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CAMBRIDGE
International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7222207883 9

MATHEMATICS **9709/42**

Paper 4 Mechanics **May/June 2026**

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. Do **not** use correction fluid or tape.
- 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 $10\,\text{m}\,\text{s}^{-2}$.

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.

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[Turn over

1 A car of mass 960 kg is moving on a straight horizontal road. There is a constant force of magnitude 620 N resisting the motion of the car.

(a) Calculate the power developed by the engine of the car when it is moving at a constant speed of $25\,m\,s^{-1}$. [2]

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(b) Given that the power is suddenly increased **by** 12 kW, find the instantaneous acceleration of the car. [2]

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2 Two particles, A and B, of masses 2.5 kg and 3.5 kg respectively are at rest on a straight smooth horizontal track. Particle B is situated 9 m from a vertical wall which is fixed at right angles to the track.

Particle A is projected directly towards B with a speed of $3\,\text{m}\,\text{s}^{-1}$. In the subsequent motion, A collides and coalesces with B to form particle C. Particle C then collides directly with the wall and rebounds. The collision of C with the wall reduces the speed of C by 25%.

(a) Find the speed of C after it rebounds from the wall. [2]

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(b) Hence find the time from the instant at which A and B collide until C is once again a distance of 9 m from the wall. [2]

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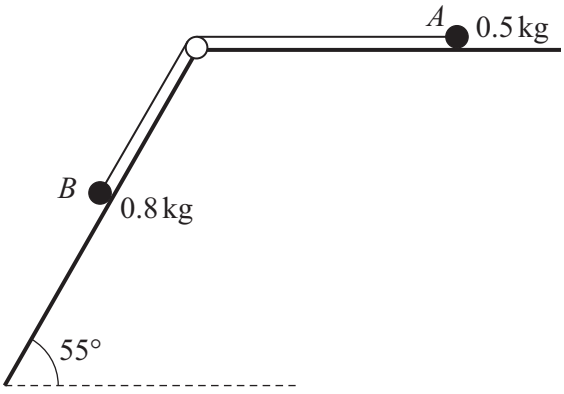

Two particles, A and B, of masses 0.5 kg and 0.8 kg respectively are attached to the ends of a light inextensible string. The string passes over a small smooth pulley fixed at the end of a rough horizontal plane and to the top of a smooth inclined plane. Particle A is held on the horizontal plane, while B lies on the inclined plane, which makes an angle of 55° with the horizontal. The string is in the same vertical plane as a line of greatest slope of the inclined plane (see diagram).

Particle A is released from rest with the string taut. Particle B moves 0.3 m down the inclined plane in 0.4 s.

(a) Find the tension in the string. [4]

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(b) Find the coefficient of friction between A and the horizontal plane. [3]

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(c) After B has been moving for 0.4 s, the string suddenly breaks. Given that A subsequently comes to rest on the horizontal plane, find the work done by the frictional force in bringing A to rest. You may assume that A does not reach the pulley. [3]

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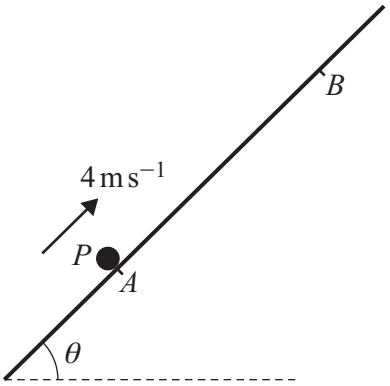

A particle P is projected from a point A with speed $4\,\text{m}\,\text{s}^{-1}$ up a line of greatest slope of a rough plane inclined at an angle θ to the horizontal, where $\tan\theta = \frac{4}{3}$.

P comes to instantaneous rest at a point B on the plane (see diagram).

The coefficient of friction between P and the plane is $\frac{1}{3}$.

(a) Using an energy method, show that the distance AB is $0.8\,\text{m}$. [4]

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(b) After coming to instantaneous rest at B, the particle slides down the plane.

Find the total time from the instant at which P is projected from A until it returns to A. [5]

5 The points A and B are at the same vertical height h m above horizontal ground. A particle P is released from rest from A. One second later, a particle Q is projected vertically downwards from B with speed $18\,\text{m}\,\text{s}^{-1}$.

Given that P and Q reach the ground at the same time, find the value of h. [6]

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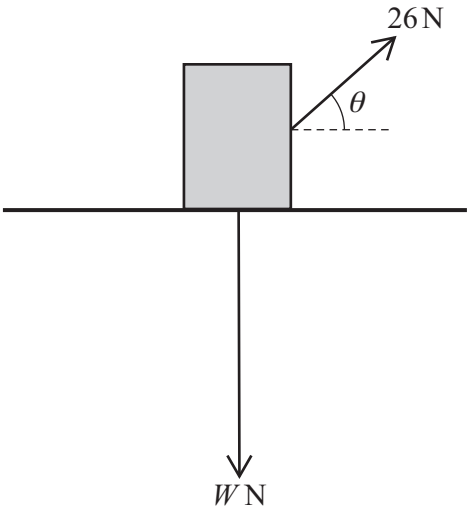

A crate of weight W N is at rest on rough horizontal ground. The crate is pulled at a constant acceleration of $1.5\,\text{m}\,\text{s}^{-2}$ along the ground in a straight line by a light rope. The rope is inclined at an angle of θ to the horizontal, where $\theta = \sin^{-1}\frac{5}{13}$. The tension in the rope is 26 N (see diagram). The coefficient of friction between the crate and the ground is 0.25.

(a) Find the value of W. [5]

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(b) When the crate reaches a point A, the rope is removed. The speed of the crate at A is $8\,\text{m}\,\text{s}^{-1}$.

The crate comes to rest at a point B.

Find the distance AB. [3]

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7 A particle P moves in a straight line. The velocity $v\,\text{m}\,\text{s}^{-1}$ of P at time $t\,\text{s}$, where $t \geqslant 0$, is given by

$$v = k_1(4t+11)^{\frac{1}{2}} - \tfrac{1}{4}(2t+1)^2 + k_2,$$

where k_1 and k_2 are constants. When $t = 1.25$ the deceleration of P is $0.5\,\text{m}\,\text{s}^{-2}$.

(a) Find the value of k_1. [4]

(b) Given that P is only at instantaneous rest when $t = 3.5$, find the distance travelled by P in the interval $0 \leqslant t \leqslant 1$. [5]

Additional page

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

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