

Cambridge International AS & A Level

CANDIDATE NAME							
CENTRE NUMBER				CANDIDA NUMBER	ΤE		

MATHEMATICS 9709/42

Paper 4 Mechanics May/June 2020

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 [].

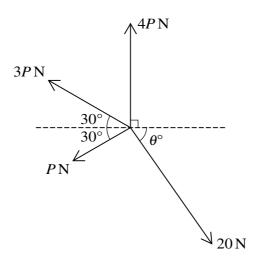
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1

A tram starts from rest and moves with uniform acceleration for 20 s. The tram then travels at a constant

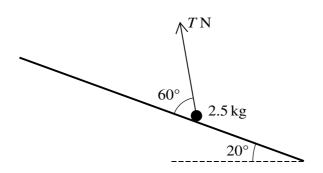
	of the acceleration. The total distance travelled by the tram is 2.775 km.
(a)	Sketch a velocity-time graph for the motion, stating the total time for which the tram is moving [2]
b)	Find V .
(c)	Find the magnitude of the acceleration. [2]

2



Coplanar forces of magnitudes $20 \,\mathrm{N}$, $P \,\mathrm{N}$, $3P \,\mathrm{N}$ and $4P \,\mathrm{N}$ act at a point in the directions shown in the diagram. The system is in equilibrium.

Find P and θ .	[6]



A particle of mass $2.5 \, \text{kg}$ is held in equilibrium on a rough plane inclined at 20° to the horizontal by a force of magnitude $T \, \text{N}$ making an angle of 60° with a line of greatest slope of the plane (see diagram). The coefficient of friction between the particle and the plane is 0.3.

Find the greatest and least possible values of T .	[8]

1	eres collide A continues to move in the same direction but with half the speed of B .	
(a)	Find the speed of B after the collision.	[2]
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41.		41
lan ut	hird small smooth sphere C , of mass 1 kg and with the same radius as A and B , is at respect to move in the same C with one third the speed of C .	lirection
lan ut	ne. B now collides directly with C . After this collision B continues to move in the same of	lirection
lar ut	ne. B now collides directly with C . After this collision B continues to move in the same C with one third the speed of C .	lirection
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1	A and B coalesce during this collision.
	Find the total loss of kinetic energy in the system due to the three collisions.
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(ii) Given that this power is suddenly decreased by 8 kW, find the instantaneous deceleration	for	a horizontal section of the road, the car has a constant speed of $32 \mathrm{m s^{-1}}$ and there is a constance of $750 \mathrm{N}$ resisting the motion.
(ii) Given that this power is suddenly decreased by 8 kW, find the instantaneous deceleration	(i	i) Calculate, in kW, the power developed by the engine of the car. [
(ii) Given that this power is suddenly decreased by 8 kW, find the instantaneous deceleration		
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	(ii	(i) Given that this power is suddenly decreased by 8 kW find the instantaneous deceleration

(b) On a section of the road inclined at $\sin^{-1} 0.096$ to the horizontal, the resistance to the motion of

he road at constant speed with the engine working at 60	OKW.
Find this constant speed.]

6	A particle P moves i	n a straight line.	The velocity $v \text{m s}^{-1}$	at time t s is given by
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$$v = 2t + 1$$
 for $0 \le t \le 5$,
 $v = 36 - t^2$ for $5 \le t \le 7$,
 $v = 2t - 27$ for $7 \le t \le 13.5$.

(a) Sketch the velocity-time graph for
$$0 \le t \le 13.5$$
. [3]

(b)	Find the acceleration at the instant when $t = 6$.	[2]
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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(s) must be clearly shown.

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