

Examiner's Report 2007. S8: Covariant Electromagnetism

This paper was taken by 5 physicists and (as part of the BT paper) by 10 P&P students. An additional 3 P&P candidates also took the BT paper but were not permitted to answer questions from this section, as they were taking the B4 Mathematical Physics option. The number of physicists taking the option is significantly down on previous years, presumably because those who might have taken it in Part B chose instead the B4 option. This year the P&P students were given the freedom to answer any four questions from the eight open to them, but in fact they all answered two questions from each section.

The overall level of the paper seemed to be satisfactory.

S8 All Candidates

N	15
Mean	36.1
Standard Deviation	6.9
Maximum	47
Minimum	25

The significant difference between physics and P&P candidates noted in previous years was still present

S8 Physics Candidates		S8 P&P Candidates	
N	5	N	10
Mean	41.8	Mean	33.3
Standard Deviation	4.4	Standard Deviation	6.1
Maximum	47	Maximum	43
Minimum	35	Minimum	25

All means have increased about two marks from last year. The mean for physics candidates is now over 80%, and on its own might indicate that the paper is too easy, but the remarks in previous reports regarding pre-selection of candidates choosing the option still apply. The P&P candidates, for whom this paper is compulsory, form a better sample to by which to judge the paper, and their mean mark is essentially equal to the EPSC norm of 65%.

The printed mark scheme was used in all cases. Most candidates answered the same two questions, with only one attempt on each of the remaining two.

S8 Question 1

N	15
Mean	17.5
Standard Deviation	5.0
Maximum	22
Minimum	8

Question 1 involved verifying a simple time-dependent solution to Maxwell's equations with complete spherical symmetry, with material on the Lorenz gauge condition. It was popular and generally well done.

S8 Question 2

N	13
Mean	18.5
Standard Deviation	5.1
Maximum	25
Minimum	9

This was a straightforward question involving the transformation of the potential from one frame to another followed by extraction of the fields in the new frame. Questions of this general type have been set every year, and candidates were obviously well-prepared to answer it.

S8 Question 3

N	1
Mean	21

Question 3 did not involve a Lorentz transformation, but did use all the relativistic notation of field tensor and energy-momentum tensor. There was only one attempt, and the candidate obviously knew what to do!

S8 Question 4

N	1
Mean	18

As always the final question was on gauge transformation of wavefunctions and potentials, and the gauge-invariant current. There was only one attempt but, as with question 3, the candidate was well-prepared.