Examiners' Report
Principal Examiner Feedback

Summer 2022

Pearson Edexcel International Advanced Level
In Mechanics 2 (WME02) Paper 01

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The majority of candidates offered responses to all eight questions on this paper. Many candidates were well prepared and demonstrated a thorough understanding of the topics examined. As usual, the best solutions were clearly presented and accompanied by appropriate diagrams.

Several candidates need to work on the clarity of their handwriting. When it is not possible to decipher the characters and figures presented then no credit can be given, even if the ”work” does appear to lead to the correct answer.

Candidates should read the questions carefully to ensure that their response matches the demand in the question. For example, in question 1 many candidates spent time finding the magnitude of the acceleration when the question had not asked for it.

In calculations the numerical value of g which should be used is 9.8. Final answers should then be given to 2 (or 3) significant figures – more accurate answers will be penalised, including fractions but exact multiples of g are usually accepted.

If there is a printed answer to show, as in 5(a) and 7(a), candidates need to ensure that they show sufficient detail in their working to warrant being awarded all of the marks available and that they end up with *exactly* what is printed on the question paper with no errors in the working.

In all cases, as stated on the front of the question paper, candidates should show sufficient working to make their methods clear to the examiner and correct answers without working may not score all, or indeed, any of the marks available.

If a candidate runs out of space in which to give their answer than they are advised to use a supplementary sheet – if a centre is reluctant to supply extra paper then it is crucial for the candidate to say whereabouts in the script the extra working is going to be done.

Question 1

(a) For most candidates this proved to be a good starter question. The majority understood that they needed to differentiate **r** twice to obtain **a**. There were a few slips in this process, but candidates were able to substitute $t = 4$ and simplify their answer. Many candidates went on to find the magnitude of the acceleration, but this was not required in this question.

(b) Those candidates who understood that it is the velocity that determines the direction of motion obtained a simple quadratic equation and usually obtained the correct answer. Candidates who tried to use the position vector obtained a cubic equation and spent some time trying to solve it. The other common error was to try to equate the velocity to $2\mathbf{i} + \mathbf{j}$.

Question 2

(a) The majority of candidates understood what they needed to do, and split the journey into the three correct stages. Most errors were due to slips in the algebra and arithmetic. A small number of candidates made no real attempt to answer the question at all, not even stating the speed after the first impact with *YZ*.

(b) Many candidates did not realise that this was simply a repeat of part (a) with a different initial speed. Most repeated all of the working again, with some getting a correct answer the second time after an incorrect answer in (a).

Question 3

This was one of the more accessible questions that candidates have seen on this topic and they gave clear and accurate answers. Some dealt with separate components, but the majority formed an expression for the impulse in terms of **i** and **j** and worked from that. Candidates who knew what to do usually gained full marks. Those who did not get as far as an expression for the impulse scored nothing.

Question 4

This was a familiar scenario, so the prepared candidates were confident in forming the required simultaneous equations. Candidates did need to take care in reading the question to ensure that they were using the correct speeds and accelerations. The other main source of errors was incorrect signs in the equations. The incorrect final answer of 1164 was very common. Candidates need to remember that after using an approximate value for g it is not appropriate to give an answer to more than three significant figures.

Question 5

(a) When an answer is given, it is important to give a full and clear explanation of how it is derived. The stronger candidates formed a moments equation, showed the values being substituted and reached a correct conclusion. Weaker candidates often appeared to play with the numbers given in the question and arrive at the given answer with no clear method being seen. Sometimes they claimed to have reached the answer when it did not follow from anything they had written.

(b) The simplest way to tackle this part of the question was to resolve horizontally and vertically, but some candidates preferred to use a second moments equation or to resolve parallel and perpendicular to the rod. There was some confusion between sine and cosine when resolving and some errors in simplifying the equations. Having found the horizontal and vertical forces acting at *A*, most candidates used the correct method to find the coefficient of friction.

Question 6

(a) The most successful candidates had a clear diagram showing the directions of motion of P and Q. This helped to avoid the many sign errors in forming equations for the impulse on the particles and for conservation of linear momentum. The majority of candidates used the Impact law correctly, but here again there were errors due to using the incorrect directions of motion.
(b) The majority of candidates used their answers from (a) correctly to find the kinetic energy lost in the collision. The most common errors were due to incorrect pairing of mass and velocity, or using the same mass for each particle.

Question 7

(a) Careful reading of the question was crucial here. Several candidates did not take account of the information that the mass per unit area of the triangle was double that of the squares. Having obtained an incorrect answer, some candidates did reconsider and correct their working, but several simply claimed to have reached the given result. The question asks for a distance from QT but some candidates created additional work for themselves by working from a different axis.

(b) The first thing that candidates needed to do was to find the distance of the centre of mass of the template below Q. A variety of methods were used, including finding the vertical distance from T and from U. Use of the incorrect mass per unit area also affected this calculation. Most candidates had a correct method for finding the angle between QT and the downward vertical, but several did not go on to find the angle between QR and the downward vertical.

Question 8

(a) The majority of candidates used a correct method to find the work done against friction. The most common error was to state the final answer to more than three significant figures following the use of an approximate value for g.
(b) The question specifies that the work-energy principle should be used, so alternative methods were not accepted. Many candidates did use the correct terms in their equation. There were some sign errors and some sine / cosine confusion, but the most common error was to omit the work done against friction.

(c) Having used energy in part (b), some candidates used it here too, to find the speed of the particle at C. They then needed to use Pythagoras to find the vertical component of that speed, then the time taken, and hence the horizontal distance travelled. A slightly easier approach was to use *suvat* to find the time taken to move from B to C and then obtain the horizontal distance. Whichever route was taken, the most common error was to use the speed found in part (b) rather than the value given in the question for the speed at B.

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