

Cambridge International AS & A Level

CANDIDATE NAME								
CENTRE NUMBER					CANDIDAT NUMBER	ΓΕ		

0123456789

MATHEMATICS 9709/04

Paper 4 Mechanics For examination from 2020

SPECIMEN PAPER 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 $10 \,\mathrm{m\,s^{-2}}$.

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 **14** pages. Blank pages are indicated.

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(a)	Find the greatest height above the ground reached by P .	[
(b)	Find the total time from projection until P returns to the ground.	
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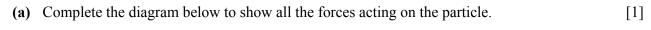
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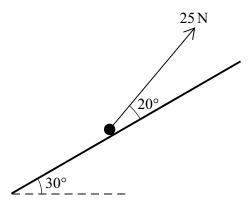
)	The car is moving along a straight level road at a constant speed of $32 \mathrm{m s}^{-1}$.	
	Find, in kW, the rate at which the engine of the car is working.	
		••••••
		•••••
)	The car travels at a constant speed down a hill inclined at an angle of θ° to the hor $\sin \theta^{\circ} = \frac{1}{20}$, with the engine working at 31.5 kW.	izontal, w
)	$\sin \theta^{\circ} = \frac{1}{20}$, with the engine working at 31.5 kW.	izontal, wl
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a j	Find the speed of <i>B</i> after this collison.	
		•••••
		•••••
h	ere B collides with C . In this collison these two spheres coalesce to form an obj	ect D.
PII	Find the speed of D after this collision.	

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Show that	the total loss	s of kinetic ene	ergy in the sys	tem due to the	e two collisions	3 1S 38.4 J.
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A particle of mass 20 kg is on a rough plane inclined at an angle of 30° to the horizontal. A force of magnitude 25 N, acting at an angle of 20° above a line of greatest slope of the plane, is used to prevent the particle from sliding down the plane. The coefficient of friction between the particle and the plane is μ .





Find the least possible value of μ .	[5]

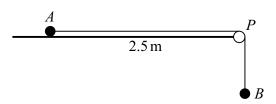
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hor The	ar of mass 1200 kg is pulling a trailer of mass 800 kg up a hill inclined at an angle of sin ⁻¹ (0.1) to the izontal. The car and the trailer are connected by a light rigid tow-bar which is parallel to the road. It driving force of the car's engine is 2500 N and the resistances to the car and trailer are 300 N and DN respectively.
(a)	Find the acceleration of the system and the tension in the tow-bar. [4]

time.	ie time, in s	seconds, b	erore un	e systen	n comes	to rest	and the	iorce in	the tow-	-bar duri
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		y = 5t(t-2)	for $0 \le t \le 4$,	
			for $4 \leqslant t \leqslant 14$,	
			for $14 \leqslant t \leqslant 20$,	
whe	ere k is a constant.			
(a)	Find <i>k</i> .			[1]
(h)	Sketch the velocity–time	e graph for 0 < t < 2	20	[3]
(D)	Sketch the velocity-thin	$c \text{ graph for } 0 \leqslant i \leqslant 2$	20.	[ء]
(c)	Find the set of values of	\hat{t} for which the acce	eleration of P is positive.	[2]
(c)	Find the set of values of	<i>t</i> for which the acce	eleration of P is positive.	[2]

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Two particles A and B, of masses 0.8 kg and 0.2 kg respectively, are connected by a light inextensible string. Particle A is placed on a horizontal surface. The string passes over a small smooth pulley P fixed at the edge of the surface, and B hangs freely. The horizontal section of the string, AP, is of length 2.5 m (see diagram). The particles are released from rest with both sections of the string taut.

	Given that the surface is smooth, find the time taken for A to reach the pulley.
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[4	method to find v.	Use an energy m

Additional page

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