AS 90930

Carry out a practical chemistry investigation, with direction

Credits 4 (Internal)

This achievement standard involves carrying out a procedure to collect and process primary data and interpret the results, with direction. With direction means that general instructions for the investigation will be specified in writing and direction will be given in the form of a purpose, an outline of the method, and the equipment and/or chemicals from which to choose. A template or suitable format for planning the investigation will be provided for the student to use.

Achievement	Achievement with Merit	Achievement with Excellence
Carry out a practical chemistry investigation, with direction.	Carry out an in-depth practical chemistry investigation, with direction.	Carry out a comprehensive practical chemistry investigation, with direction.
• developing a method for collecting primary data with units, relevant to the purpose, based on the manipulation of the independent variable over a range of values	• developing a procedure for collecting primary data, with units, relevant to the purpose, based on the manipulation of the independent variable over a valid range of values with repetition to show reliability	• developing a procedure for collecting primary data, with units, relevant to the purpose, based on the manipulation of the independent variable over a valid range of values with repetition to show reliability
	• controlling the variable(s) that could have a significant effect on the results	• controlling the variable(s) that could have a significant effect on the results
	• using techniques to increase the accuracy of the measured values of the dependent (and independent) variable	• using techniques to increase the accuracy of the measured values of the dependent (and independent) variable
• processing and representing the data in an appropriate way (table, calculation, graph etc)	• processing and representing the data to enable a conclusion to be reached	• processing and representing the data to enable a conclusion to be reached
• writing a conclusion based on the processed data.	• writing a conclusion based on the processed data that links to the purpose of the investigation.	• writing a conclusion based on the processed data that links to the purpose of the investigation.
		• justifies the choices made to increase accuracy during the investigation
		• justifies the conclusion in terms of the processed data and the purpose of the investigation
		• relates investigation findings to applicable chemistry ideas

A practical chemistry investigation includes collecting, processing, and interpreting primary data to reach a conclusion in a chemistry context using chemistry vocabulary, symbols, conventions and equations as appropriate. Suitable contexts could include: acid-metal reactions, acids and bases, rates of reaction, energy output of fuels, fermentation.

The checklist below is for a "Fair Test" type investigation which is just one of many types of investigation carried out in science.

- ❑ Can write the aim of the investigation (given on task sheet)
- ❑ Can write a plan (from general method & experience gained in trials)
- ❑ Can create a range of at least FOUR different
    - Temperatures (using water baths)
    - Concentrations (by making dilutions)
    - Surface areas (by cutting up the material in some way)
- ❑ Can identify the independent variable
- ❑ Can identify the dependent variable
- ❑ Can identify other variables to keep the same (to make it a fair test)
- ❑ Can prepare a results table with appropriate correct units
- ❑ Knows what is meant by accuracy
    - how it can be increased
    - can justify choices made to increase accuracy
- ❑ Knows what is meant by reliability
    - how it can be increased by repeat trials
    - original experiment PLUS 2 repeats (i.e. 3 experiments)
    - by spotting obviously anomalous data
    - by averaging data with good agreement
- ❑ Can convert minutes to seconds if needed
- ❑ Can average data from repeat trials – add up data and ÷ by the number of pieces of data
- ❑ Can see a trend or lack of a trend in numerical data
- ❑ Can plot an appropriate graph (optional) to better see a trend or lack of a trend in numerical data
    - Evenly spaced labelled axes
    - Line of best fit or smooth curve if appropriate
    - No "join the dots"
    - Can identify obviously anomalous results / outliers
- ❑ Can write a conclusion
    - Conclusion matches processed data
    - Conclusion links to the purpose of the investigation
    - Conclusion is related the prediction / hypothesis made
    - Conclusion is justified by reference to actual processed data
- ❑ Can relate the investigation findings to applicable chemistry ideas

Applicable chemistry ideas would be Collision theory for an investigation involving “Rates of Reaction”

- ❑ Concentration
  - More concentrated solution equals more particles per unit volume e.g. particles of A per mL
  - So more frequent collisions between “A” and “B” particles
  - So greater rate of reaction
  - Seen by the reaction taking less time to complete / reach a set fixed point

- ❑ Surface area
  - Smaller pieces equals larger surface area e.g small marble chips
  - More particles of reactant “A” exposed for collision with reactant “B”
  - So more frequent collisions between “A” and “B” particles
  - So greater rate of reaction
  - Seen by the reaction taking less time to complete / reach a set fixed point

- ❑ Temperature
  - Higher temperature means the particles have greater kinetic energy
  - Particles of “A” (and maybe “B” if also heated) are moving faster and so there are more frequent collisions
  - The particles of “A” have more energy and so more of the collisions are effective collisions / lead to reaction
  - So greater rate of reaction
  - Seen by the reaction taking less time to complete / reach a set fixed point

- ❑ Catalyst (different catalysts work in different ways so it is hard to be specific here)
  - Catalysts lower the energy (activation energy) needed by the particles “A” and “B” to have an collision that leads to a reaction
  - More of the collisions between “A” and “B” are effective collisions / lead to reaction
  - So greater rate of reaction
  - Seen by the reaction taking less time to complete / reach a set fixed point
  - The catalyst is not used up by the reaction