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Paper Reference(s)

## 6677/01

# **Edexcel GCE**

### **Mechanics M1**

### Advanced/Advanced Subsidiary

Wednesday 21 May 2008 – Afternoon

Time: 1 hour 30 minutes

Mathematical Formulae (Green)

Items included with question papers

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and intergration, or have retrievable mathematical formulae stored in them.

### **Instructions to Candidates**

In the boxes above, write your centre number, candidate number, your surname, initials and signature. Check that you have the correct question paper.

Answer ALL the questions. Write your answers in the spaces provided in this question paper. If you need more space to complete your answer to any question, use additional answer sheets. Whenever a numerical value of g is required, take g = 9.8 m s<sup>-2</sup>.

When a calculator is used, the answer should be given to an appropriate degree of accuracy.

#### **Information for Candidates**

A booklet 'Mathematical Formulae and Statistical Tables' is provided.

Full marks may be obtained for answers to ALL questions.

The marks for individual questions and the parts of questions are shown in round brackets: e.g. (2).

There are 8 questions in this question paper. The total mark for this question paper is 75.

There are 24 pages in this question paper. Any blank pages are indicated.

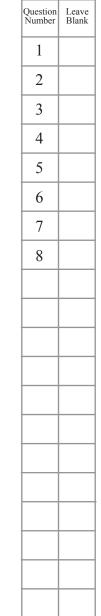
#### **Advice to Candidates**

You must ensure that your answers to parts of questions are clearly labelled. You should show sufficient working to make your methods clear to the Examiner. Answers without working may not gain full credit.

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<ul><li>at rest on a smooth horizontal table. Particle P is given an impulse of magnitude 3 N s in the direction PQ.</li><li>(a) Find the speed of P immediately before it collides with Q.</li></ul>	
<ul> <li>(a) Find the speed of P immediately before it collides with Q.</li> <li>(3) Immediately after the collision between P and Q, the speed of Q is 5 m s<sup>-1</sup>.</li> <li>(b) Show that immediately after the collision P is at rest.</li> </ul>	Two particles $P$ and $Q$ have mass 0.4 kg and 0.6 kg respectively. The particles are initially at rest on a smooth horizontal table. Particle $P$ is given an impulse of magnitude 3 N s in
Immediately after the collision between <i>P</i> and <i>Q</i> , the speed of <i>Q</i> is 5 m s <sup>-1</sup> .  (b) Show that immediately after the collision <i>P</i> is at rest.	the direction $PQ$ .
Immediately after the collision between <i>P</i> and <i>Q</i> , the speed of <i>Q</i> is 5 m s <sup>-1</sup> .  (b) Show that immediately after the collision <i>P</i> is at rest.	(a) Find the speed of <i>P</i> immediately before it collides with <i>Q</i> .
(b) Show that immediately after the collision $P$ is at rest.	(3)
(b) Show that immediately after the collision $P$ is at rest.	Immediately after the collision between $P$ and $O$ , the speed of $O$ is 5 m s <sup>-1</sup> .

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Question 1 continued	
	Q1

2.	At time $t = 0$ , a particle is projected vertically upwards with speed $u$ m s <sup>-1</sup> from a point 10 m above the ground. At time $T$ seconds, the particle hits the ground with speed 17.5 m s <sup>-1</sup> . Find	; !
	(a) the value of $u$ ,	
	(3)	
	(b) the value of $T$ . (4)	

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Question 2 continued	
	Q2
(Total 7 marks)	

3.	A particle $P$ of mass 0.4 kg moves under the action of a single constant force $\mathbf{F}$ new to The acceleration of $P$ is $(6\mathbf{i} + 8\mathbf{j})$ m s <sup>-2</sup> . Find	ons.
	(a) the angle between the acceleration and i,	
		(2)
	(b) the magnitude of <b>F</b> .	
	(e) the magnetice of the	(3)
	At time t seconds the velocity of P is $\mathbf{v}$ m s <sup>-1</sup> . Given that when $t = 0$ , $\mathbf{v} = 9\mathbf{i} - 10\mathbf{j}$ ,	
	(c) find the velocity of $P$ when $t = 5$ .	
		(3)

