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90944



Tick this box if there is no writing in this booklet

# Level 1 Science 2020

# 90944 Demonstrate understanding of aspects of acids and bases

9.30 a.m. Friday 27 November 2020 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 3–11 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.

TOTAL

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### **QUESTION ONE**

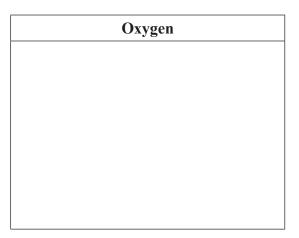
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(a) (i) Sodium and oxygen are elements on the periodic table.

11 **Na**  o

Using the information supplied, draw the electron arrangement of a sodium atom and an oxygen atom.

Sodium



Sodium ions and oxide ions have the **same** electron arrangement.

(ii) State the electron arrangement of the sodium ions and oxide ions

Electron arrangement of **both** ions:

(iii) How can sodium ions and oxide ions have the same electron arrangement but different charges?

In your answer you should refer to the number of protons, charge, and electron arrangement of the two ions.

There is more space for your answer to this question on the following page.

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- sodium hydrogen carbonate, NaHCO<sub>3</sub>
- sodium hydroxide, NaOH.

(ii)

These solutions can be identified using only red litmus paper and sulfuric acid,  $\rm H_2SO_4$ , solution.

(i) Complete the table, describing any observations that would be made.

Unlabelled solution	Observation (if any) with red litmus paper	Observation (if any) with sulfuric acid (H <sub>2</sub> SO <sub>4</sub> )
sodium hydrogen carbonate, NaHCO <sub>3</sub>		
sodium hydroxide, NaOH		

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(iii)	Complete the word and symbol equations for the reactions that take place.	
sodium h	ydrogen carbonate + sulfuric acid →	
oodidiii ii,	yanogen eanzemate eana n	
Balanced s	symbol equation	
sodium h	ydroxide + sulfuric acid →	
Balanced s	symbol equation	

### **QUESTION TWO**

Oamaru stone is used as a building material in New Zealand. It is a mixture of calcium carbonate and some unreactive chemicals.

5 g samples of Oamaru stone were each reacted with the same volume of hydrochloric acid.





Oamaru stone chips

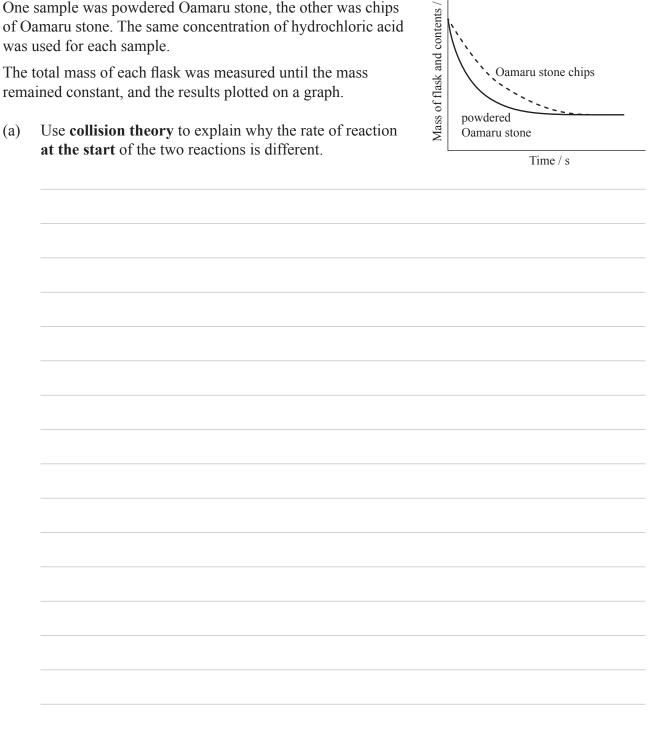
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oamaru-stone

calcium carbonate + hydrochloric acid → calcium chloride + water + carbon dioxide

One sample was powdered Oamaru stone, the other was chips of Oamaru stone. The same concentration of hydrochloric acid was used for each sample.

The total mass of each flask was measured until the mass remained constant, and the results plotted on a graph.



Calciu	um carbonate, CaCO <sub>3</sub> , reacts with hydrochloric acid, HCl, to form calcium chloride, CaCl <sub>2</sub> .
	$CaCO_3 + 2HCI \rightarrow CaCl_2 + H_2O + CO_2$
Expla o the	in why the ratio of calcium ions to chloride ions in calcium chloride, CaCl <sub>2</sub> , is different ratio of calcium ions and carbonate ions in calcium carbonate, CaCO <sub>3</sub> .
In you	ar answer you should explain how the ratio is related to the charge on the ions.

(ii)

Two solutions of equal volumes of sulfuric acid,  $\rm H_2SO_4$ , were tested using universal indicator.

The following results were obtained:

Beaker A



 $\begin{array}{c} \text{Red} \\ 0.01 \text{ mol } L^{-1} \text{ sulfuric acid} \end{array}$ 

Beaker B



 $\begin{array}{c} Orange \\ 0.0001 \; mol \; L^{-1} \; sulfuric \; acid \end{array}$ 

(a)	(i)	Which	beaker	contains	the most	concentrated	acid	solution?
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Explain why the solutions have different colours.  Link your answer to the concentration of hydrogen and hydroxide ions, and the pH of each solution.

Sulfuric acid is reacted with black copper oxide, CuO, to make blue copper sulfate,  $CuSO_4$ , solution.





Copper oxide powder is added to **warmed** sulfuric acid until the copper oxide stops disappearing.



The mixture is filtered.

What type of reaction is taking place between the copper oxide and the sulfuric acid?
Use <b>collision theory</b> to explain why the reaction happens quicker when warm sulfuric acid is used, rather than cold sulfuric acid.

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