Examiners' Report/
Principal Examiner Feedback

January 2013

GCE Mechanics M3 (6679) Paper 01

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the world's leading learning company. 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 for our BTEC qualifications.
Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

If you have any subject specific questions about this specification that require the help of a subject specialist, you can speak directly to the subject team at Pearson.
Their contact details can be found on this link: www.edexcel.com/teachingservices.

You can also use our online Ask the Expert service at www.edexcel.com/ask. You will need an Edexcel username and password to access this service.

Pearson: helping people progress, everywhere
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 2013
Publications Code UA034767

General Introduction

This was an accessible paper and many candidates scored highly on it. There were, however, some challenging parts for which less able candidates found difficult to provide solutions to.

Candidates should be reminded that illegible or ambiguously written work might not get the credit it deserves and that corrections should be made clearly by re-writing what was wrong rather than just writing over the original.

There were cases where numbers appeared without adequate reasoning; wrong answers cannot be given method marks if the method isn't shown. Some candidates work in formulae until the end, when they put all the numbers into their calculators at once. Marks are often not earned until substitution of the given values is seen and a mistake entering a value onto the calculator can lose marks.

Misquoting a given answer can also lead to the loss of many marks. This was seen particularly in Q2(b) and Q3(b). When candidates who have achieved a correct result in part (a) use a different expression in part (b) their error cannot be taken to be a mis-read but instead has to be treated as a deliberate choice to change the expression.

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.

If there is a printed answer to show then candidates 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, candidates should show sufficient working to make their methods clear to the Examiner.

If a candidate runs out of space in which to give their answer then they are advised to use a supplementary sheet.

Report on Individual Questions

Question 1

This question was answered correctly by the majority of candidates. A few used the wrong form for the acceleration and some did not calculate the constant of integration. Writing down $c = 0$ was not sufficient to earn the marks; the substitution needed to be shown since the answer was given.

Question 2

The solutions to Q2(a) which simplified the mass ratio to k : 2: k + 2 were concise and easy to follow. The danger with using the full formulae was introducing or omitting an r, π or ρ in the subsequent working sometimes leading to a dimensionally inconsistent moments equation with zero marks. There were very few instances of areas being used instead of volumes or of the formulae needed not being known. Candidates almost always took moments about O, and usually remembered, either in the table or the moments equation, that one term had to be negative.

Whilst the answer to Q2(a) was given, a small number of candidates used an incorrect expression in Q2(b). The tangent fraction was sometimes the wrong way up leading to an incorrect quadratic equation. Candidates need to be reminded to show working for their solutions to quadratics as an incorrect answer with no working will lose the method as well as the accuracy mark. They also need to indicate which of their two solutions is appropriate if both solutions to the equation are offered. Another error seen was to take the radius as $\frac{r}{2}$.

Question 3

For the majority of candidates this provided a good source of marks and there were many correct solutions seen. In Q3(a) the main challenge was for those candidates who did not realise that the applied force was in the negative x-direction although this error inevitably still led to the answer given on the question paper as the negative sign was also omitted in the integration. A few candidates who integrated correctly realised their error and used the given result to correct their error in each line of their answer but the majority made "subtle adjustments" to ensure that their final answer agreed with the required result. Only the less able used expressions other than $\frac{dv}{dt}$ for acceleration and there were few algebraic or integration errors in this part of the question.

In Q3(b) a few candidates failed to appreciate that the velocity had to be replaced with $\frac{dx}{dt}$ but the majority made progress with the question. Some candidates found the numerical work challenging and a substantial proportion failed to arrive at the required final answer with a number of errors such as $5t = 35$ or 10 when $t = 5$. For those who prefer to produce an exact answer it is expected that the logarithmic terms be combined in the final answer.

Question 4

Very few instances were seen in Q4(a) of *mg* being resolved instead of the tension. Hooke's Law was used correctly with some opting to have the extended length as the unknown rather than the extension. Most candidates were able to substitute for the cosine or sine of their angle successfully leading to a correct solution.

