

Question		Answer	Marks	Guidance
1		$P = 8\sqrt{2} \sin 45^\circ + 12 \sin 30^\circ$ $P = 14$ $Q + 8\sqrt{2} \cos 45^\circ = 12 \cos 30^\circ$ $Q = 2.39$	M1 M1 A1 B1 B1 [5]	Considering equilibrium in the vertical direction Resolution of forces of 12 N and $8\sqrt{2}$ N in the vertical direction. Do not allow sin-cos interchange for the 30° angle. Dependent on both M marks

2		mark		sub
(a)	$\downarrow 20 + 16 \cos 60 = 28$	B1		1
(b)	<p>either $\rightarrow 16 \sin 60$</p> <p>Mag $\sqrt{28^2 + 192} = 31.2409\dots$ so 31.2 N (3 s.f.)</p> <p>or Cos rule $\text{mag}^2 = 16^2 + 20^2 - 2 \times 16 \times 20 \times \cos 120$ 31.2 N (3 s. f.)</p>	<p>B1</p> <p>M1</p> <p>F1</p> <p>M1</p> <p>A1</p> <p>A1</p>	<p>Any form. May be seen in (i). Accept any appropriate equivalent resolution.</p> <p>Use of Pythag with 2 distinct cpts (but not 16 and ± 20)</p> <p>Allow 34.788... only as FT</p> <p>Must be used with 20 N, 16 N and 60° or 120°</p> <p>Correct substitution</p>	3
(c)	<p>Magnitude of accn is $15.620\dots \text{ m s}^{-2}$ so 15.6 m s^{-2} (3 s. f.)</p> <p>angle with 20 N force is $\arctan\left(\frac{16 \sin 60}{28}\right)$</p> <p>so $26.3295\dots$ so 26.3° (3 s. f.)</p>	<p>B1</p> <p>M1</p> <p>A1</p>	<p>Award only for their $F \div 2$</p> <p>Or equiv. May use force or acceleration. Allow use of sine or cosine rules. FT only $s \leftrightarrow c$ and sign errors. Accept reciprocal of the fraction. cao</p>	3
				7

- 3 (a)** $F = 2g$
- (b)** 2.5 m s^{-2}
- (c)** $F = 2g$
- (d)** 2.25 m s^{-2}

12 marks

4 (a) 1.02 m s^{-2} (2)

(b) 102 N (3)

(c) 0.102 (3)

(d) 49 m; independent of mass (3)

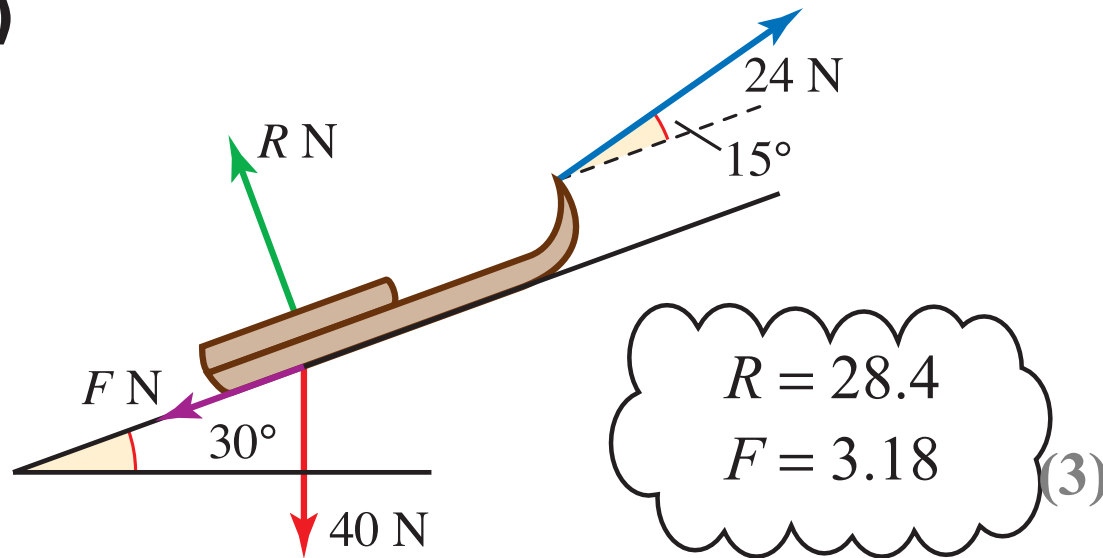
5 (a) 0.577 (2)

(b) 35° (3)

(c) 2.14 (2)

(d) 50.2° (3)

6 (a)



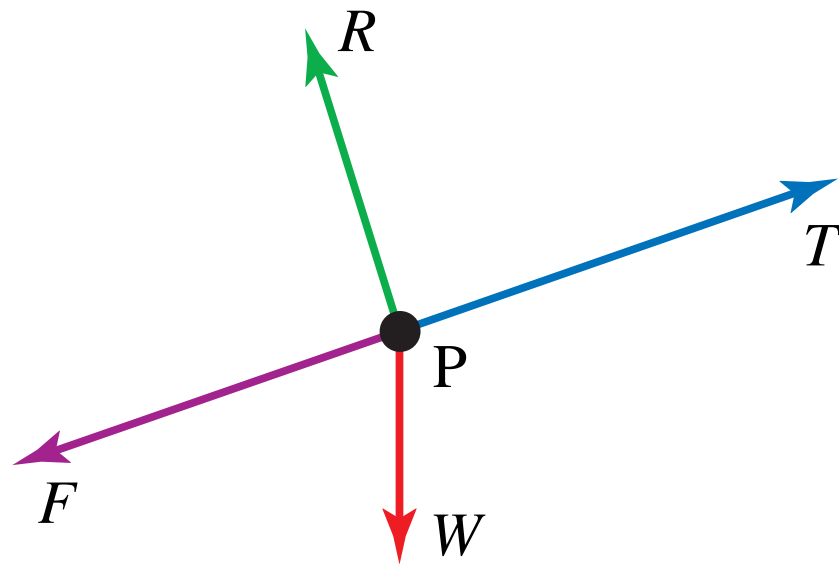
(b) Coefficient of friction > 0.1 (3)

(c) 3.46 N , 4.05 m s^{-2} (4)

7 (a) 14.4 N, 75.2 N (5)

(b) 0.364 (4)

8 (a)



(3)

(b) $T - F > 0.32$

(3)

(c) 0.1 m s^{-2}

(2)

9 (a) 97.8 N (3)

(b) 28.3 N (3)

10 (a) 0.546 N, 5.71 N, 0.0957 (3)

(b) 2.18 (3)

11 (a) Normal Force = 3.05N (2)

(b) 1.62 (3)