



Computer Marked Assignment

S354 41

Covering: **Block 1**

Make sure you know how to use the CMA form: detailed instructions are given in your student handbook (or supplement).

You are strongly advised to attempt every question in this assignment.

If you do not wish to answer a question, pencil across the 'don't know' cell ('?').

If you think that a question is unsound in any way, pencil across the 'unsound' cell ('U') in addition to pencilling across either an answer cell or the 'don't know' cell.

Note For each question you must pencil across either the required number of answer cells or the 'don't know' cell.

Cut-off date:
Friday 15 April 1988

This CMA carries 15 per cent of the total CMA marks for the course.

PART A

A particle of mass m is observed from a frame of reference in which it has position $\mathbf{x} = (x^1, x^2, x^3)$, velocity $\mathbf{v} = (v^1, v^2, v^3)$, and acceleration $\mathbf{a} = (a^1, a^2, a^3)$. Each of Q1 to Q7 consists of a description of a certain quantity. In response to each of Q1 to Q7 select the *one* item from the key that corresponds to the described quantity. *Each option may be used more than once. Pencil across one cell in each of the corresponding rows 1 to 7.*

X G ✓ Q1 A quantity that is invariant under a recalibration of the time scale from seconds to microseconds.

X G A Q2 A quantity that is invariant under a recalibration of the length scale from metres to nanometres.

X G F Q3 A quantity that is invariant under an arbitrary translation in space.

✓ G Q4 A quantity that is invariant under an arbitrary rotation in space.

X G D Q5 A quantity that is invariant under an arbitrary rotation about the 1-axis but *not* invariant under a rotation about the 2-axis.

✓ O Q6 A quantity that is invariant under an arbitrary rotation about the 3-axis, but *not* invariant under a rotation about the 2-axis.

X G B Q7 A quantity that is invariant under a reflection of the 2-axis, but *not* invariant under a reflection of the 1-axis.

KEY for Q1 to Q7

A $\frac{a^1x^2 - a^2x^3}{|\mathbf{a}|^2}$

B $\frac{x^1x^2v^2}{|\mathbf{a}|^2}$

C $\frac{m(v^1v^2 + a^3x^2)}{|\mathbf{a}|}$

D $\frac{a^2x^3 - a^3x^2}{|\mathbf{v}|^4}$

E $\frac{m(\mathbf{x} \times \mathbf{a})v^2}{|\mathbf{v}|^4}$

F $\frac{m(\mathbf{v} + (\mathbf{a} \times \mathbf{x}) \cdot \mathbf{x})}{|\mathbf{a}|^2}$

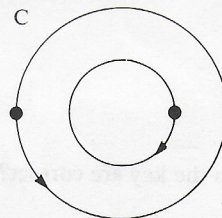
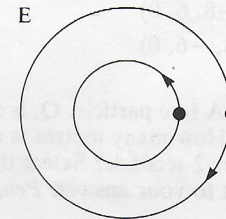
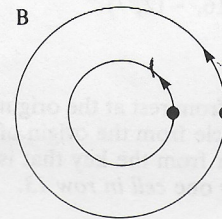
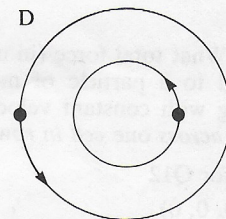
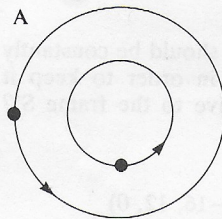
G None of the quantities A to F.

PART B

Q8 to Q10 An inertial observer looks at a completely isolated system composed of two particles of masses m_1 and m_2 . He discovers that they move with constant speeds in concentric circles of radii $r_1 = 4 \times 10^{10}$ m and $r_2 = 16 \times 10^{10}$ m.

Q8 Which *one* of the motions in the key is allowed, according to the general principles of Newtonian mechanics? *Pencil across one cell in row 8.*

KEY for Q8



Q9 What is the ratio $m_1:m_2$ of the inertial masses of the particles? Select *one* value from the key. *Pencil across one cell in row 9.*

KEY for Q9

A 1

E 16

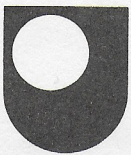
B 2

F 64

C 4

G Impossible to calculate from the information given.

