

# 1

90944



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## Level 1 Science, 2015

### 90944 Demonstrate understanding of aspects of acids and bases

9.30 a.m. Tuesday 10 November 2015  
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 2–11 in the correct order and that none of these pages is blank.

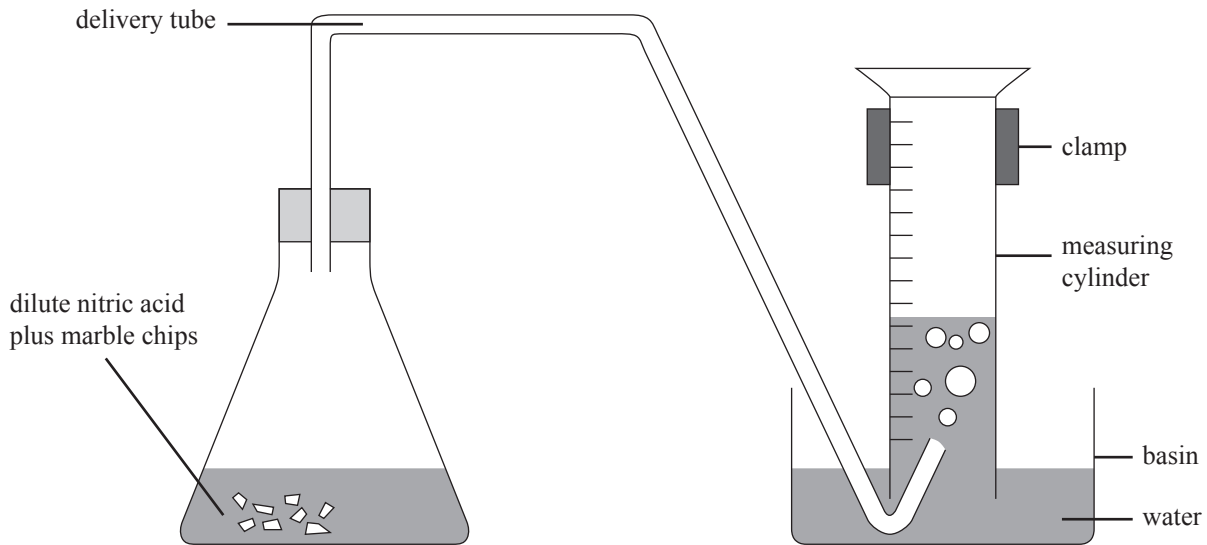
**YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.**

**TOTAL**

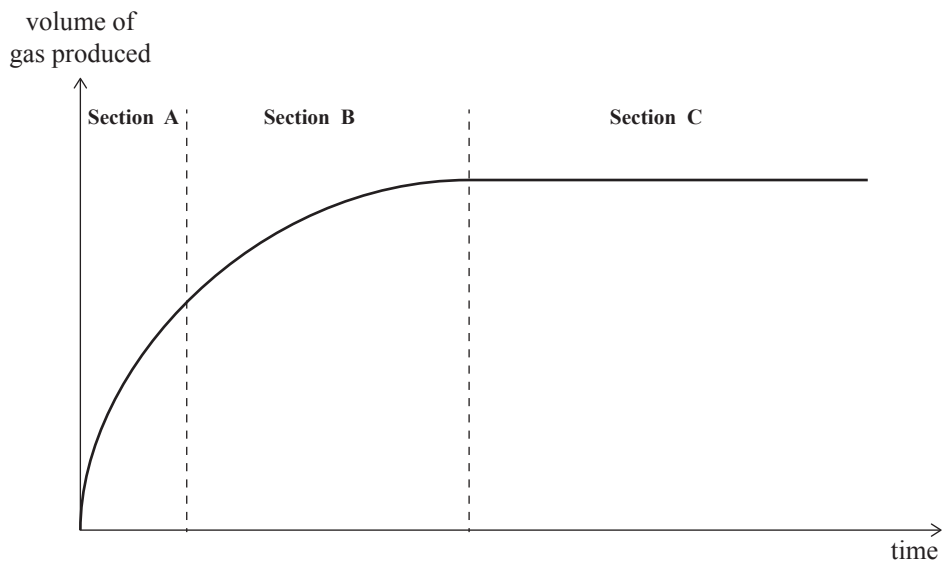
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**QUESTION ONE**

Marble chips (calcium carbonate) were added to nitric acid in a conical flask. The temperature of the acid was  $50^{\circ}\text{C}$ . The flask was connected to an inverted measuring cylinder in a basin of water to measure the volume of gas produced, as shown in the diagram below.



The graph below shows the volume of gas produced against time.



- (a) Explain what is happening in terms of particle collisions and rate of reaction in **each section** of the graph.

