Acids, bases and salts – 2023 June IGCSE Chemistry 0620

1. June/2023/Paper_ 06201/11/No.7

Which equation represents the neutralisation of nitric acid using sodium hydroxide?

A $NaOH(aq) + HNO_3(aq) \rightarrow NaNO_3(aq) + H_2O(l)$

B $NaOH(aq) + HNO_3(aq) \rightarrow NaNO_3(l) + H_2O(l)$

C $NaOH(l) + HNO_3(l) \rightarrow NaNO_3(l) + H_2O(aq)$

D $NaOH(l) + HNO_3(l) \rightarrow NaNO_3(l) + H_2O(l)$

2. June/2023/Paper_ 0620/11/No.15

Sodium hydroxide forms an alkaline solution with a pH of 14.

Which indicator turns yellow when added to this solution?

A litmus

B methyl orange

C thymolphthalein

D universal indicator

3. June/2023/Paper_ 0620/11/No.16

Which row identifies an acidic oxide and a basic oxide?

	acidic oxide	basic oxide
A	CaO	CuO
B	CaO	SO_2
C	CO_2	CuO
D	CO_2	SO_2

4. June/2023/Paper_ 0620/11/No.17

A student makes aqueous copper(II) chloride by adding excess copper(II) carbonate to dilute hydrochloric acid.

What is the next step in the method in the formation of solid copper(II) chloride?

A crystallisation

B evaporation

C filtration

D titration

5. June/2023/Paper_ 0620/12/No.15

Copper(II) chloride is made when copper(II) carbonate reacts with dilute hydrochloric acid.

What are the other products in this reaction?

A water and carbon dioxide

B carbon dioxide only

C water and hydrogen

D hydrogen only

6. June/2023/Paper_ 0620/12/No.16

Rubidium is in Group I and strontium is in Group II of the Periodic Table.

Which row describes the nature of rubidium oxide, Rb_2O, and strontium oxide, SrO?

	Rb_2O	SrO
A	acidic	acidic
B	acidic	basic
C	basic	acidic
D	basic	basic

7. June/2023/Paper_ 0620/12/No.17

Magnesium sulfate is a soluble solid which is formed when insoluble magnesium oxide reacts with dilute sulfuric acid.

Which method is used to prepare solid magnesium sulfate?

A Excess sulfuric acid is reacted with magnesium oxide. The mixture is evaporated to dryness.

B Excess sulfuric acid is reacted with magnesium oxide. The precipitate is filtered, washed and dried.

C Sulfuric acid is reacted with excess magnesium oxide. The mixture is filtered and the filtrate is evaporated to dryness.

D Sulfuric acid is reacted with excess magnesium oxide. The precipitate is filtered, washed and dried.

8. June/2023/Paper_ 0620/12/No.40

When acid is added to salt X, a gas is produced which turns limewater milky.

When sodium hydroxide is added to salt X, a gas is produced which turns litmus paper blue.

What is X?

A $CaCO_3$ **B** $(NH_4)_2CO_3$ **C** NH_4NO_3 **D** $ZnCO_3$

9. June/2023/Paper_ 0620/13/No.15

Excess hydrochloric acid is added to aqueous sodium hydroxide containing thymolphthalein.

Which colour change is observed?

A blue to colourless

B colourless to blue

C red to yellow

D yellow to red

10. June/2023/Paper_ 0620/13/No.16

Information about four oxides, J, K, L and M, is listed.

J releases ammonia when added to aqueous ammonium chloride.

K reacts with aqueous sodium hydroxide.

L is the oxide of a Group I element.

M is an oxide of an element in the top right section of the Periodic Table.

Which row is correct?

	acidic oxides	basic oxides
A	J and K	L and M
B	L and M	J and K
C	K and M	J and L
D	J and L	K and M

11. June/2023/Paper_ 0620/13/No.17

Three methods of preparing salts are listed.

1 acid + metal

2 acid + metal carbonate

3 acid + metal oxide

Which methods can be used to make copper(II) chloride?

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

12. June/2023/Paper_ 0620/21/No.15

The concentration of hydrogen ions in 100 cm^3 of 0.1 mol/dm^3 hydrochloric acid is higher than the concentration of hydrogen ions in 100 cm^3 of 0.1 mol/dm^3 ethanoic acid.

