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NZQA

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SUPERVISOR'S USE ONLY

Level 1 Science, 2018

90944 Demonstrate understanding of aspects of acids and bases

9.30 a.m. Thursday 15 November 2018
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 12

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QUESTION ONE

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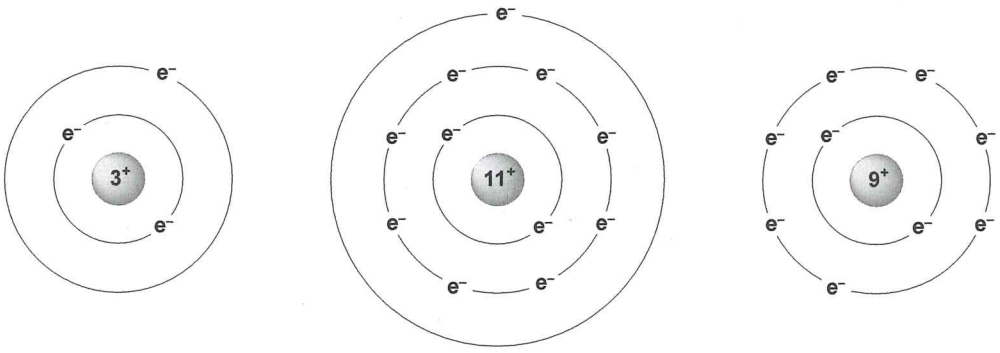
The diagrams show models of three different atoms:



Lithium 2,1 Sodium 2,8,1 Fluorine

Use the diagrams to answer parts (a), (b), and (c).

(a) Why are lithium and sodium in the same group (column) of the Periodic Table, but in different periods (rows)?

Lithium and sodium are in the same group of the Periodic table because of their electron arrangements, Lithium being 2,1 and Sodium being 2,8,1. This means that both of these elements have only 1 electron on its outer shell.

(b) Sodium +1 and fluorine -1 form ions that both have the same electron arrangement.

2,8,1 : 2,8 2,7 = 2,8

How can sodium and fluoride 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 atoms and ions.

Sodium and Fluorine ions have the same electron arrangement but different charges because of its positive and negative charges, sodium has an electron arrangement of 2,8,1 and fluorine has one of 2,7. However sodium has and positive charge of +1 and fluorine

has a negative charge of -1, this means in order for sodium to have a full outer shell it must lose one electron giving it an ionic arrangement of 2,8 and for fluorine to also be full it must gain one electron also giving it the ionic arrangement of 2,8.

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(c) Magnesium fluoride has the formula MgF_2.

Explain how the ratio of ions in the formula is linked to the charge on the ions.

In your answer you should include the number of electrons gained or lost by each atom as it forms the ionic compound.

A diagram may assist your answer.

~~The ratio.~~

A3

QUESTION TWO

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Solutions of potassium hydroxide, KOH, and sulfuric acid, H_2SO_4, are added together in a beaker.

(a) Name the type of reaction occurring.

Neutralisation

(b) Write the word equation and the balanced symbol equation for this reaction.

Word equation

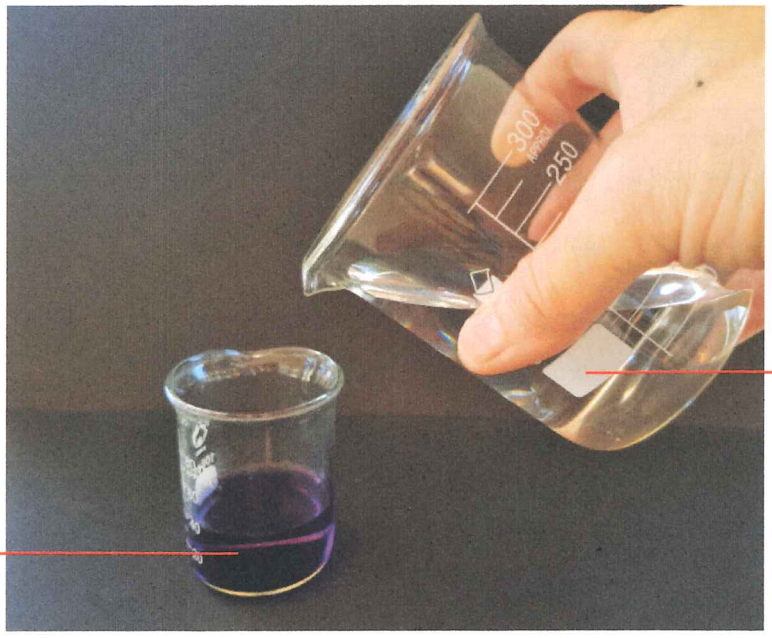
Potassium hydroxide + sulfuric acid → potassium sulfur + water

Balanced symbol equation

$KOH + H_2SO_4 \rightarrow KSO_4 + H_2O$

(c) A solution of potassium hydroxide is placed in a beaker. Universal indicator is added to it. The solution is purple, as shown in the diagram below.

