

Write your name here

Surname

Other names

**Pearson Edexcel**  
**International**  
**Advanced Level**

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--	--

# Mechanics M1

## Advanced/Advanced Subsidiary

Wednesday 25 October 2017 – Morning

**Time: 1 hour 30 minutes**

Paper Reference

**WME01/01****You must have:**

Mathematical Formulae and Statistical Tables (Blue)

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.

Turn over ►

P50804A

©2017 Pearson Education Ltd.

1/1/1/



Pearson

Leave  
blank

1. A suitcase of mass 40 kg is being dragged in a straight line along a rough horizontal floor at constant speed using a thin strap. The strap is inclined at  $20^\circ$  above the horizontal. The coefficient of friction between the suitcase and the floor is  $\frac{3}{4}$ . The strap is modelled as a light inextensible string and the suitcase is modelled as a particle. Find the tension in the strap.

(7)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Leave  
blank

Question 1 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Q1

(Total 7 marks)



P 5 0 8 0 4 A 0 3 2 8

Leave  
blank

Diagram of a beam  $AB$  with supports at  $C$  and  $D$ . The distance from  $A$  to  $C$  is  $0.5\text{ m}$ , and the distance from  $C$  to  $D$  is  $2\text{ m}$ . The total length of the beam is  $6\text{ m}$ .

### Figure 1

(a) Find

- (i) the magnitude of the reaction on the girder at  $C$ ,
- (ii) the magnitude of the reaction on the girder at  $D$ .

(6)

The boy now stands at a point  $E$  on the girder, where  $AE = x$  metres, and the girder remains horizontal and in equilibrium. Given that the magnitude of the reaction on the girder at  $D$  is now 520 N greater than the magnitude of the reaction on the girder at  $C$ ,

- (b) find the value of  $x$ .

(5)



Leave  
blank

**Question 2 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



P 5 0 8 0 4 A 0 5 2 8

Leave  
blank

Question 2 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Leave  
blank

Question 2 continued

Q2

(Total 11 marks)



P 5 0 8 0 4 A 0 7 2 8

Leave  
blank

3. Two particles  $P$  and  $Q$  have masses  $4m$  and  $m$  respectively. They are moving in opposite directions towards each other along the same straight line on a smooth horizontal plane and collide directly. Immediately before the collision the speed of  $P$  is  $2u$  and the speed of  $Q$  is  $4u$ . In the collision, the particles join together to form a single particle.

Find, in terms of  $m$  and  $u$ , the magnitude of the impulse exerted by  $P$  on  $Q$  in the collision.

(6)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Leave  
blank

**Question 3 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Leave  
blank

## Question 3 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Leave  
blank

Question 3 continued

Q3

(Total 6 marks)



Leave  
blank

4. Two forces  $\mathbf{F}_1$  and  $\mathbf{F}_2$  act on a particle. The force  $\mathbf{F}_1$  has magnitude 8 N and acts due east. The resultant of  $\mathbf{F}_1$  and  $\mathbf{F}_2$  is a force of magnitude 14 N acting in a direction whose bearing is  $120^\circ$ .

Find

- (i) the magnitude of  $\mathbf{F}_2$ , (4)

- (ii) the direction of  $\mathbf{F}_2$ , giving your answer as a bearing to the nearest degree. (5)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Leave  
blank

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 4 continued

Handwriting practice area with horizontal lines.



Leave  
blank

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

**DO NOT WRITE IN THIS AREA**

DO NOT WRITE IN THIS AREA

**DO NOT WRITE IN THIS AREA**



Leave  
blank

Question 4 continued

Q4

(Total 9 marks)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Leave  
blank

5. A small ball is projected vertically upwards from a point  $O$  with speed  $14.7 \text{ m s}^{-1}$ . The point  $O$  is  $2.5 \text{ m}$  above the ground. The motion of the ball is modelled as that of a particle moving freely under gravity.

