SQA Higher **Physics**
Formula Sheet

Marking the Exam Papers

When you are asked a question in an exam paper there are always far more things that you can get wrong than getting the correct answer! This is the nature of science; it is a very exacting process to get to the correct answer.

Showing your workings e.g., how you get to the correct answer is where you can gain marks, even if you get the answer wrong and that alone should be enough to make sure you write the whole answer down and not just the final number.

First of all, let's look at the kind of errors that can be made when you give an answer, in the table below, to give you the idea of how many ways things can go wrong.

Then we shall look at some specific examples of how you should answer questions to maximise your chances of getting the most marks, even full marks, where possible.

Table 1: The ways questions can be answered wrongly.

Type of Error	Example
Answer only No units	For 5 amps: 5 × Should be: 5 A ✓
Answer only No value	For 5 amps: A × Should be: 5 A ✓
Answer only Wrong answer	For 5 amps: 7 × Should be: 5 A ✓
Relationship only No answer	For 5 amps: I = V/R × Should be: 5 A ✓
Using a value not given in the question	You use: 1.51 V × Question stated: 1.15 V ✓
Rearrange equations wrongly	You use: I = R/V × Should be: I = V/R ✓
Forgetting to square or square root when working out	These are so often forgotten steps so keep an eye out!
Using the wrong constant from the data sheet	Picking the wrong constant
Getting the constant right but using the wrong value	You use: g = 9.81 × Should be: g = 9.8 ✓
Converting units wrongly	nm to m or kg to g or hours to seconds
Using the wrong scientific notation	Stating 10 kg as 10 x 10^5 g
Not converting values to get the right outcome units	Forgetting to convert MeV to J where required

Type of Error	Example
Wrong significant figures.	Such a common error. See example below.
Rounding too early in the sum	Leave all rounding to the last answer
Answering in fractions	Fractions should only be used in certain situations
Subscripts instead of superscripts	Less common but still a loss of a mark e.g. 10_2 which should be 10^2
Going beyond the required answer	This can jeopardise your mark as it may look like you don't know what the answer should be.
Forgetting to label a diagram	If asked to label something or describe something and you use a diagram don't forget to label the part you are being asked about.
Using the wrong symbol	You use: S for velocity × Should be: V ✓
State two answers…	If you state three you may be penalised if one is wrong
Spelling errors	Are dangerous if they indicate a wrong meaning "velosity" may be ok but "rifracshun" may not be
"Show" questions	These require you to step-by-step go from a data sheet equation to the form you need
"Justify" questions	At some point two statements need to be connected by the word "because".
Graphs	Correct, axis labelled, scale marked, correct plotting, correct best fit line if required

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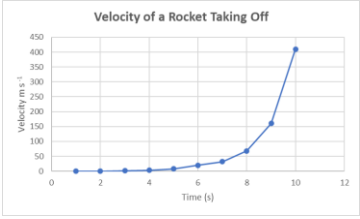
Let's look at some examples:

1. *Significant Figures*
   - The question asks you to calculate an answer. The question has two values in it, 0.150 m (measured by a ruler) and 2.2 $\mathrm{m\ s^{-1}}$ (using an ohmmeter).
   - The answer you calculate is 0.0681818181…. To apply the correct number of significant figures you should match the number of significant figures in the least precise data used in the question. In this case the distance is measured to three significant figures and the speed to two. So, we are limited to the least accurate measurement of 2 significant figures.
   - Our answer should therefore be 0.07 s (remembering that the first 0 after a decimal place is significant). In Higher Physics you can be 2 significant figures out either way, so they will likely accept 0.0682 or 0 but it is best to be right!
   - If you state more than that you will lose a mark for incorrect statement of significant figures.

2. *Forgetting to square*
   - Let's say the formula is $E_k = \frac{1}{2}mv^2$. It is quite common to forget to square the velocity (although it is even more common to forget to take the square root).
   - If you show the calculation step by step you will get marks for using the correct formula, marks for substituting in the correct numbers but you will lose 1 mark for getting the wrong answer. This is why showing working is essential. Instead of scoring 0%, you can score 66%!

3. *Converting units wrongly and mis-stating them*
   - The question states: Prove the speed of light is the value stated for c in the data sheets when you know the wavelength of a radio wave is 100 cm and the frequency is 3 GHz.
   - If you simply multiply the two you will get a value of 3×10^6 and if you use that you must use the units of $\mathrm{cm\ s^{-1}}$. You can correctly multiply this up to m not cm and state 3×10^8 $\mathrm{m\ s^{-1}}$. You must be careful not to make a typo by writing 3^8, or similar. Each of these can lose you a mark and if you don't show all your showing you can lose all the marks.

4. *Graphing incorrectly*
   - Plot correctly, label the axis, mark a title put a scale on the axis and connect with a best fit line if required. You will lose a mark for every missing component and for not taking specific actions mentioned in the question.



5. *Going beyond the answer*
   - Answer just what you are asked and no more.
   - If the question asks: Name two leptons.
   - DO not name 3 or 1! If you do, make sure they are all correct. If you put down three and only two are correct you will end on a net mark of 1.