Revision checklists

Topic: The characteristic properties of acids and bases				
Ways to practice skills	R	Y	G	Comments
Describe the characteristic properties of acids in terms of their reactions with: a. Metals (reactive) → H_2 + salt b. Bases → H_2O + salt c. Carbonates → salt + H_2CO_3 + H_2O + CO_2	☐	☐	☐	
Describe acids in terms of their effect on: a. Litmus b. Thymolphthalein c. Methyl orange	☐	☐	☐	
State that bases are oxides or hydroxides of metals and that alkalis are soluble bases	☐	☐	☐	
Describe the characteristic properties of bases in terms of their reactions with: a. Bases b. Ammonium salts → salt + NH_3 + H_2O	☐	☐	☐	
Describe alkalis in terms of their effect on: a. Litmus b. Thymolphthalein c. Methyl orange	☐	☐	☐	
State that aqueous solutions of acids contain H^+ ions and aqueous solutions of alkalis contain OH^- ions	☐	☐	☐	
Describe how to compare hydrogen ion concentration, neutrality, relative acidity and relative alkalinity in terms of colour and pH using universal indicator paper	☐	☐	☐	
Describe the neutralization reaction between an acid and an alkali to produce water, $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$	☐	☐	☐	
Describe acids as proton donors and bases as proton acceptors	☐	☐	☐	
Define a strong acid as an acid that is completely dissociated in aqueous solution and a weak acid as an acid that is partially dissociated in aqueous solution	☐	☐	☐	
State that hydrochloric acid is a strong acid, as shown by the symbol equation, $HCl(aq) \rightarrow H^+(aq) + Cl^-(aq)$	☐	☐	☐	
State that ethanoic acid acid is a weak acid, as shown by the symbol equation, $CH_3COOH(aq) \rightleftharpoons H^+(aq) + CH_3COO^-(aq)$	☐	☐	☐	
Topic: Oxides				
Classify oxides as acidic, including SO_2 and CO_2, or basic, including CuO and CaO, related to metallic and non-metallic character	☐	☐	☐	
Describe amphoteric oxides as oxides that react with acids and with bases to produce a salt and water	☐	☐	☐	

Ways to practice skills	R	Y	G	Comments
Classify Al_2O_3 and ZnO as amphoteric oxides	☐	☐	☐	
Topic: Preparation of salts				
Describe the preparation, separation, and purification of soluble salts by reaction of an acid with: a. an alkali by titration b. excess metal c. excess insoluble base d. excess insoluble carbonate	☐	☐	☐	
Describe the general solubility rules for salts: a. sodium, potassium and ammonium salts are soluble b. nitrates are soluble c. chlorides are soluble, except lead and silver d. sulfates are soluble, except barium, calcium and lead e. carbonates are insoluble, except sodium, potassium and ammonium f. hydroxides are insoluble, except sodium, potassium, ammonium and calcium (partially)	☐	☐	☐	
Define a hydrated substances as a substance that is chemically combined with water and an anhydrous substance as a substance containing no water	☐	☐	☐	
Define the term of crystallization as the water molecules present in crystals, e.g. $CuSO_5 \cdot 5H_2O$ and $CoCl_2 \cdot 6H_2O$	☐	☐	☐	

You can use the tick boxes to show when you have revised an item and how confident you feel about it.
R = **RED** means you are really unsure and lack confidence; you might want to focus your revision here and possibly talk to your teacher for help.
Y = **YELOW** means you are reasonably confident but need some extra practice
G = **GREEN** means you are very confident.
As your revision progresses, you can concentrate on the **RED** and **YELLOW** items in order to turn them into **GREEN** item. You might find it helpful to highlight each topic in red, yellow, or green to help you prioritise.

1. Dilute nitric acid is added to a solid, F, and a gas, G, is produced which is denser than air and extinguishes a burning splint. What are F and G? ✓

	solid F	gas G
A	calcium	hydrogen
B	calcium carbonate	carbon dioxide
C	calcium hydroxide	hydrogen
D	calcium oxide	carbon dioxide

2. An excess of substance Z is added to some spilt acid. ✓
The solution produced as a result is neutral.
What is Z?

A. aqueous ammonia
B. aqueous sodium hydroxide
C. calcium carbonate
D. water

3. Aqueous sodium hydroxide is added to solid Q in a test-tube.
A gas is produced which turns damp red litmus blue. ✓
What is Q?

A. aluminium
B. ammonia
C. ammonium chloride
D. sodium chloride

CORRECTION

4. A few drops of methyl orange are added to a reaction mixture.

   During the reaction, a gas is produced and the methyl orange turns from red to orange.

   What are the reactants?

   A. aqueous sodium hydroxide and ammonium chloride

   B. aqueous sodium hydroxide and calcium carbonate

   C. dilute hydrochloric acid and magnesium

   D. dilute hydrochloric acid and aqueous sodium hydroxide

5. When dilute sulfuric acid is added to solid X, a colourless solution is formed and a gas is produced. What is X?

   A. copper(II) oxide

   B. sodium oxide

   C. copper(II) carbonate

   D. sodium carbonate

6. Which statement describes a reaction of potassium hydroxide?

   A. Chlorine is formed when it is heated with ammonium chloride.

   B. It turns Universal Indicator green.

   C. It reacts with an acid to produce a salt and water.

   D. It turns methyl orange red.

7. Which property is shown by the alkali sodium hydroxide?

   A. It has a pH less than pH 7.

   B. It produces a gas when it is warmed with ammonium chloride.

   C. It turns blue litmus red.

   D. It turns Universal Indicator green.

CORRECTION

8. Solution Q is warmed with ammonium chloride. ✓

In a separate experiment, solution Q is added to methyl orange.