Find

- (a) the maximum height above the ground reached by the ball, (4)
- (b) the time taken for the ball to first reach a height of  $1 \text{ m}$  above the ground, (4)
- (c) the speed of the ball at the instant before it strikes the ground for the first time. (3)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Leave  
blank

Question 5 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Leave  
blank

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

**DO NOT WRITE IN THIS AREA**

DO NOT WRITE IN THIS AREA

**DO NOT WRITE IN THIS AREA**



Leave  
blank

Question 5 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Q5

(Total 11 marks)



P 5 0 8 0 4 A 0 1 9 2 8

Leave  
blank

6. An athlete goes for a run along a straight horizontal road. Starting from rest, she accelerates at  $0.6 \text{ ms}^{-2}$  up to a speed of  $V \text{ ms}^{-1}$ . She then maintains this constant speed of  $V \text{ ms}^{-1}$  before finally decelerating at  $0.2 \text{ ms}^{-2}$  back to rest. She covers a total distance of 1500 m in 270 s.

(a) Sketch a speed-time graph to represent the athlete's run.

(2)

(b) Show that she accelerates for  $\frac{5V}{3}$  seconds.

(2)

(c) Show that  $V^2 - kV + 450 = 0$ , where  $k$  is a constant to be found.

(6)

(d) Find the value of  $V$ , justifying your answer.

(4)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Leave  
blank

Question 6 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Leave  
blank

Question 6 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Leave  
blank

Question 6 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Q6

(Total 14 marks)



P 5 0 8 0 4 A 0 2 3 2 8

7.

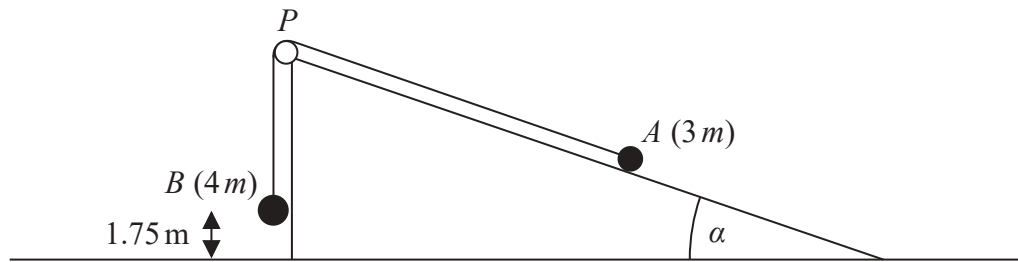


Figure 2

Figure 2 shows two particles  $A$  and  $B$ , of masses  $3m$  and  $4m$  respectively, attached to the ends of a light inextensible string. Initially  $A$  is held at rest on the surface of a fixed rough inclined plane. The plane is inclined to the horizontal at an angle  $\alpha$  where  $\tan \alpha = \frac{3}{4}$ . The coefficient of friction between  $A$  and the plane is  $\frac{1}{4}$ . The string passes over a small smooth light pulley  $P$  which is fixed at the top of the plane. The part of the string from  $A$  to  $P$  is parallel to a line of greatest slope of the plane. The particle  $B$  hangs freely and is vertically below  $P$ . The system is released from rest with the string taut and with  $B$  at a height of 1.75 m above the ground. In the subsequent motion,  $A$  does not hit the pulley.

For the period before  $B$  hits the ground,

- (a) write down an equation of motion for each particle. (4)

- (b) Hence show that the acceleration of  $B$  is  $\frac{8}{35}g$ . (5)

- (c) Explain how you have used the fact that the string is inextensible in your calculation. (1)

When  $B$  hits the ground,  $B$  does not rebound and comes immediately to rest.

- (d) Find the distance travelled by  $A$  from the instant when the system is released to the instant when  $A$  first comes to rest. (7)

---

---

---

---

---

---

---

---

---

---



Leave  
blank

Question 7 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Leave  
blank

Question 7 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Leave  
blank

Question 7 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Leave  
blank

**(Total 17 marks)**

**TOTAL FOR PAPER: 75 MARKS**

**END**

**Q7**

