Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Friday 9 January 2026

Morning (Time: 1 hour 30 minutes)

Paper reference **WME01/01**

Mathematics

International Advanced Subsidiary/Advanced Level
Mechanics M1

You must have:
Mathematical Formulae and Statistical Tables (Yellow), calculator

Total Marks

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Whenever a numerical value of g is required, take $g = 9.8\ \text{m s}^{-2}$, and give your answer to either 2 significant figures or 3 significant figures.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 7 questions in this question paper. The total mark for this paper is 75.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over ▶

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1. A particle P of mass $3m$ and a particle Q of mass $5m$ are on a smooth horizontal surface. The particles move towards each other in opposite directions along the same straight line and collide.

Immediately before the collision, the speed of P is $3u$ and the speed of Q is $4u$

The magnitude of the impulse exerted on P by Q in the collision is $\frac{33}{2}mu$

Find

(i) the speed of P immediately after the collision,

(ii) the speed of Q immediately after the collision.

(6)

Question 1 continued

(Total for Question 1 is 6 marks)

2.

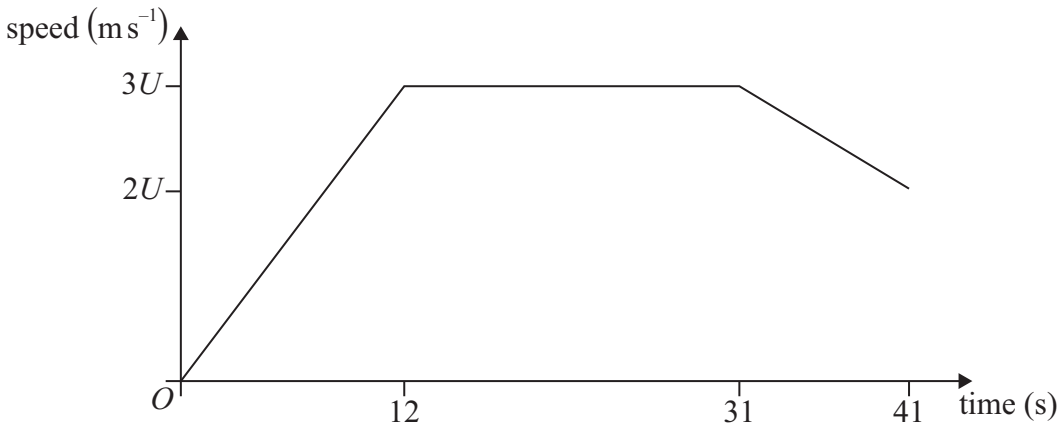

Figure 1

A particle P starts from rest at time $t = 0$ and moves in a straight line

- from $t = 0$ to $t = 12\,\text{s}$, P accelerates uniformly until it reaches a speed of $3U\,\text{m s}^{-1}$
- from $t = 12\,\text{s}$ to $t = 31\,\text{s}$, P moves with constant speed $3U\,\text{m s}^{-1}$
- from $t = 31\,\text{s}$ to $t = 41\,\text{s}$, P decelerates uniformly until it has speed $2U\,\text{m s}^{-1}$

as shown on the speed-time graph in Figure 1.

The distance travelled by P between $t = 0$ and $t = 41\,\text{s}$ is 600 m.

(a) Show that $U = 6$

(3)

(b) Find the distance travelled by P whilst moving from rest to a speed of $6\,\text{m s}^{-1}$

(2)

(c) Find the acceleration of P between $t = 0$ and $t = 12\,\text{s}$.

(1)

(d) Find the deceleration of P between $t = 31\,\text{s}$ and $t = 41\,\text{s}$.

(2)

(e) Sketch an acceleration-time graph to represent the motion of P from $t = 0$ to $t = 41\,\text{s}$.

(2)

Question 2 continued

Question 2 continued

Question 2 continued

(Total for Question 2 is 10 marks)

3. A particle moves on a smooth horizontal plane under the action of three horizontal forces, $\mathbf{F}_1$, $\mathbf{F}_2$ and $\mathbf{F}_3$, where

$$\mathbf{F}_1 = (2p\mathbf{i} - 3p\mathbf{j})\text{N}$$

$$\mathbf{F}_2 = (q\mathbf{i} + \mathbf{j})\text{N}$$

$$\mathbf{F}_3 = (3\mathbf{i} - q\mathbf{j})\text{N}$$

where p and q are constants.

The resultant force acts in the direction of the vector $(4\mathbf{i} - 5\mathbf{j})$

(a) Show that

$$2p - q = 19$$

(4)

The mass of the particle is 0.5 kg.

Given that $p = 7$

(b) find the acceleration of the particle.

(4)

Question 3 continued

Question 3 continued

Question 3 continued

(Total for Question 3 is 8 marks)

4.

