

Acids, bases and salts – 2019 Nov IGCSE

1. 0620/31/O/N/19/No.4

An isotope of sodium is written as shown.



(a) (i) Deduce the number of protons, electrons and neutrons in this isotope of sodium.

number of protons

number of electrons

number of neutrons

[3]

(ii) State **one** medical use of radioactive isotopes.

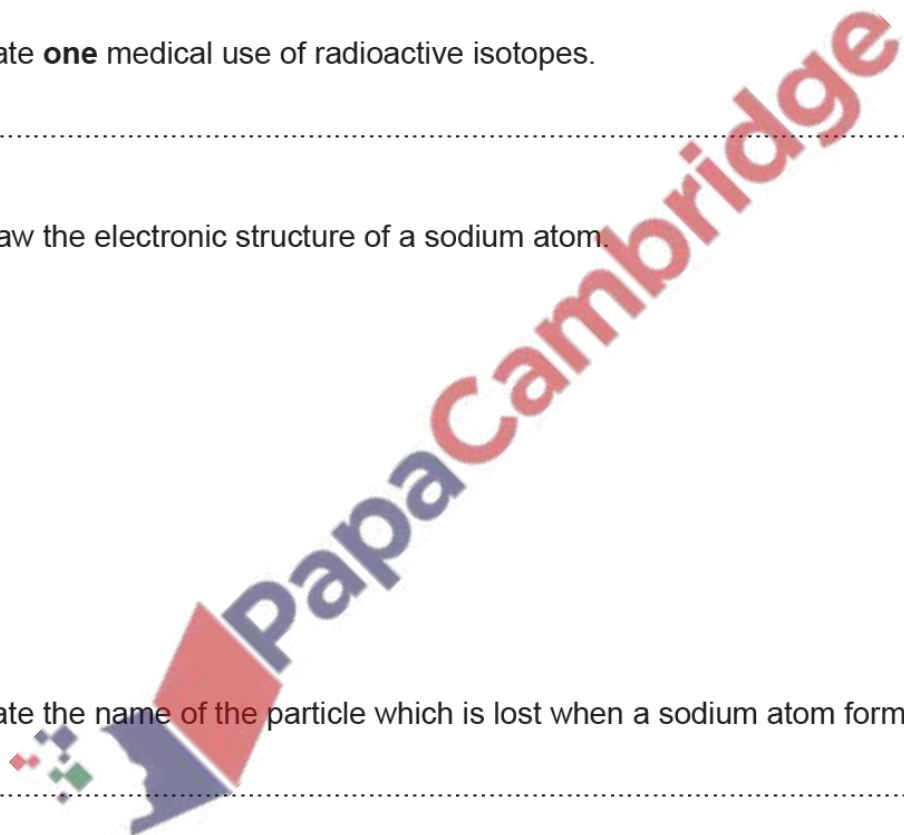
..... [1]

(b) (i) Draw the electronic structure of a sodium atom.

[2]

(ii) State the name of the particle which is lost when a sodium atom forms a sodium ion.

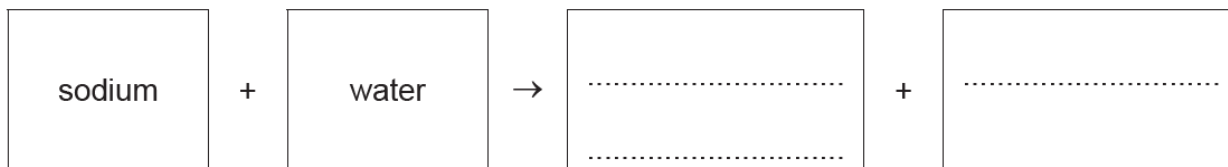
..... [1]



(c) Sodium reacts with water to form:

- an alkaline solution
- a gas which 'pops' with a lighted splint.

(i) Complete the word equation for the reaction of sodium with water.



