

Paper 3

Questions are applicable for both core and extended candidates

- 1 A list of substances is shown.

brass
calcium oxide
carbon monoxide
diamond
glucose
hydrogen
litmus
magnesium bromide
methyl orange
sodium chloride
stainless steel
thymolphthalein
water
zinc oxide

Answer the following questions about these substances.
Each substance may be used once, more than once or not at all.

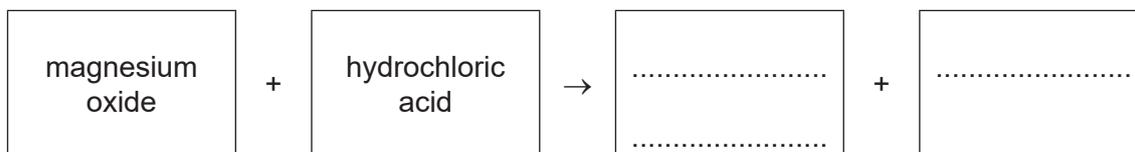
State which substance:

- (c) turns yellow when an alkali is added

..... [1]

2 Magnesium is an element in Group II of the Periodic Table.

(d) (i) Complete the word equation for the reaction of magnesium oxide with hydrochloric acid.



[2]

(ii) Magnesium oxide is insoluble in water.

Choose from the list one **other** compound that is insoluble in water.

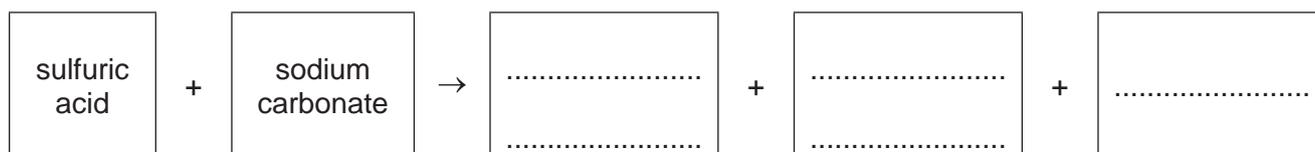
Tick (✓) **one** box.

magnesium carbonate	
magnesium chloride	
magnesium nitrate	
magnesium sulfate	

[1]

3 This question is about sulfur and compounds of sulfur.

(e) Complete the word equation for the reaction of dilute sulfuric acid with sodium carbonate.



[3]

(f) A few drops of thymolphthalein indicator are added to dilute sulfuric acid.

State the colour of the solution.

..... [1]

4 Fig. 7.1 shows the displayed formula of mesaconic acid.

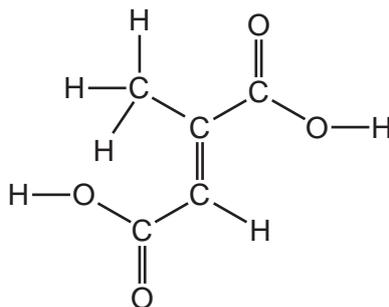
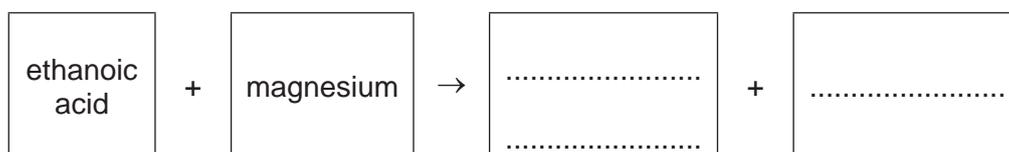


Fig. 7.1

(c) Complete the word equation for the reaction of ethanoic acid with magnesium.



[2]

5 This question is about nitrogen and compounds of nitrogen.

(c) Ammonia is a simple molecule with covalent bonds.

(iii) Aqueous ammonia is alkaline.

Choose from the list, the pH value that is alkaline.

Draw a circle around your chosen answer.

pH 1 pH 5 pH 7 pH 10 [1]

6 (c) Ammonia forms an alkaline solution in water.

(i) Give the formula of the ion that is present in all alkaline solutions.

..... [1]

(ii) Choose from the list the pH value for an alkaline solution.

Draw a circle around your chosen answer.

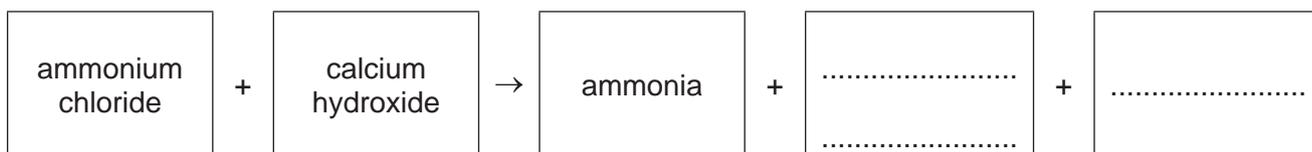
pH 1 pH 4 pH 7 pH 13 [1]

7 This question is about compounds of nitrogen.

(b) Ammonium chloride, NH_4Cl , reacts with calcium hydroxide.

