1 Aqueous sodium hydroxide can be used to test for chromium(III) ions and iron(II) ions.

Complete the table to show the expected observations.

ion	observation on adding a small volume of aqueous sodium hydroxide	observation on adding an excess of aqueous sodium hydroxide
chromium(III) (Cr^{3+})		
iron(II) (Fe^{2+})		

[3]

[Total: 3]

2 The following statements are about the procedure for making crystals of hydrated aluminium sulfate from aluminium hydroxide and sulfuric acid.

A Filter off the excess aluminium hydroxide.
B Filter off the crystals and dry between filter papers.
C Warm the filtrate to the point of crystallisation.
D Add aluminium hydroxide to warm dilute sulfuric acid and stir.
E Leave the mixture at room temperature to form more crystals.
F Add more aluminium hydroxide to the sulfuric acid until the aluminium hydroxide is in excess.

Put the statement **A**, **B**, **C**, **D**, **E** and **F** in the correct order.
The first one has been done for you.

D					

[2]

[Total: 2]

3 Aqueous ammonia is alkaline.

Which **one** of the following pH values could be the pH of aqueous ammonia?

Draw a circle around the correct answer.

pH 1 **pH 5** **pH 7** **pH 9**

[1]

[Total: 1]

4 Aqueous silver nitrate is used to test for chloride ions and iodide ions.

(a) The solutions are first acidified with dilute nitric acid.

Explain why dilute hydrochloric is **not** used to acidify the solution.

..... [1]

(b) Complete the table to show the expected observations.

ion	observations on adding aqueous silver nitrate
chloride (Cl^-)	
iodide (I^-)	

[3]

[Total: 4]

5 Is lithium oxide an acidic oxide or a basic oxide?
Give a reason for your answer.

.....

.....

..... [1]

[Total: 1]

6 This question is about solids, liquids and gases.

(a) The list gives the names of nine substances.

aqueous copper(II) sulfate

aqueous potassium manganate(VII)

aqueous sodium chloride

dilute hydrochloric acid

ethanol

hexene

mercury

octane

water

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

State which substance:

(a) is an alkane

..... [1]

(b) is used, when acidified, to test for sulfur dioxide

..... [1]

(c) turns blue litmus red

..... [1]

(d) reacts with sodium to produce only aqueous sodium hydroxide and hydrogen

..... [1]

(e) is produced by the addition of steam to ethene.

..... [1]

[Total: 5]

7 Sodium reacts with oxygen to form sodium oxide.

Is sodium oxide an acidic oxide or a basic oxide?
Give a reason for your answer.

.....

..... [1]

[Total: 1]

8 The following statements are about the procedure for making crystals of hydrated magnesium chloride from magnesium and dilute hydrochloric acid.

A Leave the mixture until no more bubbles are seen.

B Leave the mixture at room temperature to form more crystals.

C Add an excess of magnesium to dilute hydrochloric acid.

D Warm the filtrate to the point of crystallisation.

E Filter off the crystals and dry between filter papers.

F Filter off the excess magnesium.

Put the statements **A**, **B**, **C**, **D**, **E** and **F** in the correct order.
The first one has been done for you.

C					

[2]

[Total: 2]

9 The following statements are about the procedure for making crystals of hydrated zinc sulfate from zinc and dilute sulfuric acid.

A Warm the mixture until no more bubbles are seen.
B Add excess zinc to dilute sulfuric acid.
C Warm the filtrate to the point of crystallisation.
D Leave the mixture at room temperature to form more crystals.
E Filter off the excess zinc.
F Filter off the crystals and dry between filter papers.

Put the statements **A**, **B**, **C**, **D**, **E** and **F** in the correct order.
The first one has been done for you.

B					

[2]

[Total: 2]

10 Ammonia is used in the manufacture of nitric acid.

(a) Balance the chemical equation for the first step in the process.

$$4NH_3 + 5O_2 \rightarrow .....NO + 6H_2O$$

[1]

(b) The reaction is exothermic.

What is meant by the term *exothermic*?

.....

..... [1]

(c) The NO produced in the first step then reacts with oxygen to produce nitrogen dioxide, NO_2.

$$2NO + O_2 \rightarrow 2NO_2$$

How does this equation show that NO is oxidised?

.....

