

Name:

Class: ()

Date:

**S5 Chemistry
SBA Experiment
Qualitative Analysis**

Objective:

- To distinguish five colourless solutions from each other

Apparatus and Chemicals

- test tubes in rack
- droppers
- protective gloves
- wash bottle
- distilled water
- dilute $\text{HNO}_3(\text{aq})$ (2 mol dm^{-3})
- dilute $\text{CaCl}_2(\text{aq})$ (2 mol dm^{-3})
- dilute $\text{NaCl}(\text{aq})$ (2 mol dm^{-3})
- dilute $\text{Na}_2\text{CO}_3(\text{aq})$ (1 mol dm^{-3})
- dilute $\text{Pb}(\text{NO}_3)_2(\text{aq})$ (0.2 mol dm^{-3})

Safety:

1. Avoid direct contact with chemicals. Safety glasses and protective gloves must be worn.
2. Dispose of chemical wastes and excess materials according to your teacher's instruction.

Task:

- In this investigation, there are five test tubes randomly labelled as **A, B, C, D** and **E**. Each of the test tubes contains one of the following colourless solutions. Mix the solutions and record all your observations in the results table given.



Procedure:

1. Use 2 cm^3 of each reagent for all tests.
2. After the addition of any reagent, shake the test tube gently to facilitate the mixing.
3. Make careful observations and record all observations immediately after each test.

Assessment Criteria:

Marks	Remarks
10 – 9	<ul style="list-style-type: none">● Nearly all observations are accurately described.● The five solutions are logically distinguished.● Safety procedures have been observed.
8 – 6	<ul style="list-style-type: none">● Some observations are accurately described.● At least three of the solutions are logically distinguished.● Safety procedures have been observed.
5 – 3	<ul style="list-style-type: none">● Some observations are accurately described.● At least two of the solutions is logically distinguished.● Safety procedures have been observed.
2 – 1	<ul style="list-style-type: none">● Some observations are accurately described.● At least one of the solutions is distinguished.

Teacher's Remark (if any):

- During the experiment, students' practical skills can also be assessed.
- Students should be reminded that marks may be adjusted if unsafe practice is noted.

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Marks:

/10

Results:

Observation	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
<i>A</i>				
<i>B</i>	—			
<i>C</i>	—	—		
<i>D</i>	—	—	—	

From your observations, distinguish what **A**, **B**, **C** and **D** are. Explain your distinguishing process.

Solution A	Solution B	Solution C	Solution D	Solution E

Results:

Observation	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
<i>A</i>	No observable change	No observable change	White precipitate formed	No observable change
<i>B</i>	—	White precipitate formed	White precipitate formed	No observable change
<i>C</i>	—	—	White precipitate formed	Colourless gas bubbles evolved
<i>D</i>	—	—	—	No observable change

From your observations, distinguish what **A**, **B**, **C** and **D** are. Explain your distinguishing process.

C reacts with **E** to give a colourless gas, **C** and **E** may be $\text{Na}_2\text{CO}_3(\text{aq})$ and $\text{HNO}_3(\text{aq})$.
i.e. $\text{Na}_2\text{CO}_3(\text{aq}) + 2\text{HNO}_3(\text{aq}) \rightarrow 2\text{NaNO}_3(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$

E does not give any significant observable change when mixes with **A**, **B** and **D**.
It is just like that $\text{HNO}_3(\text{aq})$ would not react with $\text{CaCl}_2(\text{aq})$, $\text{NaCl}(\text{aq})$ and $\text{Pb}(\text{NO}_3)_2(\text{aq})$.

Therefore, **E** is $\text{HNO}_3(\text{aq})$ and hence **C** is $\text{Na}_2\text{CO}_3(\text{aq})$.

C ($\text{Na}_2\text{CO}_3(\text{aq})$) does not react with **A**,
A should be $\text{NaCl}(\text{aq})$.

C (Na_2CO_3) reacts with **B** and **D** to give white precipitate.
B and **D** may be $\text{CaCl}_2(\text{aq})$ or $\text{Pb}(\text{NO}_3)_2(\text{aq})$.
i.e. $\text{Na}_2\text{CO}_3(\text{aq}) + \text{CaCl}_2(\text{aq}) \rightarrow 2\text{NaCl}(\text{aq}) + \text{CaCO}_3(\text{s})$
 $\text{Na}_2\text{CO}_3(\text{aq}) + \text{Pb}(\text{NO}_3)_2(\text{aq}) \rightarrow 2\text{NaNO}_3(\text{aq}) + \text{PbCO}_3(\text{s})$

B ($\text{CaCl}_2(\text{aq})$ or $\text{Pb}(\text{NO}_3)_2(\text{aq})$) does not react with **A** ($\text{NaCl}(\text{aq})$),
B should be $\text{CaCl}_2(\text{aq})$.

D ($\text{CaCl}_2(\text{aq})$ or $\text{Pb}(\text{NO}_3)_2(\text{aq})$) reacts with **A** ($\text{NaCl}(\text{aq})$) to give a white precipitate,
D should be $\text{Pb}(\text{NO}_3)_2(\text{aq})$.
i.e. $\text{Pb}(\text{NO}_3)_2(\text{aq}) + 2\text{NaCl}(\text{aq}) \rightarrow 2\text{NaNO}_3(\text{aq}) + \text{PbCl}_2(\text{s})$

Solution A	Solution B	Solution C	Solution D	Solution E
$\text{NaCl}(\text{aq})$	$\text{CaCl}_2(\text{aq})$	$\text{Na}_2\text{CO}_3(\text{aq})$	$\text{Pb}(\text{NO}_3)_2(\text{aq})$	$\text{HNO}_3(\text{aq})$