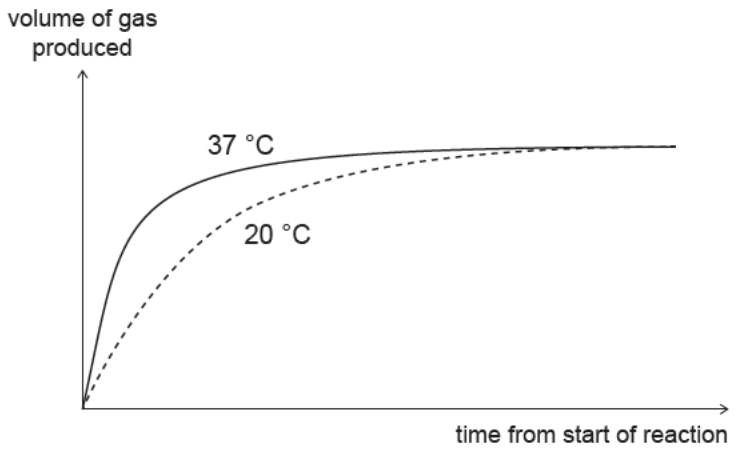
(a) Write the equations for the reaction of magnesium carbonate and hydrochloric acid.

Word equation:

Symbol equation:

(b) A student investigated the reaction between magnesium carbonate tablets and hydrochloric acid.

They placed one indigestion tablet into a flask containing 100 mL of hydrochloric acid at 20 °C.
They repeated the experiment, but this time warmed the hydrochloric acid to 37 °C.
They collected the gas produced, and recorded their findings on a graph.



(i) State which temperature had the faster rate of reaction.

(ii) Refer to particle collisions to explain the effect of increasing the temperature of the hydrochloric acid from 20 °C to 37 °C on the rate of reaction.

(c) Instructions on how to take indigestion tablets say they can be swallowed whole, or can be chewed into pieces.

Explain why the tablets work quicker when they are chewed, referring to the changes to the rate of reaction and particle collisions.

https://upload.wikimedia.org/wikipedia/commons/thumb/5/57/Antacid-L478.jpg/1200px-Antacid-L478.jpg

QUESTION THREE

Soap, pH 8, and oven cleaner, pH 12, can both be made from bases.

(a) (i) Complete the table to show the observations when these substances are mixed with red litmus and universal indicator.

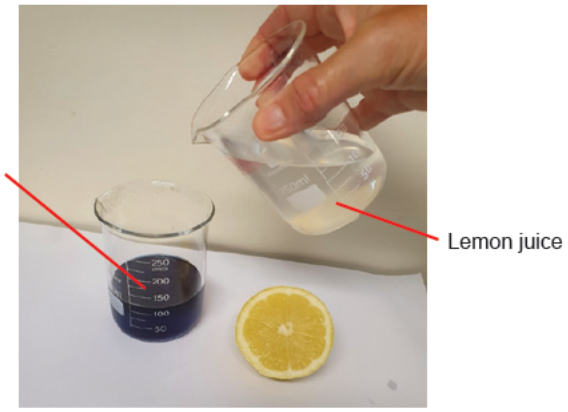
Substance	pH	Observation with red litmus	Observation with universal indicator
Soap	8		
Oven cleaner	12		

The labels for a bottle of soap and a bottle of oven cleaner have been lost.

(ii) Which indicator would you use to safely find out the contents of the two bottles?

(iii) Explain why you have chosen to use this indicator and not the other indicator.

(b) Lemon juice is an acid with pH 4. In a science lab, a student adds lemon juice to a beaker containing oven cleaner and universal indicator until no further changes are seen.



Explain what will happen to the colour of the solution while the lemon juice is added to the oven cleaner.

In your answer you should:

- link the changes in colour of the universal indicator to the approximate pH of the solution
- link the pH to the concentration of hydrogen ions and the hydroxide ions in the solution
- explain the type of reaction occurring.

Question Three continues on the next page.

(c) Explain why oven cleaner and soap cannot neutralise each other.

Extra space if required.
Write the question number(s) if applicable.

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