

Centre No.						Paper Reference						Surname	Initial(s)	
Candidate No.						6	6	7	7	/	0	1	Signature	

Paper Reference(s)

6677/01

Examiner's use only

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Edexcel GCE

Team Leader's use only

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Mechanics M1

Advanced/Advanced Subsidiary

Wednesday 16 May 2012 – Morning

Time: 1 hour 30 minutes

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
Total	

Materials required for examination	Items included with question papers
Mathematical Formulae (Pink)	Nil

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 or symbolic differentiation/integration, 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.

You must write your answer to each question in the space following the question.

Whenever a numerical value of g is required, take $g = 9.8 \text{ m s}^{-2}$.

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 7 questions in this question paper. The total mark for this paper is 75.

There are 28 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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2.

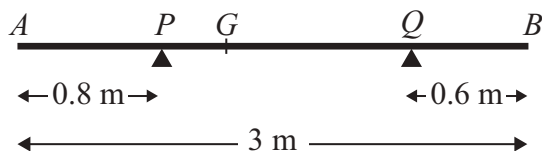


Figure 1

A non-uniform rod AB has length 3 m and mass 4.5 kg. The rod rests in equilibrium, in a horizontal position, on two smooth supports at P and at Q , where $AP = 0.8$ m and $QB = 0.6$ m, as shown in Figure 1. The centre of mass of the rod is at G . Given that the magnitude of the reaction of the support at P on the rod is twice the magnitude of the reaction of the support at Q on the rod, find

- (a) the magnitude of the reaction of the support at Q on the rod, (3)
- (b) the distance AG . (4)



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Question 2 continued

A series of horizontal lines for writing the answer to Question 2.

(Total 7 marks)

Q2



P 4 0 6 8 9 A 0 5 2 8

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3.

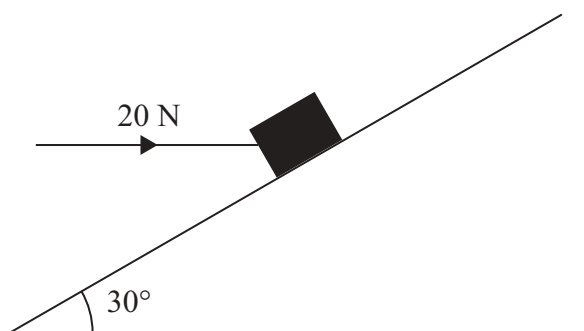


Figure 2

A box of mass 5 kg lies on a rough plane inclined at 30° to the horizontal. The box is held in equilibrium by a horizontal force of magnitude 20 N, as shown in Figure 2. The force acts in a vertical plane containing a line of greatest slope of the inclined plane. The box is in equilibrium and on the point of moving down the plane. The box is modelled as a particle.

Find

(a) the magnitude of the normal reaction of the plane on the box, (4)

(b) the coefficient of friction between the box and the plane. (5)



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Question 3 continued

Blank lined area for writing the answer to Question 3.

Q3

(Total 9 marks)



P 4 0 6 8 9 A 0 9 2 8

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4. A car is moving on a straight horizontal road. At time $t = 0$, the car is moving with speed 20 m s^{-1} and is at the point A . The car maintains the speed of 20 m s^{-1} for 25 s. The car then moves with constant deceleration 0.4 m s^{-2} , reducing its speed from 20 m s^{-1} to 8 m s^{-1} . The car then moves with constant speed 8 m s^{-1} for 60 s. The car then moves with constant acceleration until it is moving with speed 20 m s^{-1} at the point B .

(a) Sketch a speed-time graph to represent the motion of the car from A to B .

(3)

(b) Find the time for which the car is decelerating.

(2)

Given that the distance from A to B is 1960 m,

(c) find the time taken for the car to move from A to B .

(8)



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

A ship *S* is moving with constant velocity $(-12\mathbf{i} + 7.5\mathbf{j})$ km h⁻¹.

- (a) Find the direction in which *S* is moving, giving your answer as a bearing. (3)

At time *t* hours after noon, the position vector of *S* is **s** km. When *t* = 0, **s** = $40\mathbf{i} - 6\mathbf{j}$.

- (b) Write down **s** in terms of *t*. (2)

A fixed beacon *B* is at the point with position vector $(7\mathbf{i} + 12.5\mathbf{j})$ km.

- (c) Find the distance of *S* from *B* when *t* = 3 (4)

- (d) Find the distance of *S* from *B* when *S* is due north of *B*. (4)



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Question 6 continued

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Question 6 continued

Handwriting lines for question 6

(Total 13 marks)

Q6



7.



Figure 3

Two particles P and Q , of mass 0.3 kg and 0.5 kg respectively, are joined by a light horizontal rod. The system of the particles and the rod is at rest on a horizontal plane. At time $t = 0$, a constant force F of magnitude 4 N is applied to Q in the direction PQ , as shown in Figure 3. The system moves under the action of this force until $t = 6$ s. During the motion, the resistance to the motion of P has constant magnitude 1 N and the resistance to the motion of Q has constant magnitude 2 N.

Find

(a) the acceleration of the particles as the system moves under the action of F , (3)

(b) the speed of the particles at $t = 6$ s, (2)

(c) the tension in the rod as the system moves under the action of F . (3)

At $t = 6$ s, F is removed and the system decelerates to rest. The resistances to motion are unchanged. Find

(d) the distance moved by P as the system decelerates, (4)

(e) the thrust in the rod as the system decelerates. (3)



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Question 7 continued

Q7

(Total 15 marks)

TOTAL FOR PAPER: 75 MARKS

END

