

Comments on the 2003 HSC "Physics" Exam.

The exam. The HSC exam is the final high school exam in New South Wales, Australia. In that jurisdiction, the subject called physics has a peculiar syllabus. I was asked to comment on the 2003 paper.

The problem with the paper is that one can do very well on it with rote learning, 'plug and chug' (ie look up an equation in the formula sheet given to the students in the back of the exam paper, and insert the numbers from the problem), the ability to read a graph and skills in writing.

It is very rare in this paper that candidates are asked to combine quantitative relations in the solution of a problem. However, this is an extremely valuable skill, which is central to engineering, physical sciences and much technology. Exceptions on 2003 paper are Q3 (1 mark) Q17 part b at a pinch (2 or 3 marks?) but they are both very simple cases.

So without this very important skill, one could do very well on the 2003 paper. However, one could not do well without historical information and a lot of other facts, much of which could be learned by rote.

Part A is 15 short questions, 1 mark each. As short answer questions go, they are pretty good. Some test understanding, some test factual recollection, and some are plug and chug.

Part B is worth 60 marks.

Q16 is good warm-up question. Well thought out, but easy. Good for building confidence.

Q17 is mainly plug and chug but (exceptionally, as noted above) it does actually require two equations.

Q18 is factual recall

Q19 is plug and chug

Q20 requires one to know Lenz' law and that a magnetic field is formed when a current flows in a coil, but not when there's no current.

Q21 is the transformer law for currents and voltages

Q22 is recall of an experiment that the students have done (they are asked to describe it)

Q23 (a) requires an explanation of the Meissner effect. A real answer would be long. For 3 marks, I suspect that some simplistic rote learned piece is what is required. (I had already supplied a simplified 1 page answer on the HSC Physics FAQ.) (b) requires a discussion of conductivity in conventional conductors and superconductors. This is quite a deep question, and physicists are not really sure about the details, but I suspect that an answer requires just key words. Again, I've put a short answer on the web.

Q24 asks them to describe Thomson's experiment

Q25 is a plug and chug

Q26 "Describe Einstein's contributions to Special Relativity **and** to Quantum Theory and how these contributions changed the direction of scientific thinking in the Twentieth Century" (my emphasis). 6 marks only for these two important topics, and all that is wanted is factual information.

It's worth pointing out that interference of waves is no longer required in the syllabus, but that quantum physics (which depends heavily upon interference) is allegedly in the syllabus.

There was one question actually on relativity: Q5 is also a one-mark question concerning relativity. It was presumably intended as a plug and chug question, but it is badly posed and cannot be answered. I have read unofficial reports that answers to this were not included in students' scores.

Section II (25 marks) has 5 sections, students to choose the one in which they have specialised.

Q28 has factual recall and graph reading.

Q29 has factual recall and plug and chug.

Q30 has factual recall and graph reading.

Q31 has some plug and chug and some combination of information

Q32 has factual recall, a plug and chug and a requirement for logical analysis (b).

A student with no aptitude for physics, but with good language, memory and study skills could do very well on this paper. Inability to do physics would be only a slight handicap. However, the exam fairly assesses the syllabus. The syllabus is largely about factual knowledge, has a high proportion on history and social studies, and requires little problem solving ability in physics.

Prof Joe Wolfe, School of Physics, UNSW. J.Wolfe@unsw.edu.au