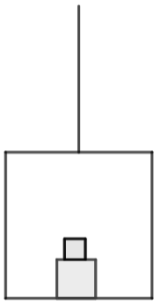
Connected Particles – Mechanics Year 1 A Level Maths – www.m4ths.com – Steve Blades

(1) A car of mass $2000kg$ tows a trailer of mass $400kg$ along a horizontal road. The trailer is connected to the car by a light inextensible tow rope which is parallel to the ground and taught when the car is in motion.
The car produces a driving force of $2kN$. The car experiences constant resistances of $300N$ and the trailer $100N$
The car starts from rest with the tow rope taught.
(a) Find the tension in the tow rope.
(b) Find the acceleration of the car.
(c) After travelling $400m$ the tow rope breaks. Given that the trailer still experiences the same resistance, find the distance the trailer travels before coming to rest.
(d) State one criticism of the model.

(2) A truck of mass $1200kg$ tows a trailer of mass $600kg$ by a light rigid towbar along a horizontal road. The towbar is parallel to the floor.
The truck experiences constant resistance of $150N$ and the trailer $100N$. The driver of the truck applies the brakes which produces a constant force of $1800N$.
Prove that the thrust in the tow bar is $\frac{1750}{3}N$

(3) A lift of mass $1800kg$ has two boxes sitting on its floor as shown below.



Box A has mass $100kg$ and Box B has mass $40kg$. Box B sits on top of Box A.
The lift descends from rest $8m$ in 6 seconds by a light inextensible cable.
(a) Find the tension in the cable.
(b) Find the reaction force Box A exerts on Box B.
(c) Find the reaction force the lift exerts on Box A.
(d) State how your answers to part (b) and (c) would change if the lift was ascending.