Answers

Please submit the following questions for marks: /30

assume R

1. A 12.0-kg sled is pulled along a level ground. The horizontal force exerted on the sled is 10.0 N. Find the acceleration of the sled if the coefficient of friction is 0.0765.

G: $m = 12.0\,kg$

$\vec{F}_{pull} = 10.0\,N[R]$

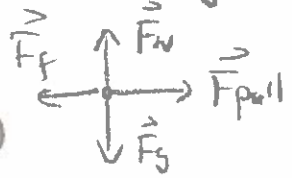
$\mu_k = 0.0765$

R: $\vec{a} = ?\,[m/s^2]$

A: $\vec{F}_{net} = m\vec{a}$

$+ \rightarrow \vec{a} = \frac{\vec{F}_{net}}{m}$

$\vec{F}_{net} = \vec{F}_g + \vec{F}_N + \vec{F}_f + \vec{F}_{pull}$



S: $F_{net} = -mg + mg - mg\mu_k + F_{pull}$

$= 0 - (12.0)(9.8)(0.0765) + 10.0$

$= -8.9964 + 10.0$

$= 1.0036\,N$

$\vec{a} = \frac{1.0036}{12.0}$

$\vec{a} \doteq 8.4 \times 10^{-2}\,m/s^2[R]$

S: ∴ The sled accelerates $8.4 \times 10^{-2}\,m/s^2[R]$.

2. The mass of an elevator plus occupants is 752 kg. The tension in the cable is 8950 N. At what rate does the elevator accelerate upwards?

G: $m = 752\,kg$

$\vec{T} = 8950\,N[up]$

$+\uparrow -\downarrow \quad g = -9.8\,m/s^2$

R: $\vec{a} = ?\,[m/s^2]$

A: $\vec{a} = \frac{\vec{F}_{net}}{m}$

$\vec{F}_{net} = \vec{F}_g + \vec{T}$

S: $F_{net} = -mg + T$

$= -(752)(9.8) + 8950$

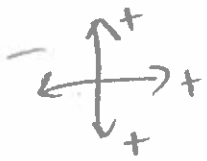
$= -7369.6 + 8950$

$= 1580.4\,N$

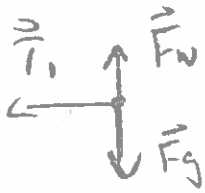
$\vec{a} = \frac{1580.4}{752}$

$\vec{a} \doteq 2.1\,m/s^2\,[up]$

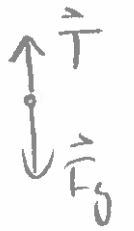
S: ∴ The elevator accelerates at $2.1\,m/s^2[up]$.



m_1:

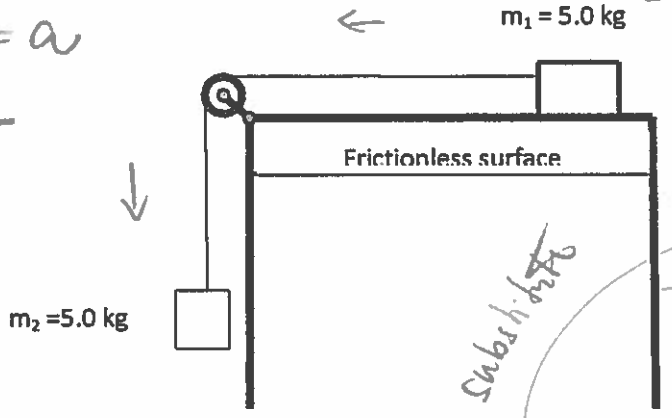


m_2:



3. a) Determine the acceleration of the system shown below/

b) Determine the tension in the rope.