..... [1]

(d) Is nitrogen dioxide an acidic oxide or a basic oxide?
Give a reason for your answer.

.....

..... [1]

[Total: 4]

11 This question is about ammonia.

When ammonia gas reacts with hydrogen chloride gas, white fumes of ammonium chloride are formed.

$$NH_3 + HCl \rightarrow NH_4Cl$$

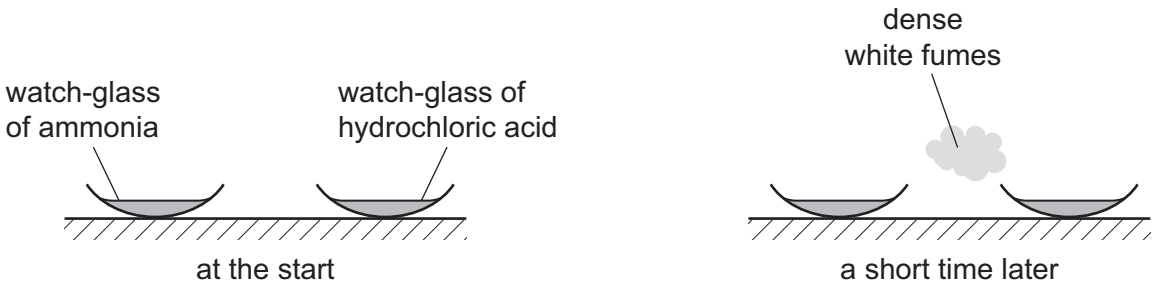
(a) What type of chemical reaction is this?

Draw a circle around the correct answer.

decomposition **neutralisation** **oxidation** **reduction**

[1]

(b) Watch-glasses of aqueous ammonia and concentrated hydrochloric acid were placed near each other on a table.
At first no white fumes were seen.
After a short time, white fumes were seen between the watch-glasses.



Explain these observations using the kinetic particle model.

.....

.....

.....

.....

.....

..... [3]

[Total: 4]

12 Aqueous sodium hydrogen sulfate, $NaHSO_4(aq)$, contains the ions $Na^+(aq)$, $H^+(aq)$ and $SO_4^{2-}(aq)$.

Describe what you would see if the following experiments were done.

(a) A flame test was done on aqueous sodium hydrogen sulfate.

..... [1]

(b) Solid copper(II) oxide was added to aqueous sodium hydrogen sulfate and the mixture was warmed.

.....

..... [2]

[Total: 3]

13 This question is about ions and ionic compounds.

Choose from the following list of ions to answer the questions.

Br^- Ca^{2+} $C\ell^-$ Cr^{3+} Cu^{2+}

K^+ Li^+ Na^+ SO_3^{2-} SO_4^{2-}

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

(a) State which ion gives a lilac colour in a flame test. ..... [1]

(b) State which ion forms a grey-green precipitate with aqueous ammonia . ..... [1]

(c) State which ion forms a white precipitate with aqueous sodium hydroxide . ..... [1]

(d) State which ion forms a cream precipitate with acidified aqueous silver nitrate . ..... [1]

(e) State which ion forms a white precipitate with acidified aqueous barium nitrate ..... [1]

[Total: 5]

14 Sulfur dioxide is a toxic gas.

(a) State one **environmental** reason why sulfur dioxide should not be released into the atmosphere.

..... [1]

(b) Describe the test for sulfur dioxide.

test .....

.....

observations .....

..... [2]

[Total: 3]

15 Describe how to do a flame test on a sample of a salt.

.....

.....

.....

..... [2]

[Total: 2]

16 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.

.....

..... [1]

[Total: 1]

17 Describe a test for iron(II) ions.

test .....

observations ..... [2]

[Total: 2]

18 A student investigates the rate of reaction of large pieces of magnesium carbonate with an excess of dilute nitric acid.

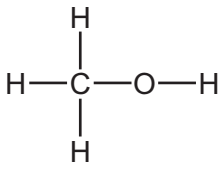
$$MgCO_3 + 2HNO_3 \rightarrow Mg(NO_3)_2 + CO_2 + H_2O$$

Name the salt formed when magnesium carbonate reacts with dilute nitric acid.