Which observations show that solution Q is basic?

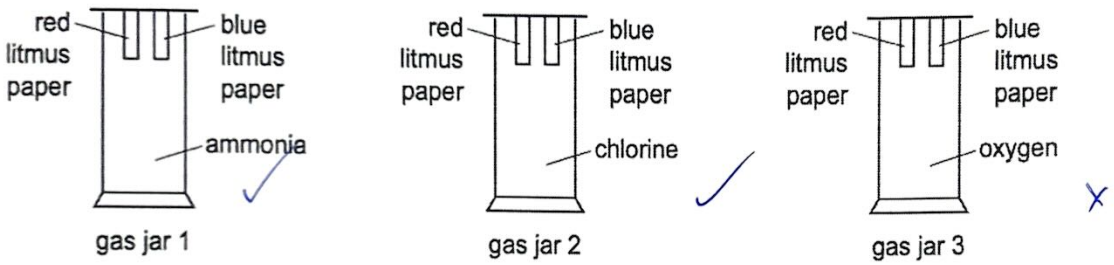
methyl orange { acid: red / base: yellow

thymolphthalein { acid: colorless / base: blue

litmus { acid: red / base: blue

	warmed with ammonium chloride	added to methyl orange
A	gas is produced ✓	turns red
(B)	gas is produced ✓	turns yellow ✓
C	no reaction	turns red
D	no reaction	turns yellow

9. Pieces of damp red litmus paper and damp blue litmus paper are placed in three different gas jars. ✓



In which gas jars does at least one piece of litmus paper change colour?

A. 1, 2 and 3

(B.) 1 and 2

C. 1 and 3

D. 2 and 3

CORRECTION

10. Which colours are seen when litmus and methyl orange are added to separate samples of aqueous sodium hydroxide?

	litmus	methyl orange
A	blue	orange
B	blue	yellow
C	purple	orange
D	purple	yellow

11. Four different solutions are separately tested with blue litmus and with methyl orange. Each solution is known to be either acidic or alkaline. The results are shown.

solution	result with blue litmus	result with methyl orange
1	red	red
2	red	yellow
3	blue	yellow
4	blue	yellow

Which statement is correct?

A. Solutions 1 and 4 are acidic.

B. Solutions 1 and 2 are alkaline.

C. Solutions 3 and 4 are alkaline.

D. Solutions 3 and 4 are acidic.

CORRECTION

12. Which row shows the colours of litmus and methyl orange with solutions of acids and bases?

	solution	litmus	methyl orange
A	acid	red	red
B	acid	blue	yellow
C	base	blue	red
D	base	red	yellow

13. Which statement describes the properties of hydrochloric acid?

A. Carbon dioxide is produced when limestone (carbonate) reacts with hydrochloric acid.

B. Hydrogen is produced when sodium hydroxide reacts with hydrochloric acid.

C. Methyl orange turns (red) yellow in strong hydrochloric acid.

D. Red litmus paper turns blue when dipped into hydrochloric acid.

14. Which statements about dilute sulfuric acid are correct?

1 It turns red litmus paper blue.

2 It reacts with magnesium(II) oxide to form magnesium(II) sulfate and water.

3 It reacts with magnesium to form magnesium(II) sulfate and carbon dioxide.

4 Its pH is below pH 7.

A. A 1 and 2 only

B. 1 and 3 only

C. 2 and 4 only

D. 3 and 4 only

CORRECTION

15. Which solution has the lowest pH?

A. 0.1 mol/dm^3 ammonia solution

B. 0.1 mol/dm^3 ethanoic acid

C. 0.1 mol/dm^3 lithium hydroxide

D. 0.1 mol/dm^3 nitric acid

16. Carbonic acid is a weak acid formed when carbon dioxide dissolves in water. What is the pH of the solution?

A. 1

B. 5

C. 7

D. 9

17. Barium hydroxide is an alkali. It reacts with hydrochloric acid.

How does the pH of the hydrochloric acid change as an excess of aqueous barium hydroxide is added?

A. The pH decreases from pH 14 and becomes constant at pH 7.

B. The pH decreases from pH 14 to about pH 1.

C. The pH increases from pH 1 and becomes constant at pH 7.

D. The pH increases from pH 1 to about pH 14.

CORRECTION

18. Which row shows the difference between a weak acid and a strong acid?

	weak acid	strong acid
A	fully ionised	partially ionised
B	concentrated	dilute
C	dilute	concentrated
D	partially ionised ✓	fully ionised ✓

19. Which statement about acids and bases is correct?

A. A base is a donor of hydrogen ions. ✗

B. An acid is an acceptor of protons. ✗

C. A strong acid is fully ionised in aqueous solution. ✓

D. A weak acid cannot be used to neutralise a strong base.

20. Ethanoic acid reacts with water to produce an acidic solution.

Which row describes the roles of ethanoic acid and water in this reaction?

	ethanoic acid	water
A	accepts a proton	donates a proton
B	accepts an electron	donates an electron
C	donates a proton ✓	accepts a proton ✓
D	donates an electron	accepts an electron

CORRECTION

21. The equation represents an equilibrium in aqueous ammonia.

$NH_3(aq) + H_2O(l) \rightleftharpoons NH_4^+(aq) + OH^-(aq)$

How does aqueous ammonia behave in this reaction?

