Q3

value	frequency
0	3
1	3
2	3
3	1

$$\lambda = E(x) = \frac{0*3 + 3*1 + 2*3 + 3*1}{10}$$

$$= 1.2$$

So the averge Counting rate is 1.2

→ probability the next Counting is Zero

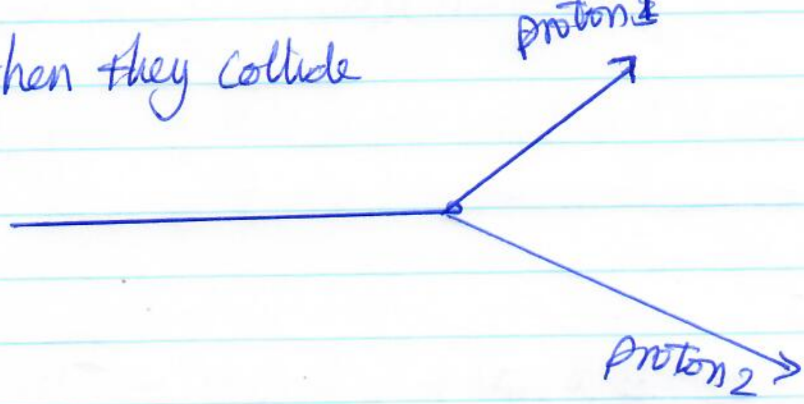
$$P(X=0) = \frac{e^{-\lambda}\lambda^{x}}{x!} = \frac{e^{-1.2}(1.2)^{0}}{0!}$$

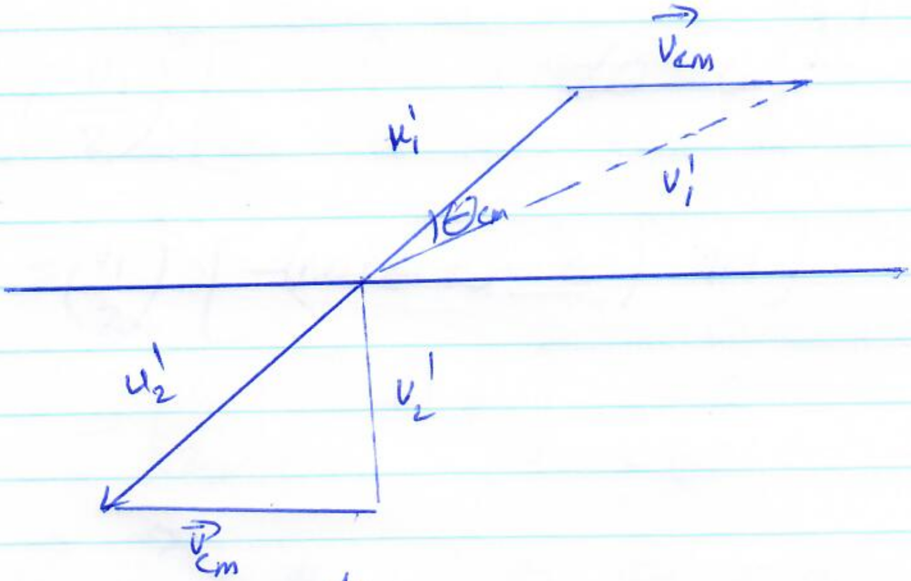
$$= 0.301$$

Q2

on the rest $V_2=0$

when they collide





the protons they have the same masses $\Rightarrow m_1 = m_2$

$$V_{cm} = \frac{V_1 m_1 + V_2 m_2}{m_1 + m_2} = \frac{V_1 m_1}{2 m_1} = \frac{u}{2}$$

when need to prove that $\vec{v_1} \cdot \vec{v_2} = 0$

$$\vec{v_1} \cdot \vec{v_2} = v_{1x} v_{2x} + v_{2y} v_{2y}$$

$$V_{1x} = \frac{1}{2} V_1 \cos\theta + \frac{1}{2} V_1 \cos 0 = \frac{1}{2} V_1 \cos\theta + \frac{1}{2} V_1$$

$$V_{1y} = \frac{1}{2} V_1 \sin\theta + \frac{1}{2} V_1 \sin 0 = \frac{1}{2} V_1 \sin\theta$$

$$V_{2x} = \frac{1}{2} V_1 \cos(\pi - \theta) + \frac{1}{2} V_2 \cos 0 = -\frac{1}{2} V_1 \cos\theta + \frac{1}{2} V$$

$$V_{2y} = \frac{1}{2} V_1 \sin(\pi - \theta) + \frac{1}{2} V_1 \sin 0 = -\frac{V_1}{2} \sin\theta$$

So $\vec{V_1} \cdot \vec{V_2} = V_{1x} V_{2x} + V_{1y} V_{2y} =$

$$\left(\frac{V_1}{2}\right)^2 \left[-\cos^2\theta + \cancel{\cos\theta} - \cancel{\cos\theta} \overset{+1}{} - \sin^2\theta \right]$$

$$= \left(\frac{V_1}{2}\right)^2 \left[-(\cos^2\theta + \sin^2\theta) + 1 \right]$$

$$= \left(\frac{V_1}{2}\right)^2 \left[-1 + 1 \right] = 0$$

$$\vec{V_1} \cdot \vec{V_2} = 0 \quad \Rightarrow \theta = \frac{\pi}{2}$$