Which statement explains the difference in hydrogen ion concentration?

A Ethanoic acid is an organic acid.

B Ethanoic acid has a lower pH than hydrochloric acid.

C Ethanoic acid is partially dissociated.

D Ethanoic acid is a strong acid.

13. June/2023/Paper_ 0620/21/No.16

Which oxide is classified as an amphoteric oxide?

A aluminium oxide

B calcium oxide

C copper(II) oxide

D nitrogen oxide

14. June/2023/Paper_ 0620/21/No.17

Which method produces the salt copper(II) carbonate?

A Add copper(II) oxide to water, then add excess aqueous sodium carbonate. Filter off the precipitate.

B Add copper(II) oxide to dilute sulfuric acid, then add excess aqueous sodium carbonate. Filter off the precipitate.

C Add copper to dilute hydrochloric acid, then add aqueous sodium carbonate. Filter off the precipitate.

D Add copper(II) oxide to excess aqueous sodium carbonate. Filter off the precipitate.

15. June/2023/Paper_ 0620/22/No.16

What is the definition of a strong acid?

A a proton acceptor that is completely dissociated in aqueous solution

B a proton acceptor that is partially dissociated in aqueous solution

C a proton donor that is completely dissociated in aqueous solution

D a proton donor that is partially dissociated in aqueous solution

16. June/2023/Paper_ 0620/22/No.17

Which statement about amphoteric oxides is correct?

A They are made by combining an acidic oxide with a basic oxide.

B They react with water to give a solution of pH 7.

C They react with both acids and bases.

D They do not react with acids or bases.

17. June/2023/Paper_ 0620/22/No.18

Copper(II) carbonate is formed when aqueous sodium carbonate is added to aqueous copper(II) nitrate.

The ionic equation for the reaction is shown.

$$CO_3^{2-}(aq) + Cu^{2+}(aq) \rightarrow CuCO_3(s)$$

How is pure copper(II) carbonate obtained from the reaction mixture?

A evaporate → filter → dry

B evaporate → wash → crystallise

C filter → evaporate → crystallise

D filter → wash → dry

18. June/2023/Paper_ 0620/22/No.20

Lead(II) sulfate is an insoluble salt.

Which reaction produces a mixture from which lead(II) sulfate is obtained by filtration?

A adding solid lead(II) carbonate to dilute sulfuric acid

B adding solid lead(II) hydroxide to dilute sulfuric acid

C adding metallic lead to dilute sulfuric acid

D adding aqueous lead(II) nitrate to dilute sulfuric acid

19. June/2023/Paper_ 0620/22/No.40

When acid is added to salt X, a gas is produced which turns limewater milky.

When sodium hydroxide is added to salt X, a gas is produced which turns litmus paper blue.

What is X?

A $CaCO_3$ **B** $(NH_4)_2CO_3$ **C** NH_4NO_3 **D** $ZnCO_3$

20. June/2023/Paper_ 0620/23/No.18

Which oxide is amphoteric?

A Al_2O_3 **B** CaO **C** Na_2O **D** SO_2

21. June/2023/Paper_ 0620/23/No.19

Four statements about strong acids are listed.

1 They react with carbonates to form carbon dioxide.

2 They completely dissociate in aqueous solution.

3 They react with ammonium salts to form ammonia.

4 They are proton acceptors.

Which statements are correct?

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

22. June/2023/Paper_ 0620/23/No.20

Which reaction mixture will produce a precipitate?

A aqueous Na_2CO_3 and aqueous $CuSO_4$

B dilute H_2SO_4 and aqueous $NaOH$

C dilute HNO_3 and solid MgO

D solid CuO and dilute H_2SO_4

23. June/2023/Paper_ 0620/23/No.22

A sample of ethanoic acid and a sample of hydrochloric acid have the same concentration.

How do the hydrogen ion concentration and pH of ethanoic acid compare to those of hydrochloric acid?

	ethanoic acid compared to hydrochloric acid	
	hydrogen ion concentration	pH
A	higher	higher
B	higher	lower
C	lower	higher
D	lower	lower

24. June/2023/Paper_ 0620/31/No.4(e, f)

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

sulfuric acid	+	sodium carbonate	→	....	+	....	+	.....

