

PAG C5 Identification of Species

Question	Maximum Mark	Mark Awarded
1	10	
2	6	
3	6	
4	5	
5	6	
6	4	
Total Mark		

1. (a) The following box contains the names of six ionic compounds.

sodium chloride	sodium carbonate	copper(II) sulfate
ammonium chloride	potassium sulfate	lithium carbonate

State which of the compounds in the box you would expect to

- (i) give a yellow flame in a flame test, [1]

.....

- (ii) produce bubbles when reacting with hydrochloric acid. [1]

.....

- (b) A student has two colourless solutions in unlabelled bottles. He knows that one is potassium chloride and that the other is potassium iodide. Describe a test that could be carried out to distinguish between the solutions, giving the observations expected in both cases. [3]

.....

.....

.....

- (c) Compounds containing ammonium ions can be identified by heating gently with sodium hydroxide solution and testing the gas produced.

Name the gas produced and describe how you would positively identify this gas. [2]

.....

.....

- (d) Iron(III) chloride solution produces a brown precipitate when it reacts with sodium hydroxide solution.

Write a balanced ionic equation for this reaction. You should include state symbols. [3]



10

2.

(a) Draw a line from each gas below to the observation made in identifying it. [3]

Gas	Observation
	relights a glowing splint
carbon dioxide	turns flame red
ammonia	turns limewater milky
oxygen	pops with a burning splint
	turns damp red litmus blue

(b) The following box contains observations made when testing for some common metal ions.

lilac flame	yellow flame	green flame
blue precipitate	brown precipitate	green precipitate
	white precipitate	

Choose from the box the result you would expect for the following tests. [3]

A flame test is carried out on a sample of sodium chloride

.....

A flame test is carried out on a sample of copper(II) sulfate

.....

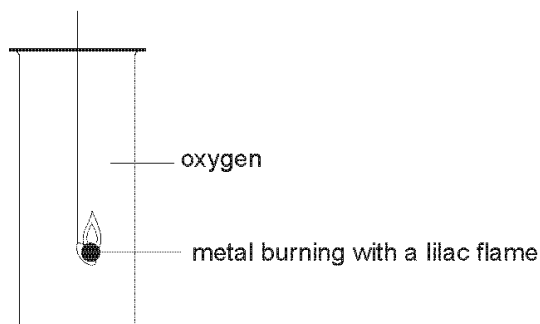
Sodium hydroxide solution is added to a solution of iron(III) chloride

.....

6

3.

A Group 1 metal is burned in a gas jar containing oxygen.



(a) Use the information in the diagram above to name the Group 1 metal. [1]

.....

(b) Write a word equation for the reaction taking place. [1]

..... + →

(c) Give the name of a Group 1 metal that would react less vigorously than the metal named in (a) above. [1]

.....

(d) A similar reaction can be carried out using chlorine instead of oxygen. The product obtained is a white solid.

(i) Choose from the box below a solution that could be used to show that the white solid contains chloride ions. [1]

limewater	silver nitrate	sodium hydroxide	sulfuric acid
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Solution

(ii) State what must be done to the white solid in order to carry out the test. [1]

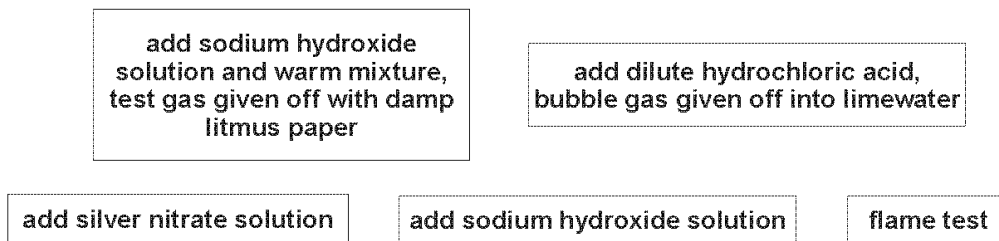
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(iii) Give the colour of the precipitate formed. [1]

.....

