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# Level 1 Science 2022

## 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.**

Make sure that you have Resource Booklet L1–SCIER.

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 – 16 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

(a) Sulfur and chlorine are elements on the periodic table.

| 16 | 17 |
|---|---|
| **S** | **Cl** |

(i) Using the information above, draw the electron arrangement of a sulfur atom and a chlorine atom.

| | |
|---|---|
| | |
| **sulfur atom** | **chlorine atom** |

Sulfide ions and chloride ions have the **same** electron arrangement as each other.

(ii) State the electron arrangement of the sulfur ions and chloride ions.

Electron arrangement of both ions: _____

(iii) How can sulfide ions and chloride 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.

(b) Humans need vitamins in their diet to keep their bodies working properly.

Vitamin C is an acid. Vitamin $B_6$ is a base.

Solutions of the vitamins can be identified using only blue litmus paper or calcium carbonate, $CaCO_3$, powder.

(i) Complete the table, to show the observations that would be made when these substances are mixed with blue litmus paper and calcium carbonate.

| **Solution** | **Observation (if any) with blue litmus paper** | **Observation (if any) with calcium carbonate, $CaCO_3$** |
|---|---|---|
| Vitamin C | | |
| Vitamin $B_6$ | | |

(ii) Explain ALL of the observations, and how these allow the solutions to be identified.

## QUESTION TWO

A volcano simulation can be made by carrying out a home science experiment.

The experiment uses an acid-carbonate reaction.

**Instructions**

Add ½ teaspoon of bicarbonate of soda to ½ cup of cold vinegar in the jar.

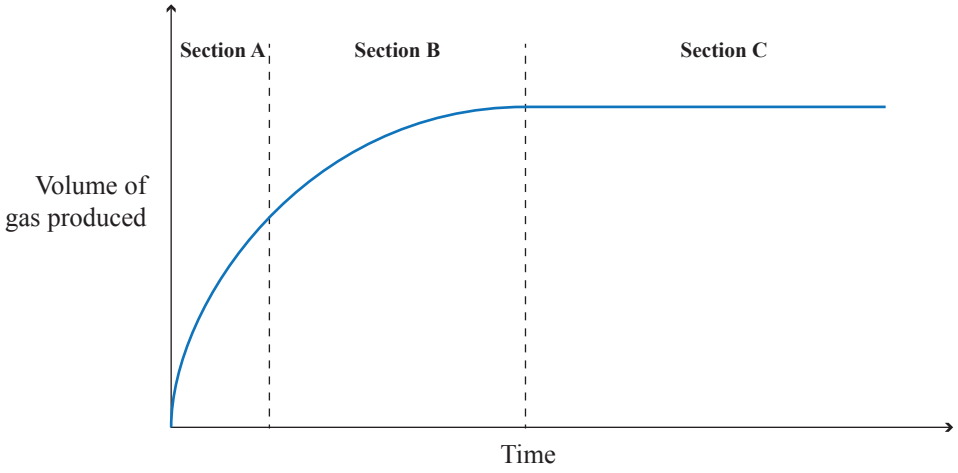
Stand back!

(a) The instructions suggest that cold acidic vinegar should be used.

Use collision theory to explain what would happen if warm vinegar was used, rather than cold vinegar.

(b) The experiment was repeated in a school lab, and the carbon dioxide gas produced was collected until no more gas was being produced.


The results were plotted on a graph.




Explain what is happening in sections A, B, and C of the graph.

You should link the rate of reaction in each section to the gradient of the line and particle collisions.

Section A: _____

Section B: _____

Section C:

(c) A different home volcano kit suggests adding water to the vinegar.
When this is tried, the reaction is slower.

(i) Identify the factor affecting the reaction rate being investigated in this experiment.

(ii) Use collision theory to explain this result.
Link your answer to particle collisions.

## QUESTION THREE

(a) Copper hydroxide, $Cu(OH)_2$, can be used by plant growers to kill fungi. Copper carbonate, $CuCO_3$, is used to colour paints.

