Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

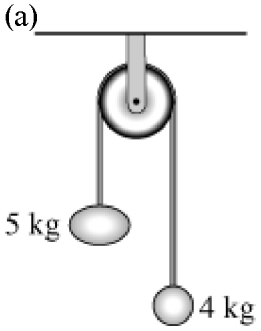
6 Connected particles

Exercise A, Question 2

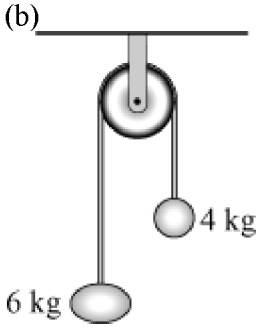
Question:

The diagrams below show particles that are connected by a light, inextensible string that passes over a smooth pulley. In each case find the acceleration of the particles and the tension in the string.

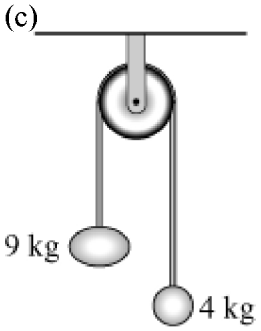
(a)



(b)



(c)



Solution:

(a) Using $F = ma$,

For 5 kg particle;	$5g - T$	$= 5a$ [1]
For 4 kg particle;	$T - 4g$	$= 4a$
Adding;	g	$= 9a$
	a	$= \frac{1}{9}g$

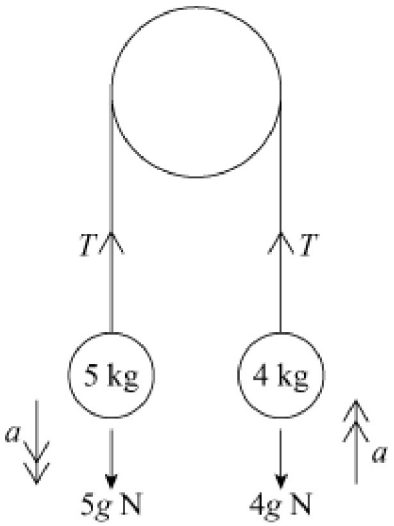
$\therefore$ Acceleration is 1.09 m s^{-2}

Substituting into equation [1]

$5g - T = 5 \times \frac{1}{9}g$

$\frac{40}{9}g = T$

∴ Tension is 43.6 N



(b) Using $F = ma$,

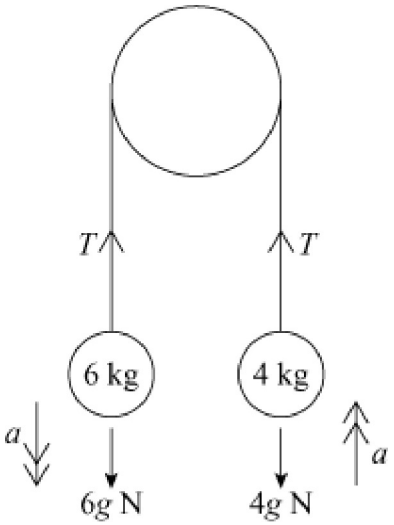
For 6 kg particle; $6g - T = 6a$ [1]
For 4 kg particle; $T - 4g = 4a$
Adding; $2g = 10a$
$a = \frac{1}{5}g$

∴ Acceleration is 1.96 m s^{-2}
Substituting into equation [1]

$6g - T = 6 \times \frac{1}{5}g$

$\frac{24}{5}g = T$

∴ Tension is 47.0 N



(c) Using $F = ma$,

For 9 kg particle; $9g - T = 9a$ [1]
For 4 kg particle; $T - 4g = 4a$
Adding; $5g = 13a$
$a = \frac{5}{13}g$

∴ Acceleration is 3.77 m s^{-2}
Substituting into equation [1]

$9g - T = 9 \times \frac{5}{13}g$

$\frac{72}{13}g = T$

∴ Tension is 54.3 N