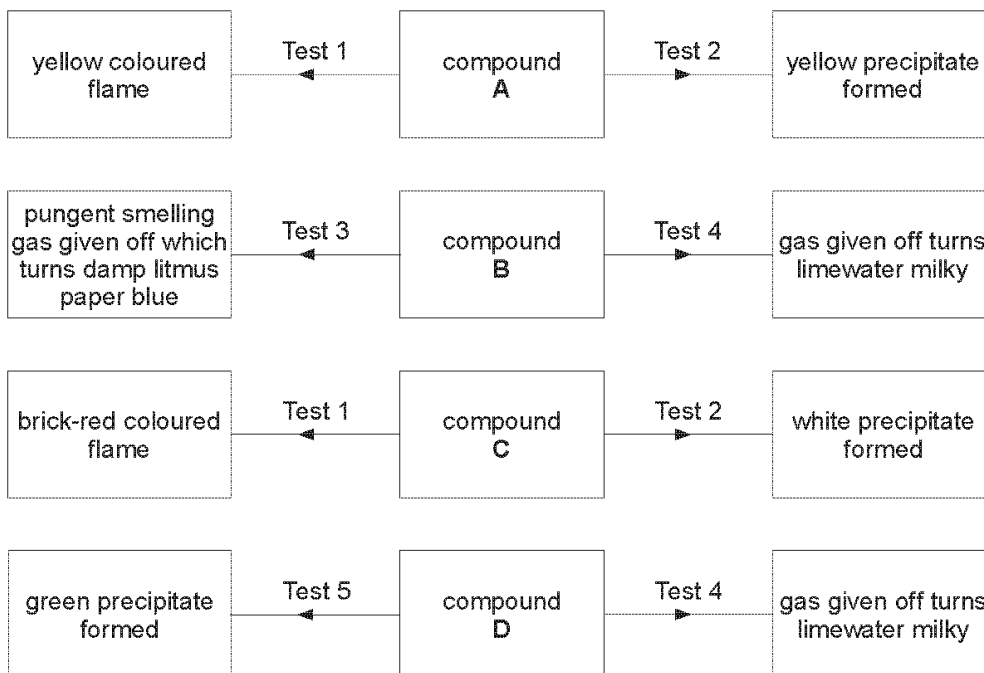
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4. (a) A pupil used the following tests to identify unknown compounds A, B, C and D.



These are described as tests 1 to 5 but not necessarily in this order.

The flow charts show the results obtained for each compound.



Deduce which test is which and hence give the names of compounds A, B, C and D. [4]

- A
- B
- C
- D

(b) Describe the test for sulfate ions in solution. Include the result for your test. [1]

.....

5

5.

Substance **S** is a white, solid metal bromide. It dissolves readily in water to give a colourless solution.

(a) On carrying out a flame test with substance **S** a red colour was seen. Name the metal ions present in substance **S**. [1]

.....

(b) Some silver nitrate solution was added to a solution of substance **S**.

(i) State what was seen. [1]

.....

(ii) Give the ionic equation for the reaction taking place. [2]

..... + \longrightarrow

(c) When a Group 7 gas, **G**, is passed through a solution of **S**, the solution turns orange.

(i) Name gas **G**. [1]

(ii) Give the name of the **type** of reaction that takes place between gas **G** and substance **S**. [1]

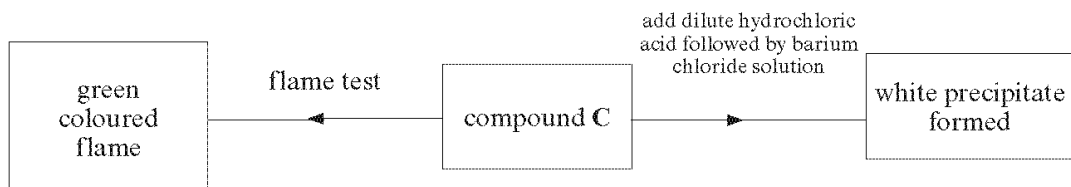
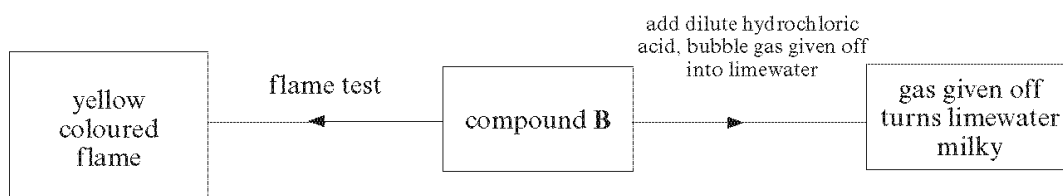
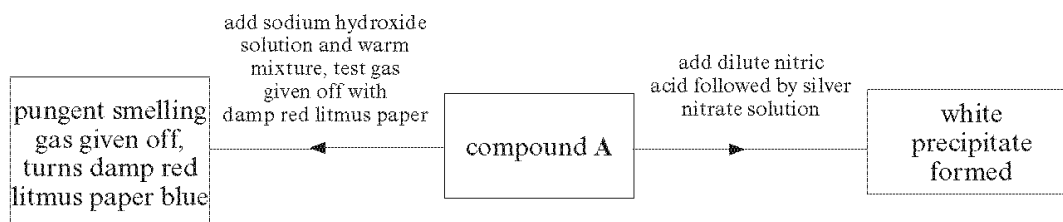
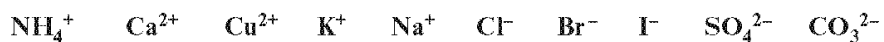
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6.

