



Suggested Answers to 2016 O level Science Chemistry 5076/5077/5078 Paper 5

In the 2016 Science (Chemistry) practicals, 3 solutions (sodium carbonate, hydrochloric acid and silver (II) nitrate) were given. The 3 solutions were labelled as P, Q and R in no particular order. Students were required to identify the unknown solutions. Additional information: Most metal carbonates are insoluble in water except Group 1 metal carbonates.

Experiment 1

Instruction	Observation	Teacher's Comment
Add P to Q	Yellow-grey ppt	Since no effervescence was seen, this is not a reaction between HCl and sodium carbonate. The yellow-grey ppt could be silver carbonate with some elemental silver.
Add R	White ppt. Effervescence.	Silver carbonate reacts with HCl to give silver chloride (white ppt) but the effervescence stops very quickly as the silver chloride forms a protective layer on the remaining silver carbonate, preventing further reaction. Therefore, R could be HCl.
Add R to P	White ppt	Since no effervescence was seen, this is not a reaction between HCl and sodium carbonate. If R is HCl, then P must be silver (II) nitrate. Since silver nitrates produce a white ppt with chlorides, this could be a reaction between AgNO_3 & HCl.
Add Q	White ppt remains. Effervescence. Gas evolved gives white ppt with limewater.	Based on the above observation, a reaction between AgNO_3 & HCl will produce AgCl (white ppt) & HNO_3 . The nitric acid produced reacts with Q (sodium carbonate) to give off carbon dioxide gas and sodium nitrate which is highly soluble in water.
Add Q to R	No ppt. Effervescence. Gas evolved gives white ppt with limewater.	HCl (R) reacts with sodium carbonate (Q) to give off carbon dioxide gas and sodium chloride.
Add P	White ppt	Sodium chloride reacts with silver (II) nitrate (P) in a precipitation reaction to produce AgCl (white ppt) and sodium nitrate which is highly soluble in water.



Experiment 2

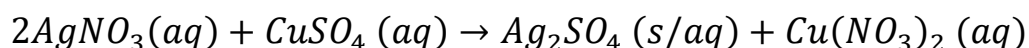
Add copper (II) sulphate to solutions P, Q & R respectively. Heat for 5 minutes without vigorous boiling. Record all observations and test for any gases produced.

Instruction	Observation	Teacher's Comment
Add 1 cm ³ of P to 1 cm ³ of copper (II) sulphate and heat strongly.	Blue solution with white ppt.	Copper sulphate reacts with silver (II) nitrate (P) in a precipitation reaction to produce Ag ₂ SO ₄ (white ppt) and copper nitrate solution (blue solution).
Add 1 cm ³ of Q to 1 cm ³ of copper (II) sulphate and heat strongly.	Green ppt	Copper sulphate reacts with sodium carbonate (Q) in a precipitation reaction to produce CuCO ₃ (green ppt) and sodium sulphate solution.
Add 1 cm ³ of R to 1 cm ³ of copper (II) sulphate and heat strongly.	No visible change	Acidified copper sulphate

Use your observations from the two experiments to identify P, Q & R and provide evidence to support your answer.

Substance	Identity	Evidence
P	silver (II) nitrate	Only silver nitrate produces a white ppt and a blue solution when added to copper sulphate and a white ppt when added to aqueous sodium chloride.
Q	sodium carbonate	Produces a green ppt when added to copper sulphate and gives off carbon dioxide when added to nitric acid.
R	hydrochloric acid	Produces no visible change when added to copper sulphate and reacts with Q to give off carbon dioxide gas.

Q: Write a chemical equation for the reaction between silver (II) nitrate and copper(II) sulphate.



Teacher's comment: Ag₂SO₄ is sparingly soluble. Hence, the state symbols can be recorded as (aq) according to the syllabus or as (s) according to the observations.



Q: Explain any other changes you saw but did not record. Give an explanation on how you arrived at your answer.

In Experiment 1, although I saw effervescence, I was not able to test for the gas evolved when R was added to the yellow ppt formed after Q was added to R.

Use information in Teacher's comment to give your explanation.