Pearson Edexcel

Examiners' Report

Principal Examiner Feedback

October 2020

Pearson Edexcel International GCE

In Mechanics M1 (WME01)

Paper : 01 Mechanics 1

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

October 2020
Publications Code: WME01_01_2020_ER

General

The paper seemed to work well with the vast majority of candidates able to make attempts at all of the questions. Question 3 was the best answered question with 66.4% of candidates scoring at least 6 out of the 8 marks. This was closely followed by question 2 and then 1. Question 6 was by far the most challenging, closely followed by question 4 and then 7.

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

In part (a), virtually all candidates attempted to apply the principle of conservation of linear momentum but, although equations were almost invariably dimensionally correct, there were occasional sign errors. This was, perhaps, surprising given that the directions of motion for both particles were the same before and after impact. The equivalent method of equating magnitudes of impulses was only rarely seen. A small number of candidates assumed that P and Q moved with the same velocity after impact. Arithmetic or algebraic slips in rearranging sometimes led to incorrect values for the speeds after impact whilst some, having calculated the speed of P correctly, forgot to multiply by 4 to find the speed of Q. In part (b), almost all knew and applied the definition of impulse in terms of difference in momenta for one particle. Either particle could be considered, and both depended on a previously found velocity. The method mark required the mass, speed before impact and speed after impact to be used consistently either for P or for Q. Those who carried forward an incorrect velocity from part (a) could achieve two out of the three marks available here. Although there were occasional sign errors or dropping of 'mu', there were many correct answers for the magnitude ($+\frac{10}{3}mu$) seen. In the final part, it was important that the direction of the impulse was described in the context of the problem, for example 'opposite to the direction of motion (of P/Q)'. Common responses such as 'to the left', 'west' or drawing an arrow did not achieve the mark.

Question 2

In part (a), the majority of candidates attempted a valid method to find the complete time of flight. The most common approach was to use $s = ut + \frac{1}{2}at^2$ although occasional sign errors led to a value of $t = 1$ rather than $t = 4$. Those who split the motion into upward and downward stages and then added the separate times were often successful. However, some wrongly assumed that $v = 0$ when the ball hit the ground and others failed to give a complete method for the total time the ball was in the air. Part (b) was generally well done. Most candidates used the given velocity downwards from a height of 19.6 m in $v^2 = u^2+2as$ to find the speed with which the ball hit the ground. Other successful attempts involved finding the maximum height (when $v = 0$) or using the complete motion with the value of t found in part (a). Many correct answers were seen although a few left the answer as -24.5 m s^{-1} rather than $+24.5$ m s^{-1} as required for speed. The total distance covered by the ball was required in part (c). Most candidates calculated the distance from the point of projection to the highest point successfully and achieved 2 out of the 4 marks available. However, not all used this to find the total distance, sometimes leaving that as their final answer or just adding 19.6 to give the maximum height above the ground. Although a fair number did combine the distances up and down, they did not always round their final answer to 2 or 3 significant figures as required following the use of $g = 9.8$ m s^{-2}. Fully correct velocity-time graphs in part (d) were in the minority. Many attempted a speed-time graph leading to a V shape rather than, for the velocity-time graph, a straight line crossing the t axis. Some had no real idea and produced a whole variety of shapes. Although a few had starting points at (0,0), most achieved one of the three available marks for a starting point at (0,14.7) or (0,−14.7). Some with an otherwise correct graph failed to achieve the final mark for either omitting one of the coordinates for the end point or having the wrong sign for the final v value.

Question 3

Most students gave numerical answers although answers in terms of g were acceptable here for all three parts. In part (a), the vast majority of candidates resolved perpendicular to the plane. Common errors included sin/cos confusion, including an extra force in their equation and omission of g. In part (b), most candidates resolved parallel to the plane, again with some sin/cos confusion, but the crucial point was to have the friction both limiting and acting in the correct direction. In the final part, candidates needed to think how the direction of the friction would change and although there were many correct answers, some just omitted it from their equation.

