

### AS Mathematics - Forces

#### Teaching ideas

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One problem that students encounter when faced with mechanics questions, is being able to extract the information in a question and represent it in a diagram.

Distribute different questions to each student.

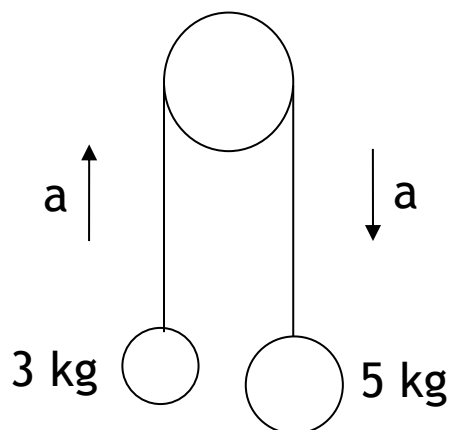
**First** the student describes in words the problem that is represented in the diagram. They need to ensure that they include all of the information that is shown. They then fold the diagram over backwards so only the written problem can be seen.

**Secondly**, they pass the written problem to another student. They then draw a diagram from the written problem given. When the diagram is completed, they can compare their diagram with the original.

#### Extension

1. Work out the acceleration and tension, where appropriate, for each problem
2. Questions 6 - using a particle on a slope.
3. Create own diagrams to describe in words etc.

1. Smooth pulley



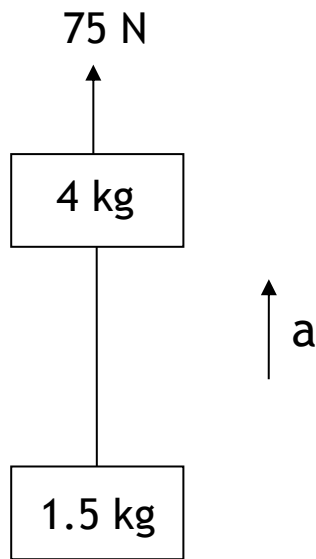
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Describe problem in words

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Draw diagram

2. Inextensible string



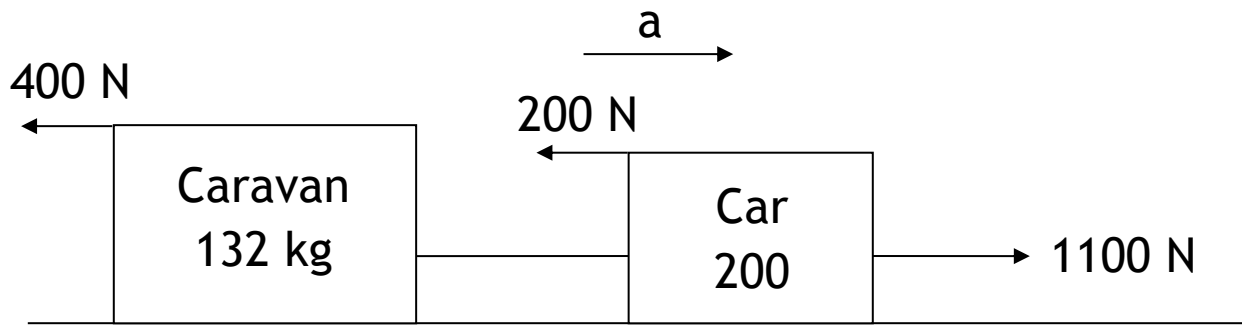
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Describe problem in words