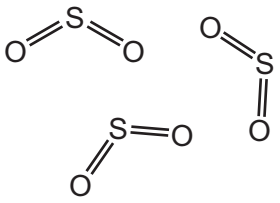
..... [1]

[Total: 1]

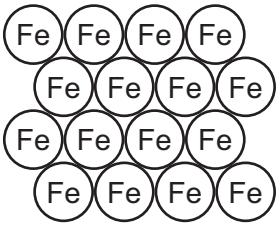
19 The diagrams show part of the structures of five substances, **A**, **B**, **C**, **D** and **E**.



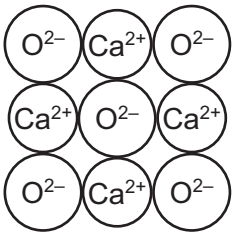
A



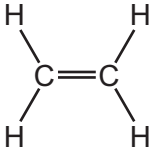
B



C



D



E

State which **one** of these structures, **A**, **B**, **C**, **D** or **E** reacts with an acid to form a salt and water.

..... [1]

[Total: 1]

20 When carbon is completely burned in air, carbon dioxide is formed.
Carbon dioxide forms a slightly acidic solution in water.

Which one of these pH values is the pH of a slightly acidic solution?
Draw a circle around the correct answer.

pH 6 pH 7 pH 8 pH 10

[1]

[Total: 1]

21 A student investigates the rate of reaction of small pieces of calcium carbonate with an excess of hydrochloric acid of concentration 1 mol / dm^3.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$$

Name the salt formed when calcium carbonate reacts with hydrochloric acid.

..... [1]

[Total: 1]

22 Describe how you could prepare a pure sample of crystals of hydrated copper(II) sulfate using dilute sulfuric acid and an excess of copper(II) oxide.

.....

.....

.....

.....

..... [3]

[Total: 3]

23 Excess sulfuric acid reacts with ammonia to make a salt which can be used as a fertiliser.

State the name of the salt formed when excess sulfuric acid reacts with ammonia.

..... [1]

[Total: 1]

24 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.

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

1 .....

2 ..... [2]

(b) 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.

1 .....

2 .....

3 ..... [3]

[Total: 5]

25 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.

..... [1]

(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.

$Pb(NO_3)_2(aq)$ + ... $NaN_3(aq) \rightarrow Pb(N_3)_2$(.....) + ...(.....) [2]

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

.....

.....

.....

..... [2]

[Total: 5]

26 Oxides can be classified as acidic, amphoteric, basic or neutral.

Classify each of these oxides:

sodium oxide .....

silicon(IV) oxide. ..... [2]

[Total: 2]

27 Describe a test for hydrogen.

test .....

result ..... [2]

[Total: 2]

28 Ammonia is a soluble base.

Which **one** of the following pH values could be the pH of aqueous ammonia?
Draw a circle around the correct answer.

pH 1 pH 5 pH 7 pH 10

[1]

[Total: 1]

29 Describe a test for sulfate ions.

test .....

observations ..... [2]

[Total: 2]

30 Describe a test for sodium ions.

test .....

result ..... [2]

[Total: 2]

31 Describe what is observed in these **two** reactions.

(a) An excess of aqueous sodium hydroxide is added to a solution containing Ca^{2+} ions.

..... [1]

(b) An excess of aqueous ammonia is added to a solution containing Ca^{2+} ions.

..... [1]

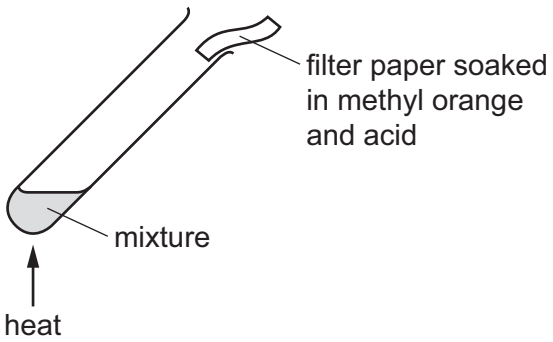
[Total: 2]

32 Describe what you would observe when aqueous silver nitrate is added to aqueous potassium bromide.

..... [2]

[Total: 2]

33 A mixture of ammonium chloride and aqueous sodium hydroxide is heated as shown.



The filter paper changes colour from red to yellow.

Explain why.

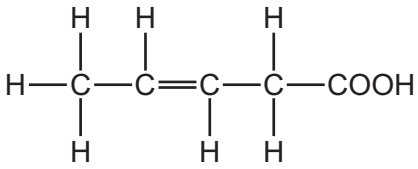
.....

