Acids, bases and salts – 2022 IGCSE

1. June/2022/Paper_11/No.17

Which products are formed when magnesium hydroxide reacts with hydrochloric acid?

A magnesium chloride, carbon dioxide and water

B magnesium chloride, hydrogen and water

C magnesium chloride and hydrogen only

D magnesium chloride and water only

2. June/2022/Paper_11/No.18

The oxides of two elements, X and Y, are separately dissolved in water and the pH of each solution tested.

oxide tested	pH of solution
X	1
Y	13

Which information about X and Y is correct?

	oxide is acidic	oxide is basic	metal	non-metal
A	X	Y	X	Y
B	X	Y	Y	X
C	Y	X	X	Y
D	Y	X	Y	X

3. June/2022/Paper_11/No.19

An acid is neutralised by adding an excess of an insoluble solid base.

A soluble salt is formed.

How is the pure salt obtained from the reaction mixture?

A crystallisation → evaporation → filtration

B evaporation → crystallisation → filtration

C filtration → crystallisation → evaporation

D filtration → evaporation → crystallisation

4. June/2022/Paper_11/No.20

Three separate samples of an aqueous compound T are tested.

The results of the tests are shown.

test	observation
acidify with dilute nitric acid, then add aqueous barium nitrate	white precipitate
add aqueous ammonia	white precipitate, soluble in excess
add aqueous sodium hydroxide	white precipitate, soluble in excess

What is T?

A aluminium chloride

B aluminium sulfate

C zinc chloride

D zinc sulfate

5. June/2022/Paper_12/No.14

Some common household substances are tested with litmus and methyl orange.

household substance	colour of litmus	colour of methyl orange
bicarbonate of soda	blue	yellow
lemonade	red	red
milk	red	red
milk of magnesia	blue	yellow
washing powder	blue	yellow
vinegar	red	red

Which statement is correct?

A Lemonade, milk and bicarbonate of soda are all acidic.

B Milk of magnesia can neutralise washing powder.

C Milk of magnesia, washing powder and vinegar are all bases.

D Vinegar can neutralise bicarbonate of soda.

6. June/2022/Paper_12/No.17

Aqueous solutions containing copper(II) ions can be identified using flame tests and by adding aqueous sodium hydroxide.

Which row describes what is observed in these tests?

	flame test	aqueous sodium hydroxide
A	blue-green flame	light blue precipitate
B	blue-green flame	green precipitate
C	lilac flame	light blue precipitate
D	lilac flame	green precipitate

7. June/2022/Paper_12/No.18

The oxides of two elements, X and Y, are separately dissolved in water and the pH of each solution tested.

oxide tested	pH of solution
X	1
Y	13

Which information about X and Y is correct?

	oxide is acidic	oxide is basic	metal	non-metal
A	X	Y	X	Y
B	X	Y	Y	X
C	Y	X	X	Y
D	Y	X	Y	X

8. June/2022/Paper_12/No.19

An acid is neutralised by adding an excess of an insoluble solid base.

A soluble salt is formed.

How is the pure salt obtained from the reaction mixture?

A crystallisation → evaporation → filtration

B evaporation → crystallisation → filtration

C filtration → crystallisation → evaporation

D filtration → evaporation → crystallisation

9. June/2022/Paper_12/No.20

Some statements about gas G are listed.

G is monoatomic.

G is found in clean, dry air.

G is used in lamps.

Which element is G?

A argon

B helium

C nitrogen

D oxygen

10. June/2022/Paper_13/No.16

Which statement explains why lime is added to soil?

A to decrease the pH of acidic soil

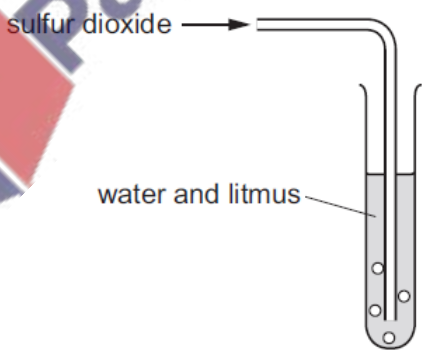
B to decrease the pH of alkaline soil

C to increase the pH of acidic soil

D to increase the pH of alkaline soil

11. June/2022/Paper_13/No.17

Sulfur dioxide is bubbled through water containing litmus.



Which row describes and explains what happens to the litmus?

	observation	explanation
A	it turns blue	sulfur dioxide is a basic oxide
B	it turns blue	sulfur dioxide is an acidic oxide
C	it turns red	sulfur dioxide is an acidic oxide
D	it turns red	sulfur dioxide is a basic oxide

12. June/2022/Paper_13/No.18

The oxides of two elements, X and Y, are separately dissolved in water and the pH of each solution tested.

oxide tested	pH of solution
X	1
Y	13

Which information about X and Y is correct?

	oxide is acidic	oxide is basic	metal	non-metal
A	X	Y	X	Y
B	X	Y	Y	X
C	Y	X	X	Y
D	Y	X	Y	X

13. June/2022/Paper_13/No.19

An acid is neutralised by adding an excess of an insoluble solid base.

