

# Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

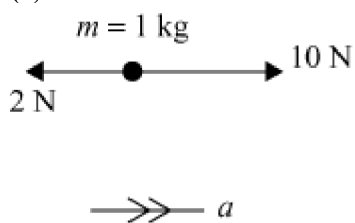
## 5 Newton's laws of motion

### Exercise B, Question 6

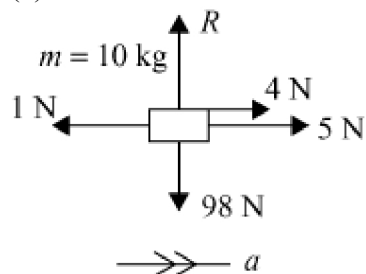
#### Question:

Find the unknown accelerations, forces and angles in the following situations.

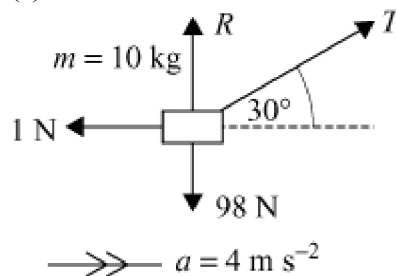
(a)



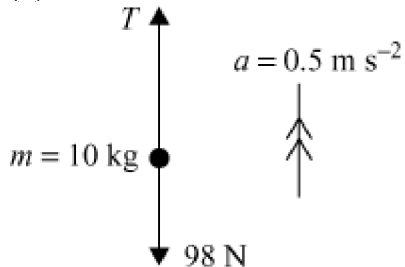
(b)



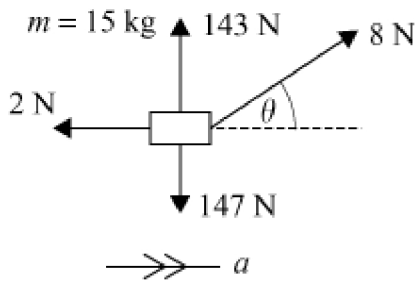
(c)



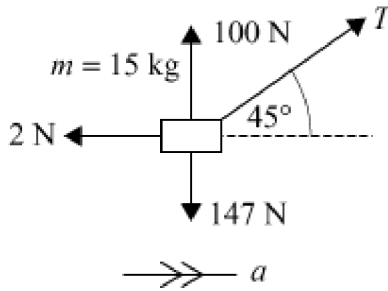
(d)



(e)



(f)

**Solution:**Newton's 2nd Law,  $\rightarrow 10 - 2 = 1 \times a$ 

$$(a) \quad \therefore a = 8 \text{ m s}^{-2}$$

Newton's 2nd Law,  $\rightarrow 4 + 5 - 1 = 10 \times a$ 

$$\therefore \frac{8}{10} = a$$

$$(b) \quad a = 0.8 \text{ m s}^{-2}$$

Newton's 2nd Law,  $\uparrow R - 98 = 10 \times 0$ 

$$\therefore R = 98 \text{ N}$$

(c) Newton's 2nd Law,  $\rightarrow$ 

$$T \cos 30^\circ - 1 = 10 \times 4$$

$$\therefore T \cos 30^\circ = 40 + 1$$

$$\therefore T = \frac{41}{\cos 30^\circ}$$

$$T = 47.342..$$

$$T = 47.3 \text{ N}$$

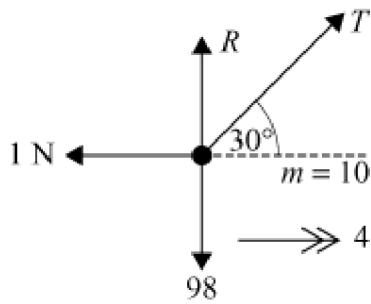
Newton's 2nd Law,  $\uparrow$ 

$$R + T \sin 30^\circ - 98 = 10 \times 0$$

$$\therefore R = 98 - 47.342 \times \sin 30^\circ$$

$$R = 74.328..$$

$$\therefore R = 74.3 \text{ N (3 s.f.)}$$



$$\text{Newton's 2nd Law, } \uparrow T - 98 = 10 \times 0.5$$

$$\begin{aligned} \text{(d) } \therefore T &= 98 + 5 \\ T &= 103 \text{ N} \end{aligned}$$

$$\text{Newton's 2nd Law, } \uparrow 143 + 8 \sin \theta - 147 = 15 \times 0$$

$$\therefore 8 \sin \theta = 147 - 143$$

$$\sin \theta = \frac{4}{8}$$

$$\begin{aligned} \text{(e) } \theta &= 30^\circ \\ \text{Newton's 2nd Law } \rightarrow 8 \cos \theta - 2 &= 15 \times a \end{aligned}$$

$$\therefore \frac{8 \cos 30^\circ - 2}{15} = a$$

$$a = 0.32854..$$

$$a = 0.329 \text{ m s}^{-2} \text{ (3 s.f.)}$$

$$\text{Newton's 2nd Law, } \uparrow T \sin 45^\circ + 100 - 147 = 15 \times 0$$

$$\therefore T \sin 45^\circ = 147 - 100$$

$$T = \frac{47}{\sin 45^\circ}$$

$$T = 66.468..$$

$$\begin{aligned} \text{(f) } \therefore T &= 66.5 \text{ N (3 s.f.)} \end{aligned}$$

$$\text{Newton's 2nd Law, } \rightarrow T \cos 45^\circ - 2 = 15 \times a$$

$$\therefore \frac{66.468 \times \cos 45^\circ - 2}{15} = a$$

$$a = 3 \text{ m s}^{-2}$$