4.

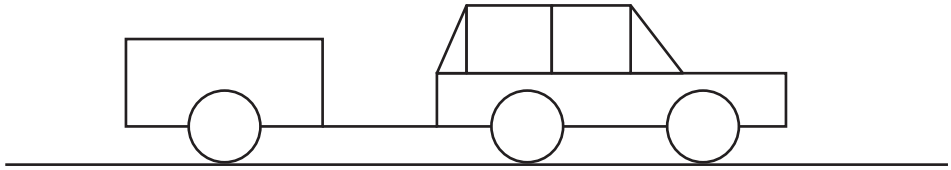

Figure 2

Figure 2 shows a car towing a trailer along a straight horizontal road.

The mass of the car is 800 kg and the mass of the trailer is 600 kg.

The trailer is attached to the car by a towbar which is parallel to the road and parallel to the direction of motion of the car and the trailer.

The towbar is modelled as a light rod.

The resistance to the motion of the car is modelled as a constant force of magnitude 400 N.

The resistance to the motion of the trailer is modelled as a constant force of magnitude R newtons.

The engine of the car is producing a constant driving force that is horizontal and of magnitude 1740 N.

The acceleration of the car is $0.6\,\text{m s}^{-2}$ and the tension in the towbar is T newtons.

Using the model,

(a) show that $R = 500$

(3)

(b) find the value of T.

(3)

At the instant when the speed of the car and the trailer is $12.5\ \text{m s}^{-1}$, the towbar breaks.

The trailer moves a further distance d metres before coming to rest.

The resistance to the motion of the trailer is modelled as a constant force of magnitude 500 N.

Using the model,

(c) show that, after the towbar breaks, the deceleration of the trailer is $\frac{5}{6}\,\text{m s}^{-2}$

(1)

(d) find the value of d.

(3)

In reality, the distance d metres is likely to be different from the answer found in part (d).

(e) Give two **different** reasons why this is the case.

(2)