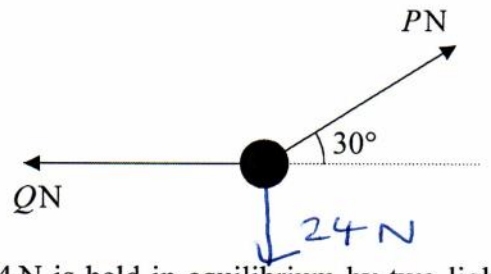
1.

Figure 1



A particle of weight 24 N is held in equilibrium by two light inextensible strings. One string is horizontal. The other string is inclined at an angle of 30° to the horizontal, as shown in Figure 1. The tension in the horizontal string is Q newtons and the tension in the other string is P newtons. Find

(a) the value of P,

(3)

(b) the value of Q.

(3)

a) $R(\uparrow)^{+ve}$

$P \sin 30° = 24$

$P = \frac{24}{\sin 30°} = 48 \text{ N}$

b) $R(\leftarrow)$

$Q = P \cos 30°$

$Q = 48 \cos 30°$

$Q = 41.569219$

$Q = 41.6 \text{ N}$ (3sf)

Leave blank

3.

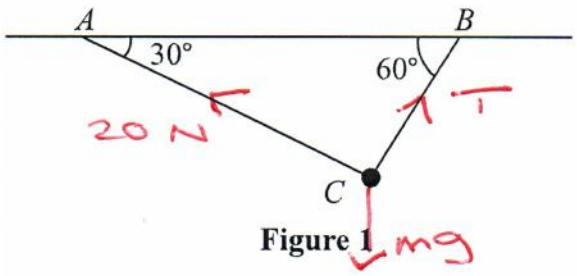


Figure 1

A particle of mass m kg is attached at C to two light inextensible strings AC and BC. The other ends of the strings are attached to fixed points A and B on a horizontal ceiling. The particle hangs in equilibrium with AC and BC inclined to the horizontal at 30° and 60° respectively, as shown in Figure 1.

Given that the tension in AC is 20 N, find

(a) the tension in BC,

(4)

(b) the value of m.

(4)

a) R (→)

$T\cos 60° - 20\cos 30° = 0$

$T = \dfrac{20\cos 30°}{\cos 60°}$

$T = 34.641016$

$T = 34.6$ N (3sf)

b) R (↑)

$T\sin 60° + 20\sin 30° - mg = 0$

$m = \dfrac{T\sin 60° + 20\sin 30°}{9.8}$

$m = \dfrac{34.641016\sin 60° + 20\sin 30°}{9.8}$

$m = \dfrac{40}{9.8} = 4.0816327$

$m = 4.08$ kg (3sf)

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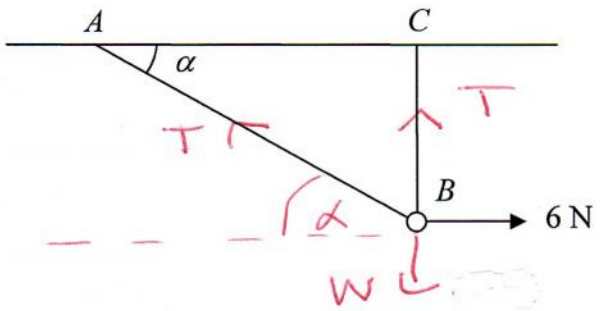
3. **Figure 1**

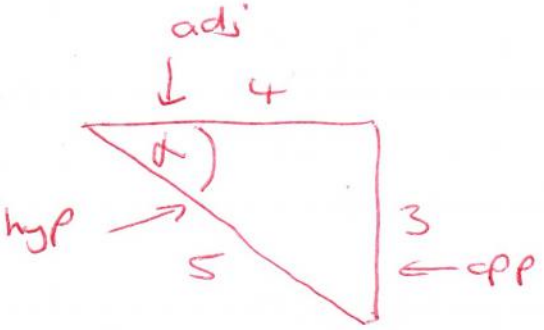


A smooth bead B is threaded on a light inextensible string. The ends of the string are attached to two fixed points A and C on the same horizontal level. The bead is held in equilibrium by a horizontal force of magnitude 6 N acting parallel to AC. The bead B is vertically below C and $\angle BAC = \alpha$, as shown in Figure 1. Given that $\tan \alpha = \frac{3}{4}$, find

(*a*) the tension in the string, **(3)**

(*b*) the weight of the bead. **(4)**

← not mass!!



