

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Pearson Edexcel
International
Advanced Level

Centre Number

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Candidate Number

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Wednesday 22 January 2020

Morning (Time: 1 hour 30 minutes)

Paper Reference **WME02/01**

Mathematics

International Advanced Subsidiary/Advanced Level
Mechanics M2

You must have:

Mathematical Formulae and Statistical Tables (Blue), 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 8 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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Question 1 continued

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(Total 5 marks)

Q1



Question 2 continued

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(Total 6 marks)

Q2



3.

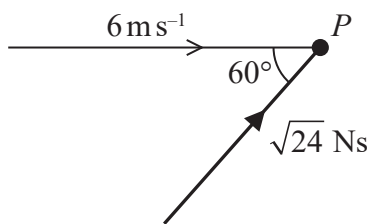


Figure 2

A particle P of mass 0.75 kg is moving along a straight line on a horizontal surface. At the instant when the speed of P is 6 ms^{-1} , it receives an impulse of magnitude $\sqrt{24} \text{ Ns}$. The impulse acts in the plane of the horizontal surface. At the instant when P receives the impulse, the line of action of the impulse makes an angle of 60° with the direction of motion of P , as shown in Figure 2.

Find

- (i) the speed of P immediately after receiving the impulse,
- (ii) the size of the angle between the direction of motion of P immediately before receiving the impulse and the direction of motion of P immediately after receiving the impulse.

(7)

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5. At time t seconds ($t \geq 0$), a particle P has velocity $\mathbf{v} \text{ m s}^{-1}$, where

$$\mathbf{v} = (3t^2 - 4)\mathbf{i} + (2t - 4)\mathbf{j}$$

When $t = 0$, P is at the fixed point O .

- (a) Find the acceleration of P at the instant when $t = 0$ (2)
- (b) Find the exact speed of P at the instant when P is moving in the direction of the vector $(11\mathbf{i} + \mathbf{j})$ for the second time. (4)
- (c) Show that P never returns to O . (4)

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Question 5 continued

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Question 5 continued

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Q5

(Total 10 marks)

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Question 6 continued

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Q6

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(Total 11 marks)



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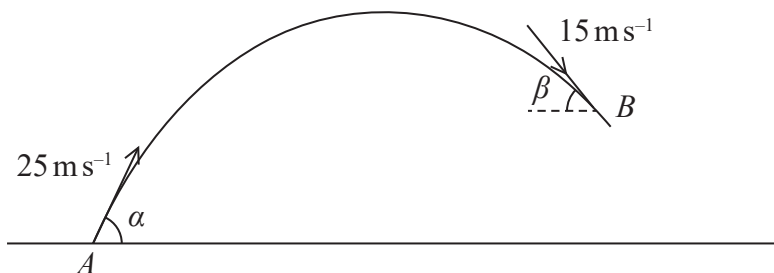


Figure 5

At time $t = 0$ a particle P is projected from a fixed point A on horizontal ground. The particle is projected with speed 25 ms^{-1} at an angle α to the ground. The particle moves freely under gravity. At time $t = 3$ seconds, P is passing through the point B with speed 15 ms^{-1} and is moving downwards at an angle β to the horizontal, as shown in Figure 5.

- (a) By considering energy, find the height of B above the ground. (3)

- (b) Find the size of angle α . (3)

- (c) Find the size of angle β . (3)

- (d) Find the least speed of P as P travels from A to B . (2)

As P travels from A to B , the speed, $v \text{ ms}^{-1}$, of P is such that $v \leq 15$ for an interval of T seconds.

- (e) Find the value of T . (3)

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Question 7 continued

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Q7

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(Total 14 marks)



P 6 1 1 6 6 A 0 2 3 2 8

8. A particle A has mass $4m$ and a particle B has mass $3m$. The particles are moving along the same straight line on a smooth horizontal plane. They are moving in opposite directions towards each other and collide directly.

Immediately before the collision the speed of A is $2u$ and the speed of B is $3u$.

The direction of motion of each particle is reversed by the collision.

The total kinetic energy lost in the collision is $\frac{473}{24}mu^2$

Find

- (i) the coefficient of restitution between A and B ,
- (ii) the magnitude of the impulse received by A in the collision.

(12)

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Question 8 continued

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Question 8 continued

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