Pearson

Examiner's Report
Principal Examiner Feedback

Summer 2018

Pearson Edexcel International A Level
In Mechanics M1 (WME01/01)

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The quality of the work seen in response to this paper was very varied. There were some excellent responses from students who had clearly prepared very thoroughly, and some students who demonstrated only a limited understanding of the basic methods. Many students offered responses to all seven questions. There were several blank responses to Question 7, but it was not clear whether this was because the students were short of time, or because this question was unusual.

Students should reflect on the presentation of their work, and whether they are doing all they can to make their responses clear for the examiner to follow; this covers everything from labelling diagrams clearly to showing clear working, and not overwriting one solution with another. If a piece of working is incorrect, strike it through and rewrite it.

Some students lose accuracy marks through not using the value of g specified in the rubric for this paper, inappropriate accuracy after the use of an approximate value for g, and simply not checking on the level of accuracy required by the question.

When working towards a given answer, students should be aware that full and clear working is required. Similarly, at all times, sufficient working should be shown to make the method clear. For example, a student solving a quadratic equation will gain no credit if they start with an incorrect quadratic equation and simply write down values obtained from their calculator.

Question 1

The majority of students demonstrated a good understanding of the method required here. However, despite quoting a correct relationship between impulse and momentum, many students did not take account of the changes in the directions of motion of the particles and made sign errors in using their equation.

Those students who did not start with a diagram to summarise the information given in the question were more likely to confuse the masses and velocities of the two particles.

Question 2

(a) Many students earned full marks for this part of the question. Although the question asks for the answers as multiples of g, several students substituted a value for g to give numerical answers. It was unusual for a student to omit a term from their moments equation, but there were some sign errors and some incorrect lengths used.

(b) This was a more challenging task, and many students did not realise that as the boy walked along the beam the forces at C and D would change - the most common error was for students to bring forward their answers to part (a) and try to use them here. In order to make any progress with their solution, the students needed to understand that when the beam is about to tilt the reaction at D is zero. Several students did succeed in finding a relevant distance, but they did not always use this to find the distance asked for in the question.

Question 3

(a) The majority of students plotted the graph for the motion of the cyclist correctly, although there were a few who had the cyclist decelerating to rest again after a period of moving at constant speed. The graph for the motorcyclist proved to be more difficult: many students had the motorcyclist starting at the same time as the cyclist, and amongst those who had the motorcyclist starting at the correct time there was confusion over T, with T frequently used in place of $T+4$.

(b) The majority of students recognised that they needed to equate the areas under the graph. They had mixed success with this, and some did not include the whole of the distance travelled by the cyclist. Some students tried unsuccessfully to apply *suvat* equations. Another common error was to see students focussing on the point when the cyclist and motorcyclist have the same velocity, rather than when the distances travelled were equal.

Question 4

(a) The mechanics of this question was generally well understood, and most students found the magnitude of the frictional force correctly. A small number of students confused sine and cosine, and some went on to give an answer that combined the friction and the component of the weight acting parallel to the plane.

(b) Most students realised that they needed to use $F = ma$ here to find the acceleration but several overlooked the contribution of the weight of the particle. There were many correct equations, but also several sign errors, with some students not expecting a negative value for the acceleration. Having obtained a value for the acceleration, the majority of students went on to use $v^2 = u^2 + 2as$ with their value of a to find the distance.

(c) A few students did not appreciate that the acceleration of the particle when moving down the slope would not be the same as the deceleration when moving up the slope, but the majority did have a correct approach. A few students made the incorrect assumption that the acceleration would be g.

A small number of students opted to use conservation of energy in parts (b) and (c), often correctly.

Question 5

In general, the response to this vector question was better than usual. Students who struggled with parts (a) and (b) were able to score marks in parts (c) and (d).

(a) The majority of students attempted to divide displacement by time. Some subtracted the two position vectors the wrong way round giving positive components and some did not deal with 20 minutes correctly as a fraction of an hour. The majority went on to use Pythagoras' theorem correctly to find the speed.

(b) Many students did employ $\mathbf{r}_P = \mathbf{r}_0 + \mathbf{v}_P t$ correctly, but there were several students for whom the velocity used here did not match the velocity found in part (a).

(c) This was the most challenging part of the question. A large number of students did give a fully correct solution, but some tried to equate $\mathbf{r}_P$ to $16\mathbf{i}+5\mathbf{j}$ rather than make the directions equal.

(d) Most students employed a correct method to find out when the two position vectors were equal. The most common errors were to consider only one pair of components, or to omit the position vector of the point of collision.

Question 6

Before attempting to answer this question, students should draw a diagram to summarise the information given. This would help to ensure that the resistances are matched to the vehicles they are acting on, and that forces are shown acting in the correct directions. In particular it should be noted that both vehicles are decelerating, and the question talks about the thrust in the towbar.

(a) Many students started by focussing on the trailer, and wrote down an equation of motion containing the relevant terms, but there was frequently a sign error. Relatively few students reached the correct answer.

(b) Here again, many students understood what they needed to do, but solutions were spoiled by sign errors. Those students who elected to write down a combined equation for the car and the trailer avoided the need to use the value found in part (a), so some did reach the correct answer.

(c) For those students who recognised that they could use the equation $s=vt-\frac{1}{2}at^2$ here, this was straightforward, and often the most successful part of the question. Many students adopted a longer route, finding u first and then finding t. The most common error was to use the incorrect *suvat* equation with $u=0$.

Question 7

The response to this question was very varied. There was several concise and fully correct solutions, and a number of blank responses. Some students made the working unnecessarily complicated by finding the sizes of angles α and β when all that was needed was the trigonometric ratios. The majority of students chose to resolve horizontally and vertically at *B* and at *C*, but there were some who formed a triangle of forces or used Lami's theorem.

(a) Many students reached the correct answer, usually by resolving vertically at *B*.

(b) For those students who resolved horizontally at *B*, this was a straight forward task. Although many students had working labelled as part (b), it was common to see only equations for the tension in *CD*. A number of students were clearly confused between *BC* and *CD*, and some called every tension *T*, which led to further confusion.

(c) Many scored full marks for this part by using the value 101.92 N obtained in (b) along with correct vertical resolution at *C* to get a correct value for *M*. Those students who had a correct value for the tension in *BC* usually resolved correctly at *C* to obtain *M*. Some students found one correct equation involving the tension in *CD* but then used an incorrect value from part (b) or did not obtain a second equation to enable them to eliminate the tension.