3.3 Newton's 2ND

(* Answers sometimes rounded in textbook)

p. 136
1, 2, 3, 4, 5, 6, 8 (9, 10, 11)

① $m = 72\text{ kg}$
$a = 1.6\text{ m/s}^2$ [Fwd]

$F_{net} = ma = (72)(1.6) = \underline{115\text{ N [Fwd]}}$

$m = 2.3\text{ kg}$
$a = 12\text{ m/s}^2$ $\quad F_{net} = ma = (2.3)(12) = \underline{28\text{ N [up]}}$

* direction of acceleration + F_{net} are the same.

② $F_{net} = 2.4 \times 10^4\text{ N [E]}$
$m = 5.0\text{ kg}$ $\quad a = \frac{F_{net}}{m} = \frac{2.4 \times 10^4}{5} = \underline{4.8 \times 10^3\text{ m/s}^2\text{ [E]}}$

$m = 160\text{ g} = 0.160\text{ kg}$
$F = 24\text{ N}$

$a = F_{net}/m = \frac{24}{0.160} = \underline{150\text{ m/s}^2\text{ [Fwd]}}$

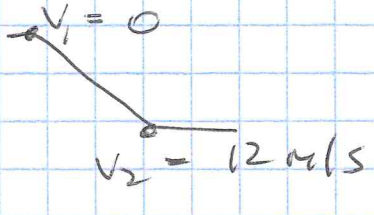
③ $a = -1.2\text{ m/s}^2$ [Fwd] (-a is slowing down + usually written as -a [Fwd])
$F = -1400$ (Fwd)

$m = \frac{F_{net}}{a} = -1400/-1.2 = \underline{1200\text{ kg}}$

~~F~~ $= 33\text{ N [Fwd]}$
~~a~~ $= 6.0\text{ m/s}^2$ [Fwd]

$m = \frac{F}{a} = \frac{33\text{ N}}{6.0\text{ m/s}^2} = \underline{5.5\text{ kg}}$

④ $m = 54\text{ kg}$
$v_2 = 12\text{ m/s}$
$t = 5.0\text{ s}$
$v_1 = 0$
$F = ?$

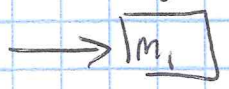


Find a, then use $F_{net} = ma$

$a = \frac{v_2 - v_1}{t} = \frac{12 - 0}{5} = 2.4\text{ m/s}^2$ [downhill]

$F = ma$
$= (54)(2.4)$
$= \underline{130\text{ N [down hill]}}$

(7)



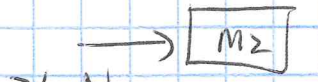
$F_{net} = 36\ N$

$m_1 = \frac{F_{net}}{a} = \frac{36}{6} = 6\ kg$

$F_{net} = 36\ N$

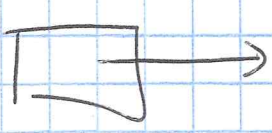
$(m_1 + m_2) = \frac{F_{net}}{a} = \frac{36}{2} = 18\ kg$

$\therefore m_2 = 18 - 6 = 12\ kg$



$a = \frac{F_{net}}{m} = \frac{36}{12} = 3.0\ M/s^2\ [fwd]$

(5)



$V_1 = 0\ M/s$

$\Delta d = 6.6\ m$

$V_2 = 3.2\ M/s$

$m = ?$ Find a 1ST then $m = F_{net}/a$

$V_2^2 = V_1^2 + 2ad$

$(3.2)(3.2) = 0 + 2a(6.6)$

$10.24 = 13.2\,a$

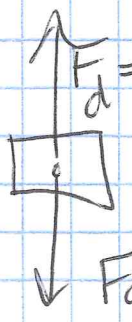
$a = 0.776\ M/s^2$

$m = F_{net}/a = \frac{1.2}{0.776} = 1.5\ kg$

Note
#6 - report final answer with correct sig digs but carry extra sig digs in further calculations

(6)

a)