[2]

(ii) The reaction of sodium with water is exothermic.

What is meant by the term *exothermic*?

.....
.....

[1]

(iii) Sodium reacts with oxygen to form sodium oxide.

Is sodium oxide an acidic oxide or a basic oxide?
Give a reason for your answer.

.....
.....

[1]

(d) The table shows some observations for the reaction of four metals with cold water and with hot water.

metal	reaction with cold water	reaction with hot water
calcium	bubbles form rapidly	bubbles form very rapidly
lanthanum	bubbles form slowly	bubbles form very rapidly
manganese	no bubbles form	bubbles form very slowly
uranium	bubbles form slowly	bubbles form rapidly

Use this information to put the **four** metals in order of their reactivity.
Put the least reactive metal first.

least reactive \longrightarrow most reactive

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[2]

[Total: 13]

(a) Concentrated hydrochloric acid is electrolysed using graphite electrodes.

(i) Name the products of this electrolysis at:

the positive electrode

the negative electrode.

[2]

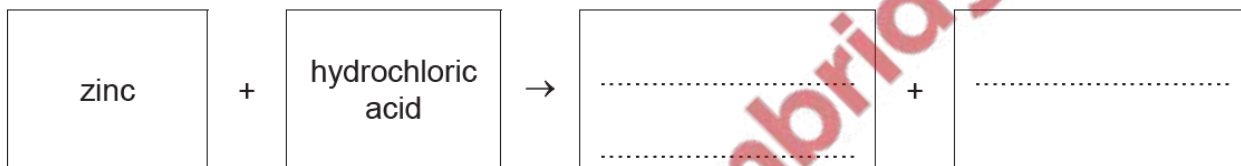
(ii) Suggest **one** observation that is made at the negative electrode.

.....

[1]

(b) Dilute hydrochloric acid reacts with zinc.

Complete the word equation for this reaction.



[2]

(c) The following statements are about the procedure for making crystals of hydrated zinc sulfate from zinc and dilute sulfuric acid.

- A** Warm the mixture until no more bubbles are seen.
- B** Add excess zinc to dilute sulfuric acid.
- C** Warm the filtrate to the point of crystallisation.
- D** Leave the mixture at room temperature to form more crystals.
- E** Filter off the excess zinc.
- F** Filter off the crystals and dry between filter papers.

Put the statements **A**, **B**, **C**, **D**, **E** and **F** in the correct order.

The first one has been done for you.

B					
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[2]

(d) Zinc is a metal.

(i) Describe **three** physical properties which are characteristic of metals.

1

2

3

[3]

(ii) An alloy of zinc, copper and nickel is used to make coins.

