Examiners' Report

Principal Examiner Feedback

Summer 2019

Pearson Edexcel GCE AS Mathematics

In Mechanics Paper 22 (8MA0/22)

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 2019
Publications Code 8MA0_22_1906_ER

<u>8MA022 Examiners' Report June 2019 (Mechanics)</u>

<u>General</u>

A significant number of the candidates were poorly prepared and were unable to make much progress on any of the questions. On Q2, 54% of the entry scored 3 or fewer marks out of 12 and only 1% scored full marks. Performance on the other two questions was slightly better but nevertheless there were still large numbers of low scores.

Q1 differentiated well and provided a good range of marks with most candidates having some understanding of what was required although full marks were relatively rare. Many scored well on Q3 showing a fair understanding of the use of calculus in variable acceleration problems although it is possible that some were running out of time at this stage.

In calculations the numerical value of g which should be used is 9.8, <u>unless otherwise stated</u>. 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 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 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.

Question 1

The first part was well done by the majority of candidates who used a *suvat* equation to find the required speed after 3 seconds.

Part (b) involved drawing a speed-time graph for the motion of the parachutist. Many correct shapes were seen for the first mark but those who included a solid vertical line at $t = T$ were penalised. Other less common errors included not starting the graph at the origin, not using a straight line for each section and having a sloping line for the final section (when the parachutist is moving with constant speed). The given figures ('30', 3, 5, T) were required to be correctly placed for the second mark; occasionally one or two were omitted but many did achieve this mark. In the third part the majority of the candidates realised that the area under the graph represented the distance travelled. However, not all used the correct structure, namely a triangle, rhombus and rectangle (or equivalent) and the relevant correct formulae for their areas. There was often confusion in the use of T (which was defined in the question) so that effectively the final stated answer was 5 less than the actual value. Some used *suvat* equations for each stage of the motion, often more or less successfully, although a fairly common error was to use a final velocity of zero in the third section. Attempts to use a single *suvat* equation to cover the entire distance were seen on occasion; these showed a lack of understanding of the situation and achieved no credit. Those with correct working did not always round the final answer to the nearest whole number as required.

Part (d) required recognition of the fact that including the effect of air resistance would lead to an increased value of T. Although this was widely understood, some candidates commented that 'it would take longer' which did not answer the question as stated.

Part (e) required a suggestion for a further refinement of the model. There were many possible acceptable answers with using a more accurate value for g, considering wind effects and allowing time for the parachute to open being some of the more popular options. A common suggestion which was not credited was to include the mass of the parachutist. If two or more answers were offered they all had to be correct to achieve the mark; this was to avoid rewarding candidates who were ‘hedging their bets’ by listing everything they could think of.

Question 2

Although the first part of this question was well done by some candidates, a significant minority failed to write down an equation of motion of the correct structure for each mass. Some included a weight term in the equation for the particle moving horizontally whilst others showed no real understanding of what was required and confused equations of motion with *suvat* equations or omitted this part completely. Those who managed to produce two valid equations generally had no difficulty in deriving the given answer for the acceleration. Since it was a ‘show that’ question, it was important that the final answer followed from sufficient and entirely correct working; those who went straight from the two simultaneous equations to writing down the answer were not awarded the final mark. Such instances were, however, fairly rare. Some attempted a ‘whole system’ approach which was equivalent to writing down just one equation with the tension eliminated. This was deemed not sufficient for a complete method and scored a maximum of two marks.

Part (b) was also completed with mixed degrees of success. To solve the problem it was necessary to split the motion into two stages, before and after one mass hits the ground. Those who attempted to use a single *suvat* equation to cover the whole motion could achieve no credit. Some successfully found the time it took for Q to fall to the ground but were then unsure how to proceed. Those who calculated the speed with which Q hit the ground generally used this in considering the subsequent motion of P as it continued to move across the table. However, the most common error at this stage was in not realising that P would move with constant speed since there was no tension and the table surface was smooth; some included an acceleration of 4.2 ms^{-2} (or even 9.8 ms^{-2}) in the relevant *suvat* equation or, more commonly, used $s = \frac{1}{2}(u + v)t$ with $v = 0$. These candidates generally scored three out of a possible six marks.

The final part required the identification of a possible limitation of the model. The assumptions of this model were listed in the question and so any one of these (such as smooth pulley, light string, inextensible string, modelling the balls as particles) could be used in describing such a limitation. Often other factors were identified which were not part of the specified assumptions for this model and so were not awarded the mark.

Question 3

In the first part, the majority of candidates knew that finding acceleration involved differentiating the given expression for the velocity and, apart from the occasional slip, this was generally done well. However, a fair number then found either t when $a = 0$ or a when $t = 0$ without realising that, to find the relevant value of t, it was necessary to solve the quadratic equation obtained by setting $v = 0$ (when the particle is at instantaneous rest) . Many of those with the correct working lost the final mark for giving a negative answer for the ‘magnitude’ of the acceleration.

Most candidates knew they had to integrate for part (b) which they did mostly successfully and many went on to substitute $t = 3$ as required to find the distance travelled. There were a few numerical slips in carrying out the substitution but there were many correct solutions seen to this part of the question.

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