April 25, 2008 **Quiz 9 - PHY244 (Modern Physics)**

Print (Hugely) Last Name: Solution

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Giving or receiving aid is cause for dismissal from the university.

$\mathbf{F} = q\mathbf{v} \times \mathbf{B}$, $p = mv$, $a = v^2/r$, $\mathbf{F} = m\mathbf{a}$, $c = 3 \times 10^8$ m/s , $e = 1.6 \times 10^{-19}$ C .

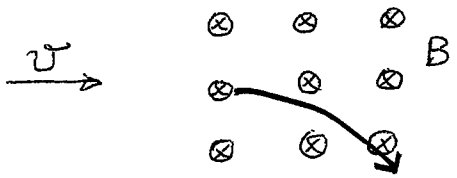
♣ All known baryons and mesons are made of combinations of following quarks,

$\frac{2}{3}u$, $-\frac{1}{3}d$, $\frac{2}{3}c$, $-\frac{1}{3}s$, $\frac{2}{3}t$, and $-\frac{1}{3}b$.

Here the charge number is denoted by the left subscript. Which of the following quark compositions is **not** correct? (Note that an overbar denotes the corresponding antiparticle.)

(a) π^+ $(\bar{d}u)$, (b) K^+ $(\bar{s}u)$, (c) $\bar{p}$ $(\bar{u}\bar{u}\bar{d})$, (d) K^0 $(\bar{s}d)$, (e) n (uud) Q = +1

♠ A non-relativistic electron of a rest mass 0.511 MeV/c^2 travels (to the right of ~~this~~ paper) with a momentum 1500 eV/c. It is deflected with a radius of curvature 1 cm in a uniform magnetic region (where $\mathbf{B}$ points into the paper).



downward

Find the strength of B field in Tesla (hint: Bc has the unit of volt/meter). Determine in which way the particle curls (up or down).

$qvB = \frac{mv^2}{r}$ $\quad B = \frac{p}{qr} = \frac{1500\,eV/c}{e\,(0.01\,m)}$

$cB = 150{,}000\ V/m$

$B = \frac{150{,}000}{3\times10^8} = 5\times10^{-4}\ T$

∇ Check both conservation laws of charge Q and nucleon number A in the following processes, and determine whether they are forbidden by certain laws.

(a) ${}^1\mathrm{H} + {}^{63}_{29}\mathrm{Cu} \rightarrow n + {}^{63}_{28}\mathrm{Ni}$ Q violation

(b) $n + {}^{56}_{26}\mathrm{Fe} \rightarrow {}^{4}_{2}\mathrm{He} + {}^{53}_{25}\mathrm{Mn}$ Q violation

(c) $n + {}^{14}_{7}\mathrm{N} \rightarrow p + {}^{13}_{6}\mathrm{C}$ A violation