

Write your name here			
Surname		Other names	
Pearson Edexcel GCE		Centre Number	Candidate Number
Mechanics M2 Advanced/Advanced Subsidiary			
Friday 15 June 2018 – Afternoon		Paper Reference	
Time: 1 hour 30 minutes		6678/01	
You must have: Mathematical Formulae and Statistical Tables (Pink)			Total Marks

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 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). Coloured pencils and highlighter pens must not be used.
- **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 two significant figures or three significant figures.
- When a calculator is used, the answer should be given to an appropriate degree of accuracy.

Information

- 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.

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1. A truck of mass 750 kg is moving with constant speed $v \text{ m s}^{-1}$ down a straight road inclined at an angle θ to the horizontal, where $\sin \theta = \frac{3}{49}$. The resistance to motion of the truck is modelled as a constant force of magnitude 1200 N. The engine of the truck is working at a constant rate of 9 kW.

(a) Find the value of v .

(4)

On another occasion the truck is moving up the same straight road. The resistance to motion of the truck from non-gravitational forces is modelled as a constant force of magnitude 1200 N. The engine of the truck is working at a constant rate of 9 kW.

(b) Find the acceleration of the truck at the instant when it is moving with speed 4.5 m s^{-1} .

(4)



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Question 1 continued

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2.

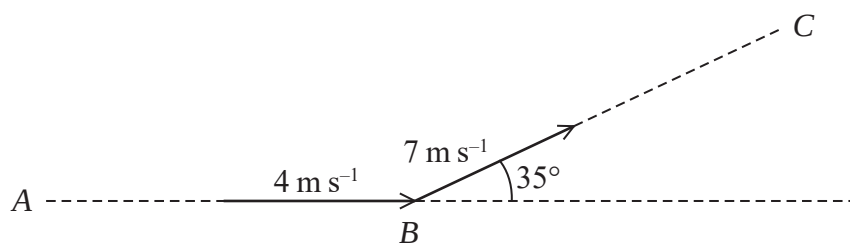


Figure 1

The points A , B and C lie on a smooth horizontal plane. A small ball of mass 0.2 kg is moving along the line AB with speed 4 m s^{-1} . When the ball is at B , the ball is given an impulse. Immediately after the impulse is given, the ball moves along the line BC with speed 7 m s^{-1} . The line BC makes an angle of 35° with the line AB , as shown in Figure 1.

- (a) Find the magnitude of the impulse given to the ball. (4)
- (b) Find the size of the angle between the direction of the impulse and the original direction of motion of the ball. (3)

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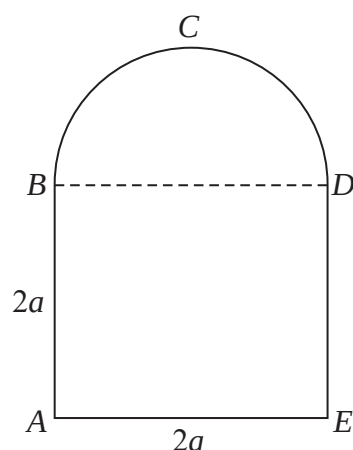


Figure 2

Figure 2 shows the uniform lamina $ABCDE$, such that $ABDE$ is a square with sides of length $2a$ and BCD is a semicircle with diameter BD .

- (a) Show that the distance of the centre of mass of the lamina from BD is $\frac{20a}{3(8 + \pi)}$. (5)

The lamina is freely suspended from D and hangs in equilibrium.

- (b) Find, to the nearest degree, the angle that DE makes with the downward vertical. (3)

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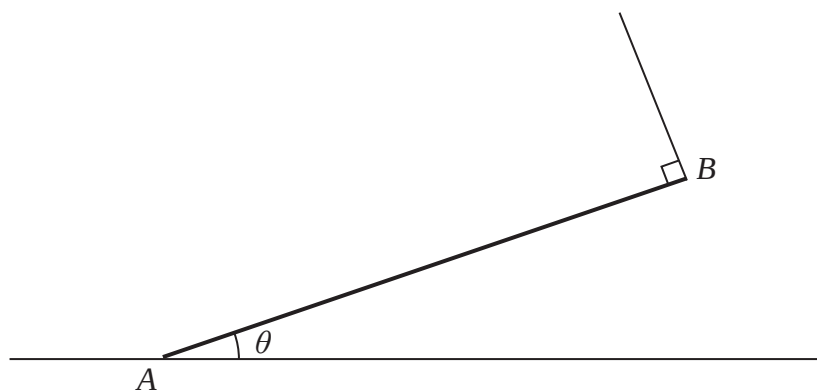
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4.

**Figure 3**

A uniform rod AB , of mass m and length $2a$, rests with its end A on rough horizontal ground. The rod is held in limiting equilibrium at an angle θ to the horizontal by a light string attached to the rod at B , as shown in Figure 3. The string is perpendicular to the rod and lies in the same vertical plane as the rod.

The coefficient of friction between the ground and the rod is μ .

Show that $\mu = \frac{\cos \theta \sin \theta}{2 - \cos^2 \theta}$ (10)

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Q4

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Question 6 continued

Q6

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Q7

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