**2.**

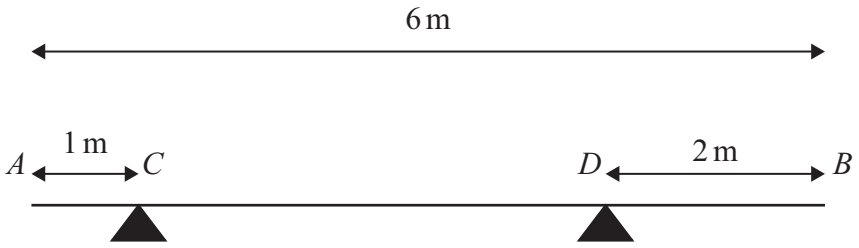


**Figure 1**

A uniform rod $AB$ has mass 30 kg and length 6 m. The rod rests in equilibrium in a horizontal position on two supports, one at $C$, where $AC = 1$ m, and the other at $D$, where $DB = 2$ m, as shown in Figure 1.

A particle of mass 60 kg is placed on the rod at a point which is 2 m from $A$.

Another particle, whose mass is 75 kg, is placed on the rod at a point that is $x$ metres from $B$.

The rod remains at rest in equilibrium in a horizontal position.

The magnitude of the force acting on the rod at $C$ is two thirds of the magnitude of the force acting on the rod at $D$.

(a) Find the magnitude of the force acting on the rod at $D$.

**(3)**

(b) Find the exact value of $x$.

**(3)**

The particle of mass 75 kg is now removed.

A particle of unknown mass is placed on the rod at $B$ and the rod is now on the point of tilting.

(c) Find the magnitude of the force that is now acting on the rod at $D$.

**(3)**

**(Total for Question 2 is 9 marks)**