

Cambridge International AS & A Level

CANDIDATE
NAME

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MATHEMATICS

9709/41

Paper 4 Mechanics

October/November 2022

1 hour 15 minutes

You must answer on the question paper.

You will need: List of formulae (MF19)

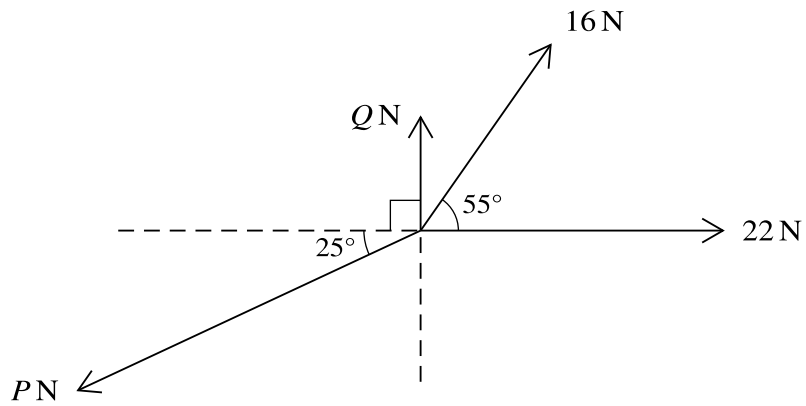
INSTRUCTIONS

- 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 **12** pages.



Coplanar forces of magnitudes P N, Q N, 16 N and 22 N act at a point in the directions shown in the diagram. The forces are in equilibrium.

Find the values of P and Q .

[5]

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- Find the loss of kinetic energy of the system due to the collision. [5]

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- 3** A constant resistance of magnitude 1400 N acts on a car of mass 1250 kg .

- (a)** The car is moving along a straight level road at a constant speed of 28 m s^{-1} .

Find, in kW, the rate at which the engine of the car is working.

[2]

[illegible]

- (b)** The car now travels at a constant speed up a hill inclined at an angle of θ to the horizontal, where $\sin \theta = 0.12$, with the engine working at 43.5 kW.

Find this speed.

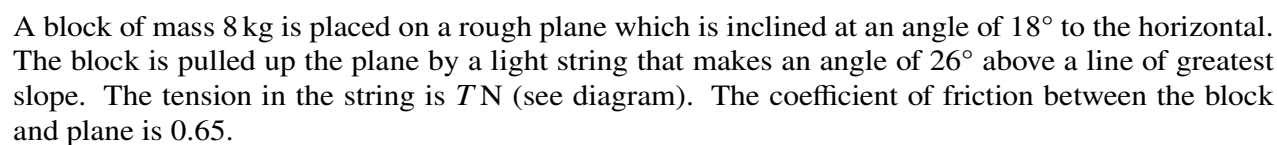
[3]

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[4]

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- Find T .

[7]

- (b) The block is initially at rest.

Find the distance travelled by the block during the fourth second of motion.

[2]

- 5 A particle P moves on the x -axis from the origin O with an initial velocity of -20 m s^{-1} . The acceleration $a \text{ m s}^{-2}$ at time $t \text{ s}$ after leaving O is given by $a = 12 - 2t$.

(a) Sketch a velocity-time graph for $0 \leq t \leq 12$, indicating the times when P is at rest. [5]

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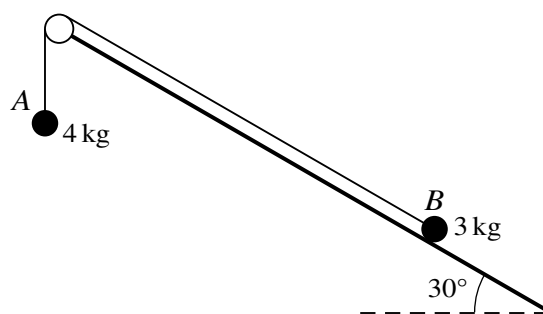


Fig. 6.1 shows particles A and B , of masses 4 kg and 3 kg respectively, attached to the ends of a light inextensible string that passes over a small smooth pulley. The pulley is fixed at the top of a plane which is inclined at an angle of 30° to the horizontal. A hangs freely below the pulley and B is on the inclined plane. The string is taut and the section of the string between B and the pulley is parallel to a line of greatest slope of the plane.

- Find the coefficient of friction between B and the plane.

[6]

[illegible]

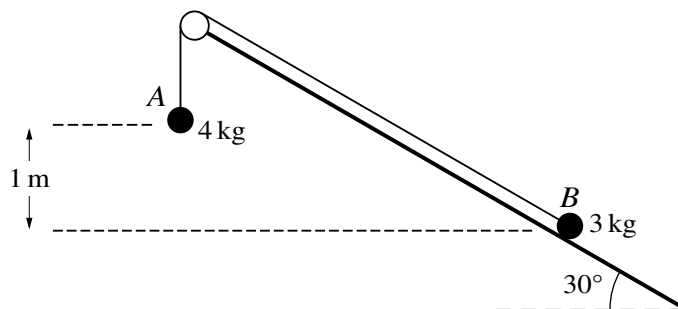


Fig. 6.2

Use an energy method to find the speed of the particles at the instant when the particles are at the same horizontal level. [6]

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