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Draw diagram

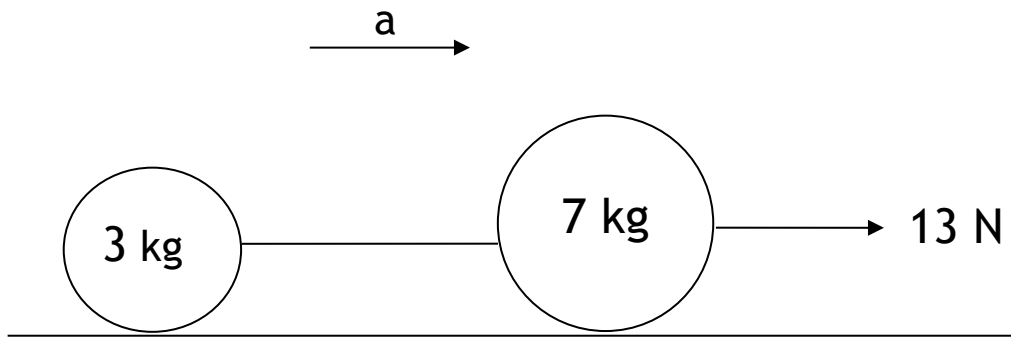
3. Tow bar is light and inextensible



Describe problem in words

Draw diagram

4. Joined by light and inextensible string



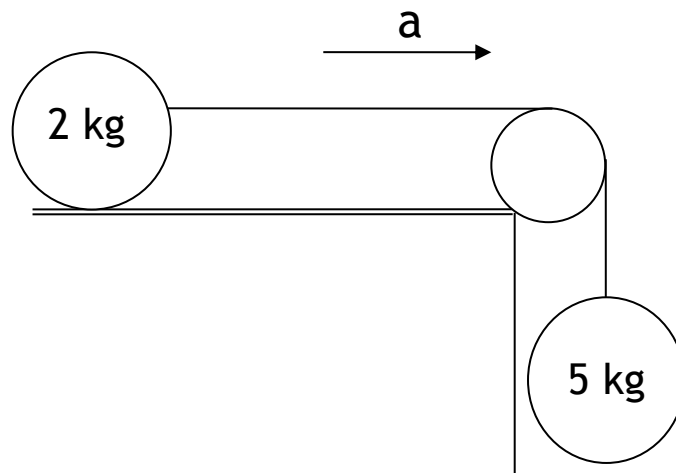
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Describe problem in words

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Draw diagram

5. Joined by light and inextensible string, over a smooth pulley



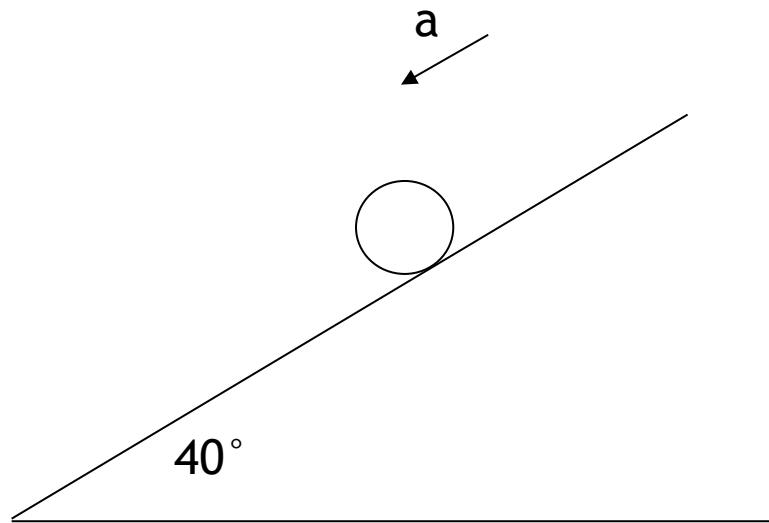
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Describe problem in words

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Draw diagram

6. Smooth surface  
Ball mass 3kg



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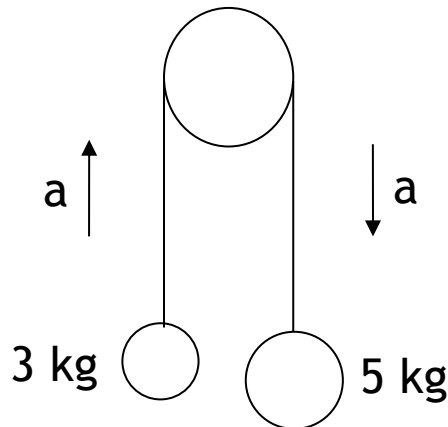
Describe problem in words