..... [2]

[Total: 2]

34 The structure of compound **P** is shown.

compound **P**



(a) Compound **P** has a –COOH functional group.

Draw the structure of the –COOH functional group. Show all of the atoms and all of the bonds.

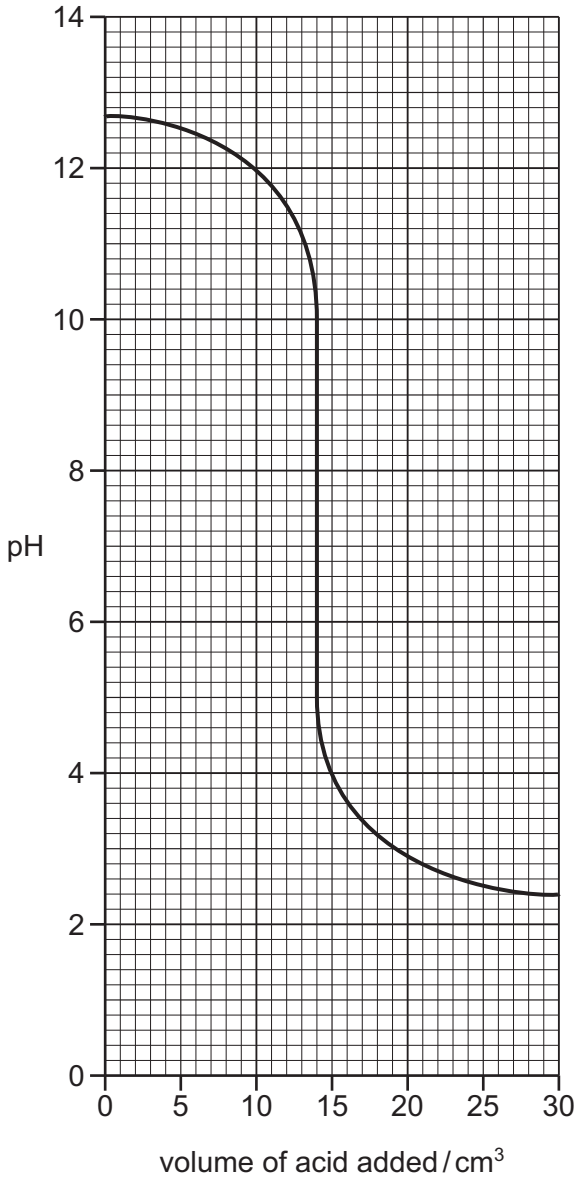
[1]

(b) What effect would compound **P** have on litmus solution?

..... [1]

[Total: 2]

35 The concentration of aqueous sodium hydroxide can be found by reacting it with an acid of known concentration.
The graph shows how the pH of aqueous sodium hydroxide in a conical flask changes as acid is added to it.



(a) Describe how the pH changes as the acid is added.

.....

.....

..... [2]

(b) What is the pH of the aqueous sodium hydroxide before the acid is added?

..... [1]

(c) What volume of acid has been added when the solution reaches neutral pH?

..... [1]

[Total: 4]

36 Copper(II) sulfate can be prepared by heating an excess of copper(II) oxide with dilute sulfuric acid.

(a) Complete the chemical equation for this reaction.

$$CuO + H_2SO_4 \rightarrow CuSO_4 + \text{.....}$$ [1]

(b) What method is used to separate the excess copper(II) oxide from the solution?

..... [1]

[Total: 2]

37 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**.

.....

..... [2]

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

..... [1]

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

..... [1]

[Total: 4]

38 The following formulae represent different substances.

Al Ag $CaCO_3$ CH_4 Cl_2 Cu SO_2

State which of these substances is a gas which bleaches damp litmus paper.

..... [1]

[Total: 1]

39 Which **one** of the following pH values could be the pH of dilute hydrochloric acid?
Draw a circle around the correct answer.

pH 1 pH 7 pH 9 pH 13

[1]

[Total: 1]

40 The names of nine gases are given.

ammonia

carbon monoxide

chlorine

ethane

ethene

helium

hydrogen

neon

oxygen

State which gas bleaches damp litmus paper.

..... [1]

[Total: 1]