Pearson Edexcel

Examiners' Report

Principal Examiner Feedback

January 2022

Pearson Edexcel International A Level

In Mechanics 1 (WME01/01)

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General

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

Question 2 was by far the best answered of all the questions, with almost 68% of candidates scoring full marks. On the other hand, question 7 proved to be the most demanding, with 7(c) causing problems and 7(d) proving to be the most demanding mark on the paper.

Question 3 was an all or nothing question with 30% scoring at most 1 mark but 42% with a mark of at least 6 out of 7.

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

The most popular method was to resolve vertically and horizontally. Many were successful in forming these equations and then eliminating either F or T to form and solve an equation in one variable and then use their value to find the other. Some made arithmetical and algebraic errors when solving these two equations and this cost them marks. Others used their calculators to solve for the two values. More efficient methods that were successfully employed involved resolving in the direction of F to obtain $F = 5\cos 30$ and in the direction of T to obtain $T = 5\sin 30$. Another direct method involved applying Lami's theorem. Errors were many and included using incorrect angles, poor rearrangement of equations and incomplete resolutions e.g. $5 = F\cos 30$ rather than $5 = F\cos 30 + T\cos 60$. It was also not uncommon for weight to be confused with mass resulting in the use of $5g$.

Question 2

This was probably the most successfully answered of all the questions on this paper.The vast majority of candidates used conservation of momentum in part (a) and were careful with signs and correct pairings of mass and velocity to obtain the correct value of $k = \frac{1}{3}$. A few found the impulse on P and then equated it to the impulse on Q but there often sign errors when this approach was used. In part (b), the majority found the impulse on Q which was the best method since k was not needed but a few chose to find the impulse on P and risked losing 2 marks if their k value was wrong. Common errors in part (a) were mainly incorrect signs or careless algebra. A few included g in their equation for part (b) which meant a dimensionally incorrect answer and lost all the marks.

Question 3

Part (a) was well attempted and had a high success rate for the candidates. Successful candidates employed one of two strategies. The majority took moments about D, producing a dimensionally correct equation leading to $m = 20$ kg. The other method was to resolve vertically to find the reaction at D and then to form a moments equation about another point on the rod. Combining these two equations would lead to an equation in m only. Some students used W for mg and could obtain full marks if this was used correctly. Common errors included omitting g and having extra forces e.g. introducing reaction forces at the ends of the rod. Some candidates who resolved vertically omitted the reaction at D. Other candidates used incorrect lengths in their moments equations. Part (b) was also well answered with many obtaining the correct answer. Successful candidates again mainly took moments about D. Others took the two equation approach of resolving vertically and taking moments about A or B. Errors here were mainly to do with lengths, although some candidates forgot that the boy had moved position to the end of the rod. Other errors involved the misuse of g. The final part was less successfully answered. Candidates need to aim for succinct answers which include all the key points. It should be noted that extra incorrect answers are penalised in this type of question.

Question 4

In part (a), there were a variety of strategies used to calculate T, the total time of flight. The information given was such that at least two *suvat* equations were required. Most candidates found the initial speed correctly as 19.6 ms^{-1}. Some found the time to the highest point, using $v = 0$ in either $v = u + at$ or $s = vt - \frac{1}{2}at^2$, and then used the total distance of 44.1 m to find the time of descent. Some found the time taken to fall the final 24.5 m and added this to twice the time to reach the greatest height. About half the candidates used their initial velocity in $s = uT + \frac{1}{2}aT^2$ using s as the total displacement; sign errors were, however, fairly prevalent in this approach. A small minority of candidates paired up distances and velocities incorrectly, such as using a zero velocity as the particle passed the starting point or as it hit the ground, showing a lack of understanding of the situation. In part (b), many candidates drew a velocity-time graph instead of a speed-time graph. Some omitted this part of the question completely whilst a few included curves or, on occasion, a trapezium. Most of those who had the correct shape made the second line longer than the first and made the angles with the t-axis approximately equal, but a few lost the second B mark for not doing this. Almost all included T (or their value of T) correctly marked.

