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Examiners' Report

January 2010

GCE

Mechanics M1 (6677)

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Introduction

The paper seemed to be of a suitable length for the vast majority and was more accessible than papers from recent sessions, with very few blank responses. The first two questions proved to be the most straightforward and the best source of marks, with Q2(a) almost always correct. The final two questions were found to be the most demanding. Overall, candidates who used large and clearly labelled diagrams and who employed clear and concise methods were the most successful. Candidates are advised to state a formula before applying it so that their methods are clear.

In calculations the numerical value of g which should be used is 9.8, as advised on the front of the question paper. Final answers should then be given to 2 (or 3) significant figures – more accurate answers will be penalised once per question. Candidates should also be aware that marks are usually only given for work that is in the appropriate part of the question.

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.

Report on individual questions

Question 1

This proved to be a good starter and was well-answered by the majority of candidates. In part (a), most knew that impulse = change in momentum and almost all errors were with the signs. Candidates would be well-advised to put impulses, with arrows, on their diagrams as well as velocities. There are still some candidates giving a negative answer for a magnitude which always loses a mark. Most used conservation of momentum in part (b) which was preferable since it did not rely on their answer from the previous part. Those who used impulse = change in momentum again, applied to the other particle, could lose two marks if their answer to part (a) was wrong.

Question 2

In part (a) the speed-time graph was almost universally correct. Most candidates realised, in the second part, that the area under the graph was equal to the distance travelled and were able to calculate the correct area of 20 for the first part of the motion. Errors in the interpretation of T caused most of the problems in the calculations of the other areas. Comparatively few used an area of a trapezium which provided the neatest solution.

Question 3

Far too many candidates worked with the triangle as given in the diagram, rather than with a (vector) triangle of forces. Use of incorrect trig. ratios was the main source of error for those who chose to resolve horizontally and vertically. Relatively few chose to exploit the fact that the tensions were at right angles by resolving along the strings. Some did successfully work with a (right-angled) triangle of forces and a tiny minority used the 'old-fashioned' Lami's Theorem. In part (a), since g was not involved, the answer needed to be given to at least 2 sf but otherwise there was no limit to the number of figures accepted. However, in the second part, since the answer was dependent on g, decimal answers needed to be given to either 2 or 3 sf and more accurate versions were penalised.

Question 4

This question was well done by the majority of candidates and was the next best answered question after 1 and 2. Most made valid attempts at taking moments, in part (a) about A and often also about C in part (b).The printed answer was an additional help to the less able students who were able to score the marks in part (b) by using it in a vertical resolution. There was some confusion in the last part over the interpretation and use of the information given. Correct statements of simply $Y = 8X$ or else $8X + X = W + 20$ were seen but also $X = 8Y$ was common as were the more surprising $X + 8Y = W + 20$ and $8X + Y = W + 20$, both of which scored nothing.

Question 5

Part (a) had a very high success rate and all three marks were regularly scored but the second part was found to be more challenging. Most were able to resolve perpendicular to the plane to find the reaction and use it to find the limiting friction. However, all too often there were omissions from the equation of motion parallel to the plane, either the mass x acceleration term and/or the weight component or else g was missing. Part (c) was a good discriminator and candidates needed to realise that this was a new system and that there was no acceleration. Those who failed to appreciate this and used their friction force from part (b) scored no marks. The majority of successful candidates resolved parallel and perpendicular to the plane (although a sizeable minority resolved vertically and horizontally) but even then a correct final answer was rarely seen due to premature approximation or else it was given to too many figures.

Question 6

Part (a) was reasonably well done by the majority of students, with good use of the printed answer to correct sign errors etc. but there was less success in the second part, with omission of m and/or g from some terms. The mark in part (c) was very rarely scored and candidates should be aware that if they give a 'list' of answers they will not be awarded the mark, even if the correct answer appears in their list. The final part was a good discriminator and led to Q6 being the worst answered question on the paper. Consideration of two stages to the motion was required, with two distinct accelerations. Many completely omitted the motion under gravity and found the distance moved by A and either gave that as their answer or else just doubled it.

Question 7

There was some confusion in parts (a), (b) and (c) over which vectors were velocities and which were displacements, with some even using acceleration. In the first part, many did not appreciate the distinction between velocity and speed and in part (b) many were unable to convert an appropriate angle into a bearing. The third part tended to be well-answered but a few used 'verification' at $t = 0$ and $t = 4$ and scored nothing. Part (d) was a good discriminator and the less able were often unable to make much progress. The majority of candidates who used Pythagoras to find the magnitude of the relative position vector and equated it to 10 scored at least 3/6 but many often lost the accuracy marks due to poor algebra. There were a number of other methods seen which used the fact that the lighthouse was on the path of the ship and that the speed of the ship was 5 km/h and these received full credit.

Grade Boundaries

The table below gives the lowest raw marks for the award of the stated uniform marks (UMS).

Module	80	70	60	50	40
6663 Core Mathematics C1	63	54	46	38	30
6664 Core Mathematics C2	54	47	40	33	27
6665 Core Mathematics C3	59	52	45	39	33
6666 Core Mathematics C4	61	53	46	39	32
6667 Further Pure Mathematics FP1	64	56	49	42	35
6674 Further Pure Mathematics FP1 (legacy)	62	54	46	39	32
6675 Further Pure Mathematics FP2 (legacy)	52	46	40	35	30
6676 Further Pure Mathematics FP3 (legacy)	59	52	45	38	32
6677 Mechanics M1	61	53	45	38	31
6678 Mechanics M2	53	46	39	33	27
6679 Mechanics M3	57	51	45	40	35
6683 Statistics S1	65	58	51	45	39
6684 Statistics S2	65	57	50	43	36
6689 Decision Maths D1	67	61	55	49	44

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