[3]

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

State the colour of the solution.

..... [1]

25. June/2023/Paper_ 0620/31/No.6(c)

(c) Zinc chloride is soluble in water.

Choose one **other** compound that is soluble in water.

Tick (✓) **one** box.

calcium carbonate	☐
lead(II) chloride	☐
silver chloride	☐
sodium nitrate	☐

[1]

26. June/2023/Paper_ 0620/32/No.4(d, e)

(d) A few drops of methyl orange indicator are added to dilute hydrochloric acid.

State the colour of the solution.

..... [1]

(e) Dilute hydrochloric acid reacts with sodium hydroxide.

(i) Complete the word equation for this reaction.

hydrochloric acid	+	sodium hydroxide	→	....	+	.....

[2]

(ii) Sodium hydroxide is an alkali.

Write the formula of the ion present in all alkalis.

..... [1]

27. June/2023/Paper_ 0620/32/No.6(b, c)

(b) Crystals of calcium chloride can be prepared by reacting excess calcium carbonate with dilute hydrochloric acid.

Name the process used to separate the unreacted calcium carbonate from the rest of the reaction mixture.

..... [1]

(c) Calcium carbonate is insoluble in water.

Choose one **other** compound that is insoluble in water.

Tick (✓) **one** box.

ammonium sulfate	☐
potassium nitrate	☐
silver chloride	☐
sodium hydroxide	☐

[1]

28. June/2023/Paper_ 0620/33/No.4(c)

This question is about bromine and compounds of bromine.

(c) Hydrobromic acid is formed when hydrogen bromide dissolves in water.

(i) Write the formula of the ion which is present in all acids.

..... [1]

(ii) Complete the word equation for the reaction of any acid with any carbonate.

acid	+	carbonate	→	.....	+	.....	+	....

[3]

(iii) A few drops of litmus indicator are added to a dilute acid.

State the colour of the solution.

..... [1]

29. June/2023/Paper_ 0620/33/No.6(b, c)

(b) Describe how crystals of magnesium chloride can be prepared after reacting excess magnesium with dilute hydrochloric acid.

.....

.....

..... [2]

(c) Magnesium chloride is soluble in water.

Choose one **other** compound that is soluble in water.

Tick (✓) **one** box.

ammonium sulfate	☐
calcium carbonate	☐
iron(II) hydroxide	☐
silver chloride	☐

[1]

30. June/2023/Paper_ 0620/41/No.6(c, d)

(c) When sulfuric acid reacts with ammonia the salt produced is ammonium sulfate.

Write the symbol equation for this reaction.

..... [2]

(d) Lead(II) sulfate is an insoluble salt.

Lead(II) sulfate can be made from aqueous ammonium sulfate using a precipitation reaction.

(i) Name a solution that can be added to aqueous ammonium sulfate to produce a precipitate of lead(II) sulfate.

..... [1]

(ii) Write an ionic equation for this precipitation reaction. Include state symbols.

..... [3]

(iii) The precipitate of lead(II) sulfate forms in an aqueous solution.

Describe how pure lead(II) sulfate can be obtained from the mixture.

.....

.....

..... [3]

31. June/2023/Paper_ 0620/42/No.4(a _ f)

Solid sodium hydroxide is a base which dissolves to form an aqueous solution, NaOH(aq).

(a) State what is meant by the term base.

..... [1]

(b) State the term given to a base which dissolves to form an aqueous solution.

..... [1]

(c) State the colour of thymolphthalein in NaOH(aq).

..... [1]

(d) Complete the word equation for the reaction of NaOH(aq) with ammonium chloride.

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

[3]

(e) Some metal oxides react with NaOH(aq).

(i) State the term given to metal oxides which react with bases such as NaOH(aq).

..... [1]

(ii) Name a metal oxide which reacts with NaOH(aq).

..... [1]

(f) Ethanoic acid, CH_3COOH, is a weak acid.

(i) Complete the dot-and-cross diagram in Fig. 4.1 of a molecule of ethanoic acid.