(a) The flow charts below show tests carried out on compounds A, B and C and the results of those tests.

The compounds were known to include some of the following ions.



Use the information to give the chemical formulae of compounds A, B and C.

[3]

A

B

C

(b) Aqueous iron(III) ions form an orange-brown precipitate when mixed with aqueous sodium hydroxide.

Give the letter A, B, C, D or E for the ionic equation which correctly represents this reaction. [1]



Letter

4

Marking Scheme

1.

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
	6	(a)	(i)	1	sodium chloride / sodium carbonate			
			(ii)	1	sodium carbonate / lithium carbonate			
		(b)		3	add silver nitrate solution (1) white precipitate with potassium chloride (1) yellow precipitate with potassium iodide (1) allow (1) for both colours correct if precipitate not used in either case	answer based on displacement reaction – bromine water; description of colour changes	add HNO ₃ flame test	
		(c)		2	ammonia (1) turns (damp) red litmus blue (1)			
		(d)		3	Fe ³⁺ + 3OH ⁻ (1) Fe(OH) ₃ (1) correct state symbols (1)			

2.

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
3		(a)		3	carbon dioxide → turns limewater milky (1) ammonia → turns damp red litmus blue (1) oxygen → relights a glowing splint (1)			
		(b)		3	yellow flame (1) green flame (1) brown precipitate (1)			

3.

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
2		(a)		1	potassium	K		
		(b)		1	potassium + oxygen → potassium oxide follow through (ft) error from (a) only if Group 1 metal given	K + O ₂ → K ₂ O (ignore balancing) consequential possible	gas	
		(c)		1	lithium / sodium ft only if Group 1 metal given is less reactive than that named in (a)	Li / Na		
		(d)	(i)	1	silver nitrate	AgNO ₃		
			(ii)	1	dissolved (in water)	diluted / solution	liquid / molten	
			(iii)	1	white independent of (i)		milky	creamy

4.

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
	7	(a)		4	<p>A sodium iodide B ammonium carbonate C calcium chloride D iron(II) carbonate</p> <p>mark positive and negative ions independently</p> <p>8 ions correct = 4 marks 6/7 ions correct = 3 marks 4/5 ions correct = 2 marks 2/3 ions correct = 1 mark</p>	<p>NaI (NH₄)₂CO₃ CaCl₂ FeCO₃</p> <p>no credit for either ion if incorrect formula given instead of name – ignore formulae if names also given</p>		
		(b)		1	<p>barium chloride (solution forms a) white precipitate</p> <p>test and result needed</p>	barium nitrate / Ba ²⁺ (aq)		

5.

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
	7	(a)		1	lithium / Li ⁺	Li Ca Sr		
		(b)	(i)	1	cream precipitate	off white ppt		pale yellow ppt
			(ii)	2	<p>Ag⁺ + Br⁻ (1) AgBr (1)</p>			
		(c)	(i)	1	chlorine / fluorine	Cl ₂ / F ₂	Cl / F	
			(ii)	1	displacement	redox		

6.

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
	8	(a)		3	<p>A NH₄Cl B Na₂CO₃ C CuSO₄</p> <p>all ions correctly identified (2) 3, 4 or 5 ions correctly identified (1) all formulae correct (1)</p>	<p>correct names only for all three compounds (2)</p>		
		(b)		1	D			