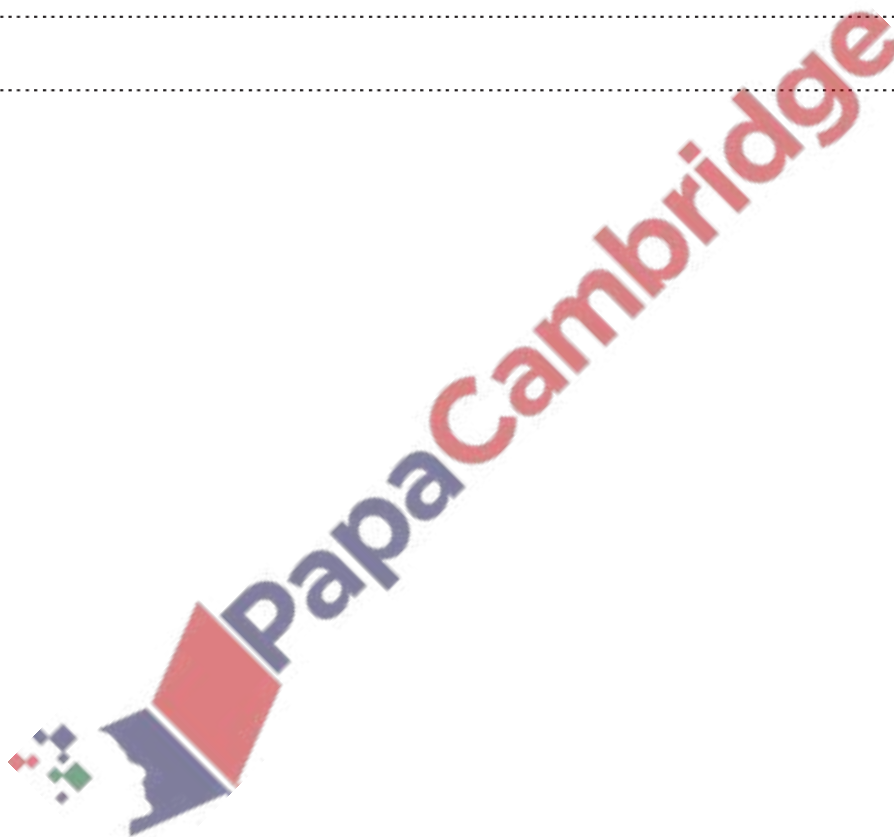
Suggest **two** reasons why an alloy is used to make coins and **not** pure copper alone.

1

2

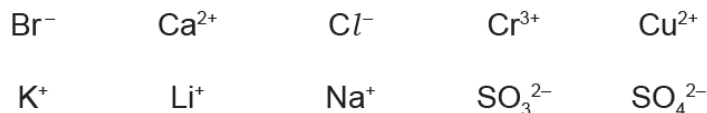
[2]

[Total: 12]



This question is about ions and ionic compounds.

(a) Choose from the following list of ions to answer the questions.



Each ion may be used once, more than once or not at all.

State which ion:

- (i) gives a lilac colour in a flame test [1]
- (ii) forms a grey-green precipitate with aqueous ammonia [1]
- (iii) forms a white precipitate with aqueous sodium hydroxide [1]
- (iv) forms a cream precipitate with acidified aqueous silver nitrate [1]
- (v) forms a white precipitate with acidified aqueous barium nitrate. [1]

(b) Describe how to do a flame test on a sample of a salt.

.....

.....

.....

..... [2]

(c) Magnesium phosphate contains magnesium ions, Mg^{2+} , and phosphate ions, PO_4^{3-} .

Deduce the formula of magnesium phosphate.

..... [1]

[Total: 8]

Insoluble salts can be made by precipitation reactions.

A student mixed solutions of some soluble salts.

The results the student obtained are shown in the table.

		second salt solution		
		$\text{Co}(\text{NO}_3)_2(\text{aq})$	$\text{AgNO}_3(\text{aq})$	$\text{Pb}(\text{NO}_3)_2(\text{aq})$
first salt solution	$\text{NaI}(\text{aq})$	no change	yellow precipitate	yellow precipitate
	$\text{Na}_2\text{CO}_3(\text{aq})$	purple precipitate	yellow precipitate	white precipitate
	$\text{Na}_2\text{SO}_4(\text{aq})$	no change	white precipitate	white precipitate

All sodium salts are soluble in water.

Use only results from the table to answer the following questions.

(a) Name:

(i) an insoluble cobalt salt [1]

(ii) an insoluble yellow lead salt. [1]

(b) Write the chemical equation for the reaction in which silver carbonate is formed.

..... [2]

(c) Write the ionic equation for the reaction in which lead(II) iodide is formed.

..... [2]

(d) Aqueous silver nitrate produces a yellow precipitate with both iodide ions and carbonate ions. When testing an unknown solution for iodide ions, the aqueous silver nitrate is acidified.

Explain why the aqueous silver nitrate is acidified.

.....

..... [1]

[Total: 7]

This question is about sulfuric acid and substances that can be made from sulfuric acid.