A. as a strong acid

B. as a strong base ✓

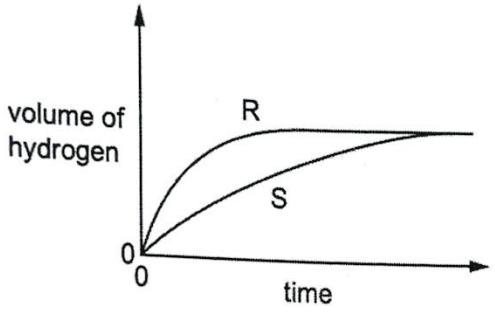
C. as a weak acid

D. as a weak base ✓

22. Solutions of acid R and acid S have the same concentration.

The same volume of each acid at the same temperature is reacted with the same mass of magnesium ribbon.

The volume of hydrogen produced is measured. The results are shown.



Which statement about the reactions is correct?

A. Acid S reacts faster than acid R.

B. The final volume of hydrogen produced in each reaction is different.

C. Acid R is a stronger acid than acid S.

D. Acid S is a stronger acid than acid R.

CORRECTION

23. Ethanoic acid is a weak acid.

Hydrochloric acid is a strong acid.

Which statements are correct?

1 Ethanoic acid molecules are partially dissociated into ions.

2 1.0 mol/dm^3 ethanoic acid has a higher pH than 1.0 mol/dm^3 hydrochloric acid.

3 Ethanoic acid is always more dilute than hydrochloric acid.

4 Ethanoic acid is a proton acceptor.

A. 1 and 2

B. 1 and 3

C. 2 and 4

D. 3 and 4

24. Which statement about oxides is correct?

A. A solution of magnesium oxide has a pH less than pH 7.

B. A solution of sulfur dioxide has a pH greater than pH 7.

C. Magnesium oxide reacts with nitric acid to make a salt.

D. Sulfur dioxide reacts with hydrochloric acid to make a salt.

25. Carbon, copper, magnesium, sodium and sulfur can all form oxides.

How many of these elements form acidic oxides?

A. 1

B. 2

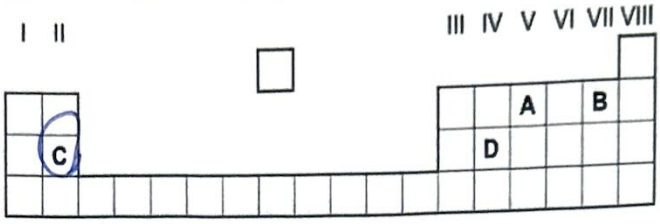
C. 3

D. 4

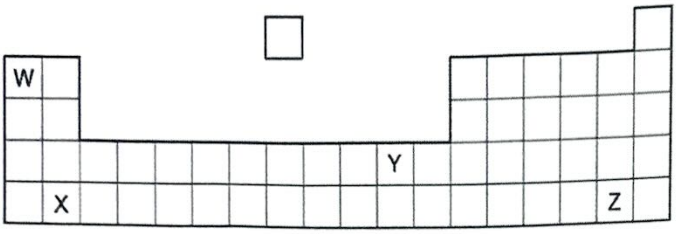
CORRECTION

26. Part of the Periodic Table is shown.

Which element forms an oxide that reacts with dilute acid to form a salt and water?



27. The positions of elements W, X, Y and Z in the Periodic Table are shown.



Which elements form basic oxides?

A. W, X and Y

B. W and X only

C. Y only

D. Z only

28. In which row are the oxides correctly identified?

	acidic	basic
A	magnesium oxide, calcium oxide	sulfur dioxide, carbon dioxide
B	magnesium oxide, sulfur dioxide	carbon dioxide, calcium oxide
C	sulfur dioxide, carbon dioxide	calcium oxide, magnesium oxide
D	sulfur dioxide, magnesium oxide	calcium oxide, carbon dioxide

CORRECTION

29. Nitrogen(I) oxide, N_2O, nitrogen(II) oxide, NO, and carbon monoxide, CO, are all non-metal oxides.

They do not react with acids or bases.

Which statement is correct?

A. They are acidic oxides.

B. They are amphoteric oxides.

C. They are basic oxides.

D. They are neutral oxides.

30. Which statement about carbon monoxide and aluminium oxide is correct?

A. Carbon monoxide and aluminium oxide are both amphoteric.

B. Carbon monoxide and aluminium oxide are both neutral.

C. Carbon monoxide is amphoteric but aluminium oxide is neutral.

D. Carbon monoxide is neutral but aluminium oxide is amphoteric.

31. Which type of oxide are carbon monoxide and aluminium oxide?

	carbon monoxide	aluminium oxide
A	acidic	amphoteric
B	acidic	basic
C	neutral ✓	amphoteric ✓
D	neutral ✓	basic

CORRECTION

32. Information about the solubility in water of four oxides is shown.

Which oxide, when added to water, gives a solution with a pH less than pH 7?

	name of oxide	solubility in water
A	nitrogen dioxide	soluble
B	copper(II) oxide	insoluble
C	silicon(IV) oxide	insoluble
D	barium oxide	soluble

33. Which statement describes a chemical property of aluminium oxide, Al_2O_3?

A. It reacts with acids but not with bases.

B. It reacts with acids and bases.

C. It reacts with bases but not with acids.

D. It reacts with water.

34. Which oxide is classified as an amphoteric oxide?

A. aluminium oxide

B. calcium oxide

C. copper(II) oxide

D. nitrogen oxide

35. Which substance is a neutral oxide?

A. aluminium oxide

B. carbon monoxide

C. sulfur dioxide

D. zinc oxide

CORRECTION

36. 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.