D 8



Feedback Letter Ref. CFASZ

Mr J A Clark
18 New Court
The Moorings
Cowley
Uxbridge
Middx

Date 14/04/88

Personal Identifier M9629534

Dear Mr Clark,

You have scored 60% on CMA S 354 41

The scores of other students on this CMA so far are as follows:

| Scores | 0-39 | 40-54 | 55-69 | 70-84 | 85-100 | TOTAL |
|-----------------|------|-------|-------|-------|--------|-------|
| No. of students | 13 | 26 | 32 | 37 | 32 | 140 |
| % of students | 9 | 19 | 23 | 26 | 23 | 100 |

You had 12 wholly correct answers, no partially correct answers,
8 wholly incorrect answers, and no 'don't knows'.

The correct answers to all the questions are:

- XXQ 1 row 1 C
- XXQ 2 row 2 A
- XXQ 3 row 3 F
- Q 4 row 4 G
- XXQ 5 row 5 D
- Q 6 row 6 G
- XXQ 7 row 7 B
- Q 8 row 8 D
- Q 9 row 9 C
- XXQ10 row 10 F
- Q11 row 11 D
- XXQ12 row 12 E
- Q13 row 13 C
- Q14 row 14 DE
- Q15 row 15 D
- Q16 row 16 AB
- Q17 row 17 E
- Q18 row 18 B
- Q19 row 19 E
- XXQ20 row 20 B

If you have any queries regarding this assignment, please contact the
Assignment Records Office. Explanatory notes are printed on the reverse.

TP Keilthy (Chief Examinations Officer)

GENERAL NOTES

- A. Please retain this letter if you are an Undergraduate or Associate student you will be sent in August a letter giving all your scores held on the computer file at that time (TMTs as well as CMA) so that you can check that the scores have been correctly recorded.
- B. On all correspondence in respect of this letter, please quote your Personal Identifier, Course Code and Assignment Number and the reference on the letter, e.g. CPAS 1.



Mr J A Clark
18 New Court
The Moorings
Cowley
Uxbridge
Middx
UB8 2LN

Date 09/06/88

Personal Identifier M9629534

Dear Mr Clark,

You have scored 82% on CMA S 354 42

The scores of other students on this CMA so far are as follows:

| Scores | 0-39 | 40-54 | 55-69 | 70-84 | 85-100 | TOTAL |
|-----------------|------|-------|-------|-------|--------|-------|
| No. of students | 1 | 6 | 11 | 15 | 34 | 67 |
| % of students | 1 | 9 | 16 | 22 | 52 | 100 |

You had 18 wholly correct answers, no partially correct answers,
4 wholly incorrect answers, and no 'don't knows'.

The correct answers to all the questions are:

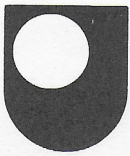
- Q 1 row 1 D Q21 row 21 E
- Q 2 row 2 D Q22 row 22 F
- Q 3 row 3 F
- Q 4 row 4 BCG
- Q 5 row 5 CE
- Q 6 row 6 F
- Q 7 row 7 B
- XXQ 8 row 8 E
- Q 9 row 9 B
- XXQ10 row 10 C
- Q11 row 11 F
- Q12 row 12 CEF
- Q13 row 13 AE
- XXQ14 row 14 B
- XXQ15 row 15 C
- Q16 row 16 CG
- Q17 row 17 CF
- Q18 row 18 DF
- Q19 row 19 DE
- Q20 row 20 BCE

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TP Keilthy (Chief Examinations Officer)

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Mr J A Clark
18 New Court
The Moorings
Cowley
Uxbridge
Middx
UB8 2LN

Date 14/07/88

Personal Identifier M9629534

Dear Mr Clark,

You have scored 85% on CMA S 354 43

The scores of other students on this CMA so far are as follows:

| Scores | 0-39 | 40-54 | 55-69 | 70-84 | 85-100 | TOTAL |
|-----------------|------|-------|-------|-------|--------|-------|
| No. of students | 3 | 7 | 14 | 23 | 27 | 74 |
| % of students | 4 | 9 | 19 | 31 | 37 | 100 |

You had 26 wholly correct answers, 2 partially correct answers,
4 wholly incorrect answers, and no 'don't knows'.

The correct answers to all the questions are:

- XXQ 1 row 1 G Q21 row 21 ABG
- Q 2 row 2 A Q22 row 22 D
- Q 3 row 3 A Q23 row 23 ABG
- Q 4 row 4 BG Q24 row 24 DF
- XQ 5 row 5 CEF Q25 row 25 D
- XXQ 6 row 6 H Q26 row 26 A
- Q 7 row 7 ABD Q27 row 27 A
- Q 8 row 8 CEF Q28 row 28 B
- XQ 9 row 9 DF Q29 row 29 B
- Q10 row 10 F Q30 row 30 C
- Q11 row 11 AD Q31 row 31 F
- Q12 row 12 CF Q32 row 32 A
- XXQ13 row 13 BE
- Q14 row 14 CG
- XXQ15 row 15 G
- Q16 row 16 BCE
- Q17 row 17 BDE
- Q18 row 18 ACE
- Q19 row 19 CDG
- Q20 row 20 EFG

