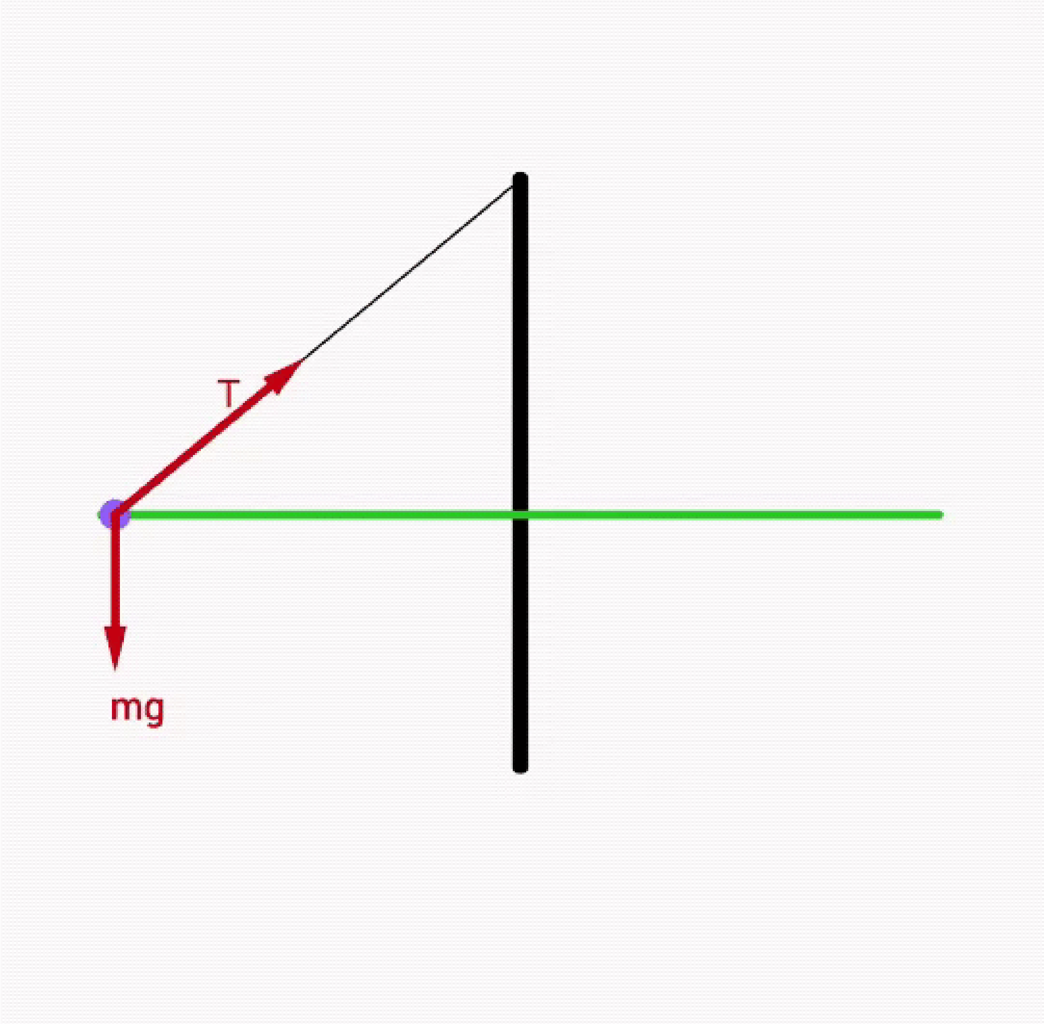
Circular Motion Scenarios
The Pendulum

IB PHYSICS | CIRCULAR MOTION

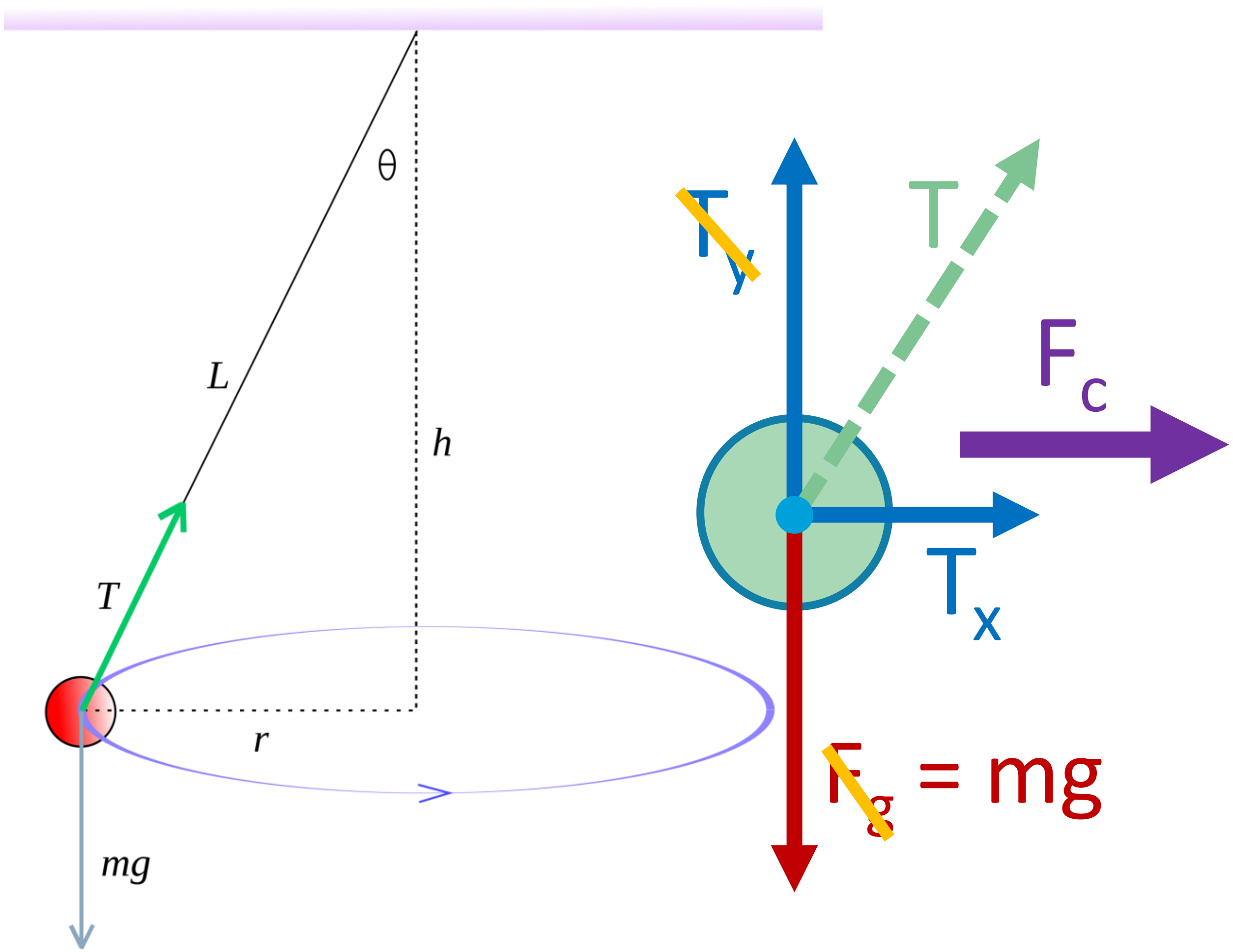
IB Physics Data Booklet

Sub-topic 6.1 – Circular motion	
$v = \omega r$ $a = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2}$ $F = \frac{mv^2}{r} = m\omega^2 r$	v – linear velocity (m s^{-1}) ω – angular velocity (rad s^{-1}) r – radius (m) T – period (s) a – centripetal acceleration (m s^{-2}) F – centripetal force (N)

