

Cambridge International AS & A Level

CANDIDATE NAME						
CENTRE NUMBER				CANDIDATE NUMBER		

MATHEMATICS 9709/43

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 [].

This document has 16 pages. Any blank pages are indicated.

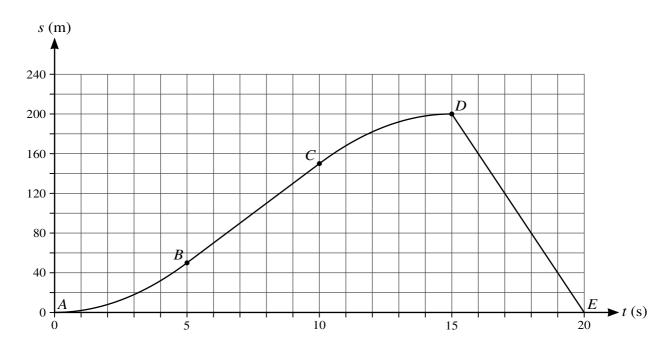
	ne. P is projected at a speed of $4 \mathrm{ms^{-1}}$ directly towards Q . After P are we with a speed of $3 \mathrm{ms^{-1}}$.	
(a)	Find the speed of <i>P</i> after the collision.	[2
plar	er the collision, Q moves directly towards a third particle R , of mass m ne. The two particles Q and R coalesce on impact and move with a spec Find m .	$d ext{ of } 2 ext{ m s}^{-1}$.
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A particle P is projected vertically upwards from horizontal ground. P reaches a maximum height

. `	Find the smead of rubish Days and least d	FO:
1)	Find the speed at which P was projected.	[2
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)	Find the total time for which the speed of P is at least $10 \mathrm{m s^{-1}}$.	[3
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(a)



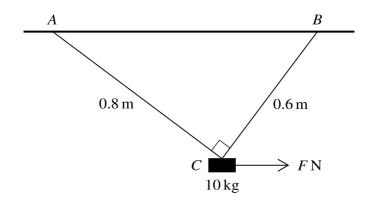
The displacement of a particle moving in a straight line is s metres at time t seconds after leaving a fixed point O. The particle starts from rest and passes through points P, Q and R, at times t = 5, t = 10 and t = 15 respectively, and returns to O at time t = 20. The distances OP, OQ and OR are 50 m, 150 m and 200 m respectively.

The diagram shows a displacement-time graph which models the motion of the particle from t = 0 to t = 20. The graph consists of two curved segments AB and CD and two straight line segments BC and DE.

Find the speed of the particle between $t = 5$ and $t = 10$.	[1]
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(a)



The diagram shows a block of mass $10\,\mathrm{kg}$ suspended below a horizontal ceiling by two strings AC and BC, of lengths $0.8\,\mathrm{m}$ and $0.6\,\mathrm{m}$ respectively, attached to fixed points on the ceiling. Angle $ACB = 90^\circ$. There is a horizontal force of magnitude $F\,\mathrm{N}$ acting on the block. The block is in equilibrium.

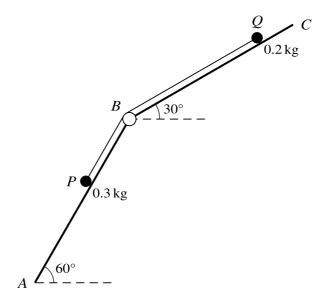
In the case where $F = 20$, find the tensions in each of the strings.	[5]

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a)	Find the power developed by the cyclist.

The cyclist comes to the top of a hill inclined at 5° to the horizontal. The cyclist stops pedalling and freewheels down the hill (so that the cyclist is no longer supplying any power). The magnitude of the resistance force remains at 30 N. Over a distance of d m, the speed of the cyclist increases from $6 \,\mathrm{m\,s^{-1}}$ to $12 \,\mathrm{m\,s^{-1}}$.

(b)	Find the change in kinetic energy.	[2]
(a)	The an energy weathed to find d	[2]
(c)	Use an energy method to find d .	[3]



Two particles P and Q, of masses 0.3 kg and 0.2 kg respectively, are attached to the ends of a light inextensible string. The string passes over a fixed smooth pulley at B which is attached to two inclined planes. P lies on a smooth plane AB which is inclined at 60° to the horizontal. Q lies on a plane BC which is inclined at 30° to the horizontal. The string is taut and the particles can move on lines of greatest slope of the two planes (see diagram).

(a) It is given that the plane BC is smooth and that the particles are released from rest.

Find the tension in the string and the magnitude of the acceleration of the particles.	[5]
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	It is given instead that the plane BC is rough. A force of magnitude 3N is applied to Q directly up the plane along a line of greatest slope of the plane.
	Find the least value of the coefficient of friction between Q and the plane BC for which the particles remain at rest. [5]
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ŀ	ass	ing O , is given by $v = \frac{9}{4} + \frac{b}{(t+1)^2} - ct^2,$
V	vhe	re b and c are positive constants. At $t = 5$, the velocity of P is zero and its acceleration is $-\frac{13}{12}$ m s ⁻² .
(a)	Show that $b = 9$ and find the value of c . [5]

of motion.	[5

Additional Page

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

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