37. The results of some experiments with sulfur dioxide are shown.

experiment	description	result
1	mix with dilute hydrochloric acid	does not react
2	mix with concentrated sodium hydroxide	a salt forms
3	add Universal Indicator	Universal Indicator turns purple
4	add acidified aqueous potassium manganate(VII)	purple solution turns colourless

Which results are correct?

A. 1, 2 and 4

B. 2, 3 and 4

C. 1 and 2 only

D. 3 and 4 only

CORRECTION

38. Which methods are suitable for preparing both zinc sulfate and copper(II) sulfate?

1 reacting the metal oxide with warm dilute aqueous sulfuric acid

2 reacting the metal with dilute aqueous sulfuric acid

3 reacting the metal carbonate with dilute aqueous sulfuric acid

A. 1, 2 and 3

B. 1 and 2 only

C. 1 and 3 only

D. 2 and 3 only

39. Two separate tests are done on separate solutions of compound X.

1 Addition of aqueous sodium hydroxide forms a green precipitate that dissolves in an excess of aqueous sodium hydroxide.

2 Addition of dilute nitric acid and aqueous silver nitrate forms a white precipitate.

What is compound X?

A. chromium(III) carbonate

B. chromium(III) chloride

C. iron(II) carbonate

D. iron(II) chloride

40. Which method is used to make the salt copper(II) sulfate?

A. dilute acid + alkali

B. dilute acid + carbonate

C. dilute acid + metal

D. dilute acid + non-metal oxide

CORRECTION

41. A student mixes silver nitrate and barium chloride to form a white precipitate of silver chloride.

The equation is shown.

$$2AgNO_3 + BaCl_2 \rightarrow 2AgCl + Ba(NO_3)_2$$

Which row describes the solubility of the salts?

	soluble	insoluble
A	silver nitrate	barium chloride, barium nitrate and silver chloride
B	silver nitrate and barium chloride	barium nitrate and silver chloride
C	silver nitrate, barium chloride and barium nitrate	silver chloride
D	silver nitrate, barium chloride and silver chloride	barium nitrate

42. The solubility of some salts is shown.

	chloride	nitrate	sulfate	carbonate
barium	soluble	soluble	insoluble	insoluble
lead(II)	insoluble	soluble	insoluble	insoluble
potassium	soluble	soluble	soluble	soluble
zinc	soluble	soluble	soluble	insoluble

Which two aqueous solutions produce an insoluble salt when mixed together?

A. barium chloride and zinc nitrate

B. barium nitrate and lead(II) nitrate

C. lead(II) nitrate and potassium carbonate

D. potassium nitrate and zinc sulfate

CORRECTION

43. An excess of aqueous sodium sulfate was added to aqueous barium chloride and the mixture was filtered.

Which row shows the identity of the residue and the substances present in the filtrate?

	residue	substances in filtrate
A	barium sulfate	barium chloride and sodium chloride
B	barium sulfate	sodium chloride and sodium sulfate
C	sodium chloride	barium chloride and sodium sulfate
D	sodium chloride	barium sulfate and sodium sulfate

44. The following steps are done to prepare solid magnesium sulfate.

1 filtration

2 measurement of 20 cm3 of dilute sulfuric acid using a measuring cylinder

3 evaporation

4 addition of an excess of solid magnesium carbonate to dilute sulfuric acid

What is the correct order for these steps?

A. 2→4→3→1

B. 2→4→1→3

C. 4→2→1→3

D. 4→2→3→1

2→4→1→3

CORRECTION

45. A student prepares solid hydrated copper(II) sulfate from dilute sulfuric acid and the insoluble base copper(II) oxide.

Which process is not used in the procedure?

A. crystallisation

B. distillation

C. evaporation

D. filtration

46. A white precipitate is produced when small amounts of two colourless solutions are mixed together.

Which pairs of solutions produce a white precipitate?

1 sodium hydroxide and zinc nitrate

2 sodium hydroxide and aluminium chloride

3 barium chloride and sulfuric acid

4 acidified barium nitrate and potassium sulfate

A. 1, 2, 3 and 4

B. 1, 2 and 4 only

C. 1 and 2 only

D. 2 only

47. How could crystals of a pure salt be prepared from dilute sulfuric acid?

A. add an excess of aqueous sodium hydroxide, filter, evaporate the filtrate to crystallisation point

B. add an excess of copper(II) carbonate, filter, evaporate the filtrate to dryness

C. add an excess of copper metal, filter, evaporate the filtrate to crystallisation point

D. add an excess of zinc oxide, filter, evaporate the filtrate to crystallisation point

CORRECTION

48. Some general rules for the solubility of salts in water are listed.

- Carbonates are insoluble (except ammonium carbonate, potassium carbonate and sodium carbonate).
- Chlorides are soluble (except lead(II) chloride and silver chloride).
- Nitrates are soluble.
- Sulfates are soluble (except barium sulfate, calcium sulfate and lead(II) sulfate).