Pendulum Circle



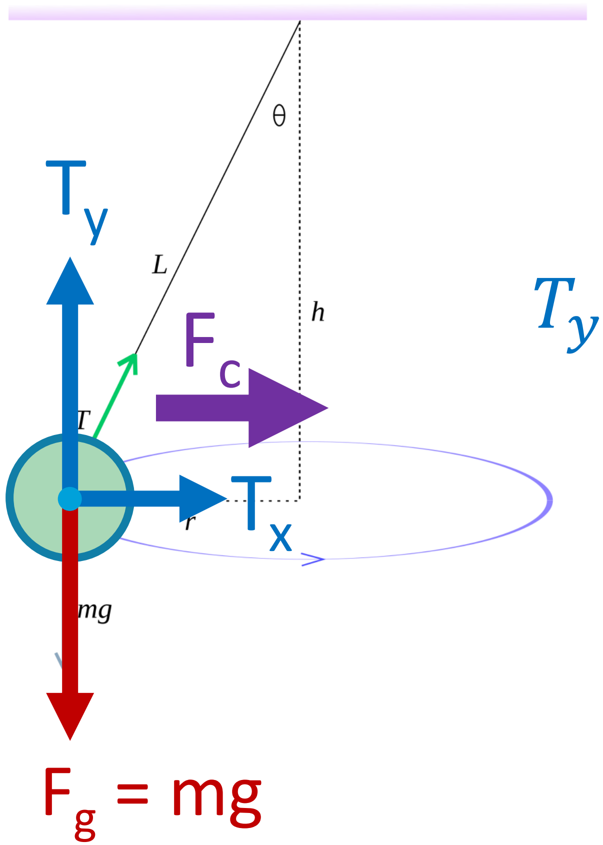
Pendulum Circle



$$F_{net} = F_c = T_x$$

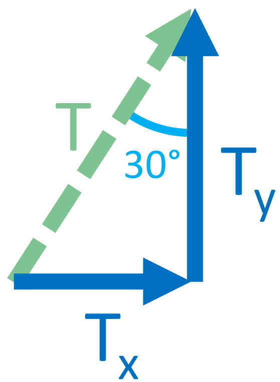
$$T_y = F_g$$

Pendulum Circle



What is centripetal force required to cause a 0.12 kg mass to swing in a horizontal circle with the string at an angle of 30°?

$$T_y = F_g = mg = (0.12)(9.81) = 1.18 \text{ N}$$



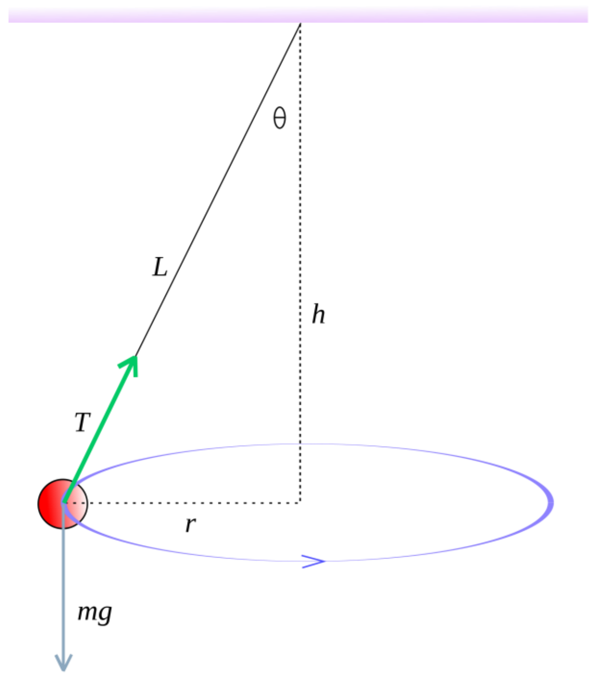
$$\tan(\theta) = \frac{T_x}{T_y} \qquad T_x = T_y \tan(\theta)$$

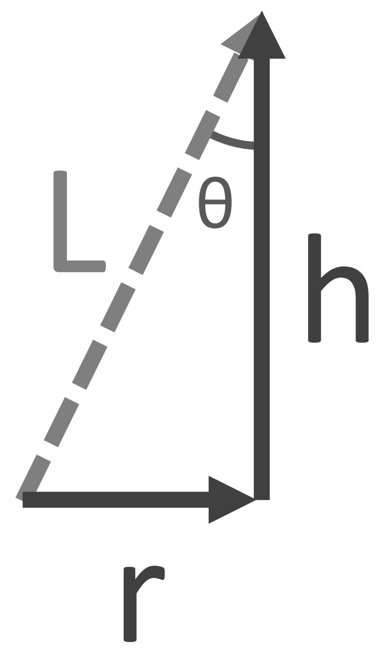
$$T_x = 1.18\tan(30°) = 0.68 \text{ N}$$

