



General Certificate of Education

Physics 5451/6451

Specification A

PA02 Mechanics and Molecular Kinetic Theory

Report on the Examination

2007 examination - January series

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General Comments

Candidates performance in this examination was quite variable, and many found the paper challenging. Questions 3 and 5 were very discriminating and not many candidates scored full marks. To balance this, question 2 proved to be particularly accessible. Presentation was good and candidates for the most part showed their working in a logical way that was easy to follow. It was a shame that significant figure and unit errors were so common, as these often spoilt perfectly good answers. Quality of written communication was good and candidates generally structured their answers well.

Question 1

Part (a) of this question was answered well, although significant figure errors were common in part (iii). Less able candidates did find the powers of ten quite challenging and this sometimes led them to incorrectly calculate the average and total kinetic energies.

Part (b) was answered less well and although most candidates had a reasonable idea of what happened to molecules when the temperature of the gas was increased, their terminology was loose. Few referred to an increase in the mean speed of molecules or the mean kinetic energy: the most common response was that molecules speeded up. There were similar problems when candidates discussed molecular collisions, referring to more collisions rather than an increased rate of collision. A significant proportion of candidates talked about inter molecular collisions rather than collisions with the surface of the balloon.

Question 2

This question proved quite straightforward and high marks were common across all ability ranges. The only common mistake in part (a) was an incorrect unit for acceleration in (i). The graph in part (b) was answered well, as was the accompanying calculation although calculating the distance between the antelope and cheetah did prove quite challenging for some. The usual mistake was to forget the initial 100 m separation.

Question 3

As mentioned earlier this question was quite discriminating. In part (a), resolving the tension was not done well and adding the two tensions was quite a common response. The calculation of work done was also answered poorly. Common errors were to multiply the force by time or to use the tension in the cables rather than the appropriate component. The latter occurred in many cases when the resultant force had been correctly calculated in (i).

Part (b) produced better responses, although few explained convincingly why the kinetic energy of the ship did not increase. Most candidates were able to give some explanation as to the initial effect of the two tugs moving closer together.

Question 4

Part (a) was reasonably well answered although it was noticeable that less able candidates were confused by the area of the panel and were not sure how to use it. The penalties for this were not major as consequential error was allowed for parts (ii) and (iii). Three or four marks were commonly awarded.

Part (b) was answered well by a number of candidates, although some did have difficulty expressing themselves clearly.

Question 5

This question was not very accessible for a number of candidates. It was surprising how many did not know the definition of the moment of a force and simply discussed turning effects in a very general way. The calculation in part (b) proved to be very discriminating and even candidates who had correctly referred to perpendicular distance in part (a) often used the incorrect distance in their calculations. The discussion about how the moment changed was only well answered by the more able candidates and full marks were rare.

Question 6

This question was answered well by a significant proportion of candidates although many wrote much more than they needed to address the essential points. In part (a) it was comparatively rare for candidates to talk about momentum being a vector but most mentioned direction and momentum cancelling. Less able candidates frequently referred to speed rather than velocity.

Part (b) generated good responses with candidates either referring to momentum conservation or correctly applying Newton's third law. The only common omission was not mentioning the fact that it was likely to be an inelastic collision in (ii).

The explanations as to how velocity might be measured were generally good, with the use of light gates described clearly. A minority of candidates did get confused and tried to use momentum conservation to calculate velocity rather than simply measure it. This question was used to mark the quality of written communication and it proved particularly effective for doing this as most candidates wrote quite extended answers.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the [Results statistics](#) page of the AQA Website.