Sulfuric acid is slowly added to the beaker until **no more colour changes are seen**.



Explain in detail what happens to the **colour** of the solution while the sulfuric acid is being added to the potassium hydroxide.

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

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The colour of the solution changes when more sulfuric acid is being added. When no acid is added to the concentration the colour is purple, it also means there are only OH ions (Hydroxide) and it has a pH of 13-14. If sulfuric acid is added then the colour should change from purple to dark blue with a pH of 11-12 and still full of hydroxide ions, as more acid is added the colouration should change to violet and has a pH of 10-11. When more acid is added the pH of the concentration will now be of 8-9 and be a normal blue with almost equal amounts of Hydrogen and hydroxide ions. The more acid is added the concentration is now green which means its neutral and has a pH of 7. As more acid is added there are now more hydrogen ions and its pH is 5-6 with a colour of yellow, when more acid is added to concentrations colour is now orange and is full of hydrogen ions with very little hydroxide ions and also has a pH of 3-4. Finally when more acid is acid all the hydroxide ions are gone and its just hydrogen ions giving off a red colour and a pH of 0-2 meaning its a very strong acid.

M5

QUESTION THREE

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Some magnesium carbonate powder is added to dilute nitric acid in an open conical flask. The flask is on an electronic balance, as shown in the illustration.

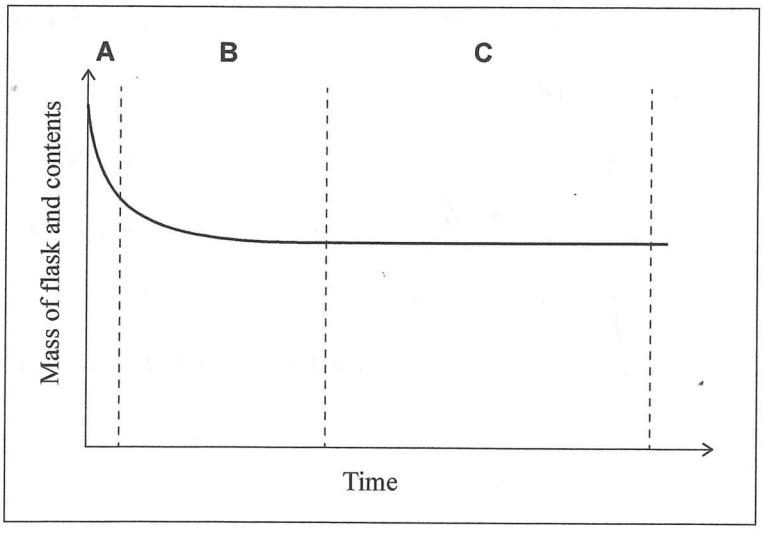
(a) Write the word equation AND the balanced symbol equation for the reaction between the nitric acid and magnesium carbonate.

Word equation: Magnesium carbonate + nitric acid → Magnesium nitrate + water + carbon dioxide

Balanced symbol equation: $MgCO_3 + NO_3$

The total mass of the flask and its contents is measured over time and recorded on the graph below.

Change in mass over time



(b) (i) Why does the mass of the flask and its contents decrease during the reaction?

Because it would mean that all present reactants will have been finished or neutralised.

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

Link your answer to rates of reaction and particle collisions.

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In section A the reaction between the contents are at its highest because there will be plenty of magnesium carbonate particles for the particles in the nitric acid to collide with, also the rate of reaction would have been fast from when it first touches.

In section B the rate of reaction between the compents will have started to decrease as there will have been less particles to collide with the acid.

In section C the rate of reaction will have been at its slowest as all particles will have already collided with eachother and eventually stops.

(c) Explain how increasing the **temperature** will make the reaction between magnesium carbonate and nitric acid faster.

Link your answer to rates of reaction and particle collisions.

Increasing the temperature will make the reaction between the magnesium carbonate and nitric acid faster because the heat created will cause the particles to move around more aggresively, colliding harder and faster with eachother. Resulting in the rate of reaction to be faster than if done at normal temperatures.

A4

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

QUESTION NUMBER

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90944

Subject	Science	Standard	90944	Total score	12

Q	Grade score	Annotation
1	A3	Part (a): identifies that both Li and Na have one electron in outer shell. Part (b): gives correct electron arrangement for: Na (2, 8, 1), F (2, 7). Correctly states Na loses one electron and F gives one electron. Part (c) not attempted.
2	M5	Part (b): equation and formula incorrect – K_2SO_4 is correct not KSO_4. Word equation incorrect. Should state potassium sulfate not sulfur. Part (c): Links all UI colours to correct pH. Explains changing ratio of OH^- and H^+ ions during colour changes. States hydroxide ions "gone but not having reacted with it".
3	A4	Part (a): word equation correct. Formula equation incomplete. Part (b)(i): Has not identified gas lost. Part (b)(ii): Identifies and explains the rate in each section and links to particles available (this is a Merit explanation but two Merit points are required for M5). Part (c): Identifies that increasing temperature means that particles move faster. Link to frequency of collisions needed for M.