# Creating Science – Precipitation, 'Tut, tut, it looks like rain!'

*Sometimes when we mix chemicals the results are invisible, but at other times, they're really obvious.*

*#CreatingSciencePrecipitation*

## Suggested Outcomes

(NOTE: This is by no means an exhaustive list of possible outcomes, neither is it intended that ONLY these outcomes can or should be met. Science is a deeply interrelated activity, and you may find cross curriculum links you can and should use.)

### Science content

- Chemical sciences 4: Natural and processed materials have a range of physical properties that can influence their use (ACSSU074)

### Science inquiry skills

- Planning and conducting 6: Identify, plan and apply the elements of scientific investigations to answer questions and solve problems using equipment and materials safely and identifying potential risks (ACSIS103)

### Science as a human endeavour

- Use and influence of science 6: Scientific knowledge is used to solve problems and inform personal and community decisions (ACSHE100)

### Science vocabulary words

Tier 3 (Specialised vocabulary)

- Precipitation. To fall out of – rain precipitates from the clouds, and in this demonstration today, solid dust precipitates from the mixture of two liquids.

## Warning

- Chemicals used today, while safe for humans in the correct dosage, should not be consumed in any way today! – Gloves, goggles and lab coats please!
- Chemicals today can stain, please be careful.

## Preparation

- Four chemicals as a powder, generally available at gardening and hardware stores:
    - Copper sulphate
    - Sodium Carbonate
    - Calcium Chloride

    - Potassium Iodine
- 4 stations for working – with spill safety gear.
    - A cup for containing our solution.
    - Water for making the solution.
    - The powder, above, for making the solution.
    - A means of measuring 50ml of water and 5-10ml of the powder.
    - A stick for mixing the solution.
    - A pipette for collecting a small amount of the solution.
- 6 test tubes per student or group, or at least 1 test tube that gets washed out a lot.[1]

# Suggestions for other year levels

As always, more material is presented here than can be used by the average class during the average lesson time. However, since the students questions can and should guide student learning, more material is presented for you convenience. Remember, it is not uncommon for students to only remember those points which answered their personal questions.

## Younger:

This activity is well suited to this age group with adult supervision. Children at this age can have difficulty with focus. Avoid tangents into interesting side tracts if you're attempting to make a key point.

## Middle:

A good focus on the importance of recording results is desirable here.

## Teen:

Helping students to utilise and research the *actual chemical formulas* for the reagents today can be fun. They can even predict what the results will be, and then find ways to test their predictions – what reaction today creates table salt? (Sodium Chloride).

# Learning Intent (student friendly)

'We are learning to' (WALT) – make precipitate reactions

## Success criteria

'What I'm looking for' (WILF) – 6 tests, with three precipitations and 3 reactions that do not result in any precipitates.

## Student learning goals

Help students make a self-monitored learning goal for this lesson.

[1] Sometimes rinsing the test tube regularly can be helpful – the precipitates can be hard to wash out (esp. calcium carbonate, aka 'chalk'). One the other hand, leaving them to sit there for hours is also interesting, to see what forms. Your call.

## Evidence of learning

How will you know when the learning goal is achieved? What EVIDENCE do you have that your students have met or exceeded the learning expectations?

- They will have made six reactions and can appreciate that 'no precipitates' is still a valid result in science. Higher groups can name the reagents and the results.

# Engage

- ⇨ Note the Learning Intention of this lesson for students.
- ⇨ Make sure all students write down any questions they may have generated during this phase regarding the topic for today.

Discuss rain and precipitation, and explain that we are going to make a solid 'dust' out of two completely liquid solutions.

# Explore

- ⇨ Encourage and validate student explanations of this phenomenon. You may like to ask students to write or draw their explanation personally to avoid embarrassment to students unfamiliar with this material. Remember, 'I don't know' is a valid explanation in science – it is the beginning of learning new things!

Perform the 'Participating in Precipitation' activity in the appendix.

# Explain

Theory: Sometimes when you mix two liquid solutions, it can create a solid that seems to 'rain' down out of the solution – called a precipitate. Which reactions above created a precipitate?

Here's a few that work really well:

Calcium chloride + sodium carbonate = Calcium carbonate (a solid – it's chalk!) + sodium chloride (table salt, dissolved in the water still)

$CaCl_2(aq)+Na_2CO_3(aq)-->CaCO_3(s)+2NaCl(aq)$

Potassium Iodine + Copper sulphate = Potassium sulphate (a white precipitate) + Copper Iodine (which dissolves in the water to make a brown solution of copper, water and iodine)

Copper sulphate + sodium carbonate = copper carbonate (aka 'malachite or azurite') and sodium sulphate (dissolves in the water).

Can you see how many of the reactions today simply traded partners? Sometimes they stayed together to create precipitates, sometimes the pull of the water molecules we too powerful and they broke apart again and thus remained as a solution.

