Pearson Edexcel

# Examiners' Report
# Principal Examiner Feedback

## January 2022

Pearson Edexcel International A Level

In Mechanics 2 (WME02/01)

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January 2022
Publications Code WME02_01_ER_2201

**Introduction**

The majority of candidates found this paper accessible and they were able to offer solutions to all seven questions in the time available. Many candidates were confident in their work and their solutions reflected a good understanding of the material.

It is important for candidates to read the questions carefully and ensure that their response matches the request. For example:

- in question 1(a) several candidates found the velocity of the particle, but not the speed, thus losing 2 marks,
- in question 2(b) several candidates ignored the request to use the work-energy principle and used a *suvat* approach instead, thus losing 4 marks,
- in question 6 several candidates ignored the description of the framework and treated the figure as a lamina, scoring a maximum of 2 marks.

The rubric to the paper gives candidates clear instruction about the value to use if they substitute for $g$, and the appropriate accuracy for final answers, but in question 2 the most common answers were 12.63 and 100.5. In question 7 several candidates used a mixture of $g = 9.81$ and $g = 10$. Candidates who do not follow the rubric will lose accuracy marks.

**Question 1**

(a) This proved to be a straight-forward starter and many candidates gave correct solutions. The only common error was to find the velocity of the particle, but not the speed.

(b) Both of the methods in the mark scheme were common. Candidates using the scalar product were usually successful. Candidates using tangents often found two relevant angles, but they did not always go on to combine them correctly. A small number of candidates used the cosine rule in an impulse-momentum triangle.

**Question 2**

(a) The candidates were familiar with the method to use and they applied this with very few arithmetic or sign errors. The question indicates that $P$ is measured in kilowatts, but some candidates did not notice this. A very common error was to give the final answer to more than three significant figures.

(b) This question requires the use of the work-energy principle, so any other approach scores no marks. Candidates who followed the correct approach often reached the correct answer, There were a few signs errors in the equations, some candidates included the change in GPE as well as the work done against the weight, and some candidates ignored the change in GPE altogether. A minority of candidates confused the two parts of the question and gave solutions including the change of speed from $15\,\mathrm{m\,s^{-1}}$ to $20\,\mathrm{m\,s^{-1}}$.

**Question 3**

(a) Most solutions were fully correct. Some candidates struggled with the differentiation. Some found the magnitude of the acceleration in order to find the magnitude of the force, but the question required the force as a vector.

(b) The integration was usually correct, but there were very few fully correct solutions. Many candidates assumed that the constant of integration was $\left(4\mathbf{i}-\sqrt{3}\mathbf{j}\right)$, without considering the value of their integral when $t=0$. A large minority of candidates set the **j** component of the position vector equal to zero to find when the direction of motion was parallel to vector **i**. Many of the candidates who did try to solve the correct equation gave their answer in degrees rather than in radians.

**Question 4**

(a) The majority of solutions were fully correct. Those candidates who drew a diagram avoided the risk of inconsistent signs in their equations.

(b) Most candidates had a correct expression for the velocity of $A$ after the impact with $B$, and the velocity of $B$ after the impact with the wall. Those candidates who had started by assuming that $A$ and $B$ were moving in opposite directions after their collision usually stated a correct condition for a second collision. The candidates who had started by assuming that $A$ and $B$ were moving in the same direction after their collision did not always seem to understand that they needed to consider the alternative.

**Question 5**

(a) Most candidates demonstrated the use of Pythagoras' Theorem, but many did not explain that this was justified because they were working in a right angled triangle.

(b) The given answer enabled most candidates to correct any errors in their equation for moments about $A$ and give a correct solution.

(c) There are many possible approaches to this question, but most candidates chose to resolve the forces horizontally and vertically. There were a few slips in the working, but many correct solutions. The most common errors were due to confusion between sine and cosine, and equations that involved resolution in more than one direction in one equation. Candidates who worked parallel and perpendicular to the rod did not always work with $\theta-\alpha$ or they introduced their own $\theta$ which they then confused with the $\theta$ given in the question.

**Question 6**

(a) Many candidates combined the two moments equations required in this question into a single vector equation in part (a). The given answer in part (a) was helpful to many candidates. The common errors were candidates who used the formula for area of a semicircle in place of the formula for the circumference, candidates who treated the whole figure as a lamina, and candidates who included an additional rod *EC*.

(b) Although the framework is to be suspended from *A*, many candidates created additional work for themselves by not measuring the vertical distances from *A*. Several candidates worked from *E*, and some worked from *D* or from the centre of the arc. The distance was not given in the question, so there were several processing errors in simplifying the moments equation. Many candidates had a correct method for finding $\alpha$. Some final answers were given in radians, but the question defines $\alpha$ measured in degrees.

**Question 7**

(a) The majority of candidates were familiar with this standard bookwork task. There were many fully correct solutions. The common omission was to jump directly from $\frac{1}{\cos^2\alpha}$ to $\left(1+\tan^2\alpha\right)$. When working towards a standard result like this, candidates need to be particularly careful to ensure that their algebra follows through correctly from line to line; there were several instances of squares disappearing and reappearing.

(b) Although they have been given the equation to use, several candidates started again from the basic *suvat* equations, often never reaching a solvable equation. Many candidates used the given equation to write down a correct equation or inequality. Most then went direct to their incorrect solutions without showing any intermediate working. It was not possible to tell whether this was due to calculator error or a method error.

(c) The majority of attempts to solve this problem failed because they were based on the incorrect assumption that the ball would be 2 metres above the ground when it passed over the pole. Fully correct solutions were rare.

(d) The majority of candidates who offered a solution had a correct method, but they often lost the accuracy mark through using $g = 9.81$ or $g = 10$.

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