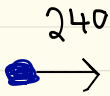
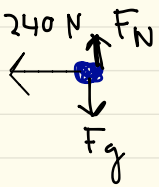
Pg. 141

#1. a)

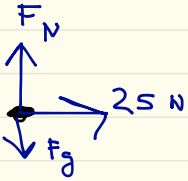
FBD of Road



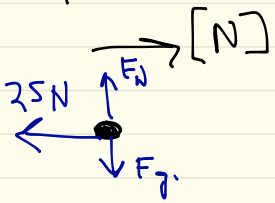
FBD of Tire



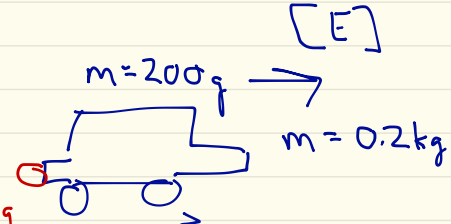
b) FBD of Desk



FBD of Person



Pg 141 #6.



ACTION

$F_A = 0.24\,N\,[W]$

$m = 50\,g$ $\quad m = 0.05\,kg$.

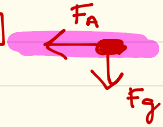
$\vec{a}_{ball} = 0.24\,kg\,\frac{m}{s^2}$

$0.05\,kg$

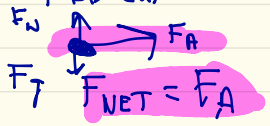
$\vec{a}_{Car} = 1.2\,\frac{m}{s^2}\,[E]$

FBD Ball

$\vec{a}_{ball} = 48\,\frac{m}{s^2}\,[W]$



FBD Car



$F_A = F_{NET}$

$= ma$

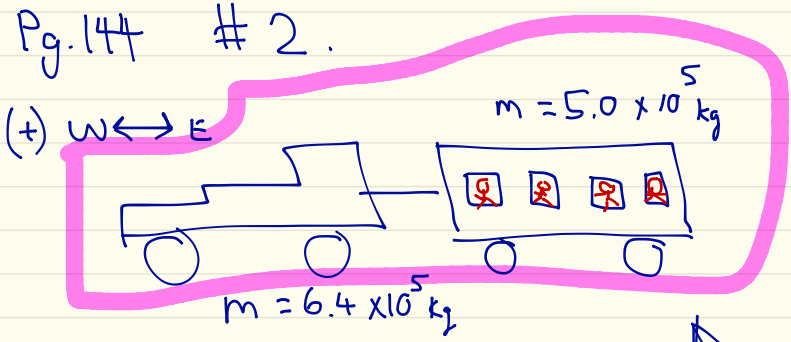
$= (0.2\,kg)\left(1.2\,\frac{m}{s^2}\right)$

$= 0.24\,N\,[E]$

(Reaction)

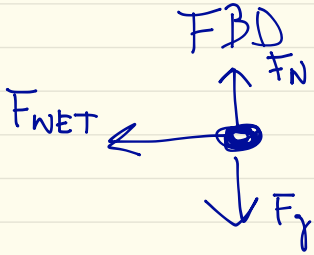
Section 3.5 Using Newton's Laws

Pg. 144 #2.



$\vec{a} = 0.12\ m/s^2\ [W]$

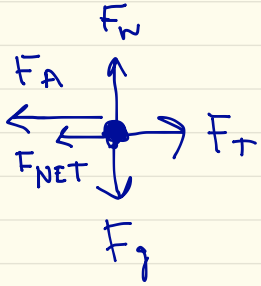
entire train
1 object
∴ 1 FBD.



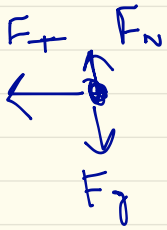
$$F_{NET} = ma$$
$$= \left(6.4 \times 10^5\ kg + 5.0 \times 10^5\ kg\right)\left(0.12 \frac{m}{s^2}\right)[W]$$
$$= \left(11.4 \times 10^5\ kg\right)\left(0.12\ m/s^2\right)[W]$$
$$= 136\,800\ N\ [W] \quad \therefore 140\,000\ N\ [W]$$

(+) W ⟷ E

b) FBD Locomotive



FBD TRAIN CAR



$F_{NET} = F_A - F_T$

2 Unknowns

$F_{NET} = ma$

$= (6.4 \times 10^5 kg)\left(0.12 \frac{m}{s^2}\right)[W]$

$F_{NET} = 76\,800 N\ [W]$

$F_T = F_{NET}$

$F_T = ma$

1 unknown.