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TP Keilthy (Chief Examinations Officer)



Feedback Letter Ref: FAS 2

Mr J A Clark
18 New Court
The Moorings
Cowley
Uxbridge
Middx
UB8 2LN

Date 26/08/88

Personal Identifier M9629534

Dear Mr Clark,

You have scored 78% on CMA S 354 44

The scores of other students on this CMA so far are as follows:

| Scores | 0-39 | 40-54 | 55-69 | 70-84 | 85-100 | TOTAL |
|-----------------|------|-------|-------|-------|--------|-------|
| No. of students | 8 | 27 | 35 | 33 | 113 | 116 |
| % of students | 7 | 23 | 30 | 28 | 12 | 100 |

You had 15 wholly correct answers, 1 partially correct answers,
4 wholly incorrect answers, and no 'don't knows'.

The correct answers to all the questions are:

- Q 1 row 1 ACE
- Q 2 row 2 BD
- Q 3 row 3 BD
- Q 4 row 4 ACE
- Q 5 row 5 G
- Q 6 row 6 G
- Q 7 row 7 A
- Q 8 row 8 C
- Q 9 row 9 G
- Q 10 row 10 B
- XXQ 11 row 11 C
- XXQ 12 row 12 B
- Q 13 row 13 B
- XXQ 14 row 14 C
- Q 15 row 15 DE
- XXQ 16 row 16 B
- Q 17 row 17 D
- Q 18 row 18 DEF
- Q 19 row 19 CE
- Q 20 row 20 AEF

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TP Keilthy (Chief Examinations Officer)



Feedback Letter Ref. CFAS 2

Mr J A Clark
18 New Court
The Moorings
Cowley
Uxbridge
Middx
UB8 2LN

Date 26/09/88
Personal Identifier M9629534

Dear Mr Clark,

You have scored 64% on CMA S 354 45

The scores of other students on this CMA so far are as follows:

| Scores | 0-39 | 40-54 | 55-69 | 70-84 | 85-100 | TOTAL |
|-----------------|------|-------|-------|-------|--------|-------|
| No. of students | 16 | 26 | 33 | 20 | 15 | 110 |
| % of students | 15 | 24 | 30 | 18 | 13 | 100 |

You had 14 wholly correct answers, no partially correct answers,
8 wholly incorrect answers, and no 'don't knows'.

The correct answers to all the questions are:

- Q 1 row 1 B
- Q 2 row 2 C
- Q 3 row 3 D
- Q 4 row 4 F
- XXQ 5 row 5 E
- XXQ 6 row 6 E
- Q 7 row 7 A
- Q 8 row 8 C
- Q 9 row 9 F
- XXQ 10 row 10 A
- XXQ 11 row 11 B
- Q 12 row 12 F
- Q 13 row 13 F
- Q 14 row 14 C
- XXQ 15 row 15 G
- Q 16 row 16 B
- XXQ 17 row 17 A
- XXQ 18 row 18 A
- XXQ 19 row 19 B
- Q 20 row 20 C

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TP Keilthy (Chief Examinations Officer)



Mr J A Clark
18 New Court
The Moorings
Cowley
Uxbridge
Middx
UB8 2LN

Date 11/10/88

Personal Identifier M9629534

Dear Mr Clark,

You have scored 92% on CMA S 354 46

The scores of other students on this CMA so far are as follows:

| Scores | 0-39 | 40-54 | 55-69 | 70-84 | 85-100 | TOTAL |
|-----------------|------|-------|-------|-------|--------|-------|
| No. of students | 5 | 17 | 24 | 41 | 39 | 126 |
| % of students | 4 | 13 | 19 | 33 | 31 | 100 |

You had 17 wholly correct answers, 1 partially correct answers, 1 wholly incorrect answers, and no 'don't knows'.

The correct answers to all the questions are:

- Q 1 row 1 F
- Q 2 row 2 E
- Q 3 row 3 C
- Q 4 row 4 A
- Q 5 row 5 CE
- Q 6 row 6 F
- Q 7 row 7 D
- Q 8 row 8 AE
- XXQ 9 row 9 BD
- Q10 row 10 AD
- Q11 row 11 C
- Q12 row 12 D
- Q13 row 13 H
- Q14 row 14 BC
- XQ15 row 15 BC
- Q16 row 16 ACE
- Q17 row 17 ACF
- Q18 row 18 AD
- Q19 row 19 ACE

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