Answer on Question #57895-Physics-Classical Mechanics

One 3.0 kg paint bucket is hanging by a massless cord from another 3.0 kg paint bucket, also hanging by a massless cord

(a) If the buckets are at rest, what is the tension in each cord (upper and lower)?

(b) If the two buckets are pulled upward with an acceleration of 1.80 m/s2 by the upper cord, calculate the tension in each cord (upper and lower).

Solution

(a) If there is no acceleration, we can write newton's second law for the upper bucket as:

$$T_1 - mg - T_2 = 0 \; or \; T_1 = mg + T_2$$

For the lower bucket, we can write:

$$T_2 - mg = 0 \; or \; T_2 = mg$$

This tells us that

$$T_2 = 3.0 \cdot 9.8 \; = \; 29.4 \; N$$

Then,

$$T_1 = 2mg = 2 \cdot 3.0 \cdot 9.8 \; = 58.8 \; N$$

b) Newton's second law is now:

$$T_1 - mg - T_2 = ma$$

$$T_2 - mg = ma \; \rightarrow \; T_2 = m(g + a) = 3.0(9.8 + 1.8) = 34.8 \; N$$

$$T_1 = T_2 + mg + ma = 2m(g + a) = 2 \cdot 3.0(9.8 + 1.8) = 69.6 \; N$$