$F_T = (5.0 \times 10^5 kg)\left(0.12 \frac{m}{s^2}\right)[W]$

$F_T = 60\,000 N\ [W]$

$F_{NET} = F_A - F_T$

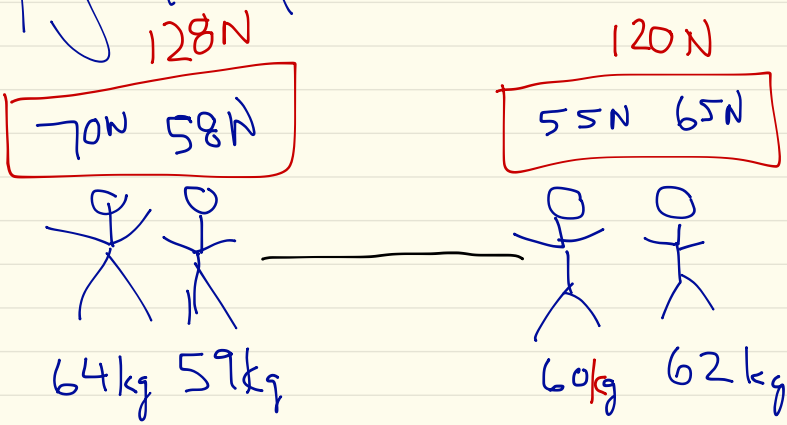
$76\,800 N = F_A - 60\,000 N$

$76\,800 N + 60\,000 N = F_A$

$136\,800 N = F_A$

∴ The locomotive applies a force of $136\,800 N\ [W]$

Pg 157 #54



$F_{NET} = 8\ N\ [Left]$

$m = 64\ kg + 59\ kg + 60\ kg + 62\ kg$

$m = 245\ kg$

$\vec{F}_{NET} = m\vec{a}$

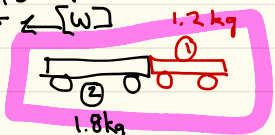
$8\ N\ [Left] = 245\ kg(\vec{a})$

$\vec{a} = \frac{8\ N\ [Left]}{245\ kg}$

$\vec{a} = 0.03\ m/s^2\ [Left]$

Pg. 146 #1

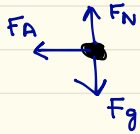
+ ← [W]



1 object

a)

FBD



$F_A = F_{NET} = ma$

$18.9\,N\,[W] = (1.8kg + 1.2kg)\vec{a}$

$18.9\,kg\frac{m}{s^2}\,[W] = (3.0kg)\vec{a}$

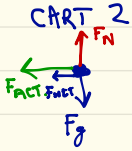
$\vec{a} = \frac{18.9\,kg\,m/s^2\,[W]}{3.0\,kg}$

$\vec{a} = 6.3\,m/s^2\,[W]$

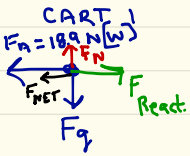
(+) [W] ←

b)

CART 2



CART 1



$F_{NET} = F_A - F_{REACT.}$

$ma = 18.9N - F_{REACT.}$

$(1.2kg)\left(6.3\frac{m}{s^2}\right) = 18.9N - F_{REACT}$

$7.56\,N = 18.9\,N - F_{REACT}$

$7.56\,N - 18.9\,N = -F_{REACT}$

$-11.34\,N = -F_{REACT}$

$F_{REACT} = 11\,N$

∴ CART 1 applies a force of 11 N [W] on CART 2.

c)

