Science Assessments: Planning

In GCSE science, 20% of the marks are given for practical work. Your teachers award you these marks while watching you do experiments in the laboratory. There are four skills involved and, when marking you on these skills, your teachers have checklists of what to look for. The checklist for "Planning" is below.

Checklist for Skill P: Planning your work	
You can:	Marks awarded
• plan a simple method	2
• plan a method to get results that are valid • plan to use suitable equipment or sources of evidence (e.g. CD-ROMs)	4

• use scientific knowledge and understanding to:
  • plan a method and explain it
  • identify key factors to vary or control
  • make a prediction if possible
• decide on a suitable number and range of readings or observations
	6

• use detailed scientific knowledge to:
  • plan a suitable method and explain it
  • aim for precise and reliable evidence
  • justify a prediction if you have made one
• use information from preliminary work to guide your plan
	8

Here are some more details on **planning**.

Valid results

Sometimes you will be asked to plan an investigation to solve a problem or answer a question. The most important thing here is to devise an experiment that will produce valid results. This includes making it a **fair test**. For example, it may be important to use the same amount of acid, the same temperature, the same mass of solid, the same apparatus, and so on. This is called **controlling the variables**.

Predicting

Before starting your practical work, you should try to predict what you think will happen. To gain higher marks it is important to base your prediction on the science you know. Say what you think will **happen** and then explain **why**. Remember that if you use text-books or other sources of information to help you in your predicting and planning, you should not copy, and you must write down where you found the information.

Selecting the most suitable apparatus

It is important to use the most suitable equipment. For example, to measure the volume of 100 cm^3 of water, you should choose a measuring cylinder and not a beaker with a 100 cm^3 mark on it. To measure a smaller volume of water you should choose a narrower measuring cylinder.

Deciding the number and range of your readings

You need to consider how many measurements or observations to make. If you plan to show your results on a graph, the minimum number of readings is four. Aim to collect at least five readings if possible.

Your results must also cover a suitable **range** to answer the original question. For example, if you are looking at the effect of temperature on the rate of a reaction, would you do tests at 20°C, 21°C, 22°C and 23°C? This is not a good range. You also need to decide whether you need to repeat the tests and so get average readings. This can improve the **reliability** of your results.

Safety

The experiment you plan must be safe; you must check your plan with your teacher.

Science Assessments: Obtaining your evidence

In GCSE science, 20% of the marks are given for practical work. Your teachers award you these marks while watching you do experiments in the laboratory. There are four skills involved and, when marking you on these skills, your teachers have checklists of what to look for. The checklist for "Obtaining your evidence" is below.

Checklist for Skill O: Obtaining your evidence	
You can:	Marks awarded
• use simple equipment safely	2
• make enough measurements or observations • record your results	4

• make observations or measurements:
  • with enough readings
  • which are accurate, and
  • repeat them if necessary
• record the results clearly and accurately
	6

• use equipment:
  • with precision and skill,
  • to obtain and record reliable evidence,
  • with a good number and range of readings
	8

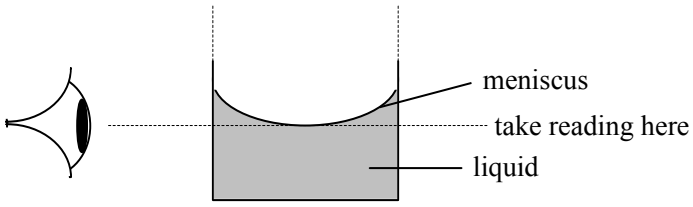
Here are some more details on **obtaining your evidence**.

Making observations accurately

Accuracy is important, as well as taking care in checking your readings.
Remember to correct for **zero-errors** (for example, you should check that the balance reads zero before you start to use it).

When reading a scale, make sure you look at right-angles to it, so that you read the correct number.

When using a measuring cylinder, remember to read the bottom of the meniscus (see on the right).



If one of your results seems unusual, make sure you **repeat** it. If it does turn out to be an error, you do not have to include it when you think about your results at the end of the investigation.

Recording your results

It is usually best to record your results in a table. When you draw out your table, make sure that it is large enough to fit all your results. Draw the lines using a pencil. Label each column with the **quantity** you are measuring and its **unit**.

An example table for an investigation into the rate of a reaction is shown on the right.

