Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

Summer 2022

Pearson Edexcel GCE

AS Mathematics (8MA0)

Paper 22 Mechanics

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Summer 2022
Publications Code 8MA0_22_2206_ER*

General

Overall the quality of the scripts was reasonably good with most candidates able to make an attempt at each of the four questions. There was no evidence of time being a limiting factor. Question 1 proved to be a good starter with a third of candidates able to score at least 5 of the 7 marks available. However, just under a quarter could only score 1 mark. Questions 1 and 3 performed at a very similar level and questions 2 and 4 were also similar, but significantly lower. Question 2 in particular proved to be a challenge for weaker candidates with 53.6% of them only scoring 2 or fewer of the 8 marks.

In calculations the numerical value of g which should be used is 9.8, unless otherwise stated as in question 1. 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

Candidates who had not read the question and used g as 9.8 or 9.81 were few and far between. Part (a) was generally well done with most candidates using the figures 10, 10 and 1.8 in a correct constant acceleration formula to obtain the given '$U = 8$'. Occasionally there was a sign error and although the correct answer was quoted, it did not actually follow from the working. A few used 0 as opposed to 10 for the final velocity. Some considered the motion 'up' and 'down' separately and used the distances to successfully derive the value of 'U'. The most common approach in part (b) was to write down a quadratic equation in t and to solve it using the quadratic formula. There were occasional sign errors in the equation and some were either unable to deal with the quadratic or misquoted the formula. Nevertheless, a significant number did successfully find the two values of t and gave the correct one as their answer. The alternative approach of 'up' and 'down' separately was seen, but often only one of the times was calculated correctly. The other most common method being use of $v = u + at$ but a significant number made a sign error in their equation and 0.2 was a very common wrong answer. In part (c), correct refinements seemed to be in the majority but only just. A more accurate value of gravity (9.8) was the most common correct response but wind, spin and dimensions of the stone were also seen. Many reasoned that due to air resistance the acceleration was smaller making the velocity smaller. Very few considered how changing the value of a in the equation they used would affect their answer for U. Weight/mass and force were the most common incorrect answers, often being given as an incorrect extra answer to what would have been a correct one, and as a result losing the B mark. In the final part, correct answers were in the minority, with most candidates failing to appreciate that if there was air resistance, the stone would have to be projected faster in order to still hit the ground at 10 ms^{-1}.

Question 2

In part (a), most diagrams were drawn with the correct shape. The most common error was to not have the deceleration phase *clearly longer* than the acceleration phase. Also a few candidates didn't account for the time travelling at constant speed and drew a triangle which generally meant that they were unable to score many marks in the remainder of the question. In the second part, most candidates connected the area under the graph to the distance of 15 km travelled, although some forgot to change km into m or converted it wrongly. Some chose to use the formula for the area of a trapezium directly, others divided the area into two triangles and a rectangle and a small number used a rectangle with two triangles subtracted. A significant number of candidates chose to solve the problem by using an explicit verification method, using t = 40 and the information given about the acceleration and deceleration times and the total time to show that the distance travelled was 15000 m but lost the final mark if they did not say that this was equal to 15 km. The vast majority of candidates scored the mark in part (c) for the acceleration. Part (d) was the most challenging part, with only better candidates able to come up with a method and of those, having worked out that the change in velocity was 5 ms^{-1}, forgot that it was decelerating at this stage and added it on to 25 ms^{-1} instead of subtracting it.

Question 3

Part (a) was generally well answered by candidates with accurate and efficient methods frequently shown. The majority knew to differentiate to obtain an expression for velocity and were able to do so correctly and differentiating again to find the acceleration was almost always done correctly also. Some didn't set their velocity equal to zero and instead put their acceleration equal to zero, commonly scoring 3 out of the 6 marks available in this part. A number of candidates integrated instead of differentiating but this was rare. A tiny minority attempted to use *suvat* formulae in this variable acceleration question. Part (b) was much more challenging and most candidates didn't see the connection with the work they'd done in part (a) and what this meant for the direction of travel and total distance travelled. The majority of the successful candidates showed three separate sets of working for each of the three sections and then knew they needed to add the modulus of each section. This was often supported by sketching a graph. Integrating the velocity between 0 and 4 or using the given equation and a single calculation between 0 and 4 was the most common error leading to an answer of 16/3. A significant number of candidates did find s_2, s_3 and s_4 (and often s_1 as well) but then just added these values together so just scored the first method mark in this part.

Question 4

Although fully correct answers were seen, it was clear that many candidates had little experience of answering this type of question. In particular, there were many equations seen with an incorrect number of terms, particularly in part (b). Clear force diagrams would have helped some candidates, but these were not often forthcoming. In part (a), many candidates gained all 3 marks. The most common error occurred where the direction of travel had been mixed up. For those who set up an equation of motion for the cage and block together, the most common mistake was '$50g - T = 50 \times 0.2$' (as if it was accelerating downwards). Some students attempted '$F = ma$' for the cage, but omitted 'R', scoring zero marks as there were an incorrect number of terms. There were instances of numerical mistakes in calculating '50×0.2' ('25' being a common one). Most students used the correct value of 9.8 for g. There were a few cases where g was omitted from the weight or added incorrectly in the 'ma' term. In part (b), few candidates gained the full 3 marks. Some failed to identify the forces which were acting on the block; others considered the forces acting on the cage rather than the block. A common error was to get the direction of motion mixed up. There were quite a few blanks here, even by students who had made a good attempt in part (a). For students who knew what to do here, there were a few instances of '$10g - R = 10 \times 0.2$'. Some students attempted '$F = ma$' for the cage rather than the block, but omitted 'T' or they tried to combine the cage and the block. For those students scoring zero marks for Q4, their responses were either completely blank, or they tried to equate forces, ignoring the fact that the cage and block were accelerating.