Defining intended outcomes of practical work

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When considering a practical, you first need to define the intended learning outcomes. The outcomes can be categorised as hands on, what students are going to do with objects, and minds on, what students are going to do with ideas to show their understanding. Filling in a table like these can help; a blank template is at the end. These examples are based on GCSE chemistry practicals.

Lower and higher levels reflect that a degree of differentiation is possible with practical effectiveness. These are suggested outcomes; further outcomes could be used to show effective practical work.

Making soluble salts

For example, making copper sulfate from copper oxide and sulfuric acid.

	Hands on	**Minds on**
Effective at a lower level	Students correctly: • Warm the acid safely and add copper oxide until the sulphuric acid is neutralised. • Set up the filtration equipment including folding the filter paper. • Concentrate the salt solution using a water bath.	• Students can talk about adding copper oxide until no more reacts as a way of ensuring all the acid has reacted. • Students can discuss how filtration removes unreacted reactants. • Students can talk about how water is being evaporated leaving the salt behind.
Effective at a higher level	Students correctly: • Recall all the correct equipment for the practical and construct a method that would be effective in producing a sample of salt.	• Students can discuss how evaporation leads to an increase in concentration of the salt solution. • Students can explain that the solubility of solutes can vary with concentration.

Chromatography

For example, separating the pigments in lipstick.

	Hands on	**Minds on**
Effective at a lower level	Students correctly: • Set up thin layer chromatography so that several spots or streaks can be observed.	• Students can talk about how different substances move at different speeds up the paper and that different spots indicate different substances.
Effective at a higher level	Students correctly: • Discuss how the pattern on the chromatogram of an unknown sample may be compared to a known sample to help identify the unknown one.	• Students can measure the distance travelled of the spots and solvent front to calculate Rf values. • Students use Rf values to correctly identify the pigments in an unknown sample.

Measuring temperature changes in a chemical reactions

For example, measuring the temperature change between sodium hydroxide and hydrochloric acid.

	Hands on	Minds on
Effective at a lower level	Students correctly: • Measure and record the temperature of the reaction before adding the reactants. • Measure and record the maximum temperature change. • Correctly add increasing amounts of sodium hydroxide.	• Students can talk about measuring a temperature change. • Students can explain that a lid and a polystyrene cup reduce energy loss from the reaction. • Students can identify that the reaction is exothermic.
Effective at a higher level	Students correctly: • Repeat each addition of sodium hydroxide. • Calculate a mean for each volume. • Draw a graph of volume against temperature increase correctly add 2 lines of best fit.	• Students can explain the reaction in terms of chemical bonds in the reactants and products. • Students can explain the apparent temperature drop as more volume of liquid is created but the concentration of acid is limiting.

Rates of reactions

For example, reacting calcium carbonate with two different concentrations of dilute acid and following the reaction over time.

	Hands on	Minds on
Effective at a lower level	Students correctly: • Set up the equipment to collect the produced gas. • Use a method of adding the reactants that minimises the amount of gas lost. • Correctly measure and record the volumes of gas collected over time.	• Students can discuss how they are minimising gas loss. • Students can identify the link between concentration and rate of reaction. • Students can use the kinetic theory to simply explain their results.
Effective at a higher level	Students correctly: • Collect data for two different concentrations of acid. • Plot the results for both concentrations on the same graph.	• Students can explain that the gradient of the line is related to the speed of reaction and also explain that both graphs plateau at the same level linked to the concentrations of reactants. • Students can explain their results using ideas about increased chance of collisions with the required energy to react.

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	Hands on	**Minds on**
Effective at a lower level	Students correctly: •	• Students
Effective at a higher level	Students correctly: •	• Students

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