

What causes anomalous results?

Education in Chemistry

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rsc.li/2qFN2M4

Possible responses to scenarios

1. Separations: salt from rock salt (11–14)

Students mixed rock salt with water. They poured the rock salt and water mixture through filter paper into an evaporating basin. They then heated the evaporating basin with a Bunsen burner.

Consider the effect on the mass of the final sample in the following situations. Put a tick in the relevant box and be prepared to justify your answer.

	What is the effect on the mass? Less/more/the same
The rock salt wasn't well crushed	Less: particles of rock might stop the water from getting to all the salt and dissolving it
Less water was added	Less: there may not be enough water to dissolve all the salt
More water was added	More: the extra water is able to dissolve more salt from the rock salt Same: the original volume of water was sufficient to dissolve all the salt in the rock salt
There was a hole in the filter paper	More: some rock particles went through the filter paper and ended up in the salt solution
The evaporating basin and salt solution was heated too strongly	Less: salt would spit out of the evaporating basin when the heat is too high Less: some of the salt could have decomposed under strong heat (unlikely with rock salt but students may have heard this when considering other salts eg copper sulfate)
The evaporating basin and salt solution wasn't heated for long enough	More: the salt would still have water with it/be wet so would weigh more

2. Rate of reaction: a reaction that produces a gas (14–16)

A student put a piece of magnesium ribbon with dilute hydrochloric acid in a conical flask. They connected it to an inverted boiling tube in a trough of water. They measured the time it takes to fill the boiling tube with hydrogen gas produced from the reaction between the magnesium and acid.

(This experiment can be found on Learn Chemistry: [rsc.li/2DzGrld](https://www.rsc.li/2DzGrld))

Consider the effect on the time taken to fill a boiling tube with gas in the following situations. Put a tick in the relevant box and be prepared to justify your answer.

	What is the effect on the time taken? Less/more/the same
The student cut the magnesium ribbon into multiple pieces before dropping them into the flask	Less: the magnesium would have a larger surface area so would react faster
The bung wasn't placed on the conical flask quick enough	More: some gas would escape until the bung was put on so it wouldn't be collected in the tube
The tubing wasn't properly under the test tube at the start of the reaction	More: some gas would escape and not be collected in the tube
The flask was shaken from side to side during the reaction	Less: the shaking would have increased the rate of reaction by encouraging collisions More: the shaking could have meant the delivery tube was moved from underneath the boiling tube
The flask was held in one of the student's hands during the reaction	Less: the heat of the student's hand would increase the temperature of the reaction mixture and increase the rate of reaction Same: it is unlikely that the student's hand would be hot enough to make a difference to the temperature of the reaction mixture.

3. Energy changes: zinc added to copper sulfate

Students added pieces of zinc to a copper(II) sulfate solution in an insulated cup. The cup had a lid with a hole to hold a thermometer. They measured the temperature rise.

(This experiment can be found on Learn Chemistry: [rsc.li/2uKF5tu](https://www.rsc.li/2uKF5tu))

Consider the effect on the temperature rise when zinc is added to copper sulfate in the following situations. Put a tick in the relevant box and be prepared to justify your answer.

	What is the effect on the temperature rise? Less/more/the same
The lid wasn't put back on the cup when the zinc was added	Lower: heat exchange with the environment
The bulb of the thermometer wasn't fully submerged in the solution	Lower: the thermometer was measuring the temperature of the air as well as the liquid
The thermometer was wiggled around in the cup	Higher: the stirring action could have made the reaction more efficient Lower: the stirring action could have caused some of the zinc to get stuck on the sides of the cup
The cup was supported with a glass beaker	Same: just supporting the cup doesn't change the reaction conditions Higher: the beaker adds additional insulation meaning less heat can escape
The students spilt some zinc when transferring it to the cup	Same: the zinc is in excess so a small loss of zinc won't affect the temperature Lower: less zinc is available to react so less energy will be released
The cup was wet when the copper sulfate was added	Lower: the copper sulfate solution will be more dilute and have a greater volume so the heat generated in the reaction will be dissipated in more solution
The students didn't read the thermometer at eye level	Either lower or higher: not reading at eye level can cause a parallax error