Examiners' Report

January 2015

Pearson Edexcel International Advanced Level in Mechanics Mathematics M1 (WME01/01)

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

January 2015
Publications Code IA040626

WME01 JANUARY 2015

General

The vast majority of candidates seemed to find the paper to be of a suitable length, but there was some evidence of a few candidates running out of time. Candidates found some aspects of the paper challenging, in particular questions 3(c), 4, 6(a) and 8(c). However, there were some parts of all questions which were accessible to the majority. The questions on dynamics (q5), impulse-momentum (q1) and velocity-time graphs (q7) were generally well understood and high marks for these questions were commonly seen. The paper discriminated well at all levels including at the top end, and there were some impressive, fully correct solutions seen to all questions. Generally, candidates who used large and clearly labelled diagrams and who employed clear, systematic and concise methods were the most successful. It should be emphasised that where a question requires a magnitude to be given, a negative answer will be penalised.

In calculations the numerical value of g which should be used is 9.8, as advised on the front of the question paper but there were a few candidates who used 9.81. Final answers should then be given to 2 (or 3) significant figures – more accurate answers will be penalised, including fractions.

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.
If a candidate runs out of space in which to give his/her answer than he/she is 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

In part (a) the vast majority of candidates wrote down and solved an appropriate conservation of momentum equation with only occasional sign errors. Since a value for the speed was required, only the positive answer u was credited with the final mark. In the second part it was important that the direction of motion of truck A was described in the context of the problem (for example ‘direction reversed by collision’ or ‘in the same direction as truck B before the collision’); responses such as ‘to the left’ or drawing an arrow were not regarded as sufficient. In the final part almost all knew and applied the definition of impulse in terms of change in momentum of one particle. However, directions were not always properly taken into account, resulting in sign errors. Those who wrote down a valid expression sometimes lost the final mark by not giving a positive value ($4mu$) for the magnitude of the impulse.

Question 2

The most popular approach to this equilibrium problem was to resolve in directions parallel and perpendicular to the plane. The former led directly to an equation in T (the tension) for part (a). Errors seen included confusion between cos/sin, and the sign of the friction term. Those who tried to resolve vertically tended to do so inconsistently and omit a force component. Most candidates who achieved a correct numerical value for T rounded it appropriately (following use of g = 9.8) to 2 or 3 significant figures. In the second part it was necessary to find a value for R (the normal reaction) in order to calculate the coefficient of friction. Horizontal resolution avoided use of the previously calculated T, but almost invariably perpendicular resolution was the preferred method. Those who just equated R to the weight component lost at least three of the available four marks. The majority of candidates used $F = \mu R$ appropriately for the block which was on the point of sliding down the plane, although some lost track of the fact that the value of F was specified in the question. Although there were a fair number of entirely correct solutions seen, there were also some very low scores often as a result of candidates not resolving forces, or omitting terms completely from their equations and it was not uncommon for the only mark gained to be the final M1 for 65.8/(their value of R).

Question 3

The majority of candidates realised, for part (a), that the velocity vector determined the direction of motion of the particle and most used the tangent to find a relevant angle but fewer continued to produce a correct bearing; use of a diagram might have helped some to identify this angle more successfully. Even when the answer was correct, it was not always given to the nearest degree as specified in the question. In the second part almost all candidates wrote down a correct position vector in terms of t. The final part proved to be a greater challenge; it required the equating of the **i**-component to the negative **j**-component (or vice-versa) to find the time at which P was north-west of O. Although there were some correct solutions seen, a number of candidates had no valid method, or they omitted this part of the question completely. Those who equated the components (so P was north-east of O) achieved one out of the three possible marks.

Question 4

Most candidates attempted to produce two equations in terms of time for the height fallen by the two stones. The main error was not having consistent values for the unknown time. The second stone was released half a second after the first, but sometimes the values t and (t + 0.5) (for first and second stone respectively) were used rather than t and (t – 0.5), or even the same t was used in both equations. Occasionally inconsistent values or wrong signs were used within the same equation. Generally the two expressions for h were equated and the resulting equation solved for t ; those who had used a correct equation tended to reach the correct answer for the time, which then led to the correct answer for the value of h.

Question 5

This unstructured question involved a particle being pushed up a rough inclined plane. The standard approach was to resolve in directions perpendicular and parallel to the plane, using Newton's Second Law in the direction of acceleration. The most common errors were equating the normal reaction to the weight component only and/or omitting the '*ma*' term completely from the parallel resolution. The few who attempted to resolve in other directions almost invariably ignored the acceleration. Marks were occasionally dropped through sin/cos confusion and sign errors. Almost all candidates used the equation '$F = 0.5R$' to eliminate R from the equations and calculate a value of X. It was encouraging to see a number of fully correct solutions.

Question 6

In part (a) many candidates failed to appreciate that the greatest possible value of x (the distance from the particle to the point A on the rod) occurs when the reaction of the support at A is zero. This meant that they could make no valid progress in solving the problem since any combination of moments equations (and a vertical resolution) had too many unknowns. Some used a lot of algebra to try to solve them whilst others made the assumption that the two reactions were equal. The second part was completed with a greater degree of success by those candidates who attempted it. The least value of x was found by equating the reaction at A to $2W$ and taking moments about a point on the rod (and vertical resolution if required). There were occasional errors in calculating relevant distances, and sometimes l was dropped from the terms, but overall the methods seemed well understood and applied.

Question 7

In the first part, a surprisingly large number of candidates were unable to make the unit conversion from km h^{-1} to m s^{-1}. In part (b), virtually all produced a speed-time graph of the correct shape (a trapezium starting at the origin and finishing on the t-axis) and most annotated it with their speed from (a) and the time 480(seconds), thereby achieving both marks. If the relevant speed was marked in km h^{-1} then the time had to be consistent (8/60 h) to achieve the second mark. In part (c) the method of equating the area under the graph (either using the area of a trapezium formula or splitting into a rectangle and two triangles) to the distance travelled was well understood. Marks lost tended to be a result of using inconsistent units, or not using a single unknown T consistent with the extra information given in the question ('time spent decelerating is three times the time spent accelerating'). Nevertheless, there were many correct solutions seen for the time of acceleration. Most candidates then evaluated the gradient to find the acceleration as required. Those who tried to use constant acceleration formulae for more than one stage of the motion at a time received no credit; such attempts were only very rarely seen.

Question 8

The vast majority of the candidates used one or more appropriate *suvat* formulae to find the correct value for the acceleration in part (a). The main error seen was in applying it to the wrong particle, using the distance from the pulley rather than the distance fallen, but this was relatively rare. The second part was also generally well done with simultaneous equations of motion set up and solved for the two particles. Those who carried forward a wrong figure for acceleration were able to achieve follow through marks for their equations. There were occasional numerical slips, but nevertheless a fair number did achieve the correct answer for the coefficient of friction (rounded to 2 or 3 significant figures to be consistent with the use of $g = 9.8$). Part (c) was more challenging and a solution involved several steps; it was necessary to find the speed when the particle hit the ground, the new deceleration of the other particle and then the distance it continued to travel. Most who attempted this part of the question were able to find the speed, but those who then tried to use the acceleration from the previous part of the question (or just use g) could make no further valid progress. Those who achieved a numerical answer for the distance from a correct method did not always achieve the final method mark for a comparison with 0.3 (or 1.3); a statement that 'the particle does not reach the pulley' was not sufficient without justification.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:
http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London WC2R 0RL