

INVESTIGATION HELP SHEET

PLANNING

- Pa1 AIM** – Identify a focused problem or research question.
- Pa2 BACKGROUND** - Look for background research from book/internet sources to reinforce your ideas. Explain what factors could be investigated, which ones you have chosen and why you have decided to choose these.
- Pa2 HYPOTHESIS**
 a) Relate the hypothesis or prediction directly to the research question.
 b) Give reasons why you think this will happen, using detailed scientific knowledge where appropriate and also quantitative measurements if applicable.
- Pb1 APPARATUS** – Select and list what you are going to use and what else you might need.
- Pb3 PLAN/METHOD** - Say **clearly** and **exactly** what you will do, with **diagrams** if that helps, so that someone else could repeat it.
- Pb3 State** how you are going to measure or observe the **dependent variable** and what number and range of measurements you will use – take into account the fact that you are trying to collect precise and reliable data (given the time factor).
- Pa3** State clearly all the **controlled variables** you need to keep the same to make it a **FAIRTEST** including those that should be kept the same but are very difficult to control in the lab or in the field. Explain why these need to be kept the same where appropriate.
- Pb2** Say **HOW** you will keep all the **controlled variables** the same.
- Pb2** Select and list the relevant **independent variables**.
- Pb2** Say **HOW** you will change the independent variable.
- What **safety** precautions you must take and why if appropriate – make a risk assessment.
- Pb3** Make your observations/measurements as **accurate** as possible, the precision depending on the nature of the investigation.
- Pb3** Take as many **different** and suitable readings as you need to **fully** answer your question based on reliable evidence.

DATA COLLECTION

- DC1** Take **measurements** or **observe** what happens and write it down.
- DC1** **Repeat** your measurements as much as possible for accuracy, time permitting.
- DC1** Consider **uncertainties** in your measurements and react appropriately.
- DC2** **Record evidence** clearly and appropriately as you carry out the work. These rough results **must be available** to the teacher for analysis.
- DC2** Put your results in a **table** with proper **headings** and **units** (e.g. seconds, ml, °C etc.).
- DC1** Where appropriate **errors** should be stated with each **set of data**.

DATA PROCESSING AND PRESENTATION

- DP1** Always process your results mathematically in some way eg. use **averages or calculations** with appropriate formula to process your results.
- DP2** Draw appropriate **bar charts, histograms, pie charts or line graphs** (using lines of **best fit** whenever relevant).
- DP2** Correctly **label** all **tables** and **graphs**.
- DP1** **Analysis** any **errors** which have been stated in your data collection.

CONCLUSION

- CE1** Use detailed **scientific knowledge** to explain a **valid conclusion** given the **evidence** available from your results. Compare your results with **information from books** or other sources if possible.
- CE1** Try to identify **trends or patterns** in the results to backup your conclusion.
- CE1** Explain how your results support or don't support your **original hypothesis**.

EVALUATION

- CE2** How might the **equipment used and/or the school environment** have **limited** the **accuracy** of your results?
- CE2** How might **weaknesses** in your **method** have contributed to incorrect results?
- CE2** Did you make any **errors** in following the **method**? How may they have **affected** your results?
- CE3** What **improvements** could you have made to your plan to overcome the **weaknesses** you have identified?
- What **further investigations** would you suggest to test your conclusions or even extend the enquiry?

Planning (a)

	ASPECTS		
LEVELS	Defining the problem or research question (Pa1)	Formulating a hypothesis or prediction (Pa2)	Selecting variables (Pa3)
Complete	Identifies a focused problem or research question.	Relates the hypothesis or prediction directly to the research question and explains it, quantitatively where appropriate.	Selects the relevant independent and controlled variable(s).
Partial	States the problem or research question, but it is unclear or incomplete.	States the hypothesis or prediction but does not explain it.	Selects some relevant variables.
Not at all	Does not state the problem or research question or repeats the general aim provided by the teacher.	Does not state a hypothesis or prediction.	Does not select any relevant variables.

Planning (b)

	ASPECTS		
LEVELS	Selecting appropriate apparatus or materials* (Pb1)	Designing a method for the control of variables (Pb2)	Designing a method for the collection of sufficient relevant data (Pb3)
Complete	Selects appropriate apparatus or materials.	Describes a method that allows for the control of the variables.	Describes a method that allows for the collection of sufficient relevant data.
Partial	Selects some appropriate apparatus or materials.	Describes a method that makes some attempt to control the variables.	Describes a method that allows for the collection of insufficient relevant data.
Not at all	Does not select any apparatus or materials.	Describes a method that does not allow for the control of the variables.	Describes a method that does not allow any relevant data to be collected.

- suitable diagrams are acceptable.

Data Collection

	ASPECTS	
LEVELS	Collecting and recording raw data (DC1)	Organizing and presenting raw data (DC2)
Complete	Records appropriate raw data (qualitative and/or quantitative), including units and uncertainties where necessary.	Presents raw data clearly, allowing for easy interpretation.
Partial	Records some appropriate raw data.	Presents raw data but does not allow for easy interpretation.
Not at all	Does not record any appropriate raw data.	Does not present raw data or presents it incomprehensibly.

Data Processing and Presentation

	ASPECTS	
LEVELS	Processing raw data (PD1)	Presenting processed data (PD2)
Complete	Presents processed data appropriately, helping interpretation and, where relevant, takes into account errors and uncertainties.	Processes the raw data correctly.
Partial	Presents processed data appropriately but with some errors and/or omissions.	Some raw data is processed correctly.
Not at all	Presents processed data inappropriately or incomprehensibly.	No processing of raw data is carried out or major errors are made in processing.

Conclusion and Evaluation

	ASPECTS		
LEVELS	Drawing conclusions (CE1)	Evaluating procedure(s) and results (CE2)	Improving the investigation (CE3)
Complete	Gives a valid conclusion, based on the correct interpretation of the results, with an explanation and, where appropriate, compares results with literature values.	Evaluates procedure(s) and results including limitations, weaknesses or errors.	Identifies weaknesses and states realistic suggestions to improve the investigation.
Partial	States a conclusion that has some validity.	Evaluates procedure(s) and results but misses some obvious limitations or errors.	Suggests only simplistic improvements.
Not at all	Draws a conclusion that misinterprets the results.	The evaluation is superficial or irrelevant.	Suggests unrealistic improvements.