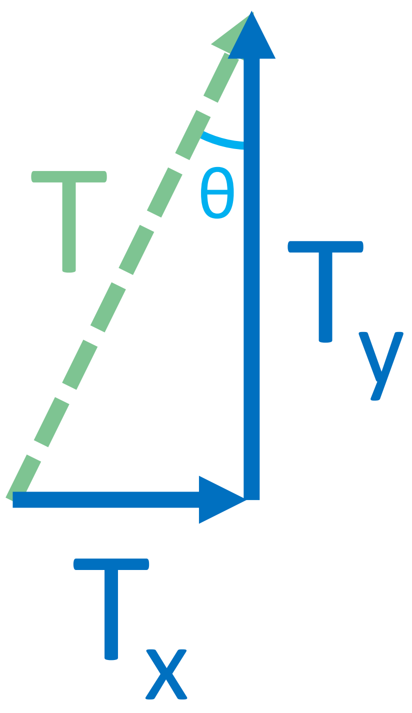
$$F_{net} = F_c = T_x = 0.68\ N$$

$$F_c = 0.68 \text{ N}$$

CAUTION! There are **two** triangles



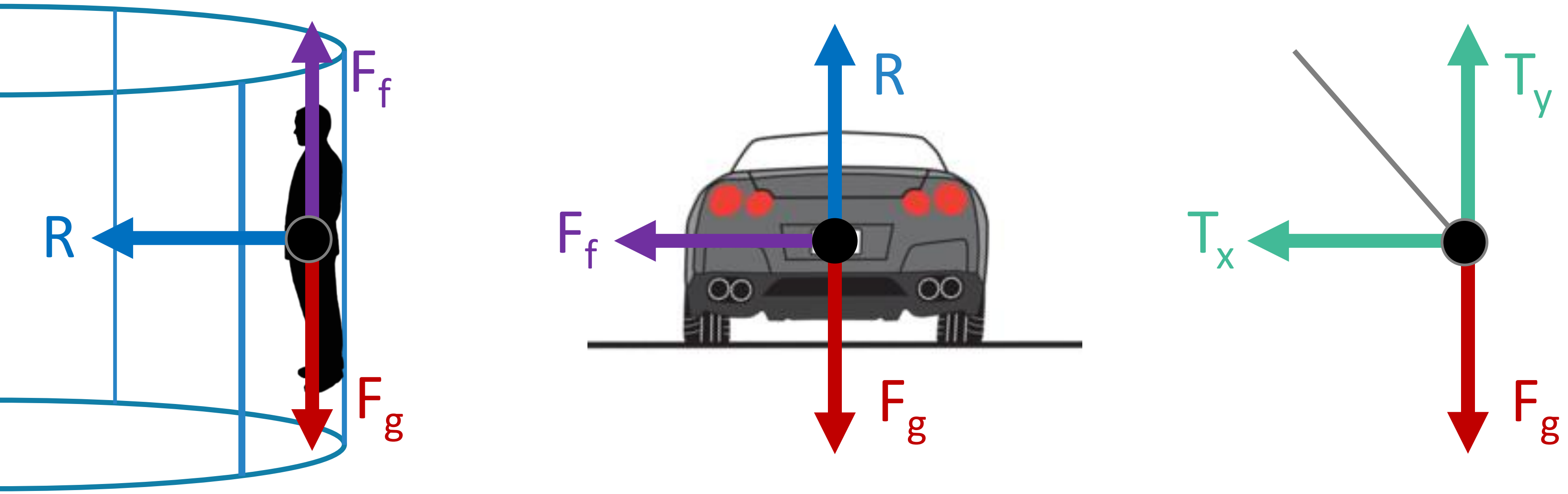




All Together Now!

$$F_f = F_g \qquad R = F_g \qquad T_y = F_g$$

$$F_c = R \qquad F_c = F_f \qquad F_c = T_x$$



Lesson Takeaways

- ❑ I can draw a free body diagram and solve a problem when circular motion is produced by **components of an angled tension force**.