Examiners' Report
Principal Examiner Feedback

October 2017

Pearson Edexcel International A Level
Mathematics
In Mechanics (WME01)

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

October 2017
Publications Code WME01_01_1710_ER

IAL Mathematics Unit Mechanics 1

Specification WME01/01

General Introduction

The vast majority of students seemed to find the paper to be of a suitable length, with no evidence of students running out of time. Overall the paper seemed to be a good discriminator at all levels, with no question found to be entirely straightforward but with all students able to make substantial progress on all questions. Questions 2 and 3 were particularly well answered with 59% and 62% respectively of students scoring full marks. Question 4, on the other hand, was by far the most poorly answered with a modal mark of 0/9 scored by 36% of the students. Students who used large and clearly labelled diagrams and who employed clear, systematic and concise methods were the most successful.

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

If there is a printed answer to show then students need to ensure that they show sufficient detail in their working to warrant being awarded all of the marks available.

In all cases, as stated on the front of the question paper, students 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 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.

Reports on Individual Questions

Question 1

This question involved a suitcase being pulled along a rough horizontal floor. Most students resolved the relevant forces vertically and horizontally; those who failed to appreciate it was moving with constant speed included a 'mass x acceleration' term which they were then unable to eliminate. Such cases were, however, relatively rare. Another mistake seen was equating the reaction to the weight only, ignoring the vertical component of the tension and thereby simplifying the equations significantly; this led to a maximum of three out of the seven available marks. The majority of students used '$F = \frac{3}{4}R$' to eliminate R and obtain an equation in T only which was then generally solved correctly. Sometimes the final mark was not achieved because of either premature rounding leading to an incorrect answer or giving the final value to an inappropriate degree of accuracy (only 2 or 3 significant figures were acceptable following the use of $g = 9.8 \text{ ms}^{-2}$). A surprising number of students completely misinterpreted the situation and assumed that the suitcase was moving on an inclined plane.

Question 2

This moments question was generally well done with a fair number of students achieving full marks. In part (a) most either took moments about a point and resolved vertically or, alternatively, took moments about two different points (usually C and D). The first method had the disadvantage that a mistake in the moments equation meant both reaction values would be wrong. Nevertheless, errors were relatively rare and many correct answers were seen. In part (b) not all students interpreted correctly the information that the reaction at D was 520N greater than the reaction at C. Occasionally a reaction of just 520N was used, or values for the reactions from part (a) were seen. These errors led to no credit being awarded. A less serious error was to have the reactions the wrong way round but that was rare. The most popular method of solution was to use a vertical resolution to find the reactions followed by a moments equation to calculate the value of x and many entirely correct solutions were seen. Those who used two moments equations leading to simultaneous equations were more likely to have errors either in the distances used or in the solution of their equations.

Question 3

In this collision question most, but not all, students realised that since the particles combined they had to be travelling with a common velocity after impact. The vast majority attempted a conservation of linear momentum equation to find this velocity. Occasionally directions were not properly taken into account leading to a sign error, or an arithmetic slip resulted in an incorrect value. Those students who attempted to equate magnitudes of impulse tended to have sign errors because of failing to take account of the directions. Almost all knew and applied the definition of impulse to find the required magnitude. Either of the particles could be considered and both depended on the previously found velocity. However, the combined mass of $5m$ was seen occasionally which showed a lack of understanding of the concept of impulse on one particle. Although there were occasional sign errors or omission of 'mu', there were many correct answers seen.