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(Total 8 marks)	

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Question 4 continued	
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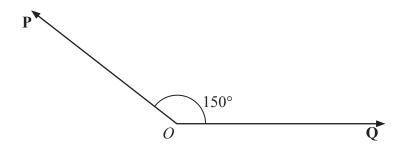


Figure 1

Two forces  $\mathbf{P}$  and  $\mathbf{Q}$  act on a particle at a point O. The force  $\mathbf{P}$  has magnitude 15 N and the force  $\mathbf{Q}$  has magnitude X newtons. The angle between  $\mathbf{P}$  and  $\mathbf{Q}$  is 150°, as shown in Figure 1. The resultant of  $\mathbf{P}$  and  $\mathbf{Q}$  is  $\mathbf{R}$ .

Given that the angle between  ${\bf R}$  and  ${\bf Q}$  is 50°, find

(a)	the magnitude of <b>R</b> ,	
		(4

(b) the value of $X$ .	(5)
	(5)

5.

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6.

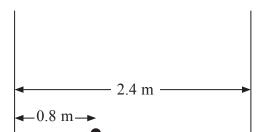


Figure 2

A plank AB has mass 12 kg and length 2.4 m. A load of mass 8 kg is attached to the plank at the point C, where AC = 0.8 m. The loaded plank is held in equilibrium, with AB horizontal, by two vertical ropes, one attached at A and the other attached at B, as shown in Figure 2. The plank is modelled as a uniform rod, the load as a particle and the ropes as light inextensible strings.

(a) Find the tension in the rope attached at B.

**(4)** 

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The plank is now modelled as a non-uniform rod. With the new model, the tension in the rope attached at A is 10 N greater than the tension in the rope attached at B.

(b) Find the distance of the centre of mass of the plank from A.

**(6)** 

Question 6 continued	Lea bla

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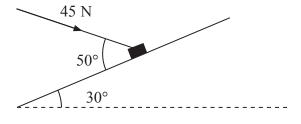


Figure 3

A package of mass 4 kg lies on a rough plane inclined at 30° to the horizontal. The package is held in equilibrium by a force of magnitude 45 N acting at an angle of 50° to the plane, as shown in Figure 3. The force is acting in a vertical plane through a line of greatest slope of the plane. The package is in equilibrium on the point of moving up the plane. The package is modelled as a particle. Find

(a) the magnitude of the normal reaction of the plane on the package,

**(5)** 

(b) the coefficient of friction between the plane and the package.

**(6)** 

7.

Question 7 continued	Le bl:
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Question 7 continued	Leav blan
	Q

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8.



Figure 4

Two particles P and Q, of mass 2 kg and 3 kg respectively, are joined by a light inextensible string. Initially the particles are at rest on a rough horizontal plane with the string taut. A constant force  $\mathbf{F}$  of magnitude 30 N is applied to Q in the direction PQ, as shown in Figure 4. The force is applied for 3 s and during this time Q travels a distance of 6 m. The coefficient of friction between each particle and the plane is  $\mu$ . Find

(a) the acceleration of Q,

**(2)** 

(b) the value of  $\mu$ ,

**(4)** 

(c) the tension in the string.

**(4)** 

(d) State how in your calculation you have used the information that the string is inextensible.

**(1)** 

When the particles have moved for 3 s, the force **F** is removed.

(e) Find the time between the instant that the force is removed and the instant that Q comes to rest.

**(4)** 

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Question 8 continued	1	Lea bla

Question 8 continued	

Question 8 continued		Lea
		C
	(Total 15 marks) TOTAL FOR PAPER: 75 MARKS	
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