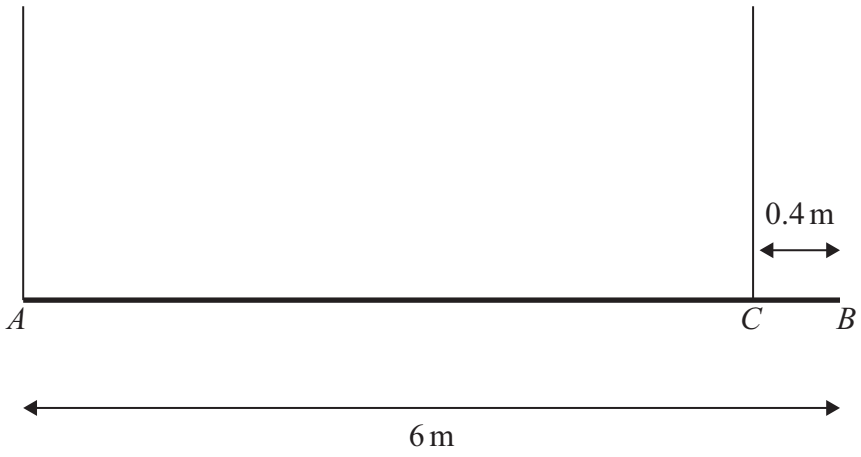

Figure 2

Figure 2 shows a uniform rod AB of length 6 m suspended by two light vertical ropes.

The first rope is attached to the rod at A.
The second rope is attached to the rod at the point C, where $CB = 0.4$ m.

The rod has mass 30 kg.

A particle of mass 20 kg is now attached to the rod at B.

The rod is in equilibrium in a horizontal position.

(a) Find

(i) the tension in the rope attached to the rod at C,
(ii) the tension in the rope attached to the rod at A.

(6)

The particle of mass 20 kg at B is removed and replaced by a particle of mass M kg.

The rod remains in equilibrium in a horizontal position.

(b) Find the exact maximum value of M.

(3)

Question 4 continued

Question 4 continued

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Question 4 continued

(Total for Question 4 is 9 marks)

5. The points O, A, B and C are on a rough horizontal surface where $OABC$ is a straight line.

A particle is projected horizontally from O and slides across the surface, passing through A, B and C in that order.

The particle passes through

- A with speed $U\,\text{m s}^{-1}$
- B with speed $\frac{U}{2}\,\text{m s}^{-1}$

The coefficient of friction between the particle and the surface is $\frac{1}{7}$

It takes 0.75 s for the particle to move from A to B.

(a) Show that $U = 2.1$ to 2 significant figures.

(6)

The particle passes through C with speed $\frac{U}{3}\,\text{m s}^{-1}$

(b) Find the time taken to move from B to C.

(3)

(c) Find the distance AC.

(3)

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Question 5 continued

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Question 5 continued

(Total for Question 5 is 12 marks)

6. [*In this question* **i** *and* **j** *are horizontal unit vectors directed due east and due north respectively and position vectors are given relative to a fixed origin O.*]

At 9 am, a ship S leaves a harbour and moves with constant velocity $(10\mathbf{i} + 15\mathbf{j})\,\text{km h}^{-1}$

(a) Find the exact speed of S

(2)

The harbour is at the origin O.

At 9 am, a boat B leaves the point with position vector $(50\mathbf{i} + 10\mathbf{j})$ km and moves with constant velocity $(-8\mathbf{i} + 10\mathbf{j})\,\text{km h}^{-1}$

(b) Find the direction in which B is moving, giving your answer as a bearing to the nearest degree.

(3)

(c) Show that at time t hours after 9 am,

$$\overrightarrow{SB} = [(50 - 18t)\mathbf{i} + (10 - 5t)\mathbf{j}]\,\text{km}$$

(4)

(d) Show that B and S do not collide.

(3)

When B is north-east of S, the distance between S and B is d km.

(e) Find the value of d.

(4)

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Question 6 continued

Question 6 continued

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Question 6 continued

(Total for Question 6 is 16 marks)

7.

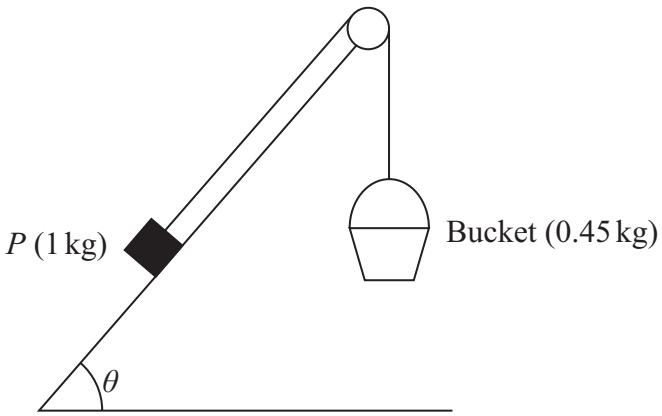

Figure 3

A rough plane is inclined at an angle θ to the horizontal, where $\tan\theta = \frac{4}{3}$

One end of a light inextensible string is attached to a package P.
The string passes over a smooth pulley that is fixed at the top of the plane.
The string from P to the pulley lies along a line of greatest slope of the plane.
The other end of the string is attached to a bucket.
The package P has mass 1 kg and is **held** at rest on the plane.
The bucket has mass 0.45 kg and hangs vertically below the pulley with the string taut, as shown in Figure 3.

The coefficient of friction between P and the plane is μ

When a small block of mass 0.2 kg is placed in the bucket, the system is released and remains at rest in **limiting equilibrium**, with P on the point of slipping down the plane.

(a) Show that $\mu = \frac{1}{4}$

(7)

Additional identical blocks of mass 0.2 kg are added one at a time into the bucket until P starts to move **up** the plane.
At the instant when P starts to move up the plane, there are a **total** of n blocks in the bucket.

(b) Find

(i) the value of n

(ii) the magnitude of the initial acceleration of P

(7)

Question 7 continued

Question 7 continued

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Question 7 continued

Question 7 continued

(Total for Question 7 is 14 marks)

TOTAL FOR PAPER IS 75 MARKS

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