

19

A wooden toy comprises a train engine and a trailer connected to each other by a light, inextensible rod.

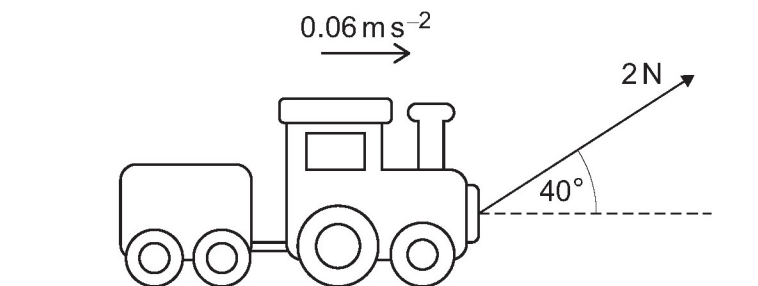
The train engine has a mass of 1.5 kilograms.

The trailer has a mass 0.7 kilograms.

A string inclined at an angle of 40° above the horizontal is attached to the front of the train engine.

The tension in the string is 2 newtons.

As a result the toy moves forward, from rest, in a straight line along a horizontal surface with acceleration 0.06 m s^{-2} as shown in the diagram below.



As it moves the train engine experiences a total resistance force of 0.8 N

19 (a)

Show that the total resistance force experienced by the trailer is approximately 0.6 N [4 marks]

19 (b)

At the instant that the toy reaches a speed of 0.5 m s^{-1} the string breaks.

As a result of this the train engine and trailer decelerate at a constant rate until they come to rest, having travelled a distance of h metres.

It can be assumed that the resistance forces remain unchanged.

19 (b) (i)

Find the tension in the rod after the string has broken.

[4 marks]

19 (b) (ii)

Find h

[3 marks]

19 (c)

State one modelling assumption that you have used about the rod when answering part (b)(i).

[1 mark]