General Certificate of Education

# Mathematics 6360

## MM05 Mechanics 5

# Report on the Examination

*2010 examination – June series*

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## General

The standard of work for this paper was very good, candidates showing sound knowledge of the specification and, generally, of the application of the principles of mechanics. Use of mathematical techniques such as integration and trigonometrical identities was impressive, and algebraic manipulation was excellent. Slight weakness was seen in numerical accuracy, and in basic geometric knowledge.

## Question 1

This was a popular question, usually yielding high marks. In part (b) some candidates did not work to a sufficient degree of accuracy to be able to give an answer correct to 3 significant figures.

## Question 2

This was a popular question, showing sound knowledge of techniques relevant to the topic. Part (a) was done very well. Part (b)(i) was attempted correctly by most candidates but was sometimes marred by inaccurate work. Part (b)(ii) revealed a lack of understanding of the cyclical harmonic motion under consideration, with few candidates giving fully correct solutions. Part (b)(iii) was answered very well; a good source of marks.

## Question 3

Candidates attempted all parts of this question with confidence, and the standard of work was very good. Part (a)(i) was answered very well, although solutions varied in efficiency. Part (a)(ii) was less successful, usually due to slips in accuracy. In part (b)(i) a variety of successful applications of the chain rule led to complete solutions, although some were let down by not being able to see the link between variables. Part (b)(ii) was completed very efficiently by the majority of candidates.

## Question 4

This proved to be a highly popular and successful question. The standard of differentiation and trigonometrical manipulation was very high. Part (a) was done well, although some solutions were long winded. Parts (b), (c) and (d) were also mostly done well, with the only notable weaknesses being in part (b), where some candidates failed to explain the impossible solution to the stationary point equation, and some gave solutions to the equation in degrees.

## Question 5

This question proved challenging for all candidates. The main difficulty was in appreciating the focus of the question being on the motion of the particle $P$, despite the hint in the early parts of the question. Part (a) was poorly answered, showing scant knowledge of the implications of forced motion. Despite this, part (b) was answered quite well, with some candidates realising that they needed to differentiate the answer from part (a). Part (c) was rarely answered well, due to reasons already mentioned, although many faked this solution. Most candidates were able to attempt the solution to the differential equation in part (d), but there were a variety of errors; some giving non-real solutions to the auxiliary equation, others ignoring the particular integral, or evaluating constants before including this.

## Question 6

In terms of the application of mechanical principles, this question was the most poorly answered of the paper. A surprising numbers of candidates could not answer part (a), either not knowing the formula for the volume of a sphere, or not appreciating the need to link the three relevant variables, radius, mass and time. In particular, part (b) was poorly attempted with only the minority of candidates attempting the required approach of small changes of the variables in the momentum equation. Part (c)(i) proved more successful, with highly prolific integration and

algebraic manipulation in evidence, and the majority of candidates were successful in part (c)(ii).

## Mark Ranges and Award of Grades

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