Examiner’s Report
Principal Examiner Feedback

Summer 2018

Pearson Edexcel GCE
In Mechanics M1 (6677/01)

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

Summer 2018
Publications Code 6677_01_1806_ER
All the material in this publication is copyright
© Pearson Education Ltd 2018

General

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. Students found the paper quite challenging, with all questions, apart from the first two which were fairly standard, providing some degree of discrimination but students were able to make some progress on all questions. Question 2 was the best answered, with 25% of students scoring the modal mark of 10/10 and the most poorly answered was question 3. 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 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 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 student runs out of space in which to give their answer then they are advised to use a supplementary sheet – if a centre is reluctant to supply extra paper then it is crucial for the student to say whereabouts in the script the extra working is going to be done.

Question 1

This was a good starter for the majority of students and 66% of students scored at least 4/6 marks. The question was mostly attempted using the impulse-momentum principle but, as is often the case, the direction of the impulse was not always considered, leading to sign errors in the equation for P in particular. Those who used a conservation of linear momentum equation to find the speed of Q (once they had found the speed of P) often carried forward a wrong value leading to a loss of accuracy marks. There were several cases where students thought that a numerical answer was required and 'u' was dropped from final answers. Also some failed to give a speed having obtained a negative velocity. There were far fewer instances of full marks achieved on this question than on previous problems of a similar type, almost entirely as a result of direction/sign errors.

Question 2
This question involved a particle resting in equilibrium on a rough inclined plane under the action of an external force at an angle to the plane. Almost all students attempted the valid strategy of resolving forces parallel and perpendicular to the plane. Occasionally 'R=2gcos30^{o}' was stated, ignoring the perpendicular component of P; this greatly simplified the problem and led to a significant loss of marks. Most, however, did include all the relevant terms in their equations. The main errors were in failing to take account of the fact that the direction of P was at 50^0 to the plane (and not 20^0 which was the given angle to the horizontal) and/or including friction in the wrong direction; these were counted as accuracy errors. The relationship $F=\mu R$ was almost invariably used to obtain two equations in P and R. Slips in eliminating R and solving for P were fairly common although there were a reasonable number of entirely correct answers seen.

Question 3
Part (a) was very well done by the majority of students with the most popular (and efficient) approach being to take moments about D to find the tension at C. A few chose to resolve vertically and take moments about a different point but, again, generally successfully. Part (b), however, proved more of a challenge. The critical piece of information here was that the extra gymnast was the heaviest possible for the beam to remain in horizontal equilibrium. This means that the tension in the rope at C must be zero ('about to tilt'). Without this assumption students could make no valid progress and lost time writing down a variety of equations which they tried to solve in an attempt to eliminate the tension at C. Some substituted the value they had found in part (a). The minority who realised that this tension was zero generally reached the correct answer but some lost the final mark through failing to round to 2 or 3 significant figures (following the use of g = 9.8 m s^{-2}).

Question 4
Part (a) required an understanding that there were two stages of the motion to be considered; the motion of the ball downwards under gravity and then the impact with the ground. This should have led to a *suvat* equation and an impulse equation. Many did not fully understand the situation and gave the required U value as the speed immediately before impact rather than using this to find the original speed of projection. A few incorrectly used v = 10 (speed after impact) in the *suvat* equation to find U. Sometimes there were sign errors in otherwise valid equations and '$\sqrt{u^2+49} = u + 7$' was seen on more than one occasion.
In part (b), finding the time taken by the ball between bouncing and reaching the given point was generally attempted with a greater degree of success. Most used a valid *suvat* method to find an equation in t. There were occasional sign errors and it should be remembered that, if a quadratic equation is incorrect, there must be an explicit method of solution shown (such as showing substitutions in the quadratic formula) to be awarded the method mark for solving. Sometimes both solutions to the quadratic were given without indicating which was the relevant answer here or, on occasion, the values were subtracted. A correct answer to 2 or 3 significant figures was required following the use of g = 9.8 m s^{-2}.

The velocity-time graph for part (c) was often completely incorrect. Some drew an appropriate straight line for the first part of the motion but were unable to deal with the next section after the impact. Those who made reasonable attempts often failed to mark relevant values on the v-axis or had an incorrect sign for one of the values. A solid vertical line joining the two stages of motion was common and the second part often crossed the t-axis (despite only the motion of the ball until it reaches the point B being required).

Question 5

Part (a) was generally well answered, showing that the students had a good understanding of which forces were associated with the woman. The majority produced a correct solution but a significant minority included the 100. A few included the tension and the weight of the lift while a few included a g with the acceleration or didn't use the acceleration at all. A few students exploited the multiple attempt ruling, putting down versions for almost all possible combinations of forces. In part(b), most students scored the B1 for having used $75n$ somewhere (if only by implication); sadly, for many that was their only mark since they had different expressions for M on the two sides of their initial equation. Some forgot to include the weight and a few students lost marks for omitting g on the LHS or for including g on the RHS. Very few students that got to an answer failed to round their answer down. A few students assumed that the woman was still in the lift! Quite a few students attempted trial and error, but they very rarely presented a complete solution. Whilst most did find a tension with 6 people, hardly any bothered to find the tension with 7 people

Question 6

Part (a) was generally well answered, but a significant minority of students interpreted "in the same direction as" to mean "equal to". The majority, however, did equate the resultant to a multiple of $(-2\mathbf{i} - \mathbf{j})$ and successfully eliminated the parameter. Subtracting the two forces was rarely seen with nearly all students earning the first mark. In the second part, the two alternatives were used fairly evenly with most correctly finding the magnitude. There was occasional confusion of resultant force and acceleration. Very few students subtracted $\mathbf{F}_1$ and $\mathbf{F}_2$ to find the resultant but dividing by 0.5 caused some problems. A common error was to use $(-10\mathbf{i} + 3\mathbf{j})$ as the resultant force. In part (c), most students realised that they needed to use arctan, but many lost the final A1 either through not managing to turn a correct angle into a bearing or for not rounding the answer to the nearest degree. Surprisingly few students made use of the fact that they had been given the direction $(-2\mathbf{i} - \mathbf{j})$ in part (a) and using this would have eliminated any errors that they might have generated in their solution.

Question 7

In part (a) it was rare to the see the mark scored. A majority spoke of the “light inextensible” string thus giving two alternative answers, one of which was incorrect. In parts (b) and (c), the vast majority resolved parallel and perpendicular to the motion and were successful in eliminating T, F and R to obtain the correct value of a. The most common errors involved the friction, sometimes it was in the wrong direction, occasionally it was omitted altogether. A few students forgot about the component of the weight of P down the plane. Many students lost the final mark in part (c) by giving their final answer as 1.176 and a significant number still resort to calculating and rounding the angle rather than using the exact trig. ratios that this question expects. This leads to potential errors for the final part as truncated answers make for messy solutions. In the final part, many students scored the first M1, but then either persisted with their acceleration from part (c), when dealing with Q’s ascent, or did not proceed further, resulting in no further marks. A surprising number assumed that P reached the bottom of the slope with speed $v = 0$, and tried to find u, its initial speed when released and many students did not appreciate that when P stops T becomes zero so the acceleration in the system must change. Nevertheless, a significant minority did manage to show the given answer.

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