A2 Skills Required

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| A: Planning |
| Title |  |  | Name, title, candidate number should be at the top of the page. |
| Aim |  |  | State what you are trying to find out.State which is the independent and which is the dependent variable. |
| Apparatus | P1 | Identifies the most appropriate apparatus required for the practical in advance |  |
| P2 | Provides clear details of apparatus required including approximate dimensions and/or component values (for example, dimensions of items such as card or string, value of resistor) | Select what range of variables you will use. |
| Diagram | P3 | Draws an appropriately labelled diagram of the apparatus to be used | Use pencil and ruler – make it clear. Mark any measured values on it e.g length |
| Method |  |  | Step by step method using numbered points explaining what is to be varied and what is to be measured, what ranges will be used. |
| P4 | States how to measure one quantity using the most appropriate instrument |  |
| P5 | Explains the choice of the measuring instrument with reference to the scale of the instrument as appropriate and/or the number of measurements to be taken  | Explain range of readings to be taken and the estimated error **in terms of experiment**. E.g The estimated error of ……….. is ……………. . This is approximately an uncertainty of …………..% in the experiment. This is acceptable/mot acceptable. |
| P6 | States how to measure a second quantity using the most appropriate instrument |  |
| P7 | Explains the choice of the second measuring instrument with reference to the scale of the instrument as appropriate and/or the number of measurements to be taken | Explain range or precision **in terms of experiment**. (Don’t just state precision) |
| Correct Measuring Techniques | P8 | Demonstrates knowledge of correct measuring techniques | Examples:• zero error checks• repeat measurements (at different places if appropriate)• eye level to avoid parallax error• use of marker at centre of oscillations to aid timing• use of set square for checking vertical or horizontal arrangements• reading off scales between two graduation points• trig methods for measuring angles. |
| Fair Test | P9 | Identifies and states how to control all other relevant quantities to make it a fair test | ALL relevant quantities. |
| Repeats | P10 | Comments on whether repeat readings are appropriate for this experiment | Don’t just say you will repeat. Say why - relate to reliability and accuracy. E.g ‘I will be repeating the experiment BECAUSE there is a large margin for error from external sources/it is difficult to control all of the variables/there is room for error in the experiment and I will take a mean of the values to improve reliability.’ |
| Safety | P11 | Comments on all relevant safety aspects of the experiment | ALL |
| Data | P12 | Discusses how the data collected will be used | What are you going to have on each axis of the graph, how will you derive the formula you need? – how will you calculate the constant? |
| Uncertainty/Error | P13 | Identifies the main sources of uncertainty and/or systematic error | List the precision of different measurements with a short explanation.Explain any possible systematic errors in method or areas of uncertainty (May link with P8) |
|  | P14 | Plan contains few grammatical or spelling errors |  |
|  | P15 | Plan is structured using appropriate subheadings |  |
|  | P16 | Plan is clear on first reading |  |
| B:Implementation and Measurements |
| Table of Results | M1 | Records all measurements with appropriate precision, using a table where appropriate | All measurements in a column should have the same number of sig fig (usually 3 sig fig) as decided by the Instrument precision |
|  | M2 | Readings show appreciation of uncertainty | At the top of the column you should show the Instrument precision (e.g.± 3mm) |
|  | M3 | Uses correct units throughout | Units should be at the top of every column |
|  | M4 | Refers to initial plan while working and modifies if appropriate | Make notes underneath table of ANY modifications that you have done. Justify why you haven’t made any. |
|  | M5 | Obtains an appropriate number of measurements | Minimum should be six different readings |
|  | M6 | Obtains measurements over an appropriate range | One variable should double in the range used |
| C: Analysis |
| Graph | A1 | Produces a graph with appropriate axes (including units)  | Logarithmic quantities are dimensionless e.g ln (x/m) |
|  | A2 | Produces a graph using appropriate scales | Scale must be over half of the graph paper. BUT must also be easy to read.  |
|  | A3 | Plots points accurately |  |
|  | A4 | Draws line of best fit (either a straight line or a smooth curve) | Do NOT force it through the origin or the first point. Get the same number of points each side of the line (ignore anomalies) |
| Mathematical Analysis | A5 | Derives relation between two variables or determines constant | Use the gradient to calculate a constant |
|  | A6 | Processes and displays data appropriately to obtain a straight line where possible, for example, using a log/log graph | Follows from P12 |
|  | A7 | Determines gradient using large triangle | Use a triangle over half the size of the date spread |
|  | A8 | Uses gradient with correct units | Correct units for gradient. No unit for a log-log graph |
|  | A9 | Uses appropriate number of significant figures throughout | Usually 3 sigfig |
| Physics Explanation | A10 | Uses relevant physics principles correctly | Physics principles; EXPLAIN why it happened.  |
| Errors | A11 | Uses the terms precision and either accuracy or sensitivity appropriately | Review of P13. Precision Did the precision or estimated error (instrument precision + measurement error) you quoted in P13 work out in the experiment for each measurement.Accuracy Did your final answer work out to be close to the true value?Sensitivity How was the sensitivity of the apparatus you used? |
|  | A12 | Discusses more than one source of error qualitatively |
|  | A13 | Calculates errors quantitatively | Calculate % error for each measurement individually.Estimated error/ Measurement taken x 100% |
|  | A14 | Compounds errors correctly | Combine the individual % errors to make a total % error. |
| Modifications | A15 | Discusses realistic modifications to reduce error/improve experiment | If you use data logging as an improvement then explain how. |
| Conclusion | A16 | States a valid conclusion clearly | State the final mathematical equation. Look back at your aim and answer it. |
|  | A17 | Discusses final conclusion in relation to original aim of experiment | Compare your answer with the theory…use the error and the LOBF to help you. |
|  | A18 | Suggests relevant further work | Relevant and realistic ideas that can be done in the lab. |