The products are ammonia, a salt and a liquid that turns anhydrous copper(II) sulfate blue.

Complete the word equation for this reaction.



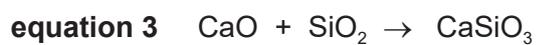
[2]

Paper 4

Questions are applicable for both core and extended candidates
unless indicated in the question

8 Iron ore contains iron(III) oxide, Fe_2O_3 . A blast furnace is used to extract iron from Fe_2O_3 .

Equations for some of the reactions in the blast furnace are shown.



(d) (i) Explain why the reaction in **equation 3** can be described as an acid–base reaction.

.....

.....

..... [2]

9 This question is about acids, bases and alkalis.

Table 3.1 shows the pH values of some substances.

Table 3.1

substance	pH
NaOH(aq)	14
Ca(OH) ₂ (aq)	10
H ₂ O(l)	7
CH ₃ COOH(aq)	4
HNO ₃ (aq)	1

(a) Define the term base. **(extended only)**

..... [1]

(b) State what is meant by the term alkali.

..... [1]

(c) Thymolphthalein is an indicator.

State the colour of thymolphthalein in:

- NaOH(aq)
 - CH₃COOH(aq).
- [2]

(d) (i) Use the information in Table 3.1 to identify the substance with the highest concentration of H⁺(aq) ions.

Explain your answer.

substance

explanation

[2]

(ii) Name an indicator which can be used to identify the substance with the highest concentration of H⁺(aq) ions.

..... [1]

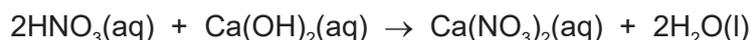
- (e) Complete the equation to show the dissociation of ethanoic acid, CH_3COOH , in aqueous solution. **(extended only)**

$\text{CH}_3\text{COOH}(\text{aq})$ [3]

- (f) Write the **ionic** equation which represents a neutralisation reaction between any acid and any alkali.

..... [1]

- (g) Dilute nitric acid, $\text{HNO}_3(\text{aq})$, reacts with aqueous calcium hydroxide, $\text{Ca}(\text{OH})_2(\text{aq})$, as shown.



20.0 cm³ of 0.0150 mol/dm³ $\text{Ca}(\text{OH})_2(\text{aq})$ reacts with 25.0 cm³ of $\text{HNO}_3(\text{aq})$.

Calculate the concentration of $\text{HNO}_3(\text{aq})$ in g/dm³.

Use the following steps.

- Calculate the number of moles of $\text{Ca}(\text{OH})_2(\text{aq})$ used.

..... mol

- Determine the number of moles of $\text{HNO}_3(\text{aq})$ which react with the $\text{Ca}(\text{OH})_2(\text{aq})$.

..... mol

- Calculate the concentration of $\text{HNO}_3(\text{aq})$ in mol/dm³.

..... mol/dm³

- Calculate the concentration of $\text{HNO}_3(\text{aq})$ in g/dm³.

..... g/dm³

[5]

[Total: 16]

10 Lithium, sodium and potassium are Group I elements.

(a) Name the type of bonding in these elements.

..... [1]

(b) Sodium reacts with cold water to form hydrogen gas and a solution of a strong alkali.

(i) State the test for hydrogen gas.

test

positive result [1]

(ii) Suggest the pH of a solution of a strong alkali.

pH = [1]

(iii) Name a substance which can be used to confirm the pH of a solution of a strong alkali.

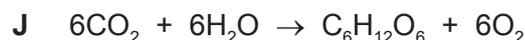
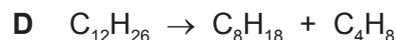
..... [1]

(iv) Write the symbol equation for the reaction between sodium and cold water.

Include state symbols.

..... [3]

11 Some symbol equations and word equations, **A** to **J**, are shown.



Use the equations to answer the questions that follow.

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

Give the letter, **A** to **J**, for the equation that represents:

(a) a neutralisation reaction [1]

12 A list of gases is shown.

ammonia
carbon dioxide
carbon monoxide
ethene
fluorine
oxygen
sulfur dioxide
xenon

Answer the following questions using only the gases from the list.

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

Give the name of the gas that:

(b) forms an alkaline solution when dissolved in water

..... [1]

13 Ethanol is manufactured by **two** methods:

method 1 fermentation of aqueous glucose

method 2 catalytic addition of steam to an alkene.

(c) The catalyst in method 2 is phosphoric acid, H_3PO_4 . Dilute phosphoric acid is a weak acid which contains phosphate ions, PO_4^{3-} .

(i) State what is meant by the term acid. **(extended only)**

..... [1]

(ii) State the meaning of weak in the term weak acid. **(extended only)**

..... [1]

(iii) Determine the oxidation number of phosphorus in the PO_4^{3-} ion. **(extended only)**

Show your working.

oxidation number = [2]