Section A: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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Section B: \_\_\_\_\_

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Section C: \_\_\_\_\_

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- (b) The reaction was carried out again but this time at 20°C. The mass and size of the marble chips, and the concentration and volume of nitric acid used were kept the same.
- (i) Draw a line on the graph that represents the reaction at 20°C.
- (ii) Explain why you drew this line where you did, and explain if this means that the rate of reaction is slower, the same, or faster.

In your answer you should

- discuss why you drew your line with the slope that you did, and why you stopped the line at the point that you did
- explain the effect of temperature on reaction rate, in terms of particle collisions.

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

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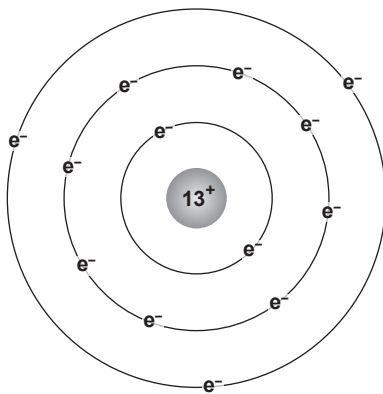
- (c) Write a word equation AND a balanced symbol equation for the reaction between nitric acid and calcium carbonate.

Word equation:

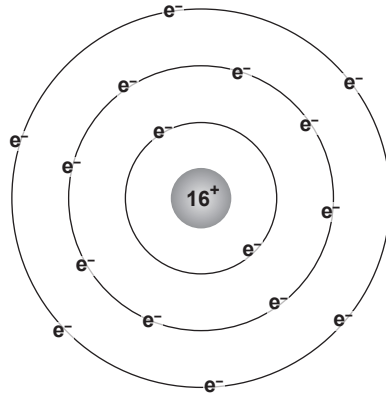
Balanced symbol equation:

## QUESTION TWO

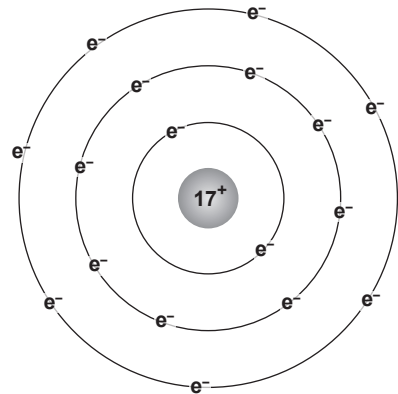
The diagrams below show models of three different atoms.



Aluminium



Sulfur



Chlorine

(a) Each of these atoms can form ions, as listed below.

- Explain why each of the **ions** has the charge it does, in terms of electron arrangement and number of protons.
- Ions are charged atoms. Explain how each of the ions below reached the charge shown. You should discuss particles gained or lost by the atoms involved, and the reasons for this.

Aluminium ion,  $\text{Al}^{3+}$ : \_\_\_\_\_

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Sulfide ion,  $\text{S}^{2-}$ : \_\_\_\_\_

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Chloride ion,  $\text{Cl}^-$ : \_\_\_\_\_

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(b) Explain why an ionic bond would **not** form between a sulfide ion and a chloride ion.

In your answer you should:

- describe an ionic bond
- refer to charges and electron arrangements of the ions involved.

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(c) Determine the ionic formulae of the compound that forms when aluminium combines with chlorine, AND when aluminium combines with sulfur.

In your answer you should:

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

Aluminium and chlorine: \_\_\_\_\_

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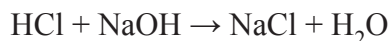
Aluminium and sulfur: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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**QUESTION THREE**

The chemical equation below represents the reaction between hydrochloric acid and sodium hydroxide:



- (a) Complete the table below to show the approximate pH for each of the three solutions.

	Colour when UI is added	pH
<b>HCl</b>	red	
<b>NaOH</b>	purple	
<b>H<sub>2</sub>O</b>	green	

- (b) Water is formed in the reaction above.

Explain what ions form water in this reaction, and where they come from.

*You may use an equation but this is not required.*

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- (c) NaOH is gradually added to a solution of HCl with universal indicator present, until no further colour change occurs.

Discuss what is occurring in the beaker at each of the pH's shown, as the NaOH is added.

In your answer you should refer to:

- the colours that would occur at each pH
- the relative amounts of hydrogen and hydroxide present at each of the pH's shown.

pH = 1 (before any NaOH is added): \_\_\_\_\_

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pH = 4: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

pH = 7: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

pH = 10: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

pH = 13: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- (d) In a different chemical reaction, hydrochloric acid reacts with magnesium hydroxide.

Write a word equation and a balanced chemical equation for this reaction in the boxes below.

Word equation:

Balanced symbol equation:





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