



Cambridge International AS & A Level

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MATHEMATICS**9709/42**

Paper 4 Mechanics

May/June 2025**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.





- 1 A crate is being pushed in a straight line along a horizontal surface by a force of magnitude 25 N inclined at 20° above the horizontal. The crate moves a distance of 12 m in 8 seconds with constant speed.

(a) Find the constant speed of the crate. [1]

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(b) Find the work done by the 25 N force. [2]

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(c) Find the power at which the 25 N force is working. [1]

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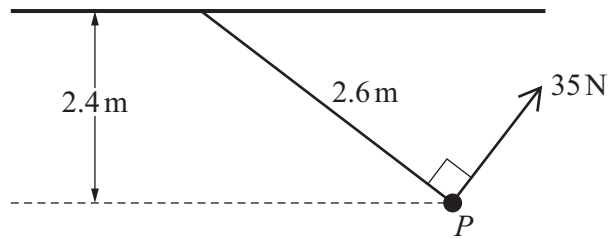


- 2 Two particles P and Q , of masses 0.2 kg and 0.1 kg respectively, are free to move in a straight line on a smooth horizontal plane. P is projected towards Q with speed 5 ms^{-1} . At the same instant, Q is projected away from P with speed 2 ms^{-1} . When P collides with Q , the particles coalesce.

Find the kinetic energy lost during the collision.

[4]

[illegible]



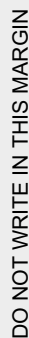
A particle P of mass m kg is attached to one end of a light inextensible string of length 2.6 m. The other end of the string is attached to a fixed point on a horizontal ceiling, and the string is taut. The particle is held in equilibrium by a force of magnitude 35 N, acting in a vertical plane which is perpendicular to the ceiling and contains the string. The force acts in a direction perpendicular to the string (see diagram). The tension in the string is T N and the vertical distance of P from the ceiling is 2.4 m.

Find, in either order, the value of m and the value of T . [4]

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- [illegible]



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The car continues its journey from *B*, decelerating uniformly at 0.5 m s^{-2} until it comes to rest at a point *C* on the road.

(c) Find the total distance from *A* to *C*. [3]

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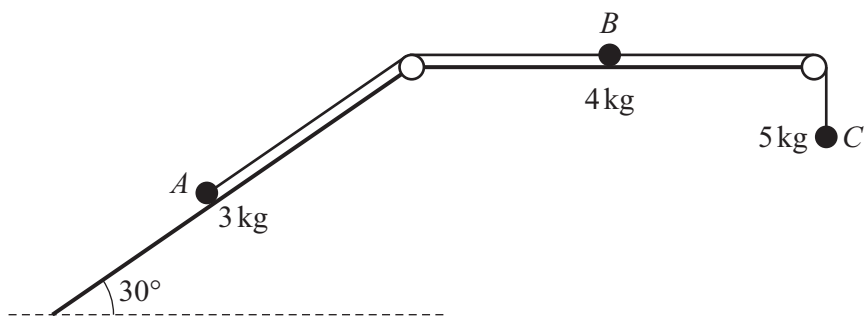
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One end of a light inextensible string is attached to a particle A of mass 3 kg . The other end of the string is attached to a particle B of mass 4 kg . Particle A is in contact with a rough plane inclined at 30° to the horizontal, and particle B is in contact with a smooth horizontal plane. A second light inextensible string is attached to B . The other end of this second string is attached to a particle C of mass 5 kg which hangs vertically.

Both strings are taut and pass over small smooth pulleys that are fixed at the ends of the horizontal plane. The part of the string from A to the pulley is parallel to a line of greatest slope of the inclined plane, and A , B and C are in the same vertical plane (see diagram).

The system is released from rest. In the subsequent motion, C moves vertically downwards with acceleration 2 ms^{-2} , and neither A nor B reach a pulley.

- (a) Find the tensions in each of the strings. [3]

[illegible]



[4]

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(c) Find the total distance that A travels up the plane from the instant that the system is released from rest to the instant that A comes to instantaneous rest. [5]

[illegible]

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(b) Find the distance of P from A at the instant when P is moving at this maximum velocity. [4]

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- Using an energy method throughout, find the speed of P at the instant it returns to A . [6]

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

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