Question 5

This question, involving the equilibrium of a particle on an inclined plane, was generally answered well, although a few candidates failed to make much progress. The vast majority of candidates achieved the first two marks for a correct resolution perpendicular to the plane leading to $R = mg\cos\alpha$. Many also used resolution parallel to the plane to produce a correct equation in $2P$ but a sign error in the equation for P was fairly common. Most used $F = \mu R$ to eliminate R and P and then solve for μ as required although some were unable to do so and left their answer in terms of P. A significant minority equated the resultant force to ma. Those who set this equal to zero at some later stage in their working could achieve all the marks, but a few failed to do so and could not solve the problem.

Question 6

Part (a) was well done by the majority of candidates who used $\mathbf{F} = m\mathbf{a}$ and equated coefficients of **i** and **j** to find the values of p and q, as required. A few neglected to include m or subtracted rather than added the forces, but such instances were rare. There were occasional slips in solving the simultaneous equations or miscopying errors but, nevertheless, full marks were often achieved for this part of the question. In part (b), almost all candidates scored the method mark for finding or writing down the relevant angle of 45° for the angle that the vector ($\mathbf{i} - \mathbf{j}$) makes with **j**. However, many did not achieve the second mark for deducing that the required angle was actually 135° (or 225°).

Question 7

Part (a) was answered successfully in many cases, but it was clear that not all candidates understood what was meant by 'an equation of motion', with some trying to find a *suvat* equation. Many candidates had extra terms in their equation of motion (either friction or mg) which then of course affected the answer to part (b). Here, the majority of responses showed candidates being successful in finding the value of friction for the particle on the slope and using $F = ma$ for both particles. The occasional candidate omitted 4 in $4ma$ or had $a = 0$. However, algebraic slips and sign errors along the way meant that the correct expression for T was not always reached. Several candidates found it easier to solve their equations to obtain the acceleration of the system and then substitute to find the tension. Part (c) was not answered very successfully with many students struggling with the obtuse angle at the pulley. The two most reliable approaches were either using the cosine rule or using horizontal and vertical components with Pythagoras. Using $2T\cos((90-\alpha)/2)$ was seen several times whilst a few candidates lost the second M mark for T being in the wrong form, usually omitting m. The final part was very rarely correct. The most common response by far was 'constant tension throughout the string' but this lost the mark as the added requirement of the word "section" was rarely seen.

Question 8

Parts (a) and (b) were answered very successfully by the majority of candidates, reaching the given answer in part (b) in the correct form. Some provided very little working which is a risk when obtaining a given answer. A few candidates misread their own writing or made sign errors but miraculously managed to obtain the given answer. A few others put **r**A = **r**B and then subtracted which is incorrect. Column vectors were used by under half the candidates and led to greater accuracy in the arithmetic, but some then failed to correctly change the answer back to **i**'s and **j**'s. In part (c), the first mark demonstrated that most candidates know how to find the distance from a displacement vector. Unfortunately this was as far as many candidates reached. All four approaches were used on the mark scheme. Several students substituted t into **r** and **s** rather than **AB**, which led to several candidates obtaining two different values for *t* and then offering two distances for *AB* before choosing the smaller. There are an increasing number of candidates who are relying heavily on their calculator and showing very little working out. This was evident where candidates formed the correct three term quadratic and simply stated the correct values for both *time* and *minimum*. Whilst candidates may be encouraged to use the quadratic solver on their calculator, they should also provide sufficient working for for a 6 mark question in case of errors early on. In the final part, a reasonable proportion efficiently used the given expression for **AB**, but many took a longer approach by finding the coordinates of *A* and *B* and then the displacement vector rather than substituting directly into part (b). Several found a relevant angle but failed to obtain the bearing. Others attempted to find the position of one point and then found the angle between their positionvector and one of the axes which does not give the required result.

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