# Solution HW # 2.

28/6/2011.

① $\boxed{\Delta t = \gamma \Delta t_0}$ ; $\gamma = \frac{1}{\sqrt{1 - u^2/c^2}} = \frac{1}{\sqrt{1 - (0.8c)^2/c^2}} = 1.67$

proper time ; $\Delta t_0 = 2 \times 5 = 10$ year.

$\Delta t = (1.67)(10) = 16.7$ year ✱

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② $\boxed{l = l_0 \sqrt{1 - u^2/c^2}}$ ; $l_0 = 100$ cm , $l = 2$ cm.

$\frac{l^2}{l_0^2} = 1 - \frac{u^2}{c^2} \rightarrow u^2 = c^2 (1 - \frac{l^2}{l_0^2}) \rightarrow u = c\sqrt{1 - \frac{l^2}{l_0^2}}$

ummah ; $u = c\sqrt{1 - \frac{2^2}{100^2}} = 0.9997c \approx 0.99c$ ✱

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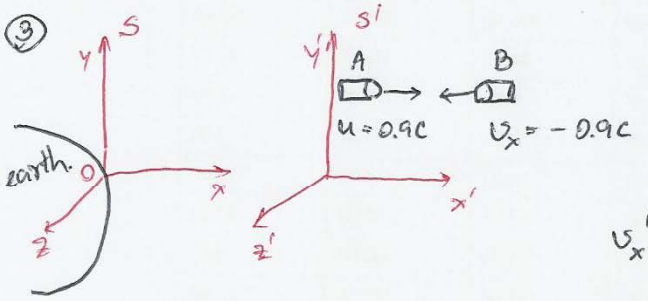
③




$\boxed{v_x' = \frac{v_x - u}{1 - u v_x / c^2}}$

$v_x' = \frac{-0.9c - 0.9c}{1 - (0.9c)(-0.9c)/c^2} = \frac{-1.8c}{1.81} = -0.9945c$ ✱

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④ $m = \frac{m_0}{\sqrt{1 - u^2/c^2}}$ ; $m_0 = 9.1 \times 10^{-31}$ kg , $u = 0.5c$

$m = \frac{9.1 \times 10^{-31}}{\sqrt{1 - (0.5c)^2/c^2}} = 1.05 \times 10^{-30}$ kg ✱

$p = mv = (1.05 \times 10^{-30})(0.5 \times 3 \times 10^8) = 1.58 \times 10^{-22}$ kg.m/s ✱

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⑤ $\boxed{E = \gamma E_0}$ ; $\gamma = \frac{1}{\sqrt{1 - u^2/c^2}} = \frac{1}{\sqrt{1 - (0.6c)^2/c^2}} = 1.25$

$E_0 = 938$ MeV

Total Energy ; $E = (1.25)(938) = 1.17 \times 10^3$ MeV ✱

$\boxed{K = E - E_0}$

$= 1.17 \times 10^3 - 938$

$= 232$ MeV ✱