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Draw diagram

Solutions

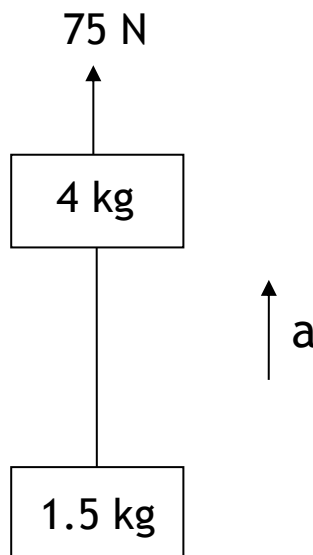
1. Smooth pulley



A light inextensible string is passed over a smooth pulley. Two particles of masses 3 kg and 5 kg are connected to either end of the string. Initially the particles are at rest. Find the tension in the string and the acceleration of the two particle when the particles are released.

**Tension = 36.75 = 37 N, Acceleration =  $g/4 = 2.45 \text{ ms}^{-2}$**

2. Inextensible string

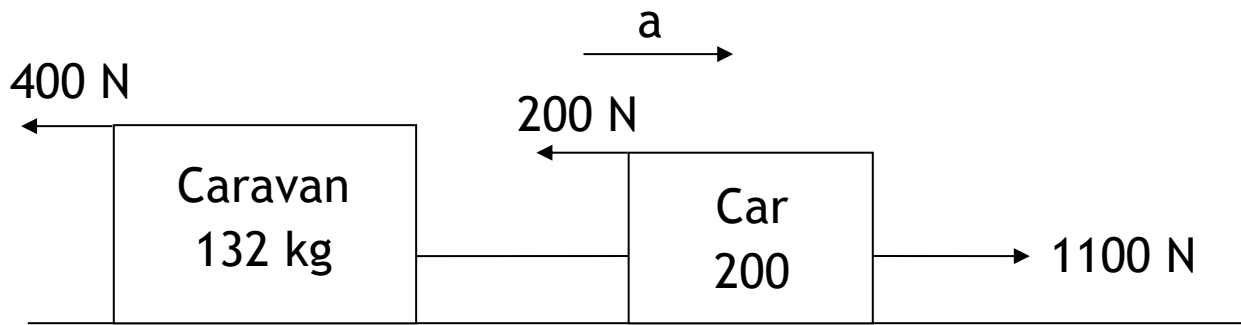


Two bricks of mass 4 kg and 1.5 kg are connected by a light inextensible string. Initially they are held at rest, with the 4 kg brick vertically above the 1.5 kg brick. A vertical force of 75 N is applied to the 4 kg brick, which causes the brick to accelerate upwards. Find the acceleration of the particles and the tension in the string.

**Tension = 20.45 = 20 N, Acceleration =  $3.84 \text{ ms}^{-2}$**



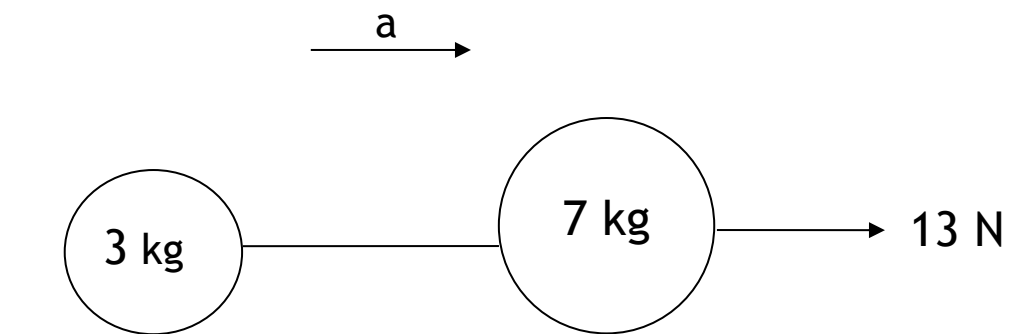
3. Tow bar is light and inextensible



A car of mass 200 kg tows a caravan of 132 kg along a straight horizontal road. The tow bar is light and inextensible. The engine of the car exerts a driving force of 1100N. The car and caravan both experience a resistance to their motion of 200 N and 400 N respectively. Find the acceleration and the tension in the tow bar.