A soluble salt is formed.

How is the pure salt obtained from the reaction mixture?

A crystallisation → evaporation → filtration

B evaporation → crystallisation → filtration

C filtration → crystallisation → evaporation

D filtration → evaporation → crystallisation

14. June/2022/Paper_13/No.20

Which ion forms a precipitate that dissolves in excess with both aqueous ammonia and with aqueous sodium hydroxide?

A calcium ion, Ca^{2+}

B copper(II) ion, Cu^{2+}

C iron(III) ion, Fe^{3+}

D zinc ion, Zn^{2+}

15. June/2022/Paper_21/No.17

Which statement about acids is correct?

A A strong acid has a higher pH than a weak acid of the same concentration.

B A strong acid is a proton acceptor.

C A weak acid is a proton donor.

D A weak acid is fully ionised in aqueous solution.

16. June/2022/Paper_21/No.18

The oxides of two elements, X and Y, are separately dissolved in water and the pH of each solution tested.

oxide tested	pH of solution
X	1
Y	13

Which information about X and Y is correct?

	oxide is acidic	oxide is basic	metal	non-metal
A	X	Y	X	Y
B	X	Y	Y	X
C	Y	X	X	Y
D	Y	X	Y	X

17. June/2022/Paper_21/No.19

An acid is neutralised by adding an excess of an insoluble solid base.

A soluble salt is formed.

How is the pure salt obtained from the reaction mixture?

A crystallisation → evaporation → filtration

B evaporation → crystallisation → filtration

C filtration → crystallisation → evaporation

D filtration → evaporation → crystallisation

18. June/2022/Paper_22/No.18

The oxides of two elements, X and Y, are separately dissolved in water and the pH of each solution tested.

oxide tested	pH of solution
X	1
Y	13

Which information about X and Y is correct?

	oxide is acidic	oxide is basic	metal	non-metal
A	X	Y	X	Y
B	X	Y	Y	X
C	Y	X	X	Y
D	Y	X	Y	X

19. June/2022/Paper_22/No.19

An acid is neutralised by adding an excess of an insoluble solid base.

A soluble salt is formed.

How is the pure salt obtained from the reaction mixture?

A crystallisation → evaporation → filtration

B evaporation → crystallisation → filtration

C filtration → crystallisation → evaporation

D filtration → evaporation → crystallisation

20. June/2022/Paper_22/No.22

Which statement about acids is correct?

A Acids are proton acceptors.

B Acids transfer electrons to bases in aqueous solution.

C Hydrochloric acid reacts with ammonium hydroxide to produce ammonia.

D Ethanoic acid partially ionises in aqueous solution.

21. June/2022/Paper_23/No.16

Which statement explains why lime is added to soil?

A to decrease the pH of acidic soil

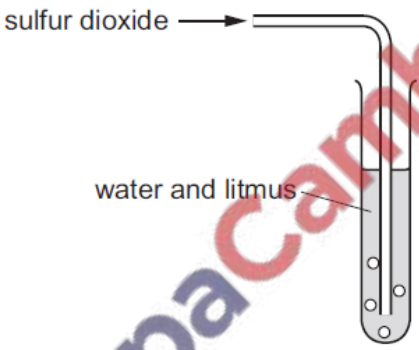
B to decrease the pH of alkaline soil

C to increase the pH of acidic soil

D to increase the pH of alkaline soil

22. June/2022/Paper_23/No.17

Sulfur dioxide is bubbled through water containing litmus.



Which row describes and explains what happens to the litmus?

	observation	explanation
A	it turns blue	sulfur dioxide is a basic oxide
B	it turns blue	sulfur dioxide is an acidic oxide
C	it turns red	sulfur dioxide is an acidic oxide
D	it turns red	sulfur dioxide is a basic oxide

23. June/2022/Paper_23/No.18

The oxides of two elements, X and Y, are separately dissolved in water and the pH of each solution tested.

oxide tested	pH of solution
X	1
Y	13

Which information about X and Y is correct?

	oxide is acidic	oxide is basic	metal	non-metal
A	X	Y	X	Y
B	X	Y	Y	X
C	Y	X	X	Y
D	Y	X	Y	X

24. June/2022/Paper_23/No.19

An acid is neutralised by adding an excess of an insoluble solid base.

A soluble salt is formed.

How is the pure salt obtained from the reaction mixture?

