Chapter 2 Review

#1 The four fundamental forces are:

i) The gravitational force (force of gravity)
- The force of attraction between all objects in the universe.

ii) Electromagnetic force
- The force caused by electric charges. It includes electric forces (like static electricity) and magnetic forces.

iii) Strong nuclear force
- Holds protons and neutrons together (short range, when particles are close together)

iv) Weak nuclear force
- noticed at very small distances. Responsible for interactions involving elementary particles.

#2 a) Electromagnetic Force
b) Electromagnetic Force
c) Strong nuclear
d) Gravitational
e) Electromagnetic

#3 If the airplane is travelling at a constant speed, the acceleration would be zero which means the net force would be zero.

The forces acting on the plane would be the forces of gravity, thrust, and air resistance.

#4 a) $\vec{F}_{NET} = \vec{F}_A + \vec{F}_f$

$\vec{F}_{NET} = 7.4\,N + (-2.0\,N)$

$\vec{F}_{NET} = 5.4\ N$ [East]

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

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

$\vec{a} = \frac{5.4\,N}{1.2\,kg}$

$\vec{a} = 4.5\ m/s^2$ [East]

#5 Newtons first law of inertia would state that while the car is moving it is experiencing motion in a direction. When it tries to turn on the ice it will continue to travel in it original path.

#6 $\vec{F} = 2.5 \times 10^4\,N$ [fwd]

a) The tractor pulls the plow with a force of $2.5 \times 10^4 N$ forward while the plow pulls back at $2.5 \times 10^4 N$ backward.

b) The action and reaction forces balance each other and give a net force of zero. This would indicate no acceleration.

#7 $m = 410\,g$

$m = 0.410\,kg$

$\vec{a} = |125g|$

$\vec{a} = 245\ m/s^2$

$\Delta t = 0.10\,s$

a) $\vec{F}_{NET} = ma$

$\vec{F}_{NET} = (0.410\,kg)(245\ m/s^2)$

$\vec{F}_{NET} = 1.0 \times 10^2\,N$ [up]

The net force imparted to the ball is $1.0 \times 10^2 N$ upward.

#7 b) The reaction force is 1.00×10^2 N down.

#8 $\vec{a} = 1.0 \times 10^3 \, m/s^2$ [up]
$m = 6.0 \times 10^{-7}$ Kg

$\vec{F}_{NET} = m\vec{a}$
$\vec{F}_{NET} = (6.0 \times 10^{-7} \, Kg)(1.0 \times 10^3 \, m/s^2)$
$\boxed{\vec{F}_{NET} = 6.0 \times 10^{-4} \, N \text{ [up]}}$

#10 $m = 9.1 \times 10^{-31}$ Kg
$\vec{F} = 8.0 \times 10^{-15}$ N

a) $\vec{F}_{NET} = ma$
$\vec{a} = \frac{\vec{F}_{NET}}{m}$
$\vec{a} = \frac{8.0 \times 10^{-15} \, N}{9.1 \times 10^{-31} \, Kg}$
$\boxed{\vec{a} = 8.8 \times 10^{15} \, m/s^2 \text{ [fwd]}}$

b) $\vec{V}_i = 0$
$\Delta \vec{d} = 0.020$ m
$\vec{a} = 8.8 \times 10^{15} \, m/s^2$ [fwd]
$\vec{V}_f = ?$

$\vec{V}_f^{\,2} = \vec{V}_i^{\,2} + 2a\Delta \vec{d}$
$\vec{V}_f^{\,2} = 0 + 2(8.8 \times 10^{15} \, m/s^2)(0.020 \, m)$
$\boxed{\vec{V}_f = 1.8 \times 10^7 \, m/s \text{ [fwd]}}$

#11 $m = 1.2\times10^4\,kg$ $\quad \vec{v}_f = 0$
$v_i = 22\,m/s$ [S] $\quad \Delta\vec{d} = 330\,m$ [S]

a) $\vec{v}_f^{\,2} = \vec{v}_i^{\,2} + 2\vec{a}\Delta\vec{d}$

$\vec{a} = \dfrac{\vec{v}_f^{\,2} - \vec{v}_i^{\,2}}{2\Delta\vec{d}}$

$\vec{a} = \dfrac{0-(22\,m/s)^2}{2(330\,m)}$

$\vec{a} = -0.73\,m/s^2$ [S]

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

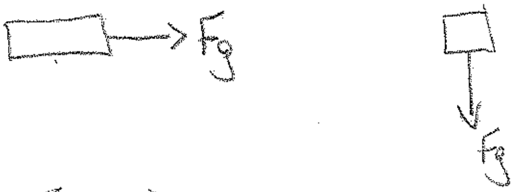
$\vec{F}_{NET} = (1.2\times10^4\,kg)(-0.73\,m/s^2)$

$\boxed{\vec{F}_{NET} = -8.8\times10^3\,N \text{ [S]}}$

The net force is $8.8\times10^3\,N$ north.

b) The braking force causes the vehicle to stop.