Which substances produce an insoluble salt when aqueous solutions of them are mixed?

A. barium chloride and magnesium nitrate

B. calcium chloride and ammonium nitrate

C. silver nitrate and zinc chloride AgCl

D. sodium carbonate and potassium sulfate

49. A substance is tested with three different reagents.

Which row shows the results obtained with aqueous iron(II) nitrate?

	aqueous sodium hydroxide	acidified aqueous silver nitrate	acidified aqueous barium nitrate
A	green precipitate, insoluble in excess	no reaction	no reaction
B	green precipitate, insoluble in excess	white precipitate	white precipitate
C	white precipitate, insoluble in excess	cream precipitate	no reaction
D	white precipitate that dissolves in excess	no reaction	white precipitate

CORRECTION

50. 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

51. Copper(II) sulfate is made when copper(II) carbonate reacts with dilute sulfuric acid.

$$CuCO_3 + H_2SO_4 \rightarrow CuSO_4 + H_2O + CO_2$$

Pure copper(II) sulfate crystals are obtained.

Which reagent is in excess and how are the crystals obtained?

	reagent in excess	how the crystals are obtained
A	copper(II) carbonate	filter and evaporate the solution to dryness
B	copper(II) carbonate	filter, evaporate to crystallising point and then cool
C	dilute sulfuric acid	evaporate the solution to dryness
D	dilute sulfuric acid	evaporate to crystallising point and then cool

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

Which process is not used to prepare a pure sample of this salt?

A. crystallisation

B. drying

C. filtration

D. precipitation

CORRECTION

53. Two separate tests are done on a solution of a compound, X.

The results are shown.

1 Adding aqueous ammonia forms a blue precipitate that dissolves in an excess of aqueous ammonia.

2 Adding dilute nitric acid and aqueous barium nitrate forms a white precipitate.

What is X?

A. chromium(III) chloride

B. chromium(III) sulfate

C. copper(II) chloride

D. copper(II) sulfate

54. Copper(II) sulfate crystals are blue. They are made by adding an excess of copper(II) oxide to sulfuric acid.

The mixture is heated and stirred.

It is then filtered and the filtrate is allowed to evaporate, leaving blue crystals. Why is filtration necessary?

A. to remove soluble properties

B. to remove sulfuric acid

C. to remove the blue crystals

D. to remove unreacted copper(II) oxide

CORRECTION

55. The results of two tests on an aqueous solution of X are shown.

test	observation
aqueous sodium hydroxide added	green precipitate formed
acidified aqueous silver nitrate added	yellow precipitate formed

What is X?

A. copper(II) chloride

B. copper(II) iodide

C. iron(II) chloride

D. iron(II) iodide

56. Four stages used to prepare an insoluble salt are listed.

1 drying

2 filtration

3 precipitation

4 washing

In which order are the stages done?

A. 2→1→3→4

B. 3→2→4→1

C. 3→4→1→2

D. 4→3→2→1

CORRECTION

57. A method used to make copper(II) sulfate crystals is shown.

1 Place dilute sulfuric acid in a beaker.

2 Warm the acid.

3 Add copper(II) oxide until it is in excess.

4 Filter the mixture.

5 Evaporate the filtrate until crystals start to form.

6 Leave the filtrate to cool.

What are the purposes of step 3 and step 4?

	step 3	step 4
A	to ensure all of the acid has reacted ✓	to obtain solid copper(II) sulfate
B	to ensure all of the acid has reacted ✓	to remove the excess of copper(II) oxide ✓
C	to speed up the reaction	to obtain solid copper(II) sulfate
D	to speed up the reaction	to remove the excess of copper(II) oxide

58. Lead(II) iodide is formed as a precipitate in the reaction shown.

$$Pb(NO_3)_2(aq) + 2NaI(aq) \rightarrow PbI_2(s) + 2NaNO_3(aq)$$

Which method is used to separate the lead(II) iodide from the mixture?

A. Crystallisation

B. distillation

C. evaporation

D. filtration

CORRECTION

59. Ammonia is an important chemical, and it is a base.

(a) In chemistry, what is meant by the term base?

proton acceptor

(b) Write a word equation to show ammonia behaving as a base.

ammonia + hydrochloric acid → ammonium chloride.

60. Ethanoic acid, CH_3COOH, is a weak acid. It reacts with copper(II) carbonate to form the salt copper(II) ethanoate, $Cu(CH_3COO)_2$.

(a) What is meant by the term weak when applied to acids?

partially dissociated / ionised.

(b) Write the word equation for the reaction between ethanoic acid and copper(II) carbonate.

ethanoic acid + copper (II) carbonate → copper (II) ethanoate + carbon dioxide + water

CORRECTION

61. Chloric(V) acid, $HClO_3$, is a strong acid. It can be made from calcium chlorate(V).

(a) What colour is methyl orange indicator in chloric(V) acid?

red.

(b) Define the term acid in terms of proton transfer.

proton donor

(c) Complete the chemical equation to show HCl O3 behaving as an acid in water.

$HClO_3 + H_2O \rightarrow$ ..... H_3O^+ ..... + ... ClO_3^- .....

