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SUPERVISOR'S USE ONLY

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.

Achievement

TOTAL 09

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QUESTION ONE

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?

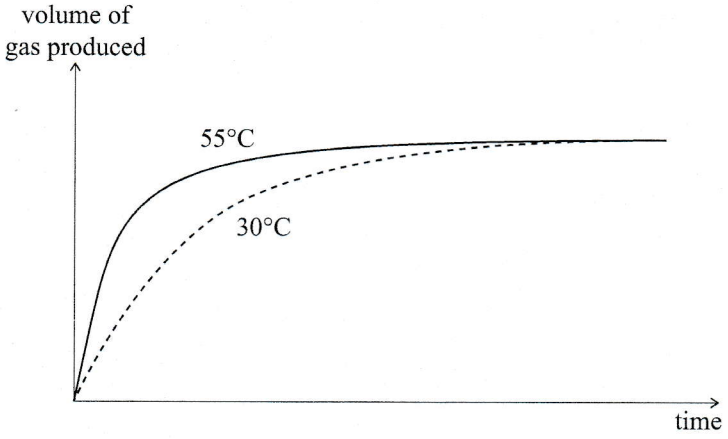
- the Sodium hydrogen carbonate and sulfuric acid.
- an ~~acid~~ base and a acid.

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

Your answer should refer to particle collisions.

the initial reaction would of been fastest due to the concentration and high density of unreacted paricles of the powdered sodium hydrogen carbonate and the acid making the particles collide with enough force and energy to spark a reaction, but as more and more particles collide it creates more space therefore not as many successful collitions occur, slowing down the amount of fizzing happening in the experiment.

(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.



ASSESSOR'S USE ONLY

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.

~~The increase~~ the collition theroy can be made up from an incress of temperature. By increasing temperature ~~the rate~~ of a solution in this case sulfuric acid, when another substance is added (sodium hydrogen carbonate) the temperature incresses the amount of successful collitions amoung particles. the particles must collide at the right orientation, sufficent speed and force to react and the incress of temperture incresses ~~the~~ that change. As we can see in the graph the data collected can back up their theroy as when the temperature incressed from 30°c to 55°c the reaction occured faster but both ended up at the same point over time.

(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:

~~Sodium hydrogen carbonate~~ + sulfuric acid → sodium sulfate + water + ~~carbonate~~ carbon dioxide gas

Balanced symbol equation:

~~$2NaHCO_3 + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O + CO_2$~~

Na^+ SO_4^{2-}

A4

QUESTION TWO

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.

Na^+ 11
K^+ 19
O 8

$Na^+ = 2, 8, 1$
$K^+ = 2, 8, 8, 1$
$O = 2, 6$

both sodium and potassium fall on the same row on the periodic table in number 1. ~~Na+~~ Sodium is highly reactive because it does not have a full outer shell of electrons or a valance shell with the atomic number 11 possasium is the same ~~Na+~~ with it not having a full valance shell ~~with~~ with the atomic nyber 19. as both Sodium and possasium are metals they would not react with one another yet because Oxygen is a gas they would indivually be reactive with it.

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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)	~~Red~~ ~~blue~~ because it is an acid	it would neutralise
Sodium chloride (NaCl)	blue ~~red~~ because it is a base	it would stay the same as it is both a base
Sodium hydrogen carbonate ($NaHCO_3$)	~~blue~~ ~~red~~ because it has an acid	

by adding patassium carbonate ~~with~~ which is a base to the uniabled solution Nitric acid it would slowly reach ~~the~~ neutralisation point $[H^+ = OH^-]$ ~~therefore meaning what would of been red litmus paper blue.~~ When adding the potassium carbonate to the sodium chloride it would keep the litmus paper the same colour as it would still be a ~~or~~ basic solution

Nitric acid + Potassium carbonate → Potassium nitrate + water + Carbon dioxide gas

Balanced symbol equation(s):

$$2HNO_3 + K_2CO_3 \rightarrow 2KNO_3 + H_2O + CO_2$$

N2

QUESTION THREE

ASSESSOR'S USE ONLY

(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.

to create the compound Ag_2O you would need the elements Ag^+ and O^{2-} as there is $2O^{2-}$ to the 1: Ag^+ they can't cancle eachother out to create the compound so the Ag^+ would have to gain one in order to create the compound

Ag^+ Ag^+ O^{2-}

therefore the ion ration of Ag_2O 2:1 as there would have to be 2: Ag^+ to 1: O^{2+} to create the ionic compound

(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:

hydrochloric acid + silver oxide → ~~hydroxide~~ + water

Balanced symbol equation:

$2HCl + Ag_2O \rightarrow H_2O$

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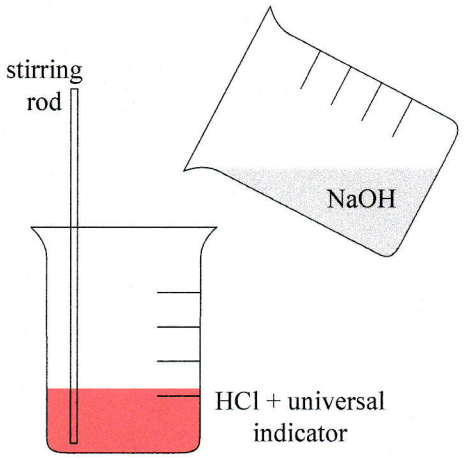
(b) A solution of sodium hydroxide (NaOH) is slowly stirred into a beaker of hydrochloric acid (HCl) with universal indicator added. The HCl and universal indicator solution **starts out red**.



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.

The colour of the universal indicator is red at the start of the experiment as it is only hydrocloric acid which is a strong acid with the PH scale of 1-2 as it is all H^+ ions. when the solution of sodium hydroxide NaOH is slowly added into the HCl solution, the concentration of the acid is slighty diluted $[H^+ >> OH^-]$ and the colour of the universal indicator would also slighty change. as more and more NaOH solution is added, the concentration of the HCl acid will change $[H^+ >> OH^-]$ and the colour of the universal indicator would change to orange or yellow a PH of 3 - 6. the concentration of the HCl with continute to diulute as the basic solution is added $[H^+ > OH^-]$ until the H^+ ions and the OH^- ions are the same and the solution is nutralized $[H^+ = OH^-]$ the colour of the pH scale would then be green.

A3

Subject:	Science	Standard:	90944	Total score:	09

Q	Grade score	Annotation
1	A4	Candidate does not show understanding of the effects of concentration or temperature on collision frequency, but does give a description of particle collision theory and recognises that increased temperature increases collisions. This candidate has a correct symbol equation, but not balanced.
2	N2	No correct information in part a as electron configurations are for atoms not ions. In part b, candidate has an achieved point for top row of the table and has a correctly balanced symbol equation.
3	A3	Candidate has attempted to explain the cancelling of charges but not sufficiently and the word equation omits silver chloride. In part b, this candidate has recognised 2 pH values and related colour changes, and the relative ion concentrations at several points. More colours through to purple or blue with pH values would have allowed access to a merit point.