A crystallisation → evaporation → filtration

B evaporation → crystallisation → filtration

C filtration → crystallisation → evaporation

D filtration → evaporation → crystallisation

25. June/2022/Paper_23/No.20

Which ion forms a precipitate that dissolves in excess with both aqueous ammonia and with aqueous sodium hydroxide?

A calcium ion, Ca^{2+}

B copper(II) ion, Cu^{2+}

C iron(III) ion, Fe^{3+}

D zinc ion, Zn^{2+}

26. June/2022/Paper_31/No.4(a _c)

This question is about acids and bases.

(a) Describe the colour of methyl orange in acidic and alkaline solutions.

in acidic solution .....

in alkaline solution .....

[2]

(b) Complete the word equation for the reaction of hydrochloric acid with calcium oxide.

hydrochloric acid	+	calcium oxide	→	....	+	.....

[2]

(c) Calcium oxide is lime.

Give **one** use of lime.

..... [1]

27. June/2022/Paper_31/No.7(d)

(d) Zinc chloride reacts with water as shown. The solution formed is acidic.

$$ZnCl_2 + 2H_2O \rightleftharpoons Zn(OH)_2 + 2HCl$$

(i) State the meaning of the symbol $\rightleftharpoons$.

..... [1]

(ii) Choose the pH value which is acidic.

Draw a circle around your chosen answer.

pH 3 pH 7 pH 9 pH 14 [1]

28. June/2022/Paper_32/No.4(a _c),(e)

This question is about acids and bases.

(a) Name the type of chemical reaction which occurs when an acid reacts with a base.

..... [1]

(b) Describe the colour of litmus in acidic and alkaline solutions.

in acidic solution .....

in alkaline solution .....

[2]

(c) Complete the word equation for the reaction of nitric acid with calcium hydroxide.

nitric acid	+	calcium hydroxide	→	....	+	.....

[2]

(e) Calcium hydroxide is slaked lime.

Give **one** use of slaked lime.

..... [1]

29. June/2022/Paper_33/No.4(a , b)

This question is about acids and carbonates.

(a) Describe the colour change when excess acid is added to a solution of methyl orange in alkaline solution.

from ..... to ..... [2]

(b) Complete the word equation for the reaction of hydrochloric acid with calcium carbonate.

hydrochloric acid	+	calcium carbonate	→	....	+	....	+	water

[2]

30. June/2022/Paper_33/No.5(e)

(e) Acid rain is formed when sulfur dioxide reacts with water vapour in the atmosphere.

(i) Choose the pH value which is acidic.

Draw a circle around your chosen answer.

pH 4 **pH 7** **pH 10** **pH 14** [1]

(ii) Describe **one** effect of acid rain on buildings.

..... [1]

31. June/2022/Paper_41/No.6(b)

(b) Zinc sulfate crystals, $ZnSO_4 \cdot 7H_2O$, are hydrated.

Zinc sulfate crystals are made by reacting zinc carbonate with dilute sulfuric acid.

The equation for the overall process is shown.

$$ZnCO_3 + H_2SO_4 + 6H_2O \rightarrow ZnSO_4 \cdot 7H_2O + CO_2$$

step 1 Large pieces of solid zinc carbonate are added to dilute sulfuric acid until the zinc carbonate is in excess. This forms aqueous zinc sulfate.

step 2 The excess zinc carbonate is separated from the aqueous zinc sulfate.

step 3 The aqueous zinc sulfate is heated until a saturated solution is formed.

step 4 The saturated solution is allowed to cool and crystallise.

step 5 The crystals are removed and dried.

(i) In **step 1**, zinc carbonate is in excess when no more zinc carbonate dissolves.

State one **other** observation that indicates the zinc carbonate is in excess in **step 1**.

..... [1]

(ii) Name a different substance, other than zinc carbonate, that can be added to dilute sulfuric acid to produce aqueous zinc sulfate in **step 1**.

..... [1]

(iii) **Step 1** is repeated using powdered zinc carbonate instead of large pieces.

All other conditions are kept the same.

The rate of reaction increases.

Give a reason why the rate of reaction increases. Explain your answer in terms of particles.

.....

.....

..... [2]

(iv) Suggest what is observed when the solution is saturated in **step 3**.

.....

.....

..... [1]

(v) The formula of zinc sulfate crystals is $ZnSO_4 \cdot 7H_2O$.

Give the formula of the solid formed if the crystals are heated to dryness in **step 3**.

..... [1]

32. June/2022/Paper_42/No.2(a, _c)

Calcium hydroxide, $Ca(OH)_2$, is slightly soluble in water.

(a) Calcium hydroxide can be made by the reaction of calcium with water.

(i) Write the chemical equation for this reaction.

..... [2]

(ii) Name another substance that reacts with water to form calcium hydroxide.

