Please check the examination deta	ils below before ent	ering your candidate information
Candidate surname		Other names
Pearson Edexcel Level 3 GCE	Centre Number	Candidate Number
	Paper reference	8MA0/22
Mathematics		
Advanced Subsidiary PAPER 22: Mechanics		
You must have: Mathematical Formulae and Stat	istical Tables (G	reen), calculator

Candidates may use any calculator allowed 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.
- Unless otherwise indicated, wherever a 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.
- The total mark for this part of the examination is 30. There are 3 questions.
- 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.
- Good luck with your examination.

Turn over ▶







1.	At time $t = 0$, a small stone is thrown vertically upwards with speed $14.7 \mathrm{ms^{-1}}$ from a point	$\operatorname{nt} A$.
	At time $t = T$ seconds, the stone passes through A , moving downwards.	
	The stone is modelled as a particle moving freely under gravity throughout its motion.	
	Using the model,	
	(a) find the value of T,	
	(a) This the value of 1,	(2)
	(b) find the total distance travelled by the stone in the first 4 seconds of its motion.	
		(4)
	(c) State one refinement that could be made to the model, apart from air resistance, that	
	would make the model more realistic.	(1)

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Question 1 continued	
	(Total for Question 1 is 7 marks)



2.	A particle	P	moves	along	a	straight	line
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At time t seconds, the velocity $v \, \text{m s}^{-1}$ of P is modelled as

$$v = 10t - t^2 - k \qquad t \geqslant 0$$

where k is a constant.

(a) Find the acceleration of *P* at time *t* seconds.

(2)

The particle P is instantaneously at rest when t = 6

(b) Find the other value of t when P is instantaneously at rest.

(4)

(c) Find the total distance travelled by P in the interval $0 \le t \le 6$

(4)

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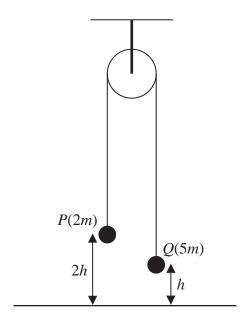


Figure 1

A ball P of mass 2m is attached to one end of a string.

The other end of the string is attached to a ball Q of mass 5m.

The string passes over a fixed pulley.

The system is held at rest with the balls hanging freely and the string taut.

The hanging parts of the string are vertical with P at a height 2h above horizontal ground and with Q at a height h above the ground, as shown in Figure 1.

The system is released from rest.

In the subsequent motion, Q does not rebound when it hits the ground and P does not hit the pulley.

The balls are modelled as particles.

The string is modelled as being light and inextensible.

The pulley is modelled as being small and smooth.

Air resistance is modelled as being negligible.

Using this model,

- (a) (i) write down an equation of motion for P,
 - (ii) write down an equation of motion for Q,

(4)

(b) find, in terms of *h* only, the height above the ground at which *P* first comes to instantaneous rest.

(7)

(c) State one limitation of modelling the balls as particles that could affect your answer to part (b).

(1)

In reality, the string will not be inextensible.

(d) State how this would affect the accelerations of the particles.

(1)

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TOTAL FOR MECHANICS IS 30 MARKS				