# Physics 106 Exam 4 Sec. 1, 2 CID#_____

**Hess (2-2108), Magleby (2-7056) Winter 09**

## Formula version

You are allowed a pencil and a non-graphing calculator. No scratch paper is allowed.

Make your calculations on the exam itself. When you are confident you have found the correct answer, fill in the appropriate bubble on the scantron sheet.

If English is your second language, you may use a dictionary.

## Modern

$$\gamma = \frac{1}{\sqrt{1 - v^2/c^2}}$$

$$\Delta t = \frac{\Delta t_p}{\sqrt{1 - \frac{v^2}{c^2}}} = \gamma \Delta t_p$$

$$L = \frac{L_p}{\gamma} = L_p \sqrt{1 - v^2/c^2}$$

$$p = \frac{mv}{\sqrt{1 - v^2/c^2}} = \gamma mv$$

$$KE_{\text{Relativistic}} = \gamma mc^2 - mc^2$$

Total Relativistic Energy $= \gamma mc^2$ = KE + RE

Rest Energy = $mc^2$

$$E^2 = p^2c^2 + (mc^2)^2$$

$$KE_{\max} = hf - \varphi = e\Delta V_s$$

$$\lambda_{\min} = \frac{hc}{e\Delta V}$$

$$\Delta\lambda = \lambda - \lambda_0 = \frac{h}{m_e c}(1 - \cos\theta)$$

$$m_p = 1.007825u = 1.672 \times 10^{-27}\, kg$$

$$m_e = 5.49 \times 10^{-4}\, u$$
$$= 9.11 \times 10^{-31}\, kg$$
$$= 0.511 MeV/c^2$$

$$m_n = 1.008665u = 1.674\,95 \times 10^{-27}\, kg$$

$$e = 1.6 \times 10^{-19}\, C$$

$$E_{photon} = hf = \frac{hc}{\lambda}$$

$$p_{photon} = \frac{E}{c} = \frac{hc}{c\lambda} = \frac{h}{\lambda}$$

$$\lambda_{photon} = \frac{h}{p}$$

$$\lambda_{DeBroglie} = \frac{h}{p} = \frac{h}{mv}$$

$$f_{matter} = \frac{E}{h}$$

$$\Delta x \Delta p_x \geq \frac{h}{4\pi}$$

$$\Delta E \Delta t \geq \frac{h}{4\pi}$$

$$R = \left|\frac{\Delta N}{\Delta t}\right| = \lambda N$$

$$N = N_0 e^{-\lambda t}$$

$$T_{1/2} = \frac{\ln 2}{\lambda} = \frac{0.693}{\lambda}$$

$$1\, Ci \equiv 3.7 \times 10^{10}\ decay/s$$

$$1\, Bq = 1\ decay/s$$

$c = 3.00 \times 10^8$ m/s

$$eV = 1.6 \times 10^{-19}\, J$$

$$h = 6.626 \times 10^{-34}\, J \cdot s$$

$$1\, u = 931.494\ meV/c^2$$