Temperature (°C)	Reaction time (s)
23	124
46	65
61	41
70	29

The first column shows the **independent variable** – this is what **you** change deliberately, step by step.
The second column shows the **dependent variable** – the size of this variable depends on the first one.
All the other variables must be controlled (kept constant) to make your investigation a fair test.

Science Assessments: Analysing your evidence

In GCSE science, 20% of the marks are given for practical work. Your teachers award you these marks while watching you do experiments in the laboratory. There are four skills involved and, when marking you on these skills, your teachers have checklists of what to look for. The checklist for "Analysing your evidence" is below.

Checklist for Skill A: Analysing your evidence	
You can:	Marks awarded
• explain simply what your results show	2
• show your results in simple diagrams, charts or graphs • find the trends or patterns in your results	4
• draw and use diagrams, charts, graphs (with a line of best fit), or calculate answers from your results • draw a conclusion that fits your results and explain it using your scientific knowledge	6
• use detailed scientific knowledge to explain your conclusion • explain how your results agree or disagree with a prediction made earlier	8

Drawing graphs and bar-charts

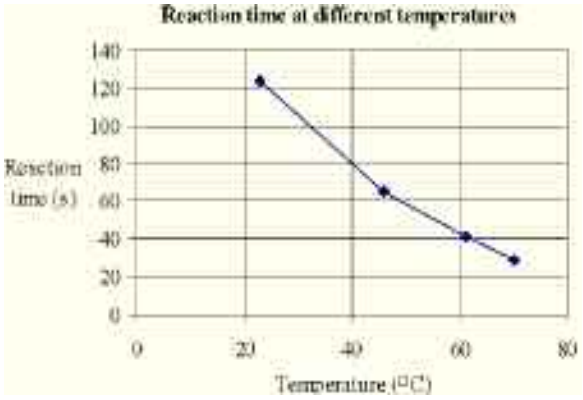
Having recorded your results, you will often need to draw a graph.
If the first column in your table (the independent variable) can have a **continuous range** of values, then use a line-graph. However if the first column can only have certain **fixed values**, then use a bar-chart.

If you draw a line-graph, do it following the five steps shown in the box on the right.

1. Choose simple scales.
   For example, 1 large square ≡ 1°C (or 2°C, 5°C, 10°C).
   Never choose an awkward scale like 1 square ≡ 3°C or 7°C!
2. Plot the points and mark them neatly. Re-check each one.
3. If the points look as though they form a straight line, draw the best straight line through them with a ruler and pencil. Check that it looks like the best line.
4. If the points form a curve, draw a "free-hand" curve of best fit. Don't just join the points "dot-to-dot" with a ruler.
5. If a point is clearly off the line, always use your apparatus to repeat the measurement and check it.

Drawing a conclusion

Every experiment has a "conclusion".
This is a **summary** of what you found out (or sometimes what you didn't find!)
Always look at your results or graph or chart to decide what you have discovered.
What reasonable or "valid" deduction can be made from your results?
What pattern can you see?



For example, from the rate of reaction investigation on the previous sheet you might conclude:

- The graph is almost a straight line; and
- As the temperature increases, the reaction time decreases. You may be able to give some examples, e.g. at 23°C the reaction time was 124s, but at 70°C the reaction time was about a quarter of this (29s).

Then use your scientific knowledge to **explain** your conclusion. Remember to refer back to your prediction, and to **explain** why your results support it or not.

Science Assessments: Evaluating your evidence

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Checklist for Skill E: Evaluating your evidence	
You can:	Marks awarded
• make a relevant comment about your method or your results	2
• comment on the quality of the results, pointing out any anomalous ones • comment on whether the method was a good one • suggest changes to improve the method, if necessary	4

• look at the evidence and:
  • comment critically on its reliability
  • explain whether it is good enough to support a firm conclusion
  • explain any anomalous results
• describe in detail how you would do further work to get more results that would be relevant to the investigation
	6

Here are some more details on **evaluating your evidence**.

Assessing the quality of your investigation

Having drawn your conclusions, you should now think about the **quality** of your investigation.
Ask yourself these questions to see if you could have **improved** your investigation:

- Were my results accurate?
- Did any seem strange compared to the others?
  These are "anomalous" results.
- Should I have repeated some tests to get more reliable results?
  Could I improve the method?
- Did I get a suitable range of results?
- If there is a pattern in my results, is it only true for the range of values I used?
  Would the pattern continue beyond this range?
- How could I develop my investigation to answer these questions, if given time?
- Are there any other aspects of the original question that I could investigate, if given time