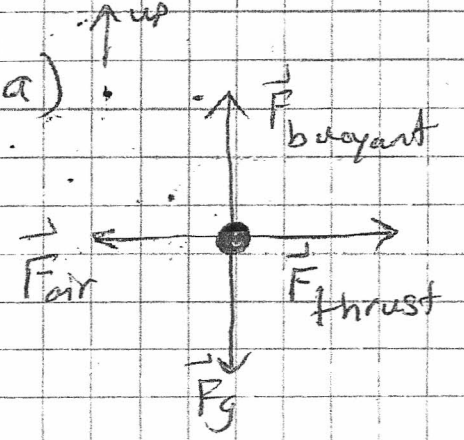
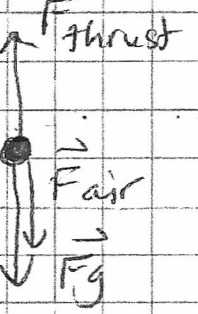
Newton's Laws Practice Problems ①

1. a)



b)



2. Forces
   a) balanced – constant velocity
   b) unbalanced – acceleration
   c) unbalanced – acceleration (change of direction)
   d) balanced – constant velocity
   e) unbalanced – acceleration
   f) balanced – constant velocity
   g) unbalanced – acceleration
   h) balanced – acceleration (change of direction)

3 a) $\vec{F}_{net} = \vec{F}_g + \vec{F}_{lift}$ [up] = +

$= -5000N + 6000N$

$= +1000N$

$= 1000\ N$ [up] → ACCELERATING

b) $\vec{F}_{net\ vert} = \vec{F}_g + \vec{F}_{buoyant}$ [up] = +

$= -2.5 \times 10^7 N + 2.5 \times 10^7 N$

$= 0\ N$

$\vec{F}_{net\ Hor} = \vec{F}_{Thrust} + \vec{F}_{water}$, [For] = +

$= 300\,000N - 300\,000N$

$= 0N$

} BALANCED FORCES → CONSTANT VELOCITY

c) $\vec{F}_{net\ VERT} = \vec{F}_g + \vec{F}_{lift}$ [up] = +

$= -3.0 \times 10^9 N + 3.0 \times 10^9 N$

$= 0N$

$\vec{F}_{net\ Hor} = \vec{F}_{Thrust} + \vec{F}_{air}$, [P] = +

$= 75000N - 55000N$

$= 20,000N$ [P]

