O Level Combined Chemistry Structured

Acids and Bases Test 1.0

Q1

Complete the table below.

	solution	approximate pH	colour of Universal Indicator
(a)	0.1 mol/dm^3 hydrochloric acid		
(b)	0.1 mol/dm^3 sodium hydroxide solution		
(c)	A mixture of 20 cm^3 of (a) and 20 cm^3 of (b)		

[3]

Q2

Some companies make products to sell to farmers as soil improvers. Some compounds in the products neutralise acidity The table shows information about some substances that companies use to make these products.

substance	chemical composition	effectiveness at neutralising acidity	other points
limestone	$CaCO_3$	fair	Insoluble in water. Needs to be ground to very fine powder
quicklime	CaO	very high	Made by heating limestone to a high temperature Reacts exothermically with water to make an alkaline solution
slaked lime	$Ca(OH)_2$	very high	Made by adding water to quicklime. Slaked lime is an alkali
blast furnace slag	mixture of $CaSiO_3$ with $CaCO_3$ and other impurities	fair	Insoluble in water. Impurities include silicon oxides and other non-metal compounds

(a) Use the information in the table to suggest why limestone is less effective at neutralising acidity than quicklime and slaked lime.

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..... [2]

(b) Slaked lime is made by adding water to quicklime. Write a balanced chemical equation for the reaction. State a test to show that slaked lime is alkaline in nature.

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..... [2]

(c) The calcium content of the substances is important as it adds to the mineral content of the soil.

Show by calculation that quicklime has a higher percentage by mass of calcium than both limestone and slaked lime.

[2]

(d) Explain how blast furnace slag, $CaSiO_3$, is produced during the extraction of iron from haematite.

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..... [2]

(e) Heating limestone produces quicklime and carbon dioxide according to the equation below.

$$CaCO_3 \rightarrow CaO + CO_2$$

Calculate the volume of carbon dioxide produced at r.t.p. when 25 tonnes of limestone are heated. (1 tonne = 1000000 g)

[2]

Q3

(a) Acid J has a relative molecular mass of 63. A 500 cm^3 aqueous sample contains 196 g of J.

Calculate the concentration of J in mol/dm^3.

[2]

(b) Name all the products formed when a piece of magnesium carbonate is added to acid J. State the test and the result for any gas that may be evolved.

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..... [3]

Q4

A list of oxides is given below.

carbon dioxide	*carbon monoxide*	*iron(II) oxide*
lead(II) oxide	*nitrogen dioxide*	*sulfur dioxide*

Each word can be used once, more than once, or not at all.

Name an oxide which

(a) reacts with both dilute hydrochloric acid and dilute potassium hydroxide,

.....[1]

(b) reacts with dilute hydrochloric acid to form a green solution,

.....[1]

(c) dissolves in water to form a solution of pH 5,

.....[1]

(d) is used as a reducing agent in the blast furnace,

.....[1]

(e) is formed by lightning activity.

.....[1]

Q5

The following substances were tested using the purple cabbage indicator and the resulting colour of the solution is shown in Table 3.3.

Table 3.3

substance	colour of solution
hydrochloric acid	pink
ethanoic acid	violet
distilled water	violet
baking soda	blue
sodium hydroxide	yellow

(i) Using the information from Table 3.3. determine the colour of the solution when the purple cabbage indicator is added to aqueous ammonia.

.....[1]

(ii) Name the limitation of using the purple cabbage indicator to determine the pH of solutions. Suggest another indicator that can be used instead.

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.....[2]

Answers

Acids and Bases Test 1.0

Q1

	solution	approximate pH	colour of Universal Indicator
(a)	0.1M HCl	1	red
(b)	0.1M NaOH	14	violet
(c)	20cm^3 of (a) and 20cm^3 of (b)	7	green

Q2

(a)	Insoluble in water must be finely powdered	1 1
(b)	$CaO + H_2O \longrightarrow Ca(OH)_2$ Add litmus paper. It turns from red to blue	1 1
(c)	% Ca in CaO = 40/56 x 100 = 71.4 % Ca in $CaCO_3$= 40/100 x 100 = 40 % Ca in $Ca(OH)_2$ = 40/76 x 100= 52.6	2
(d)	Limestone decomposes to lime Lime neutralises acidic impurities to form slag	1 1
(e)	25 tonnes = 25000000 g Moles of $CaCO_3$= 250000 Moles of CO_2 = 250000 Volume of CO_2= 250000 x 24 = 6000000 dm^3	1 1

Q3

(a)	Moles of J = 196/63 = 3.11 mols Concentration = 6.22 mols/dm^3	1 1
(b)	Magnesium nitrate, carbon dioxide and water Pass gas into limewater White precipitate seen	1 1 1

Q4

(a)	lead(II) oxide	[1]
(b)	iron(II) oxide	[1]
(c)	carbon dioxide	[1]
(d)	carbon monoxide	[1]
(e)	nitrogen dioxide	[1]

Q5

)(i)	blue	[1]
(ii)	It cannot differentiate between **weakly acidic and neutral** (uric acid and distilled water). Use universal indicator instead. [Note: litmus paper not accepted]	[1] [1]