F_{net} = SUM OF forces all ↕

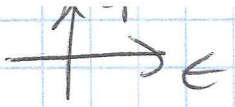
$= (+720) + (-568.4)$

$= 151.6\ N\ [up]$

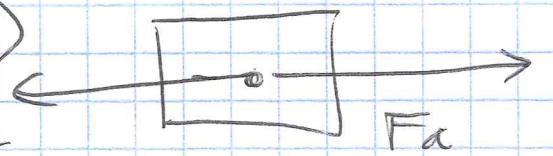
[150 N up]

$a = \frac{F_{net}}{m} = \frac{151.6\ [up]}{58} = 2.6\ M/s^2\ [up]$

(8) $a = 1.6\ m/s^2$ →



a)



$= 3800\ N$

$m = 1300\ kg$

b) Find Fnet. Then use Fnet to find Fa

$F_{net} = ma = (1300)(1.6)$

$= \underline{2080\ N\ [fwd]}$

F_{net} = SUM of all forces

$+2080 = F_f + F_a$

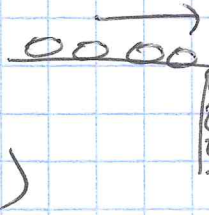
$2080 = -3800 + F_a$

$\therefore F_a = 5880\ N\ [fwd]$

$= \underline{5900\ N\ [fwd]}$

negative *

(9)



} accelerates in 2 directions.

a)

b) The acceleration will increase.

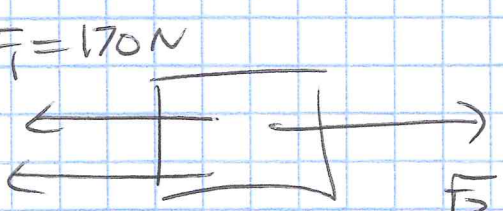
F_g is the cause of the Fnet + acceleration.

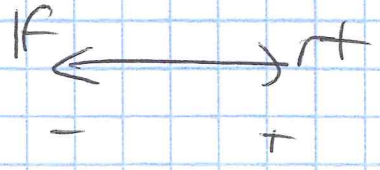
But as it moves, more of the mass of chain is pulled down into free fall ∴ ↑ Fnet.

Also the less of the chain is moving across table ∴ Friction ↓

Same mass moving but F_g ↑ and F_f ↓ ∴ a ↑

(10)





a) $m = 50\,kg$

F_{net} = SUM of all forces (watch +/− signs)

$$a = \frac{F_{net}}{m} =$$

$$a = \frac{(+150) + (-170) + (-170)}{50}$$

$$a = -2.4\ m/s^2\ [right]$$

$$= \underline{2.4\ m/s^2\ [left]}$$

b) If a 4th student jumps on top, this would normally push box + floor together more + increase friction! (or using formula $F_K = \mu F_N$ → more mass means more F_g + more F_N)

However there is NO friction so we need not worry about that.

However, the mass of moving object ↑ and since $a = \frac{F_{net}}{m}$, the more mass means less acceleration. ∴ The rate of acceleration will decrease

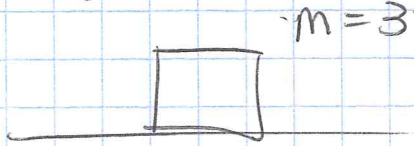
(11) 12 kg without breaking

Means $(12\text{ kg} \times 9.8\ \text{N/kg}) = 117.6\text{ N}$

Max tension for string

OR 118 N

OR 120 N



$\mu = 0$

$\longrightarrow \Delta d = 22\text{ m}$

Minimum time?

Will occur with Maximum force

$F = 117.6\text{ N}$ (no breakage)

Find a then use kinematics to find t

$$a = \frac{F_{net}}{m} = \frac{117.6}{30} = 3.92\ \text{m/s}^2\ [\text{fwd}]$$

use extra sig. dig when using in another calculation

a ✓
d ✓
$v_i = 0$ ✓ (assume since it's "sitting on ice")
$t = ?$

$$d = \cancel{v_i^{0} t} + \tfrac{1}{2} a t^2$$

$$22 = \tfrac{1}{2}(3.92)\, t^2$$

$$t = \sqrt{11.224} = 3.45$$