# Mechanics revision

Question 1

A smuggler seeking to escape arrest drops a large sack containing illegal drugs from the top of a cliff which is 75 m above the surface of the sea. The sack is initially at rest and falls into the sea at the bottom of the cliff without meeting any obstacle. By modelling the sack as a particle falling with constant acceleration g, find

(a) the speed with which the sack hits the sea,

(b) the time taken for the sack to reach the sea.

(c) Suggest two physical factors which have been ignored in modelling the situation in the above way.

Question 2
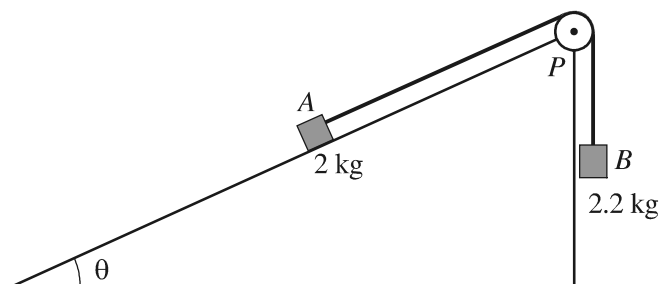
A parcel A of mass 2 kg rests on a rough slope inclined at an angle θ to the horizontal, where $\tan \theta = \dfrac{3}{4}$. A string is attached to A and passes over a small smooth pulley fixed at P. The other end of the string is attached to a weight B of mass 2.2 kg, which hangs freely, as shown above. The parcel A is in limiting equilibrium and about to slide up the slope. By modelling A and B as particles and the string as light and inextensible, find

(a) the normal contact force acting on A,

**(b)** the coefficient of friction between A and the slope.

Question 3
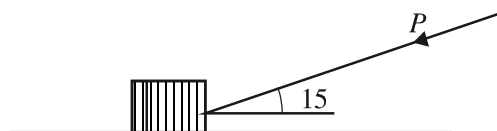
A box of mass 50 kg rests on rough horizontal ground. The coefficient of friction between the box and the ground is 0.6. A force of magnitude P newtons is applied to the box at an angle of 15° to the horizontal, as shown above, and the box is now in limiting equilibrium. By modelling the box as a particle find, to 3 significant figures, the value of P.

Mechanics revision

Question 4

$B \, (m \, \text{kg})$ $A \, (3 \, \text{kg})$
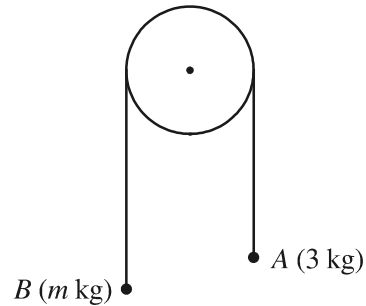
The diagram above shows two particles *A* and *B*, connected by a light inextensible string passing over a smooth fixed pulley. The mass of *A* is 3 kg, and the mass of *B* is *m* kg, where *m* < 3. The system is released from rest with the string taut, and the acceleration of each particle is 2.2 m s^{-2}. Find

(a) the tension in the string,

(b) the value of *m*,

(c) the force exerted on the pulley by the string.

(d) State how you have used the modelling assumption that the pulley is smooth.

Question 5

Question 6

Mechanics revision

Question 1

(a) 38.3 m s^{-1}
(b) 3.91 s
(c) Air resistance, wind, variation in g.

Question 2

(a) 1.6g

(b) $\dfrac{5}{8}$

Question 3

363 N

Question 4

(a) 22.8 N
(b) 1.9
(c) 45.6 N
(d) Tension same in both parts

Question 5

Mechanics revision

_____

Question 6