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NZQA

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Level 1 Science, 2017

90944 Demonstrate understanding of aspects of acids and bases

9.30 a.m. Wednesday 15 November 2017
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.

TOTAL

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QUESTION ONE

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A sample of powdered sodium hydrogen carbonate ($NaHCO_3$) was added to sulfuric acid (H_2SO_4) in a flask, and fizzing was observed.

Two experiments were carried out with the acid at different temperatures, using the same amount of powdered sodium hydrogen carbonate and the same concentration and volume of sulfuric acid:

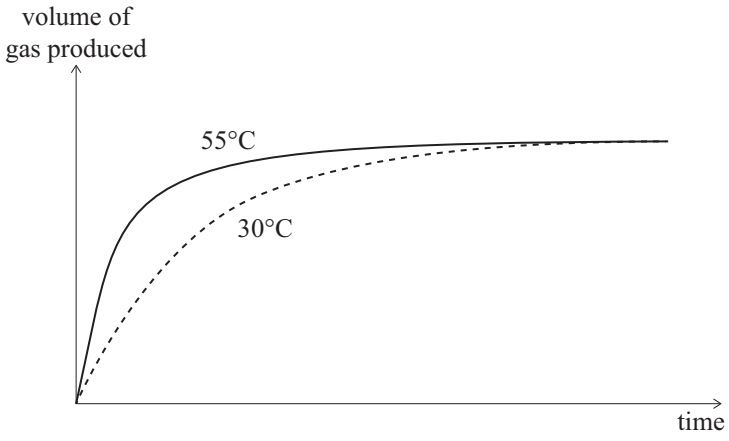
Experiment	Temperature of acid, °C
1	30
2	55

(a) What caused the fizzing?

(b) Why was the fizzing fastest immediately after the sodium hydrogen carbonate had been added?

Your answer should refer to particle collisions.

(c) The rate of reaction for each experiment was found by measuring the volume of gas produced over time, as shown in the graph below.



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Refer to the graph on the previous page to answer the following question:

What is the effect of increasing temperature on the rate of reaction?

Your answer should refer to particle collisions and explain why both lines finish at the same point.

(d) Write a word equation AND a balanced symbol equation for the reaction between sodium hydrogen carbonate ($NaHCO_3$) and sulfuric acid (H_2SO_4).

Word equation:

Balanced symbol equation:

QUESTION TWO

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Sodium and potassium are both highly reactive metals that react with oxygen gas. However, sodium and potassium do not react with each other.

(a) Why do sodium and potassium each react with oxygen, but not with each other?

In your answer you should:

- refer to the electron arrangements of each of the three atoms and three ions involved
- explain how the electron arrangement of each of the three atoms relates to its position in the periodic table
- explain how an ionic bond forms when sodium or potassium reacts with oxygen.

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(b) Three unlabelled colourless solutions are known to be:

- nitric acid (HNO_3)
- sodium chloride (NaCl)
- sodium hydrogen carbonate ($NaHCO_3$).

How could each of these unlabelled solutions be identified using only **potassium carbonate (K_2CO_3)** solution, and **red litmus paper**?

In your answer you should:

- complete the table
- explain how the observations allow you to identify each solution
- include balanced symbol equation(s) for any reactions.

Unlabelled solution	**Observation (if any) with red litmus paper**	**Observation (if any) with potassium carbonate (K_2CO_3)**
Nitric acid (HNO_3)		
Sodium chloride (NaCl)		
Sodium hydrogen carbonate ($NaHCO_3$)		

Balanced symbol equation(s):

QUESTION THREE

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(a) (i) Explain why silver oxide, Ag_2O, has a 2:1 ratio of ions.

In your answer you should:

- relate the ratio of ions to the number of electrons lost or gained by each atom when forming ions
- explain how the ratio of the ions in the compound is related to the charge on the ions.

(ii) Silver oxide is a base and will react with hydrochloric acid.

Write a word equation AND a balanced symbol equation for the reaction between silver oxide and hydrochloric acid.

Word equation:

Balanced symbol equation:

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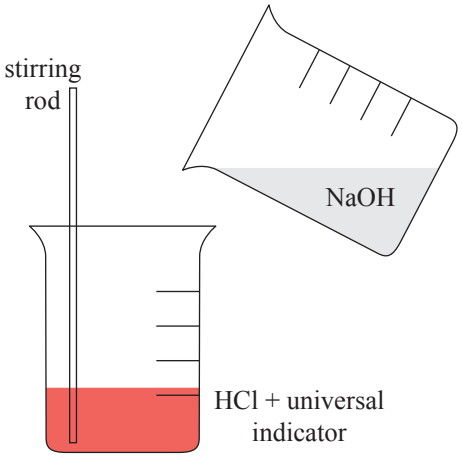
(b) A solution of sodium hydroxide (NaOH) is slowly stirred into a beaker of hydrochloric acid (HCl) with universal indicator added. The HCl and universal indicator solution **starts out red**.



Explain the changes in the colour of the universal indicator as the sodium hydroxide solution is slowly added until no further colour changes occur.

In your answer, you should:

- relate the changes in the colour of the universal indicator to the approximate pH of the solution
- link the pH to the relative concentrations of hydrogen ions and hydroxide ions in solution
- explain the neutralisation reaction occurring.

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

QUESTION NUMBER

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