

## Report on B3 (2007)

Q1: 142 attempts, Mean Mark 13.0, S.D. 4.1

A standard question on hydrostatic equilibrium which was popular and resulted in a good number of average answers. No candidates obtained full marks. Few candidates were able to fully describe the structure of an AGB star, and on the last part many assumed that if  $\gamma=4/3$  then the gas must be degenerate. It seems that the mathematical aspects of the problem were straightforward but the interpretation in the astrophysical context tended to be less well answered.

Q2: 44 attempts, Mean Mark 13.8, S.D. 4.1

This question on scaling relations in stars and main sequence lifetimes was less popular but was reasonably well-answered by those candidates who attempted it. Four candidates obtained full marks. No specific problems were identified.

Q3: 137 attempts, Mean Mark 9.1, S.D. 4.1

This was one of two cosmology questions which was popular but on the whole poorly answered. No candidates obtained full marks, although some came close. Most, but not all, candidates were able to make reasonable attempts at the first and second parts of the question. Fewer candidates were able to use the relations they derived to then estimate the ratio of photons to baryons, and few were able to discuss the ionisation of hydrogen at recombination.

Q4: 61 attempts, Mean Mark 10.1, S.D. 4.0

The second cosmology question was less popular, and again was not well-answered. Two candidates obtained full marks. Most candidates were able to obtain the bookwork result linking redshift to scale factor, but very few were able to obtain an expression for  $r$  in terms of  $z$ , which required them to use the chain rule with the expressions they were given.

Q5: 22 attempts, Mean Mark 10.8, S.D. 5.9

This question was on the KdV equation and solitons, together with a small section on the linear approximation. It was unpopular - perhaps because it was unfamiliar - but in fact was rather easy: the middle 10 marks were for bookwork, and there were simple numerical calculations at the end. Several candidates obtained full, or nearly full, marks.

Q6: 117 attempts, Mean Mark 9.2, S.D. 4.0

Many candidates attempted this question, but the overall results were disappointing. A large proportion confused this 'thin film' problem with a low Reynolds number case, and so got few marks for the scale analysis. Many did not notice that the circulation is proportional to the integral  $dp$  around a closed curve, and hence is zero since  $p$  is single-valued. Many sketches of the flow had neither axes nor arrows showing the flow directions, and quite a few had the cylinder with its axis horizontal, not vertical.

Q7: 122 attempts, Mean Mark 12.5, S.D. 4.5

A good response, both in terms of numbers and scores, was made to this straightforward question about the energy balance of hypothetical planets orbiting a sun-like star, and having thin, thick, and cloudy atmospheres respectively.

Q8: 109 attempts, Mean Mark 7.4, S.D. 3.9

This question was about calculating simple radiative-convective equilibrium models of the Earth's atmosphere. A surprising number of candidates proceeded to calculate quantities that were either given or explicitly allowed to be assumed, and then conversely assumed values for quantities that they had been asked to derive. The main reason for the relatively low mean score, however, was that most people answered this question last, and often didn't finish it. The degeneration in clarity of handwriting, gaps in answers, and scribbled marginal remarks, suggests that they ran out of time; this may also explain why they didn't read the question carefully.