$\tan \alpha = \frac{3}{4}$

$\sin \alpha = \frac{3}{5}$

$\cos \alpha = \frac{4}{5}$

a) $R(\rightarrow)$

$6 - T\cos\alpha = 0$

$T\cos\alpha = 6$

$T \times \frac{4}{5} = 6$

$T = \frac{5 \times 6}{4} = 7.5\ N$

b) $R(\uparrow)$

$T + T\sin\alpha - W = 0$

$W = T + T\sin\alpha$

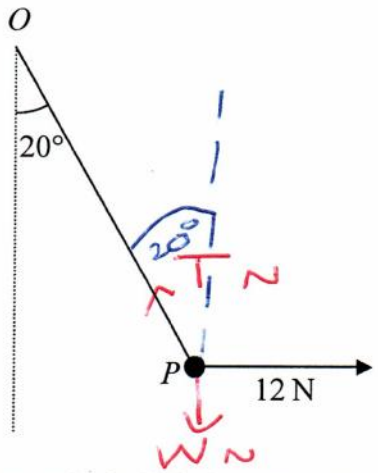
$W = 7.5 + (7.5 \times \frac{3}{5})$

$W = 12\ N$

Leave blank

1.

Figure 1



A particle P is attached to one end of a light inextensible string. The other end of the string is attached to a fixed point O. A horizontal force of magnitude 12 N is applied to P. The particle P is in equilibrium with the string taut and OP making an angle of 20° with the downward vertical, as shown in Figure 1.

Find

(a) the tension in the string,

(3)

(b) the weight of P.

(4)

a) R (←) left as +ve

$T\sin 20° - 12 = 0$

$\therefore T\sin 20° = 12$

$\therefore T = \frac{12}{\sin 20°}$

$T = 35.0856...$

$= 35.1$ N (3 sf)

b) R (↓) downwards as +ve

$W - T\cos 20° = 0$

$\therefore W = T\cos 20°$

$W = (35.0856...)\cos 20°$

$W = 32.969...$

$= 33.0$ N (3 sf)

Leave blank

3. A particle P of mass 2 kg is attached to one end of a light string, the other end of which is attached to a fixed point O. The particle is held in equilibrium, with OP at 30° to the downward vertical, by a force of magnitude F newtons. The force acts in the same vertical plane as the string and acts at an angle of 30° to the horizontal, as shown in Figure 3.

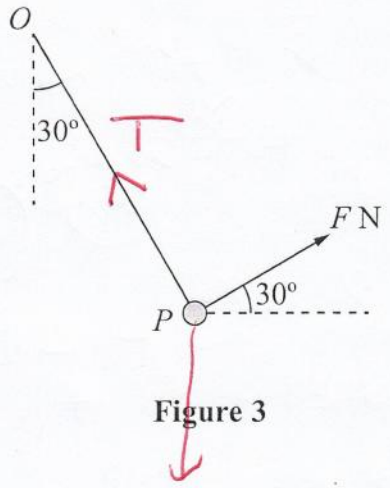


Figure 3

Find

(i) the value of F,

(ii) the tension in the string.

(8)

(i) R (↑)

$T\cos 30° + F\sin 30° - 2g = 0$ (1)

R (→) $F\cos 30° - T\sin 30° = 0$ (2)

(2) gives $T\sin 30° = F\cos 30°$

$T = \dfrac{F\cos 30°}{\sin 30°}$

sub in (1) for T

$\dfrac{F\cos 30°}{\sin 30°} \times \cos 30° + F\sin 30° = 2g$

$F\left(\dfrac{\cos 30° \times \cos 30°}{\sin 30°} + \sin 30°\right) = 2g$

$F = \dfrac{2g}{\left(\dfrac{\cos 30° \times \cos 30°}{\sin 30°} + \sin 30°\right)}$

$F = \dfrac{2g}{2} = 9.8\ \text{N}$

(ii) $T = \dfrac{9.8 \times \cos 30°}{\sin 30°} = 16.974098$

$= 17.0\ \text{N}$ (3sf)