

Some non-comprehensive advice for the comprehensive exam

(Jonathan Eastwood, Dept. of Physics, March 2010)

1. **Read the question.**
 - I. Read the whole question.
 - II. Try and understand the whole of the question. What physical situation is the question asking about? What physics are they trying to get you to use?
 - III. Answer the question that is asked.
2. **Draw a picture.**
 - I. If you don't know what to do, draw a useful picture. Then ask yourself how to include all of the information in the question in the picture.
 - II. Remember to include labelled axes where appropriate.
3. In deriving differential equations, think about what is changing. The mass? The potential energy? The angular momentum?
4. **Do not throw marks away by making simple mistakes** when calculating numerical answers.
5. If a question is taking longer than 30 minutes, stop working on it and look at another.
6. **Revise mathematical methods.** Look for common techniques that come up in derivations, proofs, and questions. See how often the same technique appears in surprisingly different places.
7. **Rearrange equations algebraically before 'subbing in'.** You'll probably get virtually full marks if you've got the right expression but make a calculator slip at the end. So given $V=5$ volts and $I=300\text{mA}$, then write $R=V/I=5/0.3=17\text{ohm}$, rather than just $R=5/0.3=17\text{ohm}$ (to give a simple example).
8. **When asked for two reasons give two reasons.** A question may say 'give two reasons why your answer is likely to be an over-estimate'. It's likely that there are many valid responses, so think laterally and use common sense.
9. **Don't be over influenced by the marking scheme.** The marking scheme is only indicative and may have been set by the examiner with a particular objective in mind. If the sub-question looks simple but carries more marks than you think it deserves then be confident, put down your answer, and move on. On the other hand, if a section has only one mark it probably doesn't require a long detailed answer.
10. The comprehensives test your general understanding of physics. At some point you have to confront what this means.
 - I. Take your notes from each lecture course, and write out a list of the things that the course covers. For Classical mechanics, this might look like:
 - i. Newton's laws and conservation principles
 - ii. 1-d motion
 - iii. 2 body dynamics
 - iv. 3d particle dynamics
 - v. Non Inertial Forces
 - vi. Rigid Bodies
 - II. Do this for each course in turn. This is what you are supposed to be familiar with.
 - III. For each core course, distil your notes into a few pages. Focus on retaining the key information – Newton's laws may take three lines, but special relativity may take more.

- IV. From your few pages of notes, you should be able to explain, in general terms, to another UG student exactly what a particular point refers to.
11. **Look at all the old papers that you have available.** Become familiar with the style of the questions. For each question, write a capsule answer – what principle, what equation, what technique would you use?
 12. Estimates – when revising, make a side list of numerical values. For example: How big is the Earth? What does it weigh? How far from the Sun to the Earth? What's the wavelength of visible light? What's the speed of sound? etc

Finally, and most importantly: **don't panic.**