Examiners' Report
Principal Examiner Feedback

Summer 2022

Pearson Edexcel International Advanced Level
In Mechanics 1 (WME01) Paper 01

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The paper seemed to work well with the majority of candidates able to make attempts at all of the questions, although there was some evidence of time issues for weaker candidates. There were some excellent scripts but there were also some where the standard of presentation left a lot to be desired. This, in some cases, made it difficult for examiners to follow the working.

Question 1 was the best answered question, with 74% of candidates able to score 3 of the 4 marks available, and Question 5, where 29% scored zero, the worst. The remainder of the questions all performed at a very similar level.

In calculations the numerical value of *g* which should be used is 9.8. 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, as in 8(b), then candidates need to ensure that they show sufficient detail in their working to warrant being awarded all of the marks available and that they end up with *exactly* what is printed on the question paper.

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

In part (a), the vast majority of candidates formed a correct impulse-momentum equation for particle Q. Errors were mainly in the signs in the initial equation, occasional algebraic errors in rearranging or using a mass of 'm' instead of '$3m$'. Solving this equation leads to either $\frac{2u}{3}$ or $-\frac{2u}{3}$, depending on which way the unknown had been chosen, but the question required a speed and some candidates lost a mark for not giving a positive answer. A few were bewildered by the fact that they had not been given information about the speed and mass of P, and mistakenly tried to form a CLM for the whole system. In the second part, the mark was only available to candidates who had obtained $\frac{2u}{3}$ or $-\frac{2u}{3}$ in part (a). Successful candidates gave a clear answer that the direction was the same as before the collision or the direction was unchanged but there are still candidates who give answers such as: 'to the left' or 'westwards' and these receive no credit.

Question 2

Part (a) was generally well done. Many students correctly applied a single *suvat* formula, $s = vt - \frac{1}{2}at^2$, in order to find the acceleration but a smaller group opted to first find the value of u, using a different *suvat* formula, and then use that to obtain the required answer. Common errors seen were using incorrect *suvat* formulae, taking u as 28 or taking u as 0. A few used $s = ut + \frac{1}{2}at^2$ with u = 28, leading to a = -1.2. This earned the M1 only, but could go on to score all three marks if it was subsequently changed to the positive value. Part(b) was much more problematic. Nearly all those who attempted this were able to find the speed or the distance at $t = 5$ (or $t = 4$). However, very few went further than this and 95 was the most popular incorrect answer. It was rare for candidates to understand what was meant by ‘during the fifth second’. Some who did attempt this found the distance travelled between $t = 5$ and $t = 6$ instead of between $t = 4$ and $t = 5$. Some incorrect attempts found the distance when $t = 15$ or $t = 1/5$.

Question 3

In part (a), most candidates used the whole system equation to obtain $a = 0.2$ and then used an equation for either the tractor or the block to obtain the answer. A significant number used masses in tonnes instead of converting to kilograms and were able to score a maximum of 4/6 for the question. Others who used incorrect conversions from tonnes to kilograms, could score 3/6. Some candidates still struggle with working out which forces are acting on which part of the system. In part (b), there were relatively few correct answers and common errors included referring to the tension in the cable.

Question 4

In part (a), the majority of candidates were able to successfully find the normal reaction and then state that $F = 3/7 \times 42 = 18$ N. However, most students failed to understand or clearly articulate that the friction calculated is the maximum friction not the friction acting in this situation. Some candidates calculated P as 12.1 N, compared it with 18 N but were unable draw the correct conclusion which was that the friction is 12.1 N and the block does not move.

Part (b) was far more successful with many scoring all the marks here. A few used the maximum friction from part (a) and were able to only score a mark for $P\cos 30 = F$. A significant number of candidates, with an otherwise correct solution, lost the final mark as they did not give the final answer to 2 or 3 sf after use of $g = 9.8$.

Question 5

In part (a), the vast majority of successful candidates took moments about D to form an equation in Rc only and then solved it. Other successful candidates resolved the forces vertically and then formed a moments equation about one of the ends. This meant that these candidates had two simultaneous equations which needed to be solved and it was only when an equation in Rc only was formed that any marks could be earned. Many lost a mark for an over accurate answer after putting $g = 9.8$. Occasionally an equation was dimensionally incorrect with a force being wrongly equated to a sum of moments and this lost the M mark and so the A marks also.

Part (b) was very similar to part (a) and candidates just needed to repeat the process but take moments about C rather than D. The final part proved to be a challenge for all but the best candidates and there were many zero scores. The successful few realised that they could use their answers to parts (a) and (b), by equating each to zero, to find the two critical values of M, and obtain a correct inequality. Some, however, wasted time and started again but did eventually get to the answer.

Question 6

This question was reasonably well-answered. Most students realised that they needed to apply **v** = **u** + **a***t* in this situation. However, a few chose to use $t = 4$ rather than 3 at the start of their solution. Another common error was then proceeding to use **v** = **u** + **a***t* again but with $t = 3.5$. Most of the correct attempts used **v** = **u** + **a***t* with $t = 3$ to find **a** then obtained an expression for **v** using **v** = **u** + **a***t* with **u** = (-**i** + 4**j**) and $t = 2.5$. An alternative approach was to set up simultaneous equations: (5**i** – 8**j**) = **u** + 4**a** and (-**i** + 4**j**) = **u** + **a**, solve for **u** and **a** then use **u** = (-3**i** + 8**j**) with $t = 3.5$ to find the velocity. A large number of candidates found **v** but failed to go on to find the magnitude to obtain the required speed.

Question 7

Scoring 3 marks in part (a) proved to be difficult for many students. The majority of candidates failed to recognise that B's graph should have steeper gradient or that the graphs should cross. A significant number also failed to read **on the same axes**, drawing two separate graphs. In the second part**,** although many candidates were able to correctly find the time taken by A to complete the race, a common incorrect approach was to use a single *suvat* equation for the whole motion. This was also a common error in part (c). Candidates were generally more successful in part (b) than in part (c). A few candidates who had a correct approach for part (c) failed to realise that $v = T$ (as the acceleration was 1 m s^{-2}) and so were not able to form an equation in T only. Of the candidates who had an otherwise fully correct solution many lost the final mark in (d) for giving an answer to only 1sf. A very small number of candidates gave a descriptive answer for (d) instead of a calculated difference.

Question 8

In part (a), most drew a diagram and were able to obtain the required bearing. In the second part, there were many successful attempts but there are still a few candidates who do not appreciate that when there is a given answer to show, they must give sufficient detail in their working to warrant being awarded all of the marks available <u>and</u> that they end up with <u>*exactly*</u> what is printed on the question paper. A common error occurred, after correctly finding **p** and **q**, when some candidates, instead of finding **q** – **p**, put **p** = **q**, losing the final 2 marks. In part (c), better candidates put $t = 10$ in the given answer to find **PQ**, and should then have been able to obtain the required bearing of 270º, but 90º was the most common answer. A significant number wasted time by finding **p** and **q** at $t = 10$, but again the correct answer was rarely seen. Part (d) was a good discriminator, with successful candidates needing to equate the **i** and **j** components of **PQ** to find the required t value of 8 before using Pythagoras to find the distance at that time. Common errors involved incorrect ways of obtaining a value for t and occasional arithmetical mistakes. The final part was quite well answered, for those that got this far. Many used Pythagoras' theorem on **PQ** to find the distance in terms of t and equated it to 200 to give a two-term quadratic equation which could then be solved. Two answers, including $t = 0$, were needed for the final mark.

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