62. Dilute sulfuric acid reacts with bases, metals and carbonates.

Write chemical equations for the reaction of dilute sulfuric acid with each of the following:

(a) magnesium hydroxide

$Mg(OH)_2 + H_2SO_4 \rightarrow MgSO_4 + 2H_2O$

(b) zinc

$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

(c) sodium carbonate

$Na_2CO_3 + H_2SO_4 \rightarrow Na_2SO_4 + H_2O + CO_2$

CORRECTION

63. This question is about ethanoic acid, CH_3COOH.

(a) How would you show that an aqueous solution of ethanoic acid is an acid without using an indicator or measuring the pH?

State the reagent you would use and give the expected observations. Write a chemical equation for the reaction that you describe.

Mg . Mg dissolve → bubble → equation

CaCO3 " " "

(b) Ethanoic acid is a weak acid.

(i) What is meant by the term acid?

proton donor

(ii) Why is ethanoic acid described as weak?

partially dissociation

CORRECTION

64. Ammonia is a base and reacts with sulfuric acid to form the salt, ammonium sulfate.

(a) What is meant by the term base?

proton acceptor.

(b) Name the industrial process used to manufacture sulfuric acid.

Contact process

(c) Write a chemical equation for the reaction between ammonia and sulfuric acid.

$2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$

65. Describe two simple experiments to show that zinc oxide is amphoteric.

Name the reagents you would use and describe the observations you would make.

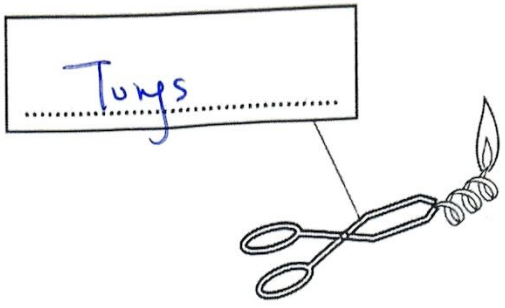
(1) react with hydrochloric acid

(2) react with sodium hydroxide

in Both experiments, solid will disappear.

CORRECTION

66. Magnesium ribbon was burned in air.



(a) Complete the box to name the apparatus.

(b) Suggest the appearance of the product formed when the magnesium ribbon was burned in air.

Smoke / white ash.

(c) Name the product formed when the magnesium ribbon was burned in air.

The product from burning the magnesium ribbon in air was added to water and heated. The solution formed was tested with Universal Indicator solution.

magnesium oxide.

CORRECTION

(d) Suggest why the product was heated after it had been added to water. Explain your answer.

to dissolve solid to make a solution

Increase speed / make dissolve complete.

(e) Suggest the pH value shown when Universal Indicator was added to the mixture.

13 / 14.

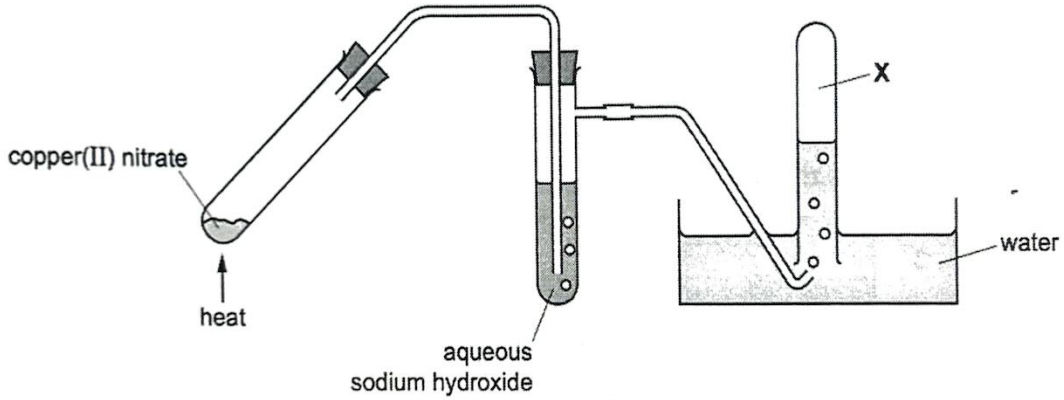
(f) State one safety precaution that should be taken when magnesium is burned in air.

goggles

CORRECTION

67. Copper(II) nitrate decomposes when heated. Two gases, oxygen and nitrogen dioxide, and a solid are made in the reaction.

(a) A sample of copper(II) nitrate was decomposed using the apparatus shown.



(i) Complete the chemical equation for the reaction.

$2Cu(NO_3)_2 \rightarrow O_2 + \ldots 4 \ldots NO_2 + \ldots 2CuO \ldots$

(ii) Only oxygen gas is collected at X. Explain why.

NO_2 is acidic oxide and can react with NaOH.

CORRECTION

(b) Nitrogen dioxide and other oxides of nitrogen are formed in car engines.

Explain how nitrogen dioxide is formed in car engines.

N_2 react with O_2 in air.
at high temperature in engine.

(c) A sample of copper(II) nitrate was dissolved in water to form an aqueous solution.

The aqueous solution was split into three portions. A separate test was done on each portionas shown.

test	reagent added	result
1	aqueous sodium hydroxide	light blue precipitate forms
2	zinc powder	solution changes from blue to colourless and a brown solid forms
3		ammonia gas is produced

(i) Give the formula of the light blue precipitate formed in test 1 (1)

$Cu(OH)_2$

(ii) Explain the changes seen in test 2 (2)

Zn is more reactive than Cu / this is the redox reaction.
solution: blue to colourless : Cu^{2+} is removed

CORRECTION

(iii) Identify the two reagents that must be added to the aqueous copper(II) nitrate in test 3.