..... [1]

(b) When calcium hydroxide dissolves in water, it dissociates into ions and forms a weakly alkaline solution.

(i) Suggest the pH of aqueous calcium hydroxide.

..... [1]

(ii) Give the formula of the ion responsible for making the solution alkaline.

..... [1]

(c) Limewater is a saturated solution of calcium hydroxide, $Ca(OH)_2(aq)$.

(i) Name the gas limewater is used to test for.

..... [1]

(ii) Suggest what is meant by the term *saturated solution*.

.....

..... [2]

(iii) Describe how you would make a sample of limewater starting with solid calcium hydroxide.

.....

.....

..... [2]

(iv) Describe how you would test for the presence of calcium ions in a sample of limewater.

test .....

observations .....

.....

[3]

33. June/2022/Paper_43/No.2(e)

(e) Ammonia and hydrazine are weak bases.

The chemical equation for the reaction between one molecule of ammonia and one molecule of water is shown.

$$NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$$

(i) State the meaning of the term *base*.

..... [1]

(ii) Write a chemical equation for the reaction between one molecule of hydrazine, N_2H_4, and one molecule of water.

..... [1]

34. March/2022/Paper_12/No.20

Methyl orange is added to dilute hydrochloric acid and to aqueous sodium hydroxide.

What is the colour of the methyl orange in each solution?

	colour in dilute hydrochloric acid	colour in aqueous sodium hydroxide
A	orange	red
B	red	yellow
C	red	orange
D	yellow	red

35. March/2022/Paper_12/No.21

Compound X is dissolved in water and two separate samples of the solution are tested.

The results of the tests are shown.

test	observation
add aqueous sodium hydroxide	a white precipitate forms which is insoluble in excess
acidify with dilute nitric acid and add aqueous silver nitrate	a yellow precipitate forms

What is compound X?

A calcium chloride

B calcium iodide

C zinc chloride

D zinc iodide

36. March/2022/Paper_22/No.20

Methyl orange is added to dilute hydrochloric acid and to aqueous sodium hydroxide.

What is the colour of the methyl orange in each solution?

	colour in dilute hydrochloric acid	colour in aqueous sodium hydroxide
A	orange	red
B	red	yellow
C	red	orange
D	yellow	red

37. March/2022/Paper_22/No.21

Zinc oxide is an amphoteric oxide.

Which types of substances will react with zinc oxide?

A acids and bases

B acids only

C bases only

D neither acids nor bases

38. March/2022/Paper_22/No.22

Information about some silver compounds is shown.

compound	formula	solubility in water
silver carbonate	Ag_2CO_3	insoluble
silver chloride	$AgCl$	insoluble
silver nitrate	$AgNO_3$	soluble
silver oxide	Ag_2O	insoluble

Which equation shows a reaction which **cannot** be used to make a silver salt?

A $AgNO_3(aq) + HCl(aq) \rightarrow AgCl(s) + HNO_3(aq)$

B $Ag_2O(s) + 2HNO_3(aq) \rightarrow 2AgNO_3(aq) + H_2O(l)$

C $Ag_2CO_3(s) + 2HNO_3(aq) \rightarrow 2AgNO_3(aq) + H_2O(l) + CO_2(g)$

D $2Ag(s) + 2HCl(aq) \rightarrow 2AgCl(s) + H_2(g)$

39. March/2022/Paper_22/No.23

Aqueous ethanoic acid is a weak acid.

Aqueous sodium hydroxide is a strong base.

Aqueous ethanoic acid is neutralised by aqueous sodium hydroxide.

Which statements are correct?

1 Aqueous ethanoic acid accepts protons from hydroxide ions.

2 The aqueous ethanoic acid used is fully dissociated into ions.

3 The aqueous sodium hydroxide used is fully dissociated into ions.

4 The reaction produces a salt and water.

A 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

40. March/2022/Paper_22/No.30

How many species are acting as bases in this reversible reaction?

$$HNO_3 + H_2O \rightleftharpoons H_3O^+ + NO_3^-$$

A 3 **B** 2 **C** 1 **D** 0

41. March/2022/Paper_32/No.4(a, b)

This question is about acids, bases and salts.

(a) Sodium hydroxide is a base.

(i) Name the products formed when sodium hydroxide reacts with dilute nitric acid.

.....

..... [2]

(ii) Describe the effect of sodium hydroxide on a named indicator.

.....

..... [2]

(iii) Complete the word equation for the reaction of sodium hydroxide with ammonium chloride.

sodium hydroxide	+	ammonium chloride	→	.....	+	....	+	water

[2]

(b) Describe how to prepare pure, dry crystals of the salt zinc sulfate from an aqueous solution of zinc sulfate.

.....

.....

..... [2]