Question 4

It was apparent that vectors in the context of this question is a topic which was not generally well understood. A significant number of students achieved few, if any, marks. The most common approach was to attempt a vector triangle but often an incorrect angle was identified (for example 60° or 120° rather than 30°). Some, however, had no real strategy and either just subtracted magnitudes or assumed a right-angled triangle and used Pythagoras. Those who used the cosine rule correctly to find the magnitude of $\mathbf{F}_2$ were awarded a method mark even if they were working with a wrong angle. However, implied use of an incorrect formula was given no credit (which is why it is always good practice to state a formula before using it). A minority of students used a component approach; sometimes this was successful but a fairly common error was to use (14cos30°+8) rather than (14cos30°- 8) or to use the wrong angle. To calculate the direction of $\mathbf{F}_2$ from the vector triangle it was necessary to use the sine (or cosine) rule to find one of the unknown angles. Those who found the angle opposite '14' almost invariably failed to realise they needed the obtuse angle from the sine value. The final mark required the angle to be translated into the bearing of $\mathbf{F}_2$ and the answer given to the nearest degree. Not all managed to do this successfully and often previous rounding errors led to a value of 150° rather than the correct 149°.

Question 5

In part (a), almost all students used a valid method to find the greatest height reached by the ball. However, the initial height of projection was not always taken into account, giving an answer of 11(.025) metres rather than the correct value of 13.5 metres. Use of g = 9.81 m s^{-2} (rather than g = 9.8 m s^{-2} as specified in the rubric) was seen on occasions and sometimes the final answer was not rounded to either 2 or 3 significant figures, as required following the use of g = 9.8 m s^{-2}. The second part proved to be more of a challenge. Although many attempted to use an appropriate *suvat* formula to find the required time, often a displacement of 1 m (the height above the ground) rather than 1.5 m (distance below point of projection) was used. There was a method mark available for solving the resulting quadratic equation. If the equation and relevant solution were both correct then this mark was automatically awarded. If, however, the equation was incorrect then substitution of values into a correct formula had to be seen in order to achieve this mark. Those who split the motion in to 'up' and 'down' and added the relevant times generally did so correctly. In part (c), attempts to find the speed with which the ball hits the ground were mostly successful with only occasional sign errors or the use of a wrong distance.

.

Question 6

In part (a), the vast majority of students produced a speed-time graph of the correct shape (a trapezium starting at the origin) and most annotated it correctly with V and 270. Most knew how to find the time of acceleration in part (b) but, since it was a 'show that' question, it was important that that there was clear supporting working. Again, in part (c), most knew that they somehow had to equate the area under the graph to the distance travelled but not all attempts were entirely successful. Since there was a given answer some made several attempts and there was much crossing out seen. Some became confused with the times for the different sections and seemed to make their working unnecessarily complicated. Others made mistakes combining the fractions together. Those who included a constant, k, in their equation right from the start could make no real progress. Nevertheless, there were some entirely correct derivations of the given equation. Those who had the correct quadratic tended to solve it correctly in part (d). The final mark was awarded for both correct answers and a stated justification of why, in this context, the V = 75 solution is rejected; this required a realisation that V = 75 is an impossible speed for an athlete running or that it would lead to a negative time for the middle section of the graph (or equivalent, such as the decelerating time is greater than 270 s). Some students gave both answers as possible solutions and a small number even rejected V = 6.

Question 7

This question involved a pulley and a rough inclined plane. Part (a) required the writing down of an equation of motion for each particle. It was generally well done with only an occasional sign error. Sometimes either the component of weight or the frictional force was omitted from the equation for *A* (or even the '*ma*' term) but such instances were rare. There were also cases seen where '*m*' was not included (either consistently or inconsistently) in the mass terms. In part (b), it was necessary to derive the given expression for the acceleration by solving the equations of motion simultaneously. Some had included the correct expression for the frictional force ($\frac{1}{4}$x3$mg\cos\alpha$) in part (a) and so had already achieved three of the available marks. It was important that exact values of the trigonometric ratios were used and that the exact given answer in terms of *g* clearly followed from the preceding working to achieve all of the marks. The implication of the 'inextensible' string in this context (accelerations of the particles being the same) was not always recognised in part (c) with alternatives such as equal tensions commonly seen or the question omitted completely. Part (d) proved 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. Some who achieved a correct answer for the distance travelled by *A* after *B* had hit the ground did not then add on the 1.75 metres to find the **total** distance covered.

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