### What about those that didn't do nothing?

Not every reaction will result in a precipitate. Most of these mixtures today will simply form a new solution. The atoms are still there, they're just free to flow around and not creating any new molecules.

The Copper Iodine is interesting. They make the solution very brown. The actual precipitate is the Potassium sulphate, which is not immediately obvious as a thin white powder.

### What else can we try?

Go easy with this activity, as with many others in chemistry. Some household chemicals are way too dangerous to use.

## Elaborate

- ⇨ Ask students if they can design new ways to test this explanation, is it really sufficient? Can they think of further or better explanations, and the experiments needed to test them?

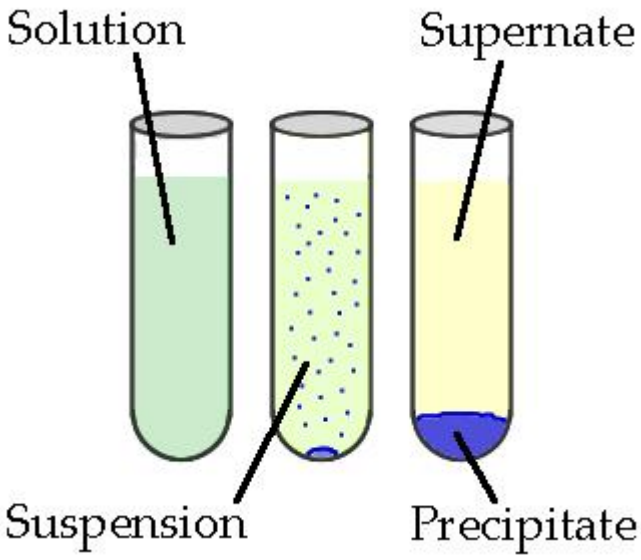


image taken 4 jun 18 from https://chem.libretexts.org/Core/Inorganic_Chemistry/Descriptive_Chemistry/Main_Group_Reactions/Reactions_in_Aqueous_Solutions/Precipitation_Reactions

### What do we use precipitation reactions for?

"A common place where precipitation is used is in treatment of wastewater. If a contaminant can form an insoluble solid then we can precipitate out the contaminant ion(s). A frequent concern in

wastewater treatment is the presence of heavy metals in water. Since many hydroxide and sulfide compounds of heavy metals are insoluble in water, we can add a source of hydroxide that is soluble (i..e NaOH or Na2S) that will result in the precipitation..." taken 4 jun 18 from https://www.enotes.com/homework-help/what-an-example-precipitation-reaction-that-used-325711

# Evaluate

- ⇨ Review with students what the felt they learnt from this unit. Did they have any questions at the start that they feel were answered?

## Success criteria

- ⇨ Review the Learning Intentions of this lesson with students. Was it met?

At the end of each class, review the learning objective and see how we did. Ask:

- Did you achieve your learning goal?
- What did You learn?
- What worked to help you achieve it?
- What might you do better next time?
- (If needed) where can you go for extra help or information?

# Assessment

## Prior Learning:

Find out what students already know about 'precipitation'. Do they think it is possible to make a solid out of two liquids?

## Formative:

As students are learning, help them self-monitor their own learning and achievements.

Help them keep accurate records of their activity.

## Summative:

Help students consider ways they can communicate their new understanding to others, just as scientists need to do.

# So what?

Solids can be made from liquids without freezing them.

Some chemical reactions create amazing new products, others not so much.

# Creating science

## Science content

- As we made precipitation reactions we learnt that - Natural and processed materials have a range of physical properties that can influence their use (ACSSU074)

## Science inquiry skills

- As we carefully did our experiment, we were - Planning and conducting 6: Identify, plan and apply the elements of scientific investigations to answer questions and solve problems using equipment and materials safely and identifying potential risks (ACSIS103)

## Science as a human endeavour

- As we learnt how precipitation reactions can help make water clean, we saw that - Scientific knowledge is used to solve problems and inform personal and community decisions (ACSHE100)

# Appendix: Participate in the Precipitate!

*Now that we've 'hidden' chemicals, and revealed them again, why don't we try uncovering chemicals we didn't even know where there!*

1. Get into four groups. Each group needs to make up ONE of the following solutions using four large beakers made up of 60ml of water and 1/3 teaspoon of:
    - Copper sulphate
    - Sodium Carbonate
    - Calcium Chloride
    - Potassium Iodine
2. Time to test and share!
    a. Place around 10ml of one chemical into a test tube (~ 3 pipettes worth).
    b. Carry that test tube CAREFULLY to another station.
    c. Place inside 1 pipette worth of the new chemical.
    d. Record you results.

| | **1st chemical** | **2nd chemical** | **Result** |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |

Now, explain your results!

| **Chemical Mix** | **Result** |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |

Dispose of your chemicals properly and try another one! Record your results *Carefully*!