#12



a) $F_g = W = mg$

$\vec{W} = (2.0\,kg)(-9.8\,m/s^2)$

$\vec{W} = -19.6\,N$

$\vec{F}_{NET} = m\vec{a}$ (total system)

$\vec{F}_{NET} = (m_1+m_2)a$

$\vec{F}_{NET} = (6.0\,kg)a$

$\vec{W} = \vec{F}_T$

$\vec{F}_{NET} = \vec{F}_A + \vec{F}_f$

$\vec{F}_{NET} = \vec{F}_T + 0$

$(6.0\,kg)a = 19.6\,N$

$\vec{a} = \dfrac{19.6\,N}{6.0\,kg}$

$\boxed{\vec{a} = 3.3\,m/s^2 \text{ [right]}}$

b) $\vec{F}_{NET} = \vec{F}_A + \vec{F}_f$

$(6.0\,kg)\vec{a} = 19.6\,N - 2.0\,N$

$\vec{a} = \dfrac{19.6\,N - 2.0\,N}{6.0\,kg}$

$\boxed{\vec{a} = 2.9\,m/s^2 \text{ [right]}}$

#14 $m = 0.50 Kg$
$\vec{F}_A = 12.0$ [fwd]

a) $\vec{F}_{NET} = \vec{F}_A + \vec{F}_R$
$\vec{F}_{NET} = 12.0N + (-8.0N)$
$\vec{F}_{NET} = 4.0N$ [Right]

$\vec{F}_{NET} = m\vec{a}$
$\vec{a} = \frac{\vec{F}_{NET}}{m}$
$\vec{a} = \frac{4.0N}{0.50Kg}$
$\vec{a} = 8.0 m/s^2$ [fwd]

b) $\vec{v}_i = 0$
$\Delta t = 0.20s$
$\Delta \vec{d} = ?$

$\Delta \vec{d} = \vec{v}_i \Delta t + \frac{\vec{a} \Delta t^2}{2}$
$\Delta \vec{d} = \frac{(8.0 m/s^2)(0.20s)^2}{2}$
$\Delta \vec{d} = 0.16m$ [fwd]

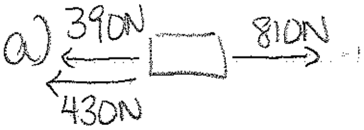
#15 $\vec{F}_g = \vec{W} = 4.0 \times 10^3 N$ [down]
$\vec{F}_A = 8.0 \times 10^3 N$ [W]
$\vec{F}_F = 6.0 \times 10^3 N$ [E]

a) $\vec{W} = m\vec{g}$
$m = \frac{\vec{W}}{\vec{g}}$
$m = \frac{-4.0 \times 10^3 N}{-9.8 m/s^2}$
$m = 4.1 \times 10^2 Kg$

b) $\vec{F}_{NET} = \vec{F}_A + \vec{F}_R$
$\vec{F}_{NET} = (8.0 \times 10^3 N) + (-6.0 \times 10^3 N)$
$\vec{F}_{NET} = 2.0 \times 10^3 N$ [W]

c) $\vec{F}_{NET} = m\vec{a}$
$\vec{a} = \frac{\vec{F}_{NET}}{m}$
$\vec{a} = \frac{2.0 \times 10^3 N}{4.1 \times 10^2 Kg}$
$\vec{a} = 4.9 m/s^2$ [W]

#16 a)



$\vec{F}_{NET} = \vec{F}_A + \vec{F}_R$

$\vec{F}_{NET} = (390N + 430N) + (-810N)$

$\boxed{\vec{F}_{NET} = 10N\ [W]}$

b)

$\vec{F}_{NET} = 0$ (constant speed)

c) $m = 1.0 \times 10^3\ Kg$

$\vec{F}_{up} = 1.2 \times 10^4\ N\ [up]$

$\vec{F}_f = -1.5 \times 10^3\ N\ [up]$

$\vec{F}_g = \vec{W} = mg$

$\vec{W} = (1.0 \times 10^3\ Kg)(-9.8\ m/s^2)$

$\vec{W} = -9.8 \times 10^3\ N\ [up]$

$\vec{F}_{NET} = \vec{F}_{up} + \vec{F}_{DOWN}$

$\vec{F}_{NET} = (1.2 \times 10^4 N) + [(-1.5 \times 10^3 N) + (-9.8 \times 10^3 N)]$

$\vec{F}_{NET} = (1.2 \times 10^4 N) + (-1.13 \times 10^4 N)$

$\boxed{\vec{F}_{NET} = 7.0 \times 10^2 N\ [up]}$

#17 $\vec{F}_{NET} = m\left(\dfrac{\vec{V}_f - \vec{V}_i}{\Delta t}\right)$

$N = Kg\left(\dfrac{m/s - m/s}{s}\right)$

$N = Kg\left(\dfrac{m/s}{s}\right) \longrightarrow \dfrac{m}{s} \div s \Rightarrow \dfrac{m}{s} \times \dfrac{1}{s} \Rightarrow \dfrac{m}{s^2}$

$N = Kg\left(\dfrac{m}{s^2}\right)$

$N = \dfrac{Kgm}{s^2} \longrightarrow$ since $N = \dfrac{Kgm}{s^2}$

$N = N$ ✓