# TRANSITION: PASSPORT TO SECONDARY SCIENCE

Learning by Questions

LbQ's Passport to Secondary Science takes year 7 students on a journey through the skills needed to plan and carry out investigations in a secondary setting. Devised around a solubility investigation, this complete scheme enables students to use a wide range of apparatus and techniques, ensuring that by the end of their journey they are proficient in all basic laboratory skills.

**Skills:**

1. Identifying and Using Laboratory Apparatus
2. Identifying Variables and Taking Readings
3. Carrying out an Investigation and Recording Data
4. Processing and Presenting Data
5. Understanding Graphs and Drawing Conclusions
6. Using Investigation Skills/Knowledge

## 1. Identifying and Using Laboratory Apparatus

| Question Sets | Objectives |
|---|---|
| Basic Laboratory Apparatus | I can identify common laboratory apparatus. |
| Drawing Laboratory Apparatus | I can scientifically draw common lab apparatus and recognise apparatus from scientific drawings. |
| Apparatus for Heating | I can identify laboratory heating apparatus and understand why certain apparatus is used. |
| Combustion: Using a Bunsen Burner | I can identify how to safely set up and use a Bunsen burner and heating equipment. |

**Practical Activity 1a: Identifying and Drawing Apparatus**

Students name and draw a selection of apparatus including: beaker, conical flask, measuring cylinder, test tube, boiling tube rack, tripod, clamp stand, clamp, boss, heatproof mat, Bunsen burner, gauze, spatula, glass rod, stirring rod, tweezers, filter funnel, filter paper, test tube rack, scalpel, syringe, dropping pipette, microscope, magnifying glass, spotting tile, petri dish, white tile, pestle, mortar, digital balance, tape measure, stop watch, metre rule.

**Practical Activity 1b: Using a Bunsen Burner**

Students set up heating apparatus and use it to gently warm a 100 $cm^3$ of water. Focus on safely lighting the Bunsen burner, using the apparatus and placing the apparatus away.

## 2. Identifying and Using Laboratory Apparatus

| Question Sets | Objectives |
|---|---|
| Identifying Independent and Dependent Variables | I can identify the dependent and independent variables in an investigation. |
| Control Variables | I can identify control variables, suggest why they should be controlled and how this should be done. |
| Identifying Intervals and Ranges | I can use information from tables, diagrams and graphs to identify the range and intervals of data. |
| Taking Readings from Scientific Equipment | I can use a range of scientific equipment to take readings. |

**Practical Activity 2: Preliminary Investigation**

Students carry out a preliminary investigation to identify a suitable range and intervals for the independent variable.

**Hypothesis:** the mass of sugar that will dissolve in 100 $cm^3$ of water is affected by the temperature of the water.

Students identify the dependent, independent and control variables.

Students work in pairs / small groups to count how many spatulas of sugar will dissolve at a given temperature (20, 25, 30, 35, 40, 45, 50, 55, 60°C).

Data is collated and used in a class discussion to establish suitable range and intervals for the investigation.

**Safety:** Students should be instructed not to heat water above 60°C.

## 3. Carrying out an Investigation and Recording Data

| Question Sets | Objectives |
|---|---|
| Designing a Table | I can design a results table having been given the names of the independent variable and dependent variable. |
| Working Safely | I can recognise risks and suggest how to work safely. |
| Investigation: Temperature and Solubility (1. Planning and Collecting Data) | I can investigate how temperature affects solubility. |

**Practical Activity 3: Carry out Investigation into how temperature affects solubility**

Students carry out the investigation.

**Practical Notes:**

If students are working in pairs / small groups, starting each group at a different temperature should allow for repeat readings to be taken and class data to be collated.

The solubility of sucrose in water 210 g/100 ml (25 °C).

In order to reduce the time spent getting results for each temperature 50 mls of sucrose solution of 180 g / 100 ml could be used.

Using a dry syringe to measure quantities of sugar provides a useful way to measure amounts of sucrose if balances are in short supply. If this method is used students should be made aware that they are comparing dry volume of sugar, not mass. As density of sucrose is 1.59 g/$cm^3$, the mass of the sugar added can be calculated by multiplying the volume added in $cm^3$ by 1.59.

## 4. Processing and Presenting Data

| Question Sets | Objectives |
|---|---|
| Calculate a Mean (1) | I can use data to calculate a mean. |
| Calculate a Mean (2) | I can calculate a mean, including identification and removal of outliers. |
| Recognising Types of Data | I can recognise whether a variable has continuous or categorical data. |
| Labelling and Scaling Axes | I can identify which variable should go on the x-axis and y-axis of a graph and can recognise suitable scales for axes. |

**Practical Activity 4: Presenting Data**

Students should be given graph paper and encouraged to present the raw data collected from their investigation in a suitable format.

Students' initial graphs should be used in a class discussion to identify strengths and weaknesses of the different ways in which the students have chosen to present the data.

Students should produce a new graph based on the standards agreed during the class discussion.

## 5. Understanding Graphs and Drawing Conclusions

| Question Sets | Objectives |
|---|---|
| Spotting Anomalies in Tables and Graphs | I can spot anomalies in tables and graphs. |
| Reading Values From a Graph | I can read values from a graph. |
| Identifying Relationships and Drawing Conclusions from Graphs | I can identify relationships and draw conclusions from graphs. |
| Testing a Hypothesis | I can identify how to test a hypothesis, recognise whether data supports a hypothesis and give a scientific explanation for a hypothesis. |
| Investigation: Temperature and Solubility (2. Analysis and Evaluation) | I can investigate how temperature affects solubility. |

**Practical Activity 5: Analysing Data and Drawing Conclusions**

Students should identify anomalies in their graphs / data, draw conclusions from their graph and use their graph to prove or disprove their original hypothesis.

## 6. Using Investigation Skills / Knowledge

| Question Sets | Objectives |
|---|---|
| Investigation: Temperature and Solubility (3. Exam-Style Questions) | I can answer exam-style questions on the investigation into how temperature affects solubility. |
| Vocabulary for Planning and Data Collection | I know the meanings of key terms used in the planning of investigations and data collection. |
| Vocabulary for Analysis and Evaluation | I know the meanings of key terms used in the analysis and evaluation of scientific investigations. |

**Practical Activity 6: Using Investigation Skills / Knowledge**

Students should produce a wall display to display their investigation and all of the key apparatus and key words.