Examiner's Report
Principal Examiner Feedback

October 2018

Pearson Edexcel International A Level
In Core Mechanics M2 (WME02/01)

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General

The response to this paper was very varied. Many students were clearly familiar with the content of the specification, and they coped well with the slightly unusual format of question 1 and the first part of question 7. At the other extreme, there were students who offered no response to items such as question 6, which followed a very familiar pattern. The diversity of the students is reflected in the scores for the last four questions, which each had a high proportion of students scoring full marks and a high proportion of students scoring no marks.

Students need to be reminded to read the rubric of the paper and the questions very carefully. Students who use $g = 9.81\,\mathrm{m\,s^{-2}}$, or who give answers to more than 3 significant figures after the use of $g = 9.8\ \mathrm{m\,s^{-2}}$, will incur accuracy penalties. If the question asks the candidate to find the velocity of an object, then the speed is not a correct answer.

The best work was clearly set out, with clearly labelled diagrams and a dialogue about what was happening at each stage. Students should make use of the answer space available; this is not a competition to answer in the smallest possible space, and cramped solutions can be difficult to follow. Do not overwrite one solution with another, even if you think that you have erased the original, because the resulting scanned response can often be very difficult to read.

Question 1.

This was a straightforward question about impulse and momentum in two dimensions, but over forty per cent of students scored no marks. The usual reason for this was that students considered only one component of the impulse, usually the component parallel to the initial direction of motion. Another common error was to assume that the impulse acted parallel to the initial direction of motion, despite the diagram and the wording of the question. Those students with a correct approach to the problem usually reached the correct answer, but a small number of students found the velocity of *P* after receiving the impulse and did not go on to find the speed.

Question 2.

(a) Although this question is clearly about work, it does not specify that it has to be answered using a work-energy equation. Several students took advantage of this and started by finding the acceleration and the net force acting on the truck. Whichever method was adopted for the initial stage, students encountered difficulties in finding the work done. Sometimes this was due to sign errors, but more often it was due to overlooking one of the forces acting, or to double-counting the change in potential energy (considering both the change in potential energy and the work done against the weight).

(b) Most students scored some marks in this part. The most common error was a sign error in the equation of motion through having the weight and the resistance to motion both acting in the same direction.

Question 3.

(a) The majority of students were clearly familiar with the method for finding the velocity from the position vector. At the next step students needed to understand that if *P* was moving parallel to the vector **j** then the **i** component of the velocity must be zero. Some students tried to equate the **j** component of the velocity to zero, and many tried to equate a component of the position vector to zero. The question asks for the velocity of *P*, so the correct answer is $\frac{8}{3}\mathbf{j}$, not simply $\frac{8}{3}$.

(b) Most students understood exactly what they needed to do here, and fully correct solutions were common.

Question 4.

(a) This question follows a very standard format, the only difference being that students have been told about the velocity of the ball after two seconds, rather than about the initial velocity. The fact that over twenty per cent of students scored no marks for this question suggests that some students were under-prepared.

Many students had the correct equation for the horizontal component of the initial velocity, but there were several sign errors in the equations for the vertical component. Those students who set up the equations for horizontal and vertical components of the velocity correctly usually reached the correct answers, but a number of solutions were given to more than 3 significant figures.

(b) All of the methods in the mark scheme for finding the height were seen, and there were many fully correct solutions.

(c) The simplest method for finding the required time, which did not depend on the accuracy of any values found earlier in the question, was the first shown on the mark scheme: to find the time to move from the maximum height to the target, and to double it. Some students did use this, but the majority used their answer to part (b) and their answers to part (a) to form a quadratic in *t*, as in the third method on the mark scheme. Having found two values for *t*, they did not always find the difference between them.

Question 5.

(a) and (b) Some students were working with incorrect mass ratios, usually because they removed the triangle *CDE* rather than fold it over. A number of students made slips in finding the positions of the centre(s) of mass of the triangle(s). Several students created additional work for themselves by not using the axes *AB* and *AE* suggested in the question, but the moments equations were usually set up correctly. The question indicates that the answers are expected to involve a and k, but many students did not use a in their working. The students did not have the guidance that can come from a given answer, but over twenty per cent of them found the distances correctly.

(c) Most students who had found the two required distances went on to score the method marks here, subject only to having answers that resulted in a three term quadratic equation in k.

Question 6.

This question was a good source of marks for many students, with nearly forty per cent scoring full marks.

(a) The majority of students started by taking moments about *A*. Those who formed a correct equation had no difficulty in reaching the given answer. There were several cases of confusion between sine and cosine, but few students identified their error(s) when they did not achieve the expected result.

(b) Most students adopted the simplest approach here, using the given answer from part (a) and resolving the forces parallel and perpendicular to the wall. There were some processing errors, including confusion between the friction and the normal reaction, but many students reached the correct final answer.

Question 7.

(a) Most students started by writing down an equation for the conservation of linear momentum (CLM), but that was not actually required here. The question can be answered by using the impact law and the direction of motion of *P*. The information given in the question is sufficient for students to deduce that the direction of motion of *P* has been reversed, although some did not appear to have realised this.

(b) Students who had given the equation for CLM in part (a) and went on to use it here scored the marks for their equation. The question asks about the kinetic energy lost by *P*, but some students found the total kinetic energy lost. The answer was given in the question, so full and clear working was required.

(c) Several students started to find key information here, particularly the time taken by *Q* to reach the wall, and the speed of *Q* after hitting the wall. Confusion over the relative directions of motion of *P* and *Q* often led to an error in stating the gap between them, and several students made errors in processing their results, which led to dimensionally incorrect equations and incorrect conclusions.

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