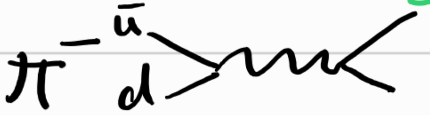
1) a) $\pi^- \to \mu^- +$ $\quad L_\mu = 0 \to 1 + (-1) \Rightarrow + \bar{\nu}_\mu$

$\bar{u}d \to \pi^-$ $\quad L_\mu = 1 \to 0 + 1 + 0$

$L_e = 0 \to 1 + 0 + (-1) \Rightarrow + \nu_\mu + \bar{\nu}_e$



b) $\mu^- \to e^- + \quad +$

data sheet

$\Lambda^0 + p \to K^- + p + p$

$\to uds \quad uud \quad s\bar{u} \quad uud \quad uud \Rightarrow$ quark flavour conservat°

2) a) $\Lambda^0 + p \to K^- + p + p$ $\quad$ = quark composit°

common f..

baryon $\quad$ photon] gluon → colour charge

⇓

STRONG FORCE

(no free photon γ that could indicate EM interact°)

b) $\pi^+ \to \mu^+ + \nu_\mu$ $\quad$: weak

meson = boson

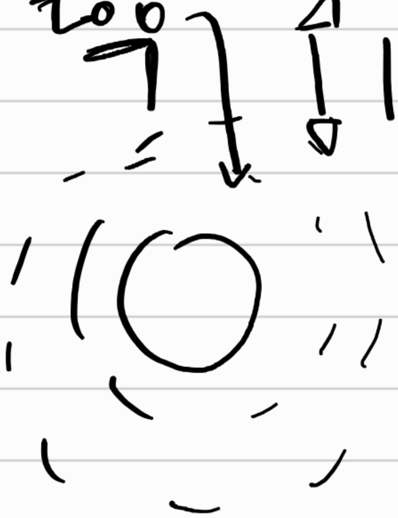
$\pi^+ \to \mu^+ + \nu_\mu \Rightarrow$ no conservat° + KE?

$u\bar{d} \to$ NO QUARKS $\quad$ neutrinos] quarks

⇓

WEAK

3) E_{00} $\quad$ 1mm $\quad E_{tot} = m_0 c^2 + KE$



?

Grav field

4) (i) $t_{1/2} = \dfrac{\ln(2)}{\lambda} \Rightarrow \lambda = \dfrac{\ln(2)}{t_{1/2}}$

$$t_{1/2} = 20.4 \times 60 s$$

$$\lambda = 5.66 \times 10^{-4}$$

(ii) Decay rate $= N_0 \lambda = 1132593.43$

(iii) nº radioactive nuclei after 8 h $= \lambda N_0 e^{-\lambda t} = 5.34 \times 10^{-5}$

$t = 8 \times 60 \times 60$
$= 28800 s$

which makes sense: way past 20m ½ life

(iv) Activity after 8 h $= \dfrac{N_0 \lambda}{2\ln(2)} = 816993.46$

(v) Mean life $= 1/\lambda = 1766.78 s$
$\simeq 29.4$ min

5. $1M = N_0$ $\qquad t = 2.2 \times 10^{-5} s$

$\lambda N_0 e^{-\lambda t}$ $\qquad t_{1/2} =$

$x = \frac{\ln(2)}{t_{1/2}}$??

6. how many decays are there per gram?

λN?

$\frac{\ln(2)}{t_{1/2}} N$

6

$266 = A$

7) $5.3 \times 60 = \underset{\sim}{\lambda} N_0 e^{-\lambda (t)}$?

attempt 2

1) a) $\pi^- \to \mu^- + ? \quad \mu^+$ conserve

Q $d\bar{u} \to \quad + \quad \bar{\nu}_\mu \quad L_e$

C $- \to \quad +$

$\Rightarrow$ STRONG

Quark flavor → Strong / EM
L_e → always con

b) $\mu^- \to e^- + ?+?$ ⇒ WEAK

L_e → $+ \bar{\nu}_e + \bar{\nu}_\mu$ ✓
C −1 → −1

3) assumed mass = 1mg
KE gaind = Potential E lost in the fall

$\boxed{KE = mg\Delta h}$

$m = 10^{-6}$ kg ← assumed mass
$g = 9.81 m/s^2$ ← g const
$\Delta h = 10^{-3}$ m ← fall

$= 9.8 \times 10^{-9}$ J

$= 6.12$ GeV

where is this coming from?? irrelevant

5) Initial $n^\circ \mu = 10^6$
$\boxed{\text{After } t = 2.2 \times 10^{-5} s}$, we have a n° $N = N_0 e^{-\lambda s / ...}$
Datasheet ⇒ lifetime $\mu = 2.197 \times 10^{-6}$

STILL CONFUSED TBH

$N = 10^6 \cdot e^{-\lambda t}$

$\lambda = \frac{1}{...} = \frac{1}{...}$

mean life 2.197×10^{-6} s

$= 455166.14$

$$N = 10^6 \cdot e^{-\lambda \cdot 2.2 \times 10^{-5} s}$$

$= 44.78$ particles

$\Rightarrow N = 44$ (full) muons ✓

6) i) $t_{1/2} = \frac{\ln(2)}{\lambda}$

How many atoms are there in 1 gram ^{226}Ra?

- 1 atom of ^{226}Ra weights A amu $= 266$ u
  $= 266 \times 1.66 \times 10^{-24}$ g

- 1 gram ^{226}Ra $\Rightarrow 2.66 \times 10^{21}$ atoms
- 1s we "lose" 3.7×10^{10} particles through decay

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