6) Calculate the momentum of a 1000g duck moving at 28 m/s and a sumo wrestler with a mass of 200 kg, moving at 0.5 km/hr.

$\vec{p} = m\vec{v}$

duck: $m = 1000g \times \frac{1kg}{1000g} = 1kg$

$\vec{v} = 28 m/s$

$\vec{p} = (1kg)(28 m/s)$

$\vec{p}_{duck} = 28 kg \cdot m/s$

Sumo: $m = 200kg$

$\vec{v} = 0.5 km/hr \times \frac{1000m}{1km} \times \frac{1hr}{3600s} = 0.138 m/s$

$\vec{p} = ?$

$\vec{p} = (200kg)(0.138 m/s)$

$\vec{p}_{sumo} = 28 kg \cdot m/s$

Physics 11 - Practice Questions
Unit: 5.1 Momentum Introduction

1) 1.0 kg object travelling at 5.0 m/s has what momentum?

$\vec{p} = m\vec{v}$

$m = 1.0kg$

$\vec{v} = 5.0 m/s$

$\vec{p} = (1.0kg)(5.0 m/s)$

$\vec{p} = 5.0 kg \cdot m/s$

2) A bullet travelling at 900 m/s has a momentum of 4.5 kg.m/s, what is it's mass in grams?

$\vec{p} = m\vec{v}$

$m = ?$

$\vec{v} = 900 m/s$

$\vec{p} = 4.5 kg \cdot m/s$

$\frac{4.5 kg \cdot m/s}{\div 900 m/s} = \frac{(m)(900 m/s)}{\div 900 m/s}$

$0.005 kg = m$

$0.005kg \times \frac{1000g}{1kg} = 5g = m$

3) What is the velocity of a 7.3g rock with a momentum of 22 kg.m/s?

$\vec{p} = m\vec{v}$

$m = 7.3\,g$

$\vec{v} = ?$

$\vec{p} = 22\ kg \cdot m/s$

$7.3\,g \times \frac{1\ kg}{1000\ g} = \boxed{0.0073\ kg}$

$\frac{22\ kg \cdot m/s}{0.0073\ kg} = \frac{(0.0073\ kg)(\vec{v})}{0.0073\ kg}$

$\boxed{3013\ m/s = \vec{v}}$

4) A 80 kg cyclist speeds up from 20 km/hr to 25 km/hr; calculate the change in momentum.

$\vec{p} = m\vec{v}$

$m = 80\ kg$

$V_i = 20\ km/hr \times \frac{1000\ m}{1\ km} \times \frac{1\ hr}{3600\ s} = \boxed{5.556\ m/s}$

$V_f = 25\ km/hr \times \frac{1000\ m}{1\ km} \times \frac{1\ hr}{3600\ s} = \boxed{6.944\ m/s}$

$\Delta\vec{p} = ?$

$\vec{p}_f = (80\ kg)(6.944\ m/s) = 555.\bar{5}\ kg \cdot m/s$

$\vec{p}_i = (80\ kg)(5.556\ m/s) = 444.\bar{4}\ kg \cdot m/s$

$\Delta\vec{p} = 555.\bar{5} - 444.\bar{4} = \boxed{111\ kg \cdot m/s}$

or $\Delta\vec{v} = 6.944 - 5.556 = 1.3889 \times 80\ kg = \boxed{111\ kg \cdot m/s}$

5) A 60 g ball leaves a rocket at 55 m/s. It was in contact for 4.0×10^{-3} s. What is the average force on the ball? Could this force lift a 60 kg person?

$m = 60\,g \times \frac{1\ kg}{1000\,g} = \boxed{0.06\ kg}$

$\vec{v} = 55\ m/s$

$\Delta t = 4.0 \times 10^{-3}\ s$

$F\Delta t = m\vec{v}$

$F_{avg}(4.0 \times 10^{-3}\ s) = (0.06\ kg)(55\ m/s)$

$\frac{F_{avg}(4.0 \times 10^{-3}\ s)}{4.0 \times 10^{-3}\ s} = \frac{3.3\ kg \cdot m/s}{4.0 \times 10^{-3}\ s}$

$F_{avg} = 825\ kg \cdot m/s^2$

$\boxed{F_{avg} = 825\ N}$