(a) Sulfuric acid is a strong acid.

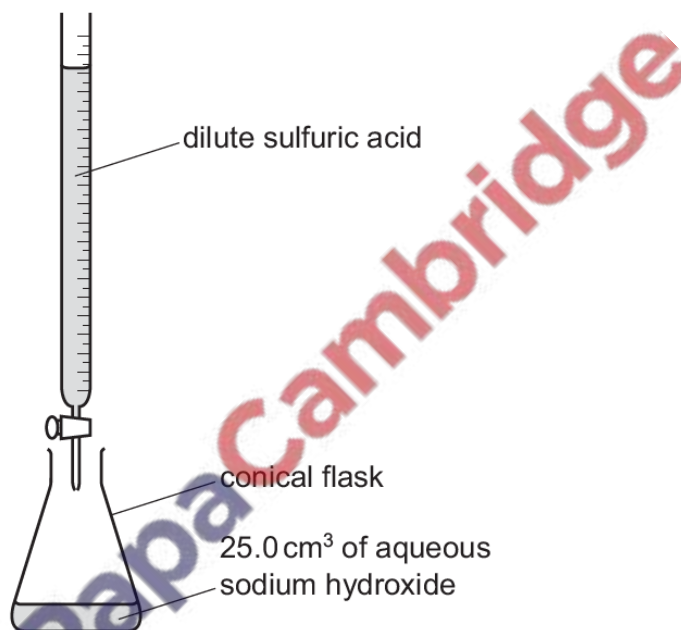
What is meant by the term *strong acid*?

strong

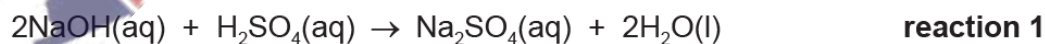
acid

[2]

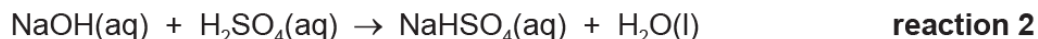
(b) Dilute sulfuric acid and aqueous sodium hydroxide are used to make aqueous sodium sulfate, $\text{Na}_2\text{SO}_4(\text{aq})$, or aqueous sodium hydrogen sulfate, $\text{NaHSO}_4(\text{aq})$. The method includes use of the following apparatus.



25.0 cm^3 of aqueous sodium hydroxide of concentration 0.100 mol/dm^3 was neutralised by 25.0 cm^3 of dilute sulfuric acid of concentration 0.0500 mol/dm^3 . The equation for the reaction is shown. This is **reaction 1**.



The same technique and the same solutions can be used to make aqueous sodium hydrogen sulfate. The equation for the reaction is shown. This is **reaction 2**.



Complete the table to calculate the volume of dilute sulfuric acid that reacts with 25.0 cm^3 of aqueous sodium hydroxide in **reaction 2**.

	volume of 0.0500 mol/dm ³ dilute sulfuric acid in cm ³	volume of 0.100 mol/dm ³ aqueous sodium hydroxide in cm ³
reaction 1	25.0	25.0
reaction 2		25.0

[1]

- (c) Aqueous sodium hydrogen sulfate, NaHSO₄(aq), contains the ions Na⁺(aq), H⁺(aq) and SO₄²⁻(aq).

Describe what you would **see** if the following experiments were done.

- (i) A flame test was done on aqueous sodium hydrogen sulfate.

..... [1]

- (ii) Solid copper(II) oxide was added to aqueous sodium hydrogen sulfate and the mixture was warmed.

.....

..... [2]

- (d) A test can be done to show the presence of SO₄²⁻(aq) by adding acidified aqueous barium chloride or acidified aqueous barium nitrate.

- (i) State the observation that would show that SO₄²⁻ is present.

..... [1]

- (ii) Write an ionic equation for the reaction that occurs if SO₄²⁻ is present. Include state symbols.

..... [2]

[Total: 9]