18.9 N [E] → (+)

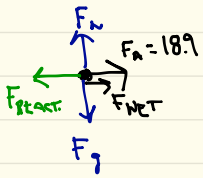
$F_{NET} = m\vec{a}$

$18.9\,N\,[E] = 3kg\,(\vec{a})$

$\frac{18.9\,N\,[E]}{3\,kg} = \vec{a}$

$\vec{a} = 6.3\,m/s^2\,[E]$

FBD CART 2



FBD CART 1

$F_{NET} = F_A - F_{REACT}$

$ma = 18.9N - F_{REACT}$

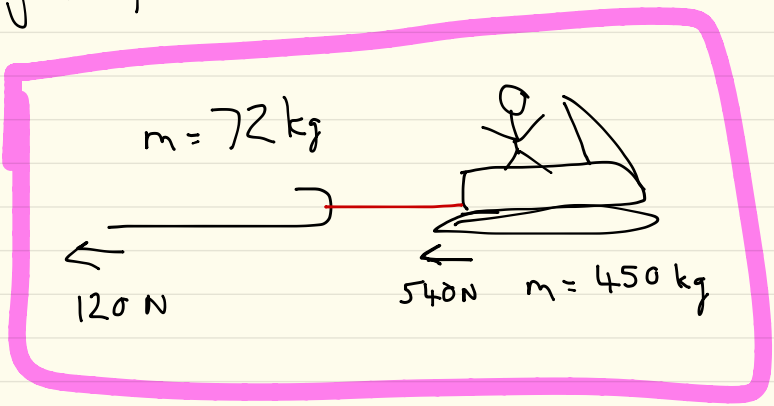
$(1.8kg)\left(6.3\frac{m}{s^2}\right) = 18.9 - F_{REACT}$

$11.3\,N - 18.9N = -F_{REACT}$

$-7.6\,N = -F_{REACT.}$

∴ CART 1 exerts a force of 7.6 N [W] on CART 2.

Pg. 147 #2.



$\vec{a} = 2.0\ m/s^2$ [Forward]

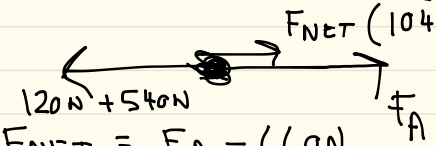
$\vec{F}_{NET} = m\vec{a}$

$= (72\,kg + 450\,kg)\ 2.0\ m/s^2$ [Forward]

$\vec{F}_{NET} = (522\,kg)(2.0\ m/s^2)$ [Forward]

$\vec{F}_{NET} = 1044N$ [Forward]

FBD of Combined (Snowmobile + Sled)

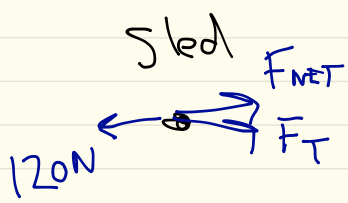


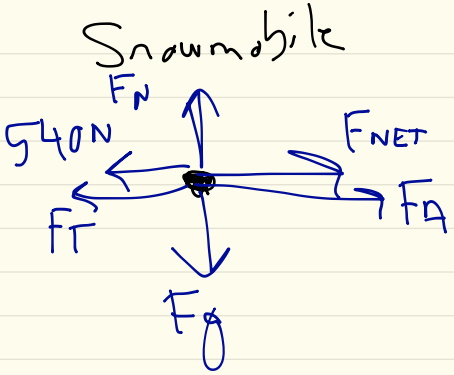
$F_{NET} = F_A - 660N$

$1044N = F_A - 660N$

$F_A = 1044N + 660N$

$F_A = 1704N$ [Forward]





$F_{NET} = F_T - 120N$

$ma = F_T - 120N$

$(72kg)(2.0\,m/s^2) = F_T - 120N$

$144N = F_T - 120N$

$144N + 120N = F_T$

$264N = F_T$

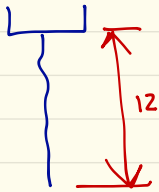
$\therefore F_T = 260N.$

Pg 147 #5, 8

Remember Big 5

Quiz Friday!

Pg. 147 #5.



$m_{person} = 85\ kg$

rope can support 120 kg.

max force $= mg$

$F_{NET} = (120\ kg)\left(9.8 \frac{m}{s^2}\right)$

$F_{NET} = 1176\ N$

$F_{NET} = ma$

$1176\ N = (85\ kg)\ a$

$$\frac{1176\ kg\frac{m}{s^2}}{85\ kg} = a$$

$\vec{a} = 13.8\ m/s^2$