TESTS FOR GASES, CATIONS AND ANIONS 2

Q1.

(i) The jar contained a mixture of common salt (sodium chloride, NaCl) and washing soda (sodium carbonate, Na_2CO_3).

To show that the mixture contains chloride ions, silver nitrate solution ($AgNO_3$) and nitric acid (HNO_3) are added. A white precipitate is produced.

$$AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$$

The carbonate ions in the mixture will affect the test for chloride ions.

Use the equations to explain why carbonate ions affect the test for chloride ions and how nitric acid overcomes this problem

$AgCl\ (s)$	+	$HNO_3\ (aq)$	→	no reaction				
$2AgNO_3\ (aq)$	+	$Na_2CO_3\ (aq)$	→	$Ag_2CO_3\ (s)$ white	+	$2NaNO_3\ (aq)$		
$Ag_2CO_3\ (s)$	+	$2HNO_3\ (aq)$	→	$2AgNO_3\ (aq)$	+	$H_2O\ (l)$	+	$CO_2\ (g)$

_____

_____

_____

_____

(2 marks)

(ii) Hydrochloric acid (HCl) should not be used instead of nitric acid when testing for chloride ions with silver nitrate solution.

_____

(1 mark)

Q2. Alums are salts. They have been used since ancient times in dyeing and medicine and still have many uses today.
Three alums are shown in the table.

Name	Ions present		
Ammonium alum	NH_4^+	Al^{3+}	SO_4^{2-}
Potassium alum	K^+	Al^{3+}	SO_4^{2-}
Sodium alum	Na^+	Al^{3+}	SO_4^{2-}

A student tested these alums to show which ions were present.

(a) The student did a flame test on these alums. A sample of each alum was held on a wire in a colourless flame.

In (i) and (ii) use the correct word from the box to complete each sentence.

blue	lilac	yellow	green

(i) Sodium ions give a ..... flame.

(1 mark)

(ii) Potassium ions give a ..... flame.

(1 mark)

(iii) Draw a ring around the correct answer to complete the sentence.

The wire used in a flame test should have a high

density.
electrical conductivity.
melting point.

(1 mark)

(b) Draw a ring around the correct word to complete the sentences.

(i) The student tested a solution of each salt for sulfate ions (SO_4^{2-}).

The student added dilute hydrochloric acid and

barium chloride
nitric acid
silver nitrate

solution and a white

gas
liquid
solid

was formed.

(2 marks)

(ii) The student tested a solution of each salt for aluminium ions (Al^{3+}).
The student added sodium hydroxide solution and a

green
red
white

precipitate was formed. When excess sodium hydroxide solution was added, the precipitate

boiled.
condensed.
dissolved.

(2 marks)

(c) Aluminium ions do not give a colour in flame tests. However, flame tests can be used to distinguish between these three alums.

Explain how these three alums could be identified from the results of flame tests.

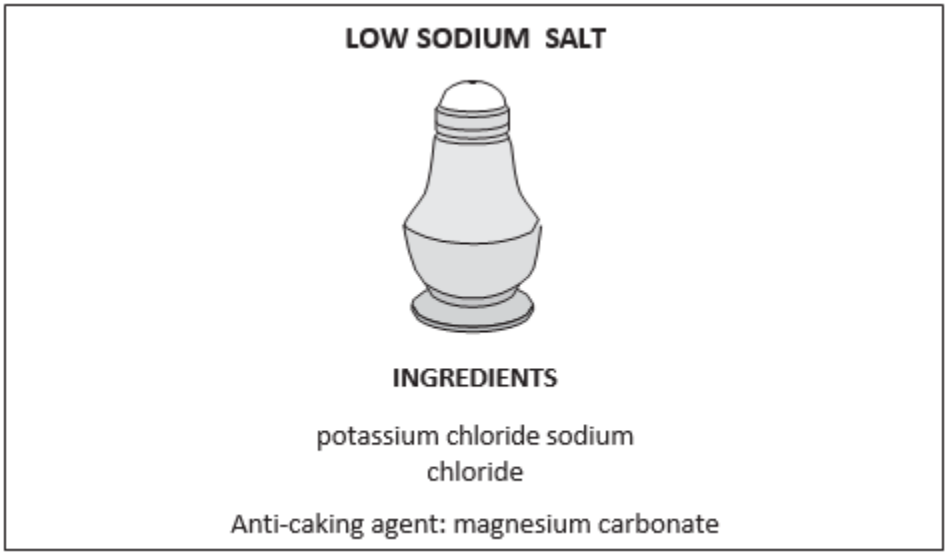
_____

_____

_____

(2 marks)

Q3. The label is from a packet of Low Sodium Salt.



A student tested some Low Sodium Salt to show that it contains carbonate ions and chloride ions.

(i) Describe and give the result of a test for carbonate ions.

_____

_____

_____

(2 marks)

(ii) A student identified chloride ions using acidified silver nitrate solution. State what you would see when acidified silver nitrate solution is added to a solution of Low Sodium Salt.

_____

_____

(1 mark)

(iii) Flame tests can be used to identify potassium ions and sodium ions. Suggest why it is difficult to identify both of these ions in Low Sodium Salt using a flame test.

_____

_____

(1 mark)

Q4. A bottle of washing soda was found in a school laboratory. The modern name of washing soda is sodium carbonate.

A student tested the washing soda to prove that it was sodium carbonate.

(a) The student did a flame test to show that washing soda is a sodium compound.
The student used a clean wire to put the washing soda into the flame.

(i) Why should the wire be clean when used for a flame test?

_____

(1 mark)

(ii) The table shows some properties of metals.
Two of these are properties that the wire must have if it is used for a flame test.

Put a tick (✓) next to the two correct properties.

Property	**(✓)**
Good electrical conductor	
High density	
High melting point	
Low boiling point	
Unreactive	

(2 marks)

(iii) Which one of the following flame colours shows that washing soda is a sodium compound?

Draw a ring around your answer.

brick-red **lilac** **yellow-orange**

(1 mark)

(b) The student used dilute hydrochloric acid to show that washing soda was a carbonate.
Carbon dioxide gas was given off.

(i) Describe what you see happening when a gas is given off.

_____

(1 mark)

(ii) The student used limewater to prove that the gas given off was carbon dioxide.
Complete this sentence by choosing the correct word from the box.

clear	colourless	milky

When carbon dioxide reacts with limewater, the limewater turns _____.

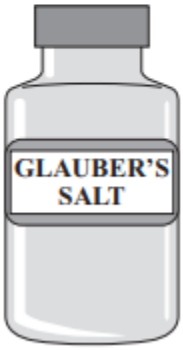
(1 mark)

Q5. Four bottles of chemicals made in the 1880s were found recently in a cupboard during a Health and Safety inspection at Lovell Laboratories.

Sodium carbonate

Sodium chloride

Sodium nitrate



Sodium sulfate

The chemicals are correctly named.
You are provided with the following reagents:

- aluminium powder
- barium chloride solution acidified with dilute hydrochloric acid

- dilute hydrochloric acid
- silver nitrate solution acidified with dilute nitric acid
- sodium hydroxide solution.

(i) Describe tests to show that these chemicals are correctly named.
In each case give the reagent(s) you would use and state what you would see.

Test and result for carbonate ions:

_____

_____

Test and result for chloride ions:

_____

_____

Test and result for nitrate ions:

_____

_____

Test and result for sulfate ions:

_____

_____

(5 marks)

(ii) Suggest why a flame test would not distinguish between these four chemicals.

_____

(1 mark)

Total marks (28)