$\|\vec{a}_1\| = \|\vec{a}_2\| = a$

$\|\vec{T}_1\| = \|\vec{T}_2\| = T$

① $\vec{F}_{1net} = m_1 a$

$= \vec{F}_g + \vec{F}_N + \vec{T}$

$m_1 a = T$

② $\vec{F}_{2net} = m_2 a$

$= \vec{F}_g + \vec{T}$

$= m_2 a = -mg + T$

$-m_2 a = -m_2 g + m_1 a$

$m_2 g = m_1 a + m_2 a$

$m_2 g = a(m_1 + m_2)$ ⊛

⊛ $a = \dfrac{m_2 g}{m_1 + m_2}$

$a = \dfrac{(5.0)(9.8)}{(5.0+5.0)}$

$a = 4.9\ m/s^2$

$T = m_1 a$

$= (5.0)(4.9)$

$= 24.5\ N$

$\doteq 25\ N$

4. Suppose the above system rests on a sanded surface with coefficient of friction of 0.31. Determine the acceleration of the system.

m_1:

$\vec{F}_{net} = \vec{F}_g + \vec{F}_N + \vec{F}_f + \vec{T}$

$-m_1 a = 0 + m_1 g\mu - T$

$T = m_1 g\mu + m_1 a$

$T = (5.0)(9.8)(0.31) + (5.0)a$

$T = 15.19 + 5a$

m_2:

$\vec{F}_{net} = \vec{F}_g + \vec{T}$

$-m_2 a = -m_2 g + T$

$a = \dfrac{-m_2 g + T}{-m_2}$

$a = \dfrac{(-5.0)(9.8) + 15.19 + 5a}{-5.0}$

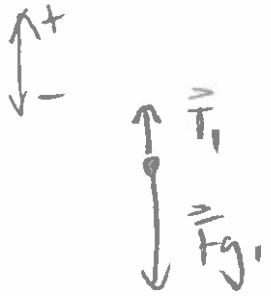
$a = 9.8 - 3.038 - a$

$2a = 6.762 \rightarrow a = 3.4\ m/s^2$

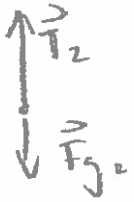
$\therefore a = 3.4\ m/s^2$

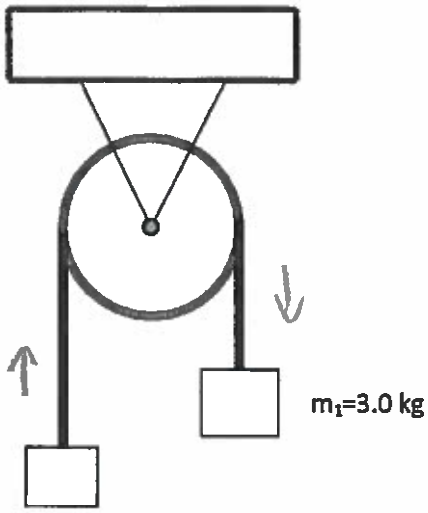
5. A 2.0-kg mass and a 3.0-kg mass are attached to a lightweight cord that passes over a frictionless pulley. The nagging masses are left free to move. What is the acceleration (magnitude and direction) of both masses?

m_1:



m_2:





- $\|\vec{a}_1\| = \|\vec{a}_2\| = a$
- $\|\vec{T}_1\| = \|\vec{T}_2\| = T$

m_1:

$\vec{F}_{net} = \vec{F}_{g_1} + \vec{T}_1$

$-m_1 a = -m_1 g + T$

$a = \dfrac{-m_1 g + T}{-m_1}$

$a = \dfrac{-(3.0)(9.8) + 23.52}{-3.0}$

$a = 1.96\ m/s^2$

m_2:

$\vec{F}_{net_2} = \vec{F}_{g_2} + \vec{T}_2$

$m_2 a = -m_2 g + T$

$m_2\left(\dfrac{-m_1 g + T}{-m_1}\right) = -m_2 g + T$

$(2.0)\left(\dfrac{-3.0(9.8) + T}{-3.0}\right) = -(2.0)(9.8) + T$

$19.6 - \frac{2}{3}T = -19.6 + T$

$39.2 = 1.6T$

$T = 23.5200\ N$

$T = 24N$

$\therefore$ m_1 accelerates $2.0\ m/s^2$ [D] and m_2 accelerates $2.0\ m/s^2$ [U].