Impulse

1. A rocket at rest with a mass of 9.5×10^3 kg is acted on by an average net force of 1.5×10^5 N upwards for 15 s. What is the final velocity of the rocket?

$m\Delta v = F_{net}\, t$

$\Delta v = \frac{F_{net} \cdot t}{m} = \frac{(1.5\times10^5\ N)(15s)}{9.5\times10^3\ kg}$

$= 240\ m/s$

2. A 26.3 kg object is traveling at 21.0 m/s north. What average net force is required to bring this object to a stop in 2.60 s?

$F_{net}\, t = m\Delta v$

$F_{net} = \frac{m\Delta v}{t} = \frac{(26.3\ kg)(0 - 21.0\ m/s)}{2.60 s}$

$= 212\ N\ (South)$

3. An average force of 31.6 N south is used to accelerate a 15.0 kg object uniformly from rest to 10.0 m/s. What is the change in momentum?

$\Delta p = m\Delta v$

$= m(v_f - v_i)$

$= (15.0\ kg)(10.0\ m/s - 0)$

$= 150\ kg\,m/s \quad = 1.50\times10^2\ kg\,m/s$

4. An average net force of 25.0 N acts north on an object for 7.20×10^{-1} s. What is the change in momentum of the object?

$\Delta p = F_{net} \cdot t = (25.0\ N)(7.20\times10^{-1}\ s)$

$= 18\ N \cdot s$

5. A 5.00 kg object accelerates uniformly from rest to a velocity of 15.0 m/s east. What is the change in momentum on the object?

$\Delta p = m\Delta v = (5.00\ kg)(15.0\ m/s - 0)$

$= 75\ kg\,m/s$

6. An average net force caused an 11.0 kg object to accelerate uniformly from rest. If this object travels 26.3 m west in 3.20 s, what is the change in momentum of the object?

$v = ?$, $v_0 = 0$, $a = ?$, $d = 26.3\ m$, $t = 3.20\ s$

$d = v_0 t + \frac{1}{2}at^2$ ($v_0 = 0$)

$a = \frac{2d}{t^2}$

$= 5.14\ m/s^2$

$v = v_0 + at = 16.44\ m/s$

$\Delta p = m\Delta v$

$= (11.0\ kg)(16.44\ m/s - 0)$

$= 181\ kg\,m/s$

7. A 1.30 kg object is dropped from a height of 6.5 m. How far did the object fall when its momentum is 6.0 kgm/s?

$p = mv$

$v = \frac{p}{m} = \frac{6.0\ kg\,m/s}{1.30\ kg}$

$= 4.615\ m/s$

$v = -4.615\ m/s$, $v_0 = 0$, $a = -9.80$, $d = ?$, t

$v^2 = v_0^2 + 2ad$ ($v_0 = 0$)

$d = \frac{v^2}{2a}$

$= -1.1\ m$

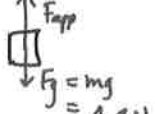
8. An average net force of 16.0 N acts on an object for 2.00×10^{-1} s causing it to accelerate from rest to 3.50 m/s. What is the mass of the object?

$m\Delta v = F_{net}\, t$

$m = \frac{F_{net}\, t}{\Delta v} = \frac{(16.0\ N)(2.00\times10^{-1}\ s)}{(3.50\ m/s - 0)} = 0.914\ kg$

9. A 0.500 kg object is thrown vertically upward with an average applied force of 8.20 N by a student. The force is applied through a displacement of 1.50 m.

a. What is the average net force acting on the object?



$F_{net} = F_{app} - F_g$

$= 8.20\ N - 4.9\ N$

$= 3.3\ N$

b. What is the velocity of the object when it leaves the student's hand? (Assume initial velocity is zero)

$a = \frac{F_{net}}{m} = 6.6\ m/s^2 \quad t = \sqrt{\frac{2d}{a}} = 0.6742\ s$

$m\Delta v = F_{net} \cdot t$

$\Delta v = \frac{F_{net} \cdot t}{m} = \frac{(3.3\ N)(0.6742\ s)}{0.500\ kg}$

$= 4.45\ m/s$

1) 240 m/s 2) 212 N South 3) 150 kgm/s 4) 18 Ns 5) 75 kgm/s 6) 180. kgm/s 7) 1.1 m 8) 0.914 kg 9)a. 3.30 N b. 4.45 m/s