NaOH / Al

(d) Copper(II) nitrate can be made by reacting copper(II) carbonate with nitric acid. One of the products is carbon dioxide.

(i) Write a chemical equation for the reaction of copper(II) carbonate with nitric acid.

$CuCO_3 + 2HNO_3 \rightarrow Cu(NO_3)_2 + CO_2 + H_2O$

(ii) Carbon dioxide is added to the air by living things.
Name the chemical process by which living things add carbon dioxide to the air.

respiration

(iii) Carbon dioxide is removed from the air by plants.
Name the chemical process by which plants remove carbon dioxide from the air. photosynthesis

CORRECTION

68. Dilute sulfuric acid is used to make salts known as sulfates.

A method consisting of three steps is used to make zinc sulfate from zinc carbonate.

step 1 Add an excess of zinc carbonate to 20 cm3 of 0.4 mol / dm3 dilute sulfuric acid until the reaction is complete.

step 2 Filter the mixture.

step 3 Heat the filtrate until a saturated solution forms and then allow it to crystallise.

(a) Name a suitable piece of apparatus for measuring 20 cm^3 of dilute sulfuric acid in step 1.

measuring cylinder / pipette

(b) State two observations which would show that the reaction is complete in step 1.

No bubbles appear

No more solid disappear

(c) Why is it important to add an excess of zinc carbonate in step 1?

all H_2SO_4 can be used, and $ZnCO_3$ is easy to be remove

CORRECTION

(d) What is meant by the term saturated solution in step 3?

no more solute can dissolve at the specified temp.

(e) The equation for the reaction is shown.

$$ZnCO_3(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2O(l) + CO_2(g)$$

Complete the equation by inserting the state symbol for zinc sulfate.

Name another zinc compound which could be used to make zinc sulfate from dilute sulfuric acid using this method.

zinc oxide / zinc hydroxide

(f) Suggest why this method would not work to make barium sulfate from barium carbonate and dilute sulfuric acid.

Barium sulfate is insoluble.

CORRECTION

69. Potassium hydrogensulfate, $KHSO_4$, is an acid salt. It dissolves in water to produce an aqueous solution, X, containing K^+, H^+ and SO_4^{2-} ions.

Describe what you would see when the following experiments are done.

(a) Magnesium ribbon is added to an excess of solution X.

bubbles
solid Mg disappears

(b) A flame test is done on solution X.

lilac flame

(c) An aqueous solution containing barium ions is added to solution X.

white precipitate

CORRECTION

70. Ethanoic acid is a weak acid and hydrochloric acid is a strong acid. Both ethanoic acid and hydrochloric acid dissociate in aqueous solution.

(a) (i) Define the term acid.

proton donor

(ii) The chemical equation shows the changes which occur when the strong acid, hydrochloric acid, is added to water.

$$HCl(aq) \rightarrow H^+(aq) + Cl^-(aq)$$

Complete the chemical equation to show the changes which occur when the weak acid, ethanoic acid, is added to water.

$CH_3COOH(aq)$ ..... $\rightleftharpoons$ $CH_3COO^-(aq) + H^+(aq)$ .....

(b) A student does experiments to show that hydrochloric acid is a strong acid and ethanoic acid is a weak acid. The student adds an excess of hydrochloric acid and an excess of ethanoic acid to separate samples of lumps of calcium carbonate. Only the identity of the acid is changed between the experiments. All other conditions are kept the same.

(i) State two observations which would show that hydrochloric acid is a stronger acid than ethanoic acid.

more bubbles in unit time
solid disappear quicker

CORRECTION

(ii) The student uses the same size container and checks that the pressure is the same for each experiment.
State three other conditions which must be kept the same to ensure fair testing.

temperature
concentration of acid / volume of acid.
mass of $CaCO_3$

(c) A student prepares crystals of magnesium chloride by adding an excess of magnesium carbonate to 50.00 cm^3 of 2.00 mol/dm^3 hydrochloric acid.
The student filters the mixture and rinses the residue.

(i) Why does the student add an excess of magnesium carbonate?

- make sure all acids are used up.

(ii) Why does the student rinse the residue?

make sure no $MgCl_2$ left behind

CORRECTION

(iii) Describe how the student would obtain pure crystals of magnesium chloride from the filtrate.

evaporation
↓
the starting of crystallisation
↓
drying the crystals

(d) Silver chloride, AgCl, is insoluble. It can be made by a precipitation reaction between aqueous barium chloride and a suitable aqueous silver salt.

(i) What is meant by the term precipitate?

when two solution are mixed
a solid was formed.

(ii) Name a suitable silver salt to use to prepare silver chloride.
Complete the chemical equation to show the formation of insoluble silver chloride from aqueous barium chloride and the silver salt you have named.

name of a suitable silver salt ..... silver nitrate .....

$BaCl_2$ + ... $2AgNO_3$ → ..... $2AgCl$ ..... + ... $Ba(NO_3)_2$ .....

CORRECTION

71. Lead(II) azide is insoluble in water. Solid lead(II) azide can be made in a precipitation reaction between aqueous lead(II) nitrate and aqueous sodium azide.

Lead(II) azide has the formula $Pb(N_3)_2$.

(a) Deduce the formula of the azide ion.

N_3^-

(b) Complete the chemical equation for the reaction between aqueous lead(II) nitrate and aqueous sodium azide to form solid lead(II) azide and aqueous sodium nitrate. Include state symbols.