(i) Complete the table to state the ratio of ions in the two compounds, copper hydroxide and copper carbonate.

| | **Copper hydroxide, $Cu(OH)_2$** | | **Copper carbonate, $CuCO_3$** | |
|---|---|---|---|---|
| | **$Cu^{2+}$** | **$OH^-$** | **$Cu^{2+}$** | **$CO_3^{2-}$** |
| **Ratio** | | | | |

(ii) Explain why the ratio of copper ions to hydroxide ions in copper hydroxide, $Cu(OH)_2$, is different to the ratio of copper ions and carbonate ions in copper carbonate, $CuCO_3$.

In your answer, you should explain how the ratio is related to the charge on the ions.

(b) Copper hydroxide can react with hydrochloric acid.

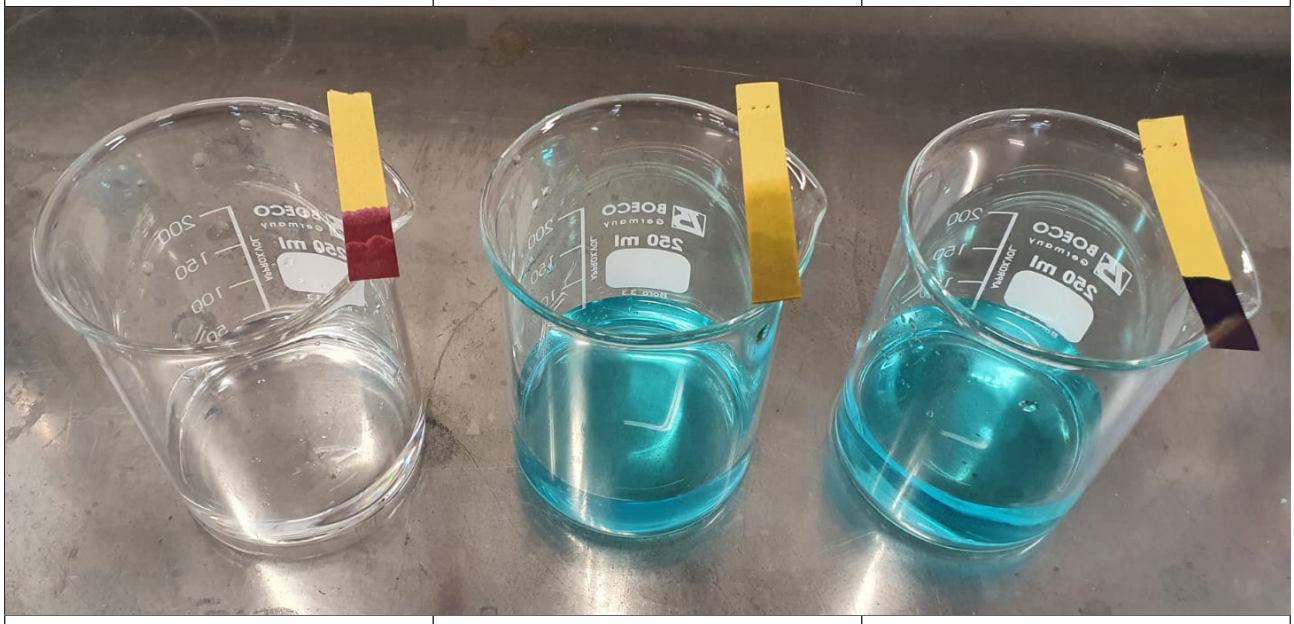
Complete the word and symbol equations for the reaction that takes place.

| |
|---|
| copper hydroxide + hydrochloric acid → |

| |
|---|
| Balanced symbol equation: |

(c) A solution of hydrochloric acid is placed in a beaker. Pieces of universal indicator paper are dipped in it. After dipping, the paper is red, as shown in the picture below.

Copper hydroxide powder is slowly added to the beaker. After each addition, the solution is retested with new universal indicator paper until no more colour changes are seen.

| Universal indicator paper in hydrochloric acid only | Universal indicator paper after some copper hydroxide added to the beaker | Universal indicator paper after a lot of copper hydroxide added to the beaker |
|---|---|---|
|  | | |
| Paper turns red | Paper turns green | Paper turns blue |

(i) Name the type of reaction that is occurring when copper hydroxide is added to hydrochloric acid.

(ii) Explain in detail what happens to the colours of the universal indicator paper while the copper hydroxide is being added to the hydrochloric acid.

Link your answer to the concentration of ions and the changing pH of the solution.

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

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