

# Both Hanging Freely

## Question Paper 2

<b>Level</b>	A Level
<b>Subject</b>	Maths
<b>Exam Board</b>	AQA
<b>Module</b>	Mechanics 1
<b>Topic</b>	Connected Particles
<b>Sub Topic</b>	Both hanging freely
<b>Booklet</b>	Question Paper - 2

**Time Allowed:** 48 minutes

**Score:** /40

**Percentage:** /100

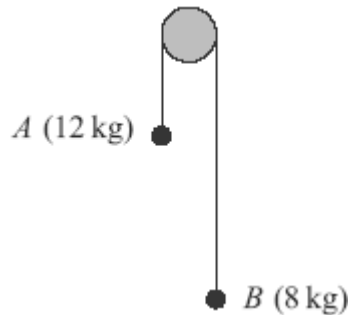
**Grade Boundaries:**

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

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**Q1.** Two particles,  $A$  and  $B$ , have masses 12 kg and 8 kg respectively. They are connected by a light inextensible string that passes over a smooth fixed peg, as shown in the diagram.

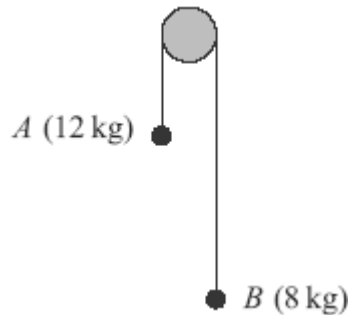


The particles are released from rest and move vertically. Assume that there is no air resistance.

- (a) By forming two equations of motion, show that the magnitude of the acceleration of each particle is  $1.96 \text{ m s}^{-2}$ . (5)
- (b) Find the tension in the string. (2)
- (c) After the particles have been moving for 2 seconds, both particles are at a height of 4 metres above a horizontal surface. When the particles are in this position, the string breaks.
- (i) Find the speed of particle  $A$  when the string breaks. (2)
- (ii) Find the speed of particle  $A$  when it hits the surface. (3)

**(Total 12 marks)**

**Q2.** Two particles,  $A$  and  $B$ , have masses 12 kg and 8 kg respectively. They are connected by a light inextensible string that passes over a smooth fixed peg, as shown in the diagram.



The particles are released from rest and move vertically. Assume that there is no air resistance.

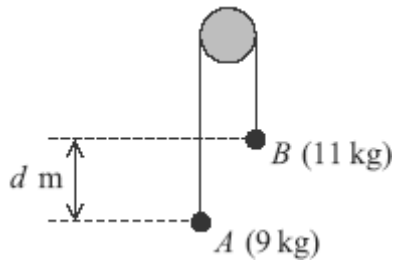
- (a) By forming two equations of motion, show that the magnitude of the acceleration of each particle is  $1.96 \text{ m s}^{-2}$ . (5)
- (b) Find the tension in the string. (2)
- (c) After the particles have been moving for 2 seconds, both particles are at a height of 4 metres above a horizontal surface. When the particles are in this position, the string breaks.
- (i) Find the speed of particle *A* when the string breaks. (2)
- (ii) Find the speed of particle *A* when it hits the surface. (3)
- (iii) Find the time that it takes for particle *B* to reach the surface after the string breaks.  
Assume that particle *B* does not hit the peg.

(5)  
(Total 17 marks)

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**Q3.** Two particles,  $A$  and  $B$ , are connected by a light inextensible string that passes over a smooth fixed peg, as shown in the diagram. The mass of  $A$  is  $9\text{ kg}$  and the mass of  $B$  is  $11\text{ kg}$ .



The particles are released from rest in the position shown, where  $B$  is  $d$  metres higher than  $A$ .

Assume that no resistance forces act on the particles.

(a) By forming an equation of motion for each of the particles  $A$  and  $B$ , show that the acceleration of each particle has magnitude  $0.98\text{ m s}^{-2}$ .

(5)

(b) When the particles have been moving for  $0.5$  seconds, they are at the same level.

(i) Find the speed of the particles at this time.

(2)

(ii) Find  $d$ .

(4)

(Total 11 marks)