AQA

AS LEVEL
FURTHER MATHEMATICS

7366/2M Mechanics
Report on the Examination

7366/2M
June 2023

Version: 1.0

Further copies of this Report are available from aqa.org.uk

General comments

The general improvement in standard continued with students showing sound understanding of all techniques and concepts. Solutions were generally well structured and explanations clear. Algebraic techniques were very strong indeed.

Question 1

Almost 90% of students chose the correct answer. The fourth option was the most common incorrect answer, obtained by multiplying force and distance when $x = 2$. No option was left unchosen.

Question 2

Over 90% of students chose the correct answer. No option was left unchosen.

Question 3

Almost all students chose the correct answer.

Question 4

This was a very successful question in which students showed good understanding of circular motion. In part (a), 80% of students obtained the correct answer, with errors occurring where students worked in degrees.

Three quarters of students stated and used an appropriate formula correctly to obtain the magnitude of the horizontal resultant force for part (b)(i). Most errors arose from misquoted formulas.

Part (b)(ii) was a little more challenging with 70% of students correctly showing the direction of the horizontal resultant force acting on the skater. Incorrect attempts gave the force tangentially, horizontally away from the circle, around the circle and from the centre.

Question 5

Part (a) was answered correctly by 90% of students, showing that they understood how to find the magnitude of a two dimensional impulse, with the most common error being squaring -5 incorrectly.

In part (b), 90% of students knew impulse related to change in momentum and thus scored the first mark. However, many then tried to work with speeds rather than velocities. Over a half of students scored two marks for using a correct formula with correct velocities but only a third successfully completed the question to obtain the required answer. A small number of students left their answer as a velocity rather than finding the requested speed.

Question 6

Responses on this topic have improved immensely since the specification began. In part (a), almost 90% of students applied dimensional analysis to the given formula, with 80% using correct dimensions for speed and at least one displacement. 40% of students successfully manipulated their equations to obtain the dimensions of k. Common incorrect answers seen were T^{-1}, T^{-2}, LT^{-1} and 'dimensionless'.

Part (b) was answered correctly by over 40% of students.

In questions about dimensional analysis students **must** use dimensions and not units, so only L, M and T to represent the dimensions of distance, mass and time respectively are acceptable. No marks can be scored if SI units are used instead of dimensions.

Question 7

Responses on this topic have improved considerably since the specification began, especially in relation to conservation of momentum. In this question the unusual request in part (a)(i) to show that *A* did not change direction caused some difficulty with only a quarter of students scoring both marks. Just over a third scored one mark for correct application of the restitution formula or for finding the velocity of *A* in terms of e.

In contrast over 80% of students correctly answered the standard request in part (a)(ii) to obtain $e = \frac{1}{2}$.

Part (b) was then done exceptionally well with almost 80% scoring all three marks, by forming and solving a correct conservation of momentum equation. The 10% who scored only two marks either solved the momentum equation incorrectly or didn't state the units of mass.

Question 8

This was another topic where responses showed significant improvement since the specification began. Students had a much better understanding of different types of energy and how to apply conservation of energy in complex problems. Elastic potential energy was the most challenging

aspect with a significant number of students misusing Hooke's law whilst others confused the formulae $\frac{\lambda x^2}{2l}$ and $\frac{kx^2}{2}$.

95% of students scored at least one mark, most often for correctly calculating the initial gravitational potential energy. Some students found it difficult to express the extension in terms of L. Just under a half of students scored full marks with some losing the final mark for incorrectly solving the quadratic equation or giving the extension as their answer rather than the value of L.

In part (b), 60% of students scored at least one mark with about half of these scoring both marks. Too often students thought that the length of the cord would be greater. There were many invalid comments about air resistance, rather than Omar's height.

Question 9

This was a different type of question about power than had been set in previous series and it was also worth considerably more marks. Part (a)(i) was done the best of all with 80% of students scoring all three marks. Where marks were lost it was either because of misapplication of Newton's second law or incorrect use of the power formula.

In part (a)(ii) over 60% scored two marks with a few who correctly obtained 255 ms^{-1} deciding it was too large and incorrectly changing their answer!. Both marks were lost if the correct driving force was not used.

In part (b)(i) the 80% of students who formed a correct equation almost always solved it correctly and obtained two marks.

Part (b)(ii) was more difficult with the 50% of students who formed a correct equation also solving it correctly. The key issue here was realising that the driving force needed to be $\frac{51000}{v}$, whereas many repeated the same calculations they had done in earlier parts.

In part (c), 60% of students made a reasoned value judgement about one of the models and just under a half scored both marks. The majority of valid comments focused on resistances rather than the reasonableness of the speeds calculated in parts (a)(ii) and (b)(ii).

Part (d) proved most challenging with only 20% suggesting a valid refined model. Many students just repeated an idea from earlier in the question, albeit using a different letter for their parameter.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.