Cambridge International AS & A Level

CANDIDATE NAME						
CENTRE NUMBER				CANDIDATE NUMBER		

MATHEMATICS 9709/42

Paper 4 Mechanics May/June 2022

1 hour 15 minutes

You must answer on the question paper.

You will need: List of formulae (MF19)

INSTRUCTIONS

- Answer all questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do not use an erasable pen or correction fluid.
- Do not write on any bar codes.
- If additional space is needed, you should use the lined page at the end of this booklet; the question number or numbers must be clearly shown.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- Where a numerical value for the acceleration due to gravity (g) is needed, use 10 m s⁻².

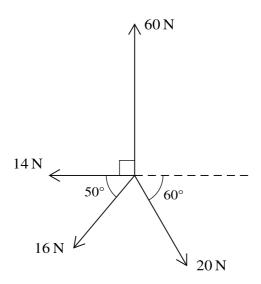
INFORMATION

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [].

Small smooth spheres A and B, of equal radii and of masses 5 kg and 3 kg respectively, lie on a smooth

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hori coll of <i>B</i>	izontal plane. Initially B is at rest and A is moving towards B with speed $8.5 \mathrm{ms^{-1}}$. The spheres ide and after the collision A continues to move in the same direction but with a quarter of the speed B .
(a)	Find the speed of B after the collision. [3]
(b)	Find the loss of kinetic energy of the system due to the collision. [2]



Coplanar forces of magnitudes 60 N, 20 N, 16 N and 14 N act at a point in the directions shown in the diagram.

Find the magnitude and direction of the resultant force.							

Two particles A and B, of masses 2.4 kg and 1.2 kg respectively, are connected by a light inextensible

ıbs	equent motion A reaches the plane and does not rebound and B does not reach the pulley.
a)	Show that the tension in the string before A reaches the plane is 16 N and find the magnitude of the acceleration of the particles before A reaches the plane. [4]

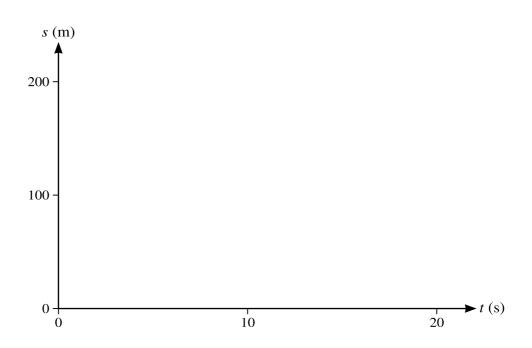
(b)	Find the greatest height of B above the plane.	[3]

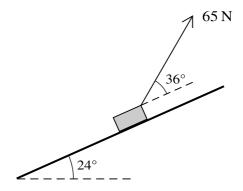
A particle A, moving along a straight horizontal track with constant speed $8 \,\mathrm{m\,s^{-1}}$, passes a fixed point O. Four seconds later, another particle B passes O, moving along a parallel track in the same

Find expressions, in terms of t , for the displacement from O of each particle t seconds after passes O .

(b)	Find the values of t when the particles are the same distance from O .	[3]	
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(c) On the given axes, sketch the displacement-time graphs for both particles, for values of *t* from 0 to 20. [3]





A block of mass 12 kg is placed on a plane which is inclined at an angle of 24° to the horizontal. A light string, making an angle of 36° above a line of greatest slope, is attached to the block. The tension in the string is 65 N (see diagram). The coefficient of friction between the block and plane is μ . The block is in limiting equilibrium and is on the point of sliding up the plane.

Find μ .	[6]

)	Find the work done against the resistive forces during the 12s.

The car then travels along a straight horizontal road. There is a resistance to the motion of the car of (1520 + 4v) N when the speed of the car is v m s⁻¹. The car travels at a constant speed with the engine working at a constant rate of 32 kW.

(b)	Find this speed.	[3]

A particle P moves in a straight line. The velocity $v \, \text{m s}^{-1}$ at time t seconds is given by

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		$v = 0.5t$ $v = 0.25t^2 - 8t + 60$	for $0 \le t \le 10$, for $10 \le t \le 20$.	
(a)	Show that there is an	instantaneous change in	the acceleration of the particle at $t = 10$.	[3]
				,

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Additional Page

If you use the following lined page to complete the answer(s) to any question(s), the question number must be clearly shown.	(s)
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