Godalming College

# Mechanics 7 – Connected Particles 2

Please **complete** this homework by _____. Start it early. If you can't do a question you will then have time to ask your teacher for help or go to a drop in session.

## Section 1 – Review of previous topics. Please complete all questions.

1. Using the equations of motion for constant acceleration
   (i) Find v when u = 5, a = 3, t = 2.
   (ii) Find v when u = 4, a = -2, t = 3.
   (iii) Find s when v = 10, u = 4, a = 6.
   (iv) Find s when u = 15, a = -5, t = 3.

2.
   (i) Find a when u = 6, s = 4, v = 1.
   (ii) Find a when s = 12, u = 3, t = 4.
   (iii) Find u when v = 0, a = 4, s = -12.
   (iv) Find u when s = 10, t = 2, a = -4.

3.
   (i) If u = 5, a = 2 and t = 3 find v and s.
   (ii) If v = -18, s = -64 and t = 8 find a and u.

## Section 2 – Consolidation of this week's topic. Please complete all questions.

1. Two particles of masses 3 kg and 9 kg respectively are connected by a light, inextensible string passed over a smooth pulley. Both masses hang vertically. Find the tension in the string and the acceleration when the system is released from rest.

   **(6 marks)**

2. A particle of mass 4 kg rests on a smooth horizontal table. It is connected by a light inextensible string which passes over a smooth pulley at the edge of the table to a mass of 1.5 kg which hangs freely. The system is released from rest. Find the acceleration of the particles and the tension in the string.

   **(7 marks)**

3. A particle of mass $m$ rests on a smooth horizontal table. It is connected by a light inextensible string which passes over a smooth pulley at the edge of the table to a particle of mass $m$ which hangs freely. The system is released from rest. Find the distance travelled by each particle and the speed at the end of the first 0.5 seconds of motion.

   **(9 marks)**

(continued overleaf)

4.

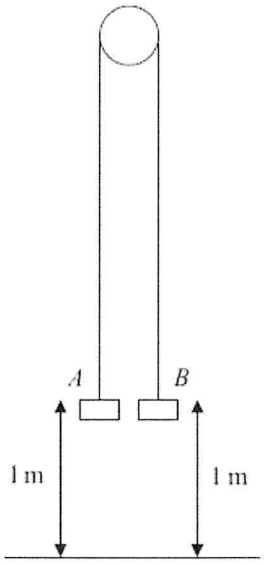


**Figure 1**

Two particles $A$ and $B$ have mass 0.4 kg and 0.3 kg respectively. The particles are attached to the ends of a light inextensible string. The string passes over a small smooth pulley which is fixed above a horizontal floor. Both particles are held, with the string taut, at a height of 1 m above the floor, as shown in Figure 3. The particles are released from rest and in the subsequent motion $B$ does not reach the pulley.

($a$) Find the tension in the string immediately after the particles are released.

**(6)**

($b$) Find the acceleration of $A$ immediately after the particles are released.

**(2)**

When the particles have been moving for 0.5 s, the string breaks.

($c$) Find the further time that elapses until $B$ hits the floor.

**(9)**

**(Total 39 marks)**

## Section 3 – Extension questions. If you are aiming for a top grade, you should attempt these questions.

## Past exam Questions

### M1 May 2013

A woman travels in a lift. The mass of the woman is 50 kg and the mass of the lift is 950 kg. The lift is being raised vertically by a vertical cable which is attached to the top of the lift. The lift is moving upwards and has constant deceleration of 2 m $s^{-2}$. By modelling the cable as being light and inextensible, find

(*a*) the tension in the cable,

(*b*) the magnitude of the force exerted on the woman by the floor of the lift.

**M1 May 2012**


**Figure 1**

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 1. 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**,

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

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

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,

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