Tension = 599 N, Acceleration =  $1.51 \text{ ms}^{-2}$

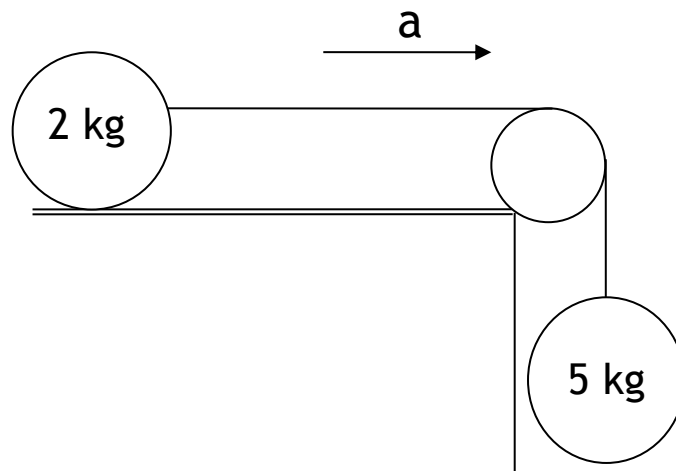
4. Joined by light and inextensible string



Two particles of mass 3 kg and 7 kg are at rest on a smooth horizontal surface and are connected by a light inextensible string. A force of 13 N is applied to the 7 kg particle, causes it to move to the right in a horizontal direction. Find the acceleration of the particles and the tension in the sting.

Tension = 3.9 N, Acceleration =  $1.3 \text{ ms}^{-2}$

5. Joined by light and inextensible string, over a smooth pulley

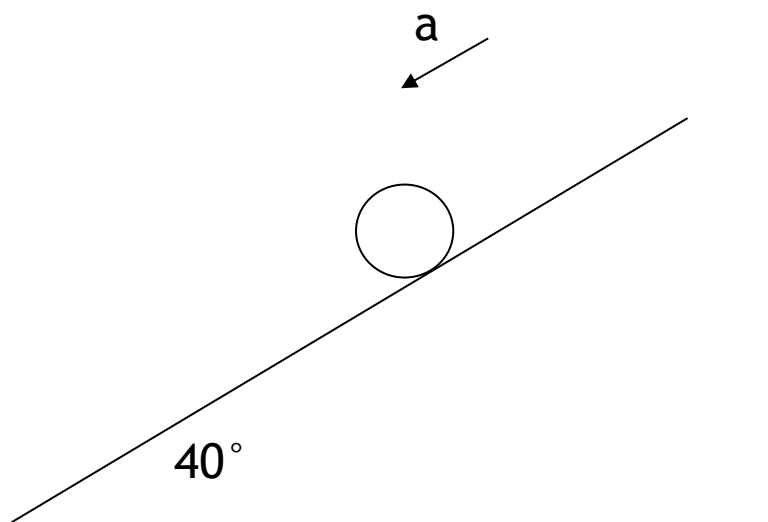


A particle of mass 5 kg is connected to particle of mass 2 kg by a light inextensible string, which is passed over a smooth pulley at the edge of a table. The 2 kg particle is held rest on the table and the 5 kg particle is suspended vertically below the pulley. When the 2 kg particle is released it moves along the table towards the pulley. Find the acceleration of the particles and the tension in the string.

**Tension = 14 N, Acceleration =  $7 \text{ ms}^{-2}$**

6. Smooth surface

Ball mass 3kg



A particle of mass 3 kg is placed on a smooth plane, which is inclined at  $40^\circ$  to the horizontal. The ball is held at rest, when it is released it will accelerate down the plane. Find the acceleration of the particle.

**Acceleration =  $6.3 \text{ ms}^{-2}$**