A LEVEL
PHYSICS

7408/3BA
Report on the Examination

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General Introduction to the November Series

This has been an unusual exam series in many ways. Entry patterns have been very different from those normally seen in the summer, and students had a very different experience in preparation for these exams. It is therefore more difficult to make meaningful comparisons between the range of student responses seen in this series and those seen in a normal summer series. The smaller entry also means that there is less evidence available for examiners to comment on.

In this report, senior examiners will summarise the performance of students in this series in a way that is as helpful as possible to teachers preparing future cohorts while taking into account the unusual circumstances and limited evidence available.

Overview of Entry

This was an atypical cohort of students. There were a few students who showed good skills and an excellent knowledge of the material. There were fewer students in the middle of the ability range than usual, but more at the lower end. Some students appeared to have little or no experience of the Astrophysics option and managed to pick up only a few marks from their general knowledge of the core.

Comments on Individual Questions

Question 01.1
There were some excellent diagrams which showed a good understanding of how the telescope works. Other students appeared to be trying to remember a diagram without understanding it. This led to the primary mirror appearing as two separate mirrors, together with rays that did not cross at the correct place. A surprising number of students attempted to draw a ray diagram for an astronomical refracting telescope rather than a reflector with a Cassegrain mounting.

Question 01.2
Most students realised they had to calculate the resolution of the instrument and did so accurately. Many then either calculated the angle subtended by the crater or the smallest detail that could be resolved by the telescope. Only a few explained that it was suitable to study detail in the crater because the resolution was much smaller than the crater. Some students thought that the telescope would be inappropriate because it could only ‘see’ objects up to 27m across and so would not ‘see’ the crater.

Question 01.3
There were many good answers to this question where students clearly knew what they were doing and calculated a ratio. Others thought the collecting power was proportional to diameter and scored no marks. Some students tried to use resolving power to answer the question and stated that the telescope in Question 01.2 had better collecting power.

Question 01.4
Many students focussed on the fact that reflecting telescopes can be made larger; this is not relevant for the small telescope on the spacecraft. A number of students failed to separate chromatic and spherical aberration. Discussion of cost was treated as neutral.

Question 02.2
Most students were able to calculate the temperature correctly from the peak wavelength on the graph, though there were a number who had difficulties in reading the wavelength from the graph. The link between colour and either the spectral class or the emitted wavelengths was less well made. Those who went down the spectral class route often scored better. There were no marks for stating the colour; this was in the table above.

Question 02.4
Many students did the calculations very well and scored full marks. A common error was failure to convert distance to parsec. Students should recognise that the '10' appears in the equation because the standard distance is 10 pc. A number of students found it difficult to re-arrange the equation.

Question 02.5
The majority of students did this calculation accurately. Common mistakes were: to use *g* instead of *G*, a failure to square the speed of light, and omitting the factor of 2. There was also a significant number of students who were not able to perform the calculation on their calculators.

Question 03.1
Many students were quite clear that it is knowledge of the absolute magnitude that is important. Supernovae were often stated as the only example of a standard candle; there are others (e.g. Cepheid variables).

Question 03.2
There were many excellent graphs. Some scored marks without being very well drawn. It was common to see the peak at +19.3 and/or the magnitude axis going in the wrong direction. Time scales seen ranged from a few seconds to millions of years. The time scale should be such that it takes around 100 days for the absolute magnitude to decrease through 5 magnitudes.

Question 03.3
There were many answers where the student was clear about the data they needed and what graph to plot. Some students thought they could find the recession velocity by measuring the distance a year later and finding the distance through which the supernova had moved. The limitations on the result were often less clear. It is not enough to just state "uncertainty in the measurements" - there needs to be a reason given. A larger than usual number of students failed to attempt this question.

Question 04.1
Many students did this calculation faultlessly. Common errors, however, were using the formula for volume instead of area, failing to raise temperature to the fourth power, and giving the final answer to only one significant figure.

Question 04.2
It was rare to read a very good answer to this question, though many students knew that the star would go supernova and leave a black hole or neutron star. Often the danger was thought to be that the star was much hotter than our sun so would overheat the planet. Gamma Ray Bursts are highly collimated, and this is an important point.

Concluding Remarks

This paper was broadly similar in difficulty to previous years. There were questions which have appeared in the same or similar forms in previous years (e.g. 01.1 and 02.5), along with questions on familiar topics which have been in the specification for a long time (e.g. 03.3). Question 04.2 tested knowledge of Gamma Ray Bursts (which was added to the specification at the latest revision) and most students did not know this.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.