Several different methods were seen for Q4(b) but errors often led to the loss of the last mark. Some found an expression for the cosine or sine of their angle, others found the radius, but the most common errors were due to losing the a in the radius or gaining an a in the trigonometric ratio. The presentation of candidates' work if poor, untidy or cramped led to them misreading their own writing and cancelling incorrectly. A small number of candidates used a similar triangle method.

Question 5

The symmetry inherent in any simple harmonic motion ensured that there were many successful routes possible in this question although it would seem that candidates occasionally made things more complicated for themselves by ignoring the initial conditions as described in the problem. In this case the flexibility with which the different approaches could yield the final answer meant that this often did make the solution more complex.

A range of methods were applied in Q5(a) with varying success. The fact that the period of the motion was given in the question meant that candidates knew at an early stage the result they were going to achieve. There was a good proportion of accurate and straightforward solutions produced and many candidates scored full marks in this part of the question. Those who made use of a more circuitous route were often able to arrive at the correct final. The reference circle method works well in this case and those who employed this method arrived very swiftly at their goal. Those who ignored the initial state and used $x = a \cos \omega t$ gave themselves more to do. Those candidates who did not recognise the correct amplitude tended to be rather less successful.

In Q5(b) a good proportion of those using $x = a \sin \omega t$ were able to pick up marks although a few made errors in identifying the distance from B. Many candidates used $x = a \cos \omega t$ even though they had been informed that the particle was at the centre of the oscillation at the start of the motion.

Q5(c) and Q5(d) were very standard results for this type of question and the majority of candidates were able to score straightforward marks.

Question 6

Many candidates began Q6 (a) with an energy equation. Some realised that this would not work and then resolved along the radius. Candidates should ensure that their square root signs are written correctly, covering both the numerator and denominator.

Q6(b) did need an energy equation and most candidates applied conservation of energy correctly using the given answer for Q6(a).

Q6(c) proved to be very challenging. Many used the wrong angle when resolving to find the horizontal and vertical speeds at B and a few used u rather than the velocity at B. The equation of motion often contained sign errors and a minority tried to find the time of flight first, often using an incorrect distance. Some misinterpreted the question and used distances rather than velocities to find the direction of motion. Presentation of solutions given was often a factor in this part such as a lack of clear diagrams showing velocities and directions. This was particularly evident in the final tangent ratio where candidates had to pick out the correct components of the correct velocities from their working. Some candidates did not recognise that they had made a mistake when they obtained, for instance, $v^2 = -\frac{5ag}{8}$ but instead, just dropped the minus. Very few used the energy method.

Question 7

In Q7(a) of the question all but the weakest candidates were able to score full marks for a simple application of Hooke’s Law.

Q7(b) was a slightly more complex problem which required the candidates to set up the problem carefully. Most were able to identify the extension of either the string or half-string and the trigonometry did not pose a difficulty for most of the candidates. There were some errors in applying Newton’s Second Law with incorrect resolutions and, occasionally, a single term in T. Those who were successful in setting up the problem usually managed to arrive at the correct answer although a number retained too many significant figures in their final result.

In Q7(c) a substantial proportion of candidates assumed that the Elastic Potential Energy was automatically zero in one of the two positions examined; most candidates were able find correct expressions for the other energy components. The majority of those who set up the energy equation successfully found little difficulty in arriving at the correct final result.

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

Further copies of this publication are available from
Edexcel Publications, Adamsway, Mansfield, Notts, NG18 4FN

Telephone 01623 467467
Fax 01623 450481
Email publication.orders@edexcel.com
Order Code UA034767 January 2013

For more information on Edexcel qualifications, please visit
www.edexcel.com/quals

Pearson Education Limited. Registered company number 872828
with its registered office at Edinburgh Gate, Harlow, Essex CM20 2JE

Llywodraeth Cynulliad Cymru
Welsh Assembly Government

Rewarding Learning