HookED Planning an Investigation for the Science Fair Resource

OBSERVE	**[SOLO Multistructural Task]**
What do you see happening? *List three things you notice. What can you see, hear, smell, taste or touch? Describe what you observe.* I see	**Useful strategies:** Qualitative observation Quantitative observation HOT Describe Map
THINK	**[SOLO Relational Task]**
What do you think is happening? *Trying to explain your observations. What do you infer from what you have seen? What is changing? Asking questions to explain what is observed.* Is [X] changing because of ....?	**Useful strategies:** HOT Cause and Effect Map
WONDER	**[SOLO Extended Abstract Task]**
What do you wonder? *Making predictions of what a future observation will be. Forming a generalisation that can be tested.* I guess/predict that changing [Y] will cause [X] to ..... Write a generalisation that seems true in most cases/ a hypothesis based on what you see and know. Your hypothesis should • contain only **ONE** variable • be able to be tested • describe the anticipated results.	**Useful strategies:** HOT Predict Map HOT Generalise Map

DESIGN A CONTROLLED EXPERIMENT [SOLO Extended Abstract Task]	
Design a controlled experiment to test the hypothesis. In any situation there are a number of things that change. Things that change are called "variables". Variables can be **continuous** (a measurement or number eg distance or time) or **categoric/discrete** (can only be described in words eg type of material or colour) Variables can be connected in some way Science experiments deliberately change one variable (the independent variable) and measure the effect on the other variable (dependent variable). When trying to investigate the connection between the independent and dependent variables it is important to recognise that other variables that affect what happens must not change when the experiment is repeated. We call these controlled variables. Unless we control these, the experiment is not a **"fair test".** Identify the experimental variables you will need to change, measure and control. • **independent variable -** the thing (variable) you plan to change • **dependent variable –** the thing (variable) you will observe and measure as it changes in response to the change in the independent variable • **controlled variables** - all the other things (variables) that you keep **unchanged.** Include an experimental control if necessary – e.g. an experiment which has all the conditions the same except for the one being investigated.	**Useful strategies:** Experimental Design Template Fair Test Template Bioethics Approval Identify the thing/s that could change the results of an experiment. Test one variable at a time. Control all the other variables
CARRY OUT A CONTROLLED EXPERIMENT	
Carrying out the controlled experiment by following the method in the experimental design	**Useful strategies:** Following instructions Accuracy and precision Recording results truthfully and carefully in a data table

	Measurement – qualitative and quantitative Reading scales Parallax error
REPEAT THE CONTROLLED EXPERIMENT	
Repeat the controlled experiment to test the reliability of the results. *How reliable are my results?* Do you get the same answer? Repeat the experiment at least twice to test the reliability of your results. When using living things you will need to use several plants and animals in each trial.	**Useful strategies:** Average Upper and lower limits Standard deviation Confidence limits
RECORD RESULT DATA APPROPRIATELY	
Data display Display the data appropriately (e.g. tables) so it can be easily interpreted. Note: The independent variable goes in the first column, the dependent variable in the next column.	**Useful strategies:** Scientific units Tally charts Table construction "Variable/unit"
ANALYSE AND INTERPRET RESULTS	
Finding patterns in the results *What happened to what I measured when I changed ...?* Display data in appropriate graphs to show patterns/trends. Learn the correct use of bar graphs (to plot categoric values of an independent variable) and line graphs (to plot continuous data). Note that all graphs must have • a title which states that it is a graph of "variable on y axis" against "variable on x axis" for whatever is being investigated • axes clearly labelled with the variable and the unit (for continuous data) • a key if more that one set of data is plotted on the same axes In line graphs • the axes must be evenly divided • all points are clearly marked (do not use a •) • if the relationship is linear, then a line of best fit is drawn using a ruler; if it is a curve then a smooth curve	**Useful strategies:** Fair Test Template Graph construction Continuous and discrete data Graph analysis Statistical analysis

is drawn (not ruled from point to point) Are the results fair? Are they reliable? Are they valid?	
CONCLUSION - ACCEPT OR REJECT THE HYPOTHESIS	
Making sense of the patterns in your results *What do your results mean?* Write a conclusion where you accept or reject your hypothesis, giving reasons and justification.	**Useful strategies:** Fair Test Template HOT Conclusion Map
WRITE UP REPORT ON EXPERIMENT	
Aim>Method>Results>Analysis>Conclusion **Aim** **–** why you did the experiment, what you hope to find out **Method** **–** what you did in the experiment (including diagrams of any apparatus used) **Results** – include qualitative and quantitative data (use tables) **Analysis and interpretation** **–** explain your results **Conclusion** **–** a general statement about what can be reliably and validly claimed from your results	**Useful strategies:**