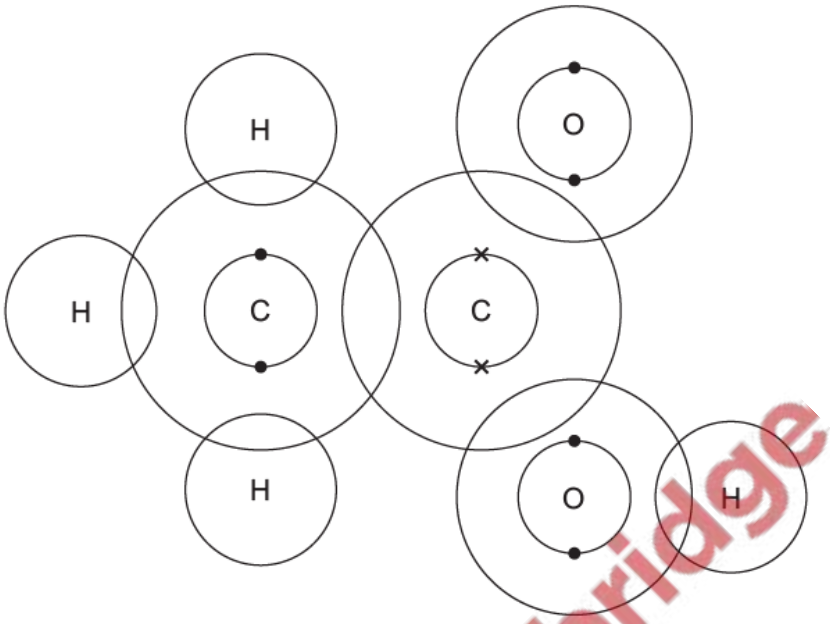

Fig. 4.1

[3]

(ii) Suggest the pH of dilute ethanoic acid.

..... [1]

(iii) Complete the symbol equation to show the dissociation of ethanoic acid.

CH_3COOH ..... [3]

(iv) Write the ionic equation for the reaction when an acid neutralises a soluble base.

..... [1]

32. March/2023/Paper_ 0620/12/No.16

An aqueous solution reacts with a solid. The products are an alkaline gas, a salt and water.

What are the aqueous solution and the solid?

	aqueous solution	solid
A	sodium hydroxide	magnesium carbonate
B	hydrochloric acid	magnesium carbonate
C	hydrochloric acid	ammonium chloride
D	sodium hydroxide	ammonium chloride

33. March/2023/Paper_ 0620/12/No.17

Both calcium oxide, CaO, and calcium hydroxide, $Ca(OH)_2$, are used to remove sulfur dioxide, SO_2, from flue gases in industrial plants.

Which row classifies calcium oxide, calcium hydroxide and sulfur dioxide?

	calcium oxide	calcium hydroxide	sulfur dioxide
A	acidic	acidic	basic
B	acidic	basic	acidic
C	basic	acidic	acidic
D	basic	basic	acidic

34. March/2023/Paper_ 0620/12/No.18

Copper(II) sulfate is prepared by adding excess copper(II) carbonate to sulfuric acid.

Why is an **excess** of copper(II) carbonate added?

A to ensure all the copper(II) carbonate has reacted

B to ensure all the sulfuric acid has reacted

C to increase the rate of reaction

D to increase the amount of copper(II) sulfate produced

35. March/2023/Paper_ 0620/22/No.19

An aqueous solution reacts with a solid. The products are an alkaline gas, a salt and water.

What are the aqueous solution and the solid?

	aqueous solution	solid
A	sodium hydroxide	magnesium carbonate
B	hydrochloric acid	magnesium carbonate
C	hydrochloric acid	ammonium chloride
D	sodium hydroxide	ammonium chloride

36. March/2023/Paper_ 0620/22/No.20

Butanoic acid partially dissociates in aqueous solution.

Which row about butanoic acid is correct?

	pH	effect on thymolphthalein
A	3	turns blue
B	5	turns colourless
C	8	turns blue
D	10	turns colourless

37. March/2023/Paper_ 0620/22/No.21

Copper(II) sulfate is prepared by adding excess copper(II) carbonate to sulfuric acid.

Why is an **excess** of copper(II) carbonate added?

A to ensure all the copper(II) carbonate has reacted

B to ensure all the sulfuric acid has reacted

C to increase the rate of reaction

D to increase the amount of copper(II) sulfate produced

38. March/2023/Paper_ 0620/42/No.2(b)

(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]