

EduTrend Contents

W4C · CHEMISTRY · MIDDLE SCHOOL

Mystery Powders

Use chemical tests to identify five white powders.

Ages 11–14 | Level: Intermediate | 60 minutes | Pairs · up to 30 | Activity 03

Inside: activity at a glance · step-by-step session plan · facilitator notes · 3 student worksheets · assessment checklist

ACTIVITY 03 · AT A GLANCE

Mystery Powders

Students act as forensic chemists. Five white powders look almost identical, but each behaves differently with water, vinegar and iodine solution. Students test each known powder, build an identification table and then identify a mystery sample using evidence. The activity develops systematic testing, observation and reasoning from data.

Learning outcomes

By the end of the session students can:

- carry out simple chemical tests safely and systematically;
- record observations in a results table;
- use a table of results to identify an unknown substance;
- distinguish between physical and chemical changes in their observations.

KEY WORDS

chemical test · reactant · dissolve · effervescence · indicator · starch · identification key

CURRICULUM LINKS

Science: chemical reactions, working scientifically. Maths: organising data in tables. Links to forensic science careers.

1	2	3	4	5	6
QUESTION	**PREDICT**	**PLAN**	**TEST**	**OBSERVE**	**EXPLAIN**
What do we want to know?	What will happen?	Keep it fair	Try it safely	Record results	Why did it happen?

Materials (per pair)

- 5 labelled powders: salt, sugar, bicarbonate of soda, cornflour, plaster of Paris (or chalk powder)
- Mystery powder (one of the five)
- Spotting tile or 6 small cups
- Water, vinegar and dilute iodine solution in dropper bottles
- Spatulas and a hand lens
- Worksheets 1, 2 and 3

Before the session

- Put each powder in a labelled pot with its own spatula.
- Prepare mystery samples in numbered bags and keep a key.
- Dilute iodine solution to a pale yellow-brown.
- Try all tests yourself to check results.
- Set up goggles for everyone.

SAFETY

Goggles on throughout. Iodine solution stains skin and clothes: use droppers and wipe spills. Do not taste any powder. Wash hands at the end.

ACTIVITY 03 · SESSION PLAN

Step by step

The test results table on Worksheet 1 is the key output. Collect class results before the mystery challenge so that pairs can check against each other.

Time	What happens	Say or ask
0–5 min **Hook**	Show a "crime scene" photo with white powder on a table. Which powder is it? How could we find out without tasting?	*"What makes a good test?"*
5–10 min **Observe**	Pairs look at each powder with a hand lens and note texture and grain shape.	*"Can you tell them apart by looking alone?"*
10–35 min **Test**	Pairs test each powder with water, then vinegar, then iodine, using a small spatula tip each time. They record observations on Worksheet 1.	*"What exactly do you see? Fizzing, dissolving, colour change?"*
35–40 min **Check**	Compare results across the class and agree a final table.	*"Which result was unexpected? Why might pairs differ?"*
40–55 min **Solve**	Pairs identify the mystery powder and write their evidence on Worksheet 2.	*"Which test was decisive?"*
55–60 min **Reflect**	Discuss which tests showed chemical changes. Worksheet 3.	*"Which observations show a new substance was made?"*

CHALLENGE CARD (print or copy onto the board)

Identify the mystery powder using no more than three tests. Write a conclusion that a detective could use in court: what you did, what you saw and what it proves.

ACTIVITY 03 · FACILITATOR NOTES

The chemistry in brief

Each powder has its own set of properties. Salt and sugar dissolve in water; cornflour and plaster do not. Bicarbonate of soda fizzes with vinegar because it reacts with the acid to make carbon dioxide. Iodine solution turns blue-black with starch, so cornflour gives a striking colour change. Plaster of Paris feels warm and starts to set when mixed with water.

Dissolving is a physical change: the substance is still there and could be recovered by evaporating the water. Fizzing with vinegar and the blue-black colour with iodine are chemical changes: new substances are formed. Real forensic and quality-control laboratories use the same logic, building a set of tests where each substance has a unique pattern of results.

Common ideas to listen for

- "If it disappears in water it has gone." It has dissolved and is still present.
- "All fizzing is dissolving." Fizzing shows a gas being made by a reaction.
- "One test is enough." Several substances can give the same result in one test.

Adapting the activity

Support

Provide a partly completed results table and limit the tests to water and vinegar.

Stretch

Design a flow chart key that identifies any of the five powders in the fewest possible tests.

WORKSHEET 1

Results table

Name: _____ Class: _____ Date: _____

Test a tiny amount of each powder. Record exactly what you observe.

Observations

Powder	Looks like	Water	Vinegar	Iodine
Salt				
Sugar				
Bicarbonate				
Cornflour				
Plaster				

WORKSHEET 2

Solve the mystery

Mystery sample number: _____

My tests

Test	What I saw	What it tells me
1		
2		
3		

Conclusion

The mystery powder is _____ because

Flow chart key (stretch)

WORKSHEET 3

Reflection

Tick the statements you are confident about.

What I can do

I can…	Not yet	Partly	Confidently
carry out tests safely			
record precise observations			
tell a physical change from a chemical change			
use evidence to identify a substance			

Which test was most useful, and why?

FOR THE TEACHER

Assessment checklist

Use during the session. One sheet covers up to eight students; copy as needed.

Student	Works safely and systematically	Records precise observations	Reasons from evidence

Suggested codes: W = working towards · E = expected · G = greater depth

ABOUT THIS ACTIVITY

Mystery Powders is a sample activity from the EduTrend Contents W4C Chemistry programme (middle school, level: intermediate). Every activity in the programme follows the same format: a practical challenge, a clear session plan, facilitator notes and ready-to-print worksheets, so that teachers, club leaders and parents can run it without extra preparation.

Full 15-, 20- and 32-week programmes are available from EduStore at edutrend.org.

© 2026 EduTrend Contents. This activity may be printed and copied for use with students in your own school, club or home. It may not be resold or published elsewhere. Photos: Clint Patterson / Unsplash.