# Assignment 6 Solutions

1. $^{235}U \longrightarrow \alpha + {}^{231}X$

Momentum of $^{235}U$ before Disintegration $= 0$.
" " $\alpha$ & $^{231}X$ after " " = $\alpha$ momentum + $^{231}X$ mom.

$$\therefore 0 = m_\alpha v_\alpha + m_X v_X$$

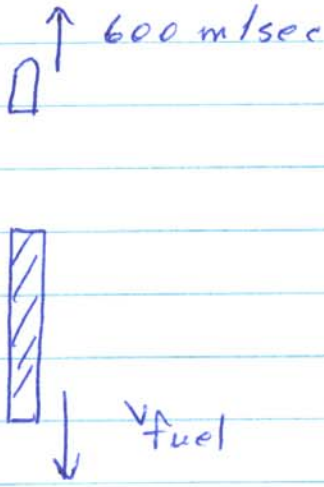
$$v_X = -\frac{m_\alpha}{m_X} v_\alpha$$

$$= -\frac{4}{231} \times 3 \times 10^5$$

$$\therefore v_X = -5.2 \times 10^3 \text{ m/sec.}$$

2. Before Burn


After Burn



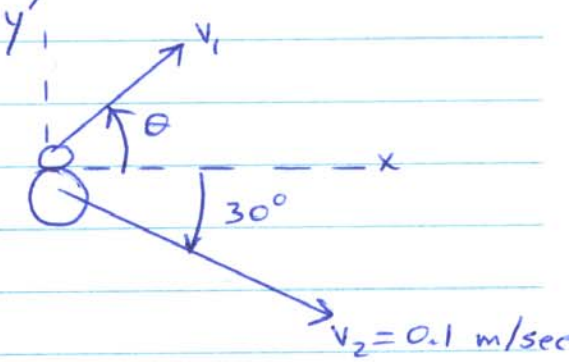

Momentum Rocket + Momentum Fuel $= 0$.
After Burn After Burn

$$1000\text{kg} \times 600\text{ m/sec} + 4000\text{kg}\ v_{fuel} = 0.$$

$$\therefore v_{fuel} = -150 \text{ m/sec.}$$

3. Before Collision


After Collision




Cons. of Mom. in x Direction: $m_1 u_1 = m_1 v_1 \cos\theta + m_2 v_2 \cos 30$

$0.5 = v_1 \cos\theta + 0.2 \cos 30^\circ$

$v_1 \cos\theta = 0.327 \quad (1)$

Cons. of Mom. in y Direction: $0 = m_1 v_1 \sin\theta - m_2 v_2 \sin 30^\circ$

$= v_1 \sin\theta - 0.2 \sin 30^\circ$

$v_1 \sin\theta = 0.1 \quad (2)$

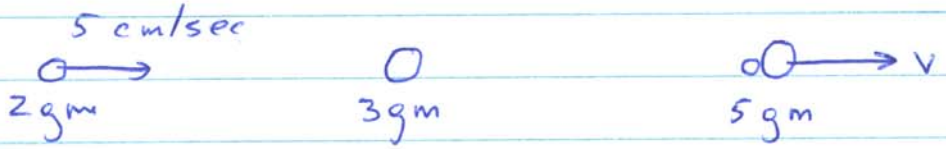
$(1)^2 + (2)^2 \Rightarrow v_1^2 = (0.327)^2 + (0.1)^2$

$\therefore v_1 = 0.34$ m/sec.

$(2) \div (1) \Rightarrow \tan\theta = \dfrac{0.1}{0.327}$

$\therefore \theta = 17^\circ.$

4. Before Collision After Collision




a) Momm. Conservation: $.002\,kg \times .05 \frac{m}{sec} = .005\,kg\ v.$

$\therefore v = 0.02\ m/sec$

$= 2\ cm/sec.$

b) Initial K.E. $= \frac{1}{2}(.002\,kg)(.05\ m/sec)^2$

$= 2.5 \times 10^{-6}\ J$

c) Final K.E. $= \frac{1}{2}(.005\,kg)(.02\ m/sec)^2$

$= 1 \times 10^{-6}\ J$

d) Initial K.E - Final K.E. $= 1.5 \times 10^{-6}\ J$ possibly went into sound (noise of collision), heating of two balls etc.