∴ accelerating

4. $m = 290\,g \times \frac{1\,kg}{1000\,g} = 0.290\,kg$

$\vec{a} = 7.5\,m/s^2\,[E]$

$\vec{F}_{net} = ?$

$\vec{F}_{net} = m\,\vec{a}$

$= (0.290\,kg)(7.5\,m/s^2\,[E])$

$= 2.175\,N\,[E]$

$\simeq 2.2\,N\,[E]$

5. $m = 9.1 \times 10^{-31}\,kg$

$\vec{F}_{net} = 5.0 \times 10^{-27}\,N\,[F]$

$\vec{a} = ?$

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

$= \frac{5.0 \times 10^{-27}\,N\,[F]}{9.1 \times 10^{-31}\,kg}$

$= 5494.5\,m/s^2\,[E]$

$= 5.5 \times 10^{3}\,m/s^2\,[E]$

6. $\vec{F}_{net} = 25\,N\,[LeFt]$

$\vec{a} = 5.0\,m/s^2\,[LeFt]$

$m = ?$

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

$= \frac{25\,N\,[LeFt]}{5.0\,m/s^2\,[LeFt]}$

$= 5.0\,kg$

7. $m = 250\,kg$

$\vec{F}_{thrust} = 25000N\,(F)$

$\vec{F}_{air} = 12{,}000N\,[B]$

$\vec{F}_{net} = ?$

$\vec{a} = ?$

$\vec{F}_{net} = \vec{F}_{thrust} + \vec{F}_{air}$ $[F] = +$

$= 25000N - 12000N$

$= 13000N\,[F]$

$\vec{a} = \frac{\vec{F}_{Net}}{m} = \frac{13000N\,[F]}{250\,kg}$

$= 52\,m/s^2\,[F]$

8. $m = 320\,kg$

$\vec{a} = 0.10\,m/s^2\,[F]$

$\vec{F}_p = 140N\,[B]$

$\vec{F}_{net} = ?$

$\vec{F}_{app} = ?$

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

$= (320\,kg)(0.10\,m/s^2\,[F])$

$= 32\,N\,[F]$

$\vec{F}_{net} = \vec{F}_{app} + \vec{F}_F \quad [F] = +$

$\vec{F}_{app} = \vec{F}_{net} - \vec{F}_F$

$= 32N[F] - 140N[B]$

$= 32N - (-140N)$

$= 32N + 140N$

$= 172N\,[F]$

9. $m = 1600\,kg$

$\vec{F}_{app_1} = 1200N\,[F]$

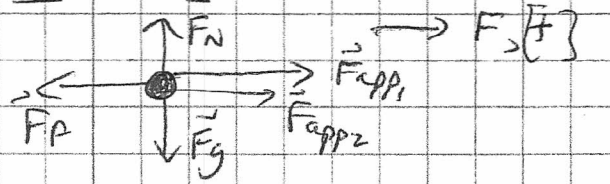
$\vec{F}_{app_2} = 780N\,[F]$

$\vec{F}_F = 2300N\,[B]$

$\vec{F}_{net} = ?$

$\vec{a} = ?$

FBD:



$\vec{F}_{net} = \vec{F}_{app_1} + \vec{F}_{app_2} + \vec{F}_F$

$= 1200N\,[F] + 780N\,[F] + 2300N\,[B]$

$= 1200N + 780N - 2300N$

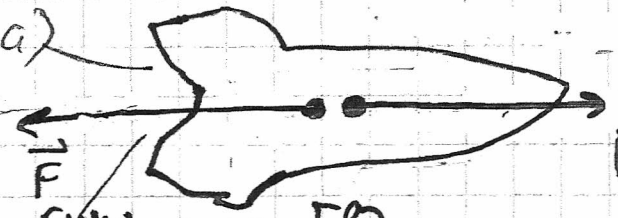
$= -320N$

$= 320N\,[B]$

$\vec{a} = \dfrac{\vec{F}_{net}}{m} = \dfrac{320N\,[B]}{1600\,kg} = 0.20\,\dfrac{m}{s^2}\,[B]$

∴ the car must be slowing down as it is moving forward.

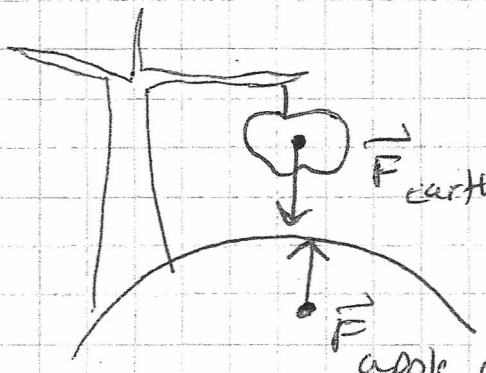
10 a)



$\vec{F}$ rocket on gases [B]

$\vec{F}$ expanding gas on rocket [F]

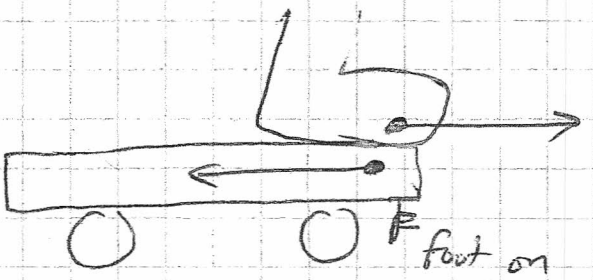
b)



$\vec{F}$ earth on apple [down]

$\vec{F}$ apple on earth [up]

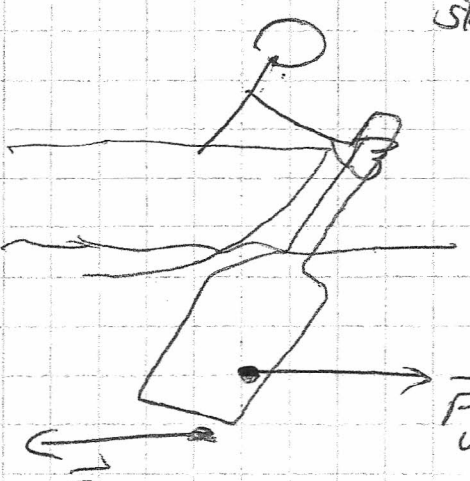
c)



$\vec{F}$ Skateboard on foot [forward]

$\vec{F}$ foot on Skateboard [backward]

d)



$\vec{F}$ water on paddle [forward]

$\vec{F}$ paddle on water [backward]