Please check the examination details below before entering your candidate information

| Candidate surname | Other names |
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Centre Number | Candidate Number

# Pearson Edexcel International Advanced Level

## Friday 9 January 2026

Morning (Time: 1 hour 30 minutes)

Paper reference **WME01/01**

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# 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)**

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**Question 1 continued**

**(Total for Question 1 is 6 marks)**

**2.**

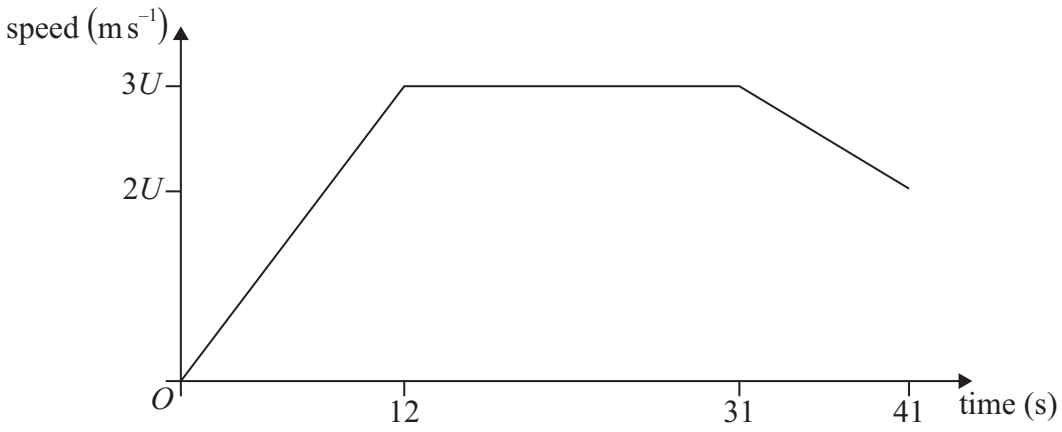



**Figure 1**

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

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

**(1)**

(d) Find the deceleration of $P$ between $t = 31$ s and $t = 41$ s.

**(2)**

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

**(2)**

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**Question 2 continued**

**Question 2 continued**

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**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)**

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**Question 3 continued**

**Question 3 continued**

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**Question 3 continued**

**(Total for Question 3 is 8 marks)**

**4.**

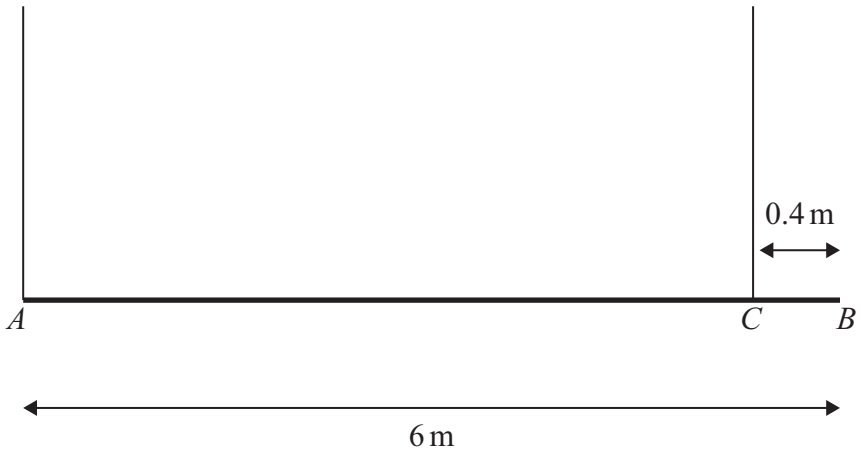



**Figure 2**

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)**

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**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**

**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 $(50\mathbf{i} + 10\mathbf{j})\,\text{km}$ 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.**

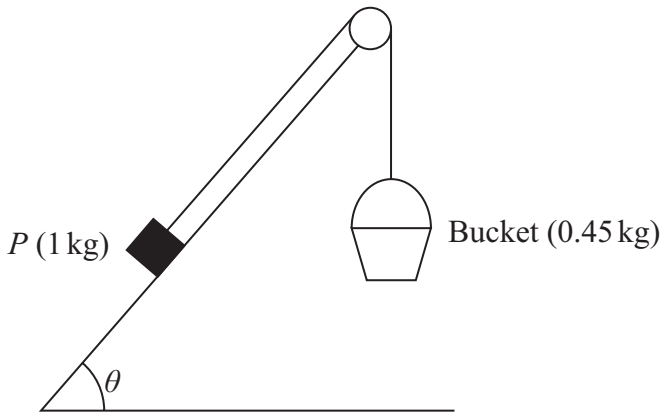



**Figure 3**

A rough plane is inclined at an angle $\theta$ 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 $\mu$

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)**

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**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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