Question 4

Candidates needed to realize that in each of the two scenarios one of the two tensions became zero as the beam was about to tilt. If they didn't, little progress could be made as there were too many unknowns. Because of this there were many solutions (34.2%) that scored full marks and many (39.2%) that scored zero, with relatively few scoring part marks. Most successful candidates had two separate diagrams, took moments about C for the first scenario and about D for the second, giving two simultaneous equations in M and d, which they then solved to give $M = 32$. Others chose to resolve vertically and take moments about other points, for each scenario, and then eliminate an unwanted tension in each case to obtain their two simultaneous equations in M and d. Common errors included choosing the wrong tension as zero, incorrect distances used in a moments equation, trying to combine the two situations into one with both gymnasts on the beam together and using the same tension at C and D.

Question 5

In part (a), almost all students scored the first mark and the vast majority went on to earn full marks, but a few failed to find the speed, leaving the answer as a velocity vector. In part (b), most earned the first two marks, obtaining a relevant angle, but a significant number failed to round their answer to the nearest degree whilst others couldn't find the appropriate angle with $\mathbf{j}$. The majority used a tan equation, but a few tried to use either sin or cos, with mixed success, and a small number tried to use the scalar product, usually unsuccessfully. In the third part, either comparison with $\mathbf{v} = \mathbf{u} + \mathbf{a}t$ was used by rearranging the given expression or less often, two specific points were used. A few used differentiation and got the answer very quickly and easily. In part (d), there were occasional sign errors for those using the ratio method but there were many correct solutions. Some used a multiplying factor, again largely successfully but there were still a significant number of candidates who simply equated $\mathbf{i}$ and $\mathbf{j}$ components and scored nothing.

Question 6

The crucial part of this question was knowing which forces were acting on the engine and which were acting on the truck. Common errors were to have the driving force acting on the truck, the thrust force appearing in the whole system equation and omission of the weight component(s). In part (a), those candidates who did not realise that they should be considering the motion of the truck *only* were unable to make progress (unless they had written down both the whole system equation and the engine only equation and eliminated D.) In part (b), some candidates, who had found an incorrect acceleration in part (a), were able to redeem themselves and earn a few marks for a correct system or engine equation making use of their incorrect acceleration. There were many solutions (37.8%) that scored full marks and many (31.8%) that scored zero, with relatively few scoring part marks.

Question 7

In part (a), most candidates were able to write down the equations of motion for the two particles and then solve them to find the tension. Common errors were extra g's and wrong signs. A few omitted the m's from their equations which was a costly mistake. There were a few who did not really have any idea where to start. Many candidates eliminated T first to find the acceleration and then went back to find T. This was usually successful although quite a few ended up with a mixture of fractions and decimals. Far fewer candidates realised that the force on the pulley was $2T$. Some candidates had learnt a formula for the force on the pulley as $2T\cos(\theta/2)$ but they were not all able to apply this formula to the given situation, often using $\cos 45^\circ$. A few wrongly used Pythagoras. Some lost the final mark for not giving their answer in terms of m and g. In part (b), only a small number referred to the pulley in their answer. Many seemed to know it had something to do with the tension, but answers were often badly expressed. 'The tension is the same throughout the string' or 'the tension is the same for both particles' were common incorrect answers. Wrong answers often focussed on friction and acceleration.

Question 8

Many candidates were able to score full marks on this question. In part (a), the majority of candidates obtained the correct answer. Quite a few found the speed and used suitable methods to get the right answer. Some candidates, however, found the speed at 4 seconds but then used a constant speed equation, $d = vt$. In part (b), the most successful candidates were those who attempted to sketch a velocity-time graph. Many had difficulty finding the relevant speeds for each section of the motion. The method for finding the distance travelled in the middle section was often correct using either the area of a trapezium or *suvat* formulae, so many were able to score one or both of these marks. The last section proved more problematic with a significant number finding the area of a triangle. A surprising number of candidates used "distance = area under graph" without apparently noticing that they had been given an acceleration-time graph rather than a velocity-time graph. Other errors included using $a = v/t$ for all three parts of the motion or assuming that the car came to rest at the end.

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