$Pb(NO_3)_2(aq) + \underline{2}\,NaN_3(aq) \rightarrow Pb(N_3)_2(\underline{s}) + \underline{2}\,\underline{NaNO_3}(aq)$

(c) Describe how you could obtain a sample of lead(II) azide that is not contaminated with any soluble salts from the reaction mixture.

filter & wash with water

CORRECTION

72. A student did the following steps to make zinc chloride crystals from solid zinc oxide.

step 1 Pour 40 cm^3 of dilute hydrochloric acid into a beaker. Add a small amount of zinc oxide. Warm the mixture and stir it.

step 2 Continue to add zinc oxide to the beaker until all of the dilute hydrochloric acid has reacted.

step 3 Remove the excess zinc oxide.

step 4 Obtain crystals of zinc chloride from the solution.

(a) Name the apparatus used in step 1 to:

(i) add the zinc oxide

spatula

(ii) warm the mixture.

Bunsen burner

(b) How did the student know that all of the dilute hydrochloric acid had reacted in step 2?

No more ZnO can continue to react (disappear)

CORRECTION

(c) (i) What is meant by the term excess in step 3?

more than enough to react

(ii) How is the excess zinc oxide removed in step 3?

filtration

(d) Describe how the crystals are obtained in step 4.

evaporate
↓
crystallising point
↓
leave to cool.

(e) Suggest how the method would differ if zinc carbonate were used instead of zinc oxide.

heating is not necessary

CORRECTION

73. Two substances, solution D and solid E, were analysed. Solution D was dilute sulfuric acid.

Tests were done on the substances.

tests on solution D

Complete the expected observations.

Solution D was divided into four equal portions in four test-tubes.

(a) The pH of the first portion of solution D was tested.

2

(b) A strip of magnesium ribbon was added to the second portion of solution D. The gas produced was tested.

bubbles

(c) Dilute nitric acid and aqueous silver nitrate were added to the third portion of solution D.

no observation

(d) Dilute nitric acid and aqueous barium nitrate were added to the fourth portion of solution D.

white precipitate

CORRECTION

tests on solid E

Some of the tests and observations are shown.

tests on solid **E**	observations
The appearance of solid **E** was studied.	white solid
test 1 Solid **E** was heated gently and then more strongly. Distilled water was added to the residue and the pH of the mixture was tested.	basic oxide white solid residue pH = 10
test 2 Dilute hydrochloric acid was added to solid **E**. The gas produced was tested. Distilled water was added to the solution and the mixture was shaken. An excess of aqueous sodium hydroxide was added to the mixture.	rapid effervescence CO_3^{2-} limewater turned milky white precipitate formed which was insoluble in excess $CaCO_3$

(e) Identify the gas produced in test 2.

CO_2

(f) What conclusions can you draw about solid E?

$CaCO_3$

CORRECTION

74. 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		
		$Co(NO_3)_2(aq)$	$AgNO_3(aq)$	$Pb(NO_3)_2(aq)$
first salt solution	NaI(aq)	no change	yellow precipitate	yellow precipitate
	$Na_2CO_3(aq)$	purple precipitate	yellow precipitate	white precipitate
	$Na_2SO_4(aq)$	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

Cobalt(II) carbonate

(ii) an insoluble yellow lead salt

lead(II) iodide

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

$Na_2CO_3(aq) + 2AgNO_3(aq) \rightarrow Ag_2CO_3(s) + 2NaNO_3(aq)$

CORRECTION

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

Pb^{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.

Both AgI and Ag_2CO_3 are precipitate.

Ag_2CO_3 was dissolved in acidified solution.

CORRECTION

75. All sodium salts are soluble in water. All nitrates are soluble in water. Barium carbonate is insoluble in water.

Describe how you would make a pure, dry sample of barium carbonate by precipitation.

Include:

- the names of the starting materials
- full practical details
- a chemical equation.

Mix sodium carbonate and barium nitrate in solution
filtration to collect residue (barium carbonate)
wash residue by water and drying

$Ba(NO_3)_2 + Na_2CO_3 \rightarrow BaCO_3 + 2NaNO_3$.

CORRECTION

76. Potassium chloride is a salt that dissolves in water.

The solubility of a salt is the mass in grams of the salt that dissolves in 100 cm^3 of water at a particular temperature.

Plan an investigation to determine the solubility of potassium chloride in water at 40 °C.

You are provided with potassium chloride and common laboratory apparatus.

Use pipette to measure 50mL water and place in beaker
Heat the water to 40°C
add KCl and stir until no more dissolves.
filter mixture
evaporate filtrate to dryness
weigh solid

CORRECTION

77. Calcium carbonate, calcium hydroxide and calcium oxide can be used to neutralise the acid in soil.

Plan an investigation to find out which of these calcium compounds neutralises acid most effectively.

You are provided with the three calcium compounds, dilute hydrochloric acid and common laboratory apparatus and chemicals.

measure 50 mL HCl by measuring cylinder
add litmus to show red color.
measure the mass of $CaCO_3$ and record m initial
add $CaCO_3$ into HCl and stir until turns purple color.
measure the mass of $CaCO_3$ and record m final.
mass of $CaCO_3$ required to neutralise = m initial − m final
repeat with other calcium compounds.
Compare the mass of each calcium compounds
the smallest one is the most effective.

CORRECTION