Examiner's Report
Principal Examiner Feedback

Summer 2018

Pearson Edexcel International A Level
In Mechanics M3 (WME03/01)

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Summer 2018
Publications Code: WME03_01_1806_ER

This paper tested all areas of the specification giving all students the opportunity to demonstrate their knowledge. Most students could start all questions even if they were unable to complete them. It seemed that students who were capable of completing the paper had sufficient time to do so.

Students should remember that there can be benefits in quoting the general form of equations before substituting the numbers specific to the question being solved. Substitution errors are then shown to be just that, rather than errors in the general equations, and so the method marks can be awarded.

Answers which depend on a numerical value for g having been used should always be given to 2 or 3 significant figures. Any other answers which required rounding may also be given to the same degree of accuracy unless the question specifies otherwise.

Question1

This was answered very well by most students apart the final mark. Almost every student formed a correct equation and used it to get the correct answer. Unfortunately nearly all left it as 1/3, losing the final mark. The answer had to be given to 2 or 3 significant figures since a numerical value of g was used in the solution. Some students made the mistake of using 0.5 as the extension and so lost all the marks.

Question 2

Part (a) A few students lost a mark by not dealing with the negative sign, when the modulus was required. Some did not use the correct equation to find ω. Use of $v = r\omega$ was seen on a number of occasions to obtain $\omega = 15$. Almost all students could find the period by using $T = \frac{2\pi}{\omega}$.

Part (b) A correct equation was seen in most responses with very few errors. Most did this correctly even if ω was incorrect from part a). A handful of students used $v^2 = \omega^2\left(a^2 - x^2\right)$ and used the period from a) instead of ω.

Part (c) This was the most demanding part of the question and students used a variety of methods or in some cases left it blank. The most straightforward was the use of $\sin\omega t$ as on the main scheme although some multiplied by 2 instead of 4 to obtain the final answer. Those who used $\cos\omega t$ made more errors in completing to the final answer. The reference circle was also used successfully by a small number of students.

Question 3

Part (a) This was answered very well, with most students forming two correct equations, with the trigonometry usually fairly clearly labelled on their diagrams. There were very few mistakes in calculating the trigonometric ratios and the radius of the circle. Considering the potential pitfalls in solving the two simultaneous equations, very few actually slipped up, with most students arriving at a correct form for the tensions. In this case it was fairly rare for any fractions within fractions to be left in their answer. A rarely used alternative was to resolve along the directions of the strings, which led straight to each tension with no need for any simultaneous equations.

Part (b) This was far less successful. When the final inequality is given, students should always use in the same form in their solution so in this question should not use $T > 0$ or $T = 0$. Many students started with the given inequality and failed to register that the tension needed to be the starting point. Where students started with $T > 0$ to arrive at an inequality for ω, and then tried to work back towards it using the given inequality, the reasoning tended to be unconvincing. A significant number, having arrived at an inequality for ω, went on to work in equations when changing to *R*, losing the final 2 marks, even if they did arrive at $k = 8$.

Question 4

Many students did not know how to cope with the impulse, not realising that they needed to use it to find *v* and hence the kinetic energy. This resulted in a dimensionally incorrect equation when they came to formulate their energy equation. Several calculated the friction correctly but then omitted to multiply by 0.6 to find the work done and some ignored the kinetic energy completely both of which lost the second method mark. There was also confusion about the distance travelled as frequently 1.2 was used instead of 0.6. Some students tried to use a force method instead of work – energy, invariably incorrectly. Although there were many correct solutions, there were also several which only scored the first mark for the EPE.

Question 5

Part (a) was very accessible and the majority were successful. Part (b) caused problems for most.

Part (a) A significant number started from use of a formula such as $\int a\,\mathrm{d}x = \frac{1}{2}v^2$ or $\int F\,\mathrm{d}x = \frac{1}{2}mv^2$ or $\frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{1}{2}v^2\right) = a$ rather than explicitly showing $F = mv\frac{\mathrm{d}v}{\mathrm{d}x}$ and separation of variables. The integration was not a problem and all could find the constant of integration easily. On the whole the quality of working, to a given answer, was good.

Part (b) This was often not attempted and many did not know where to start. A surprising number of students made careless errors and did not start with the correct expression for $\frac{\mathrm{d}x}{\mathrm{d}t}$ or made errors when separating the variables. Many struggled to rearrange a correct integral into a form that could be integrated. Some students did not have the correct integral and solved their integral by other means which gained no marks. A handful of very poor attempts were seen such as use of $s = \int v\,\mathrm{d}x$ and then using x = 2 and x = 4 as limits. A significant minority did however achieve full marks and the correct answer for part (b) was seen.

Question 6

Part (a) This was standard bookwork but was often very difficult to mark. When the main method was used solutions were generally not too hard to follow, although clear substitution of limits was not always shown. Many students realised that they could do plenty of cancelling before integration, which meant that the given result was reached very neatly, and the lack of working became justified. When the alternative equation was used, however, the substitution became far more of an issue. Very few clear solutions of 1/12 were seen, with students presumably deciding it was too messy and therefore failing to realise that they needed an extra final step. A few students had incorrect starting equations, for instance $y = \frac{x}{6}$, but they could score the method marks if they proceeded "correctly".

Part (b) Some students ignored the masses given in the question and worked with the volumes of the shapes which lost all but the first mark. The final answer was often left with fractions within fractions, so that a correct answer lost the final A mark.

Part (c) This was not answered well, mainly because students often failed to identify the required angle correctly and then sometimes had an equation which was upside down. A whole number answer was required but was not always given.

Question 7

Part (a) This was usually done well. The energy equation from the top to A was almost always correct. The equation of motion at A was often written down correctly without reference to the reaction force, R. If R was included this was usually correct but sometimes there was a sign error seen. Occasionally the student did not resolve the weight.

Part (b) Many correct solutions were seen usually starting from $\cos\alpha < 1$ although some students did use $R_{top} > 0$. However many students did not know where to start, so either left it blank or tried an invalid approach to produce the given answer. Others used equations and an inequality was never seen although it was given on the paper.

Part (c) The method on the main scheme was by far the most straightforward but the majority did not use it. Energy from A to the plane was the most common but many were unclear about u and v and used u as the speed at A instead of using v from part (a). Only a handful of approaches using suvat were successful, with many not scoring any marks as they did not consider vertical and horizontal components separately. In many cases, students lost marks through not being able to read their own writing with u and v often being almost identical.