10/15

IB Physics
Pre Quiz 30.1

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What you will miss the most about TuHS Physics

Murray Dedicated

Show your work, circle your answers, and use sig figs to receive full credit.

1 u = 1.6605E-27 kg = 931.5 MeV, (neutral atom masses: $^{1}_{1}p$ = 1.007825 u, $^{2}_{1}d$ = 2.014102 u, $^{3}_{1}t$ = 3.016049 u, $^{4}_{2}\alpha$ = 4.002602 u) $^{0}_{0}\gamma$ = ? $^{1}_{0}n$ = 1.008665 u

1. What is the binding energy of ^{13}N? Z = 7, m = 13.005738 u (94.11 MeV)

$7\ {}^{1}_{1}H = 7(1.007825) = 7.054775$
$6\ n = 6(1.008665) = 6.051990$
13.106765
-13.005738
$.101027 \times 931.5 = 94.1066$
≈ 94.11 MeV

2. Fill in the table (not all these decays or reactions occur)

Decay	Mass Number (A)	Atomic Number (Z)	Reaction	???	
$^{83}_{39}Y \rightarrow ??? + \alpha\ {}^{4}_{2}He$	79 $83-4$	37 $39-2$	$^{16}_{8}O(\alpha,t)???$ $2\alpha\ {}^{3}_{1}t$	$^{17}_{9}F$	$^{17}_{9}F$
$^{83}_{39}Y \rightarrow ??? + \beta- {}^{0}_{+1}$	83 $83-0$	40 $39+1$	$???(p,n)^{239}_{94}Pu$ $1\ 0$	$^{239}_{93}Np$	$^{239}_{93}Np$
$^{83}_{39}Y \rightarrow ??? + \beta+ {}^{0}_{-1}$	83 $83-0$	38 $39-1$	$^{16}_{8}O(\alpha,???)^{19}_{10}Ne$ 1	$^{1}_{0}n$	$^{1}_{0}n$
$^{83}_{39}Y \rightarrow ??? + \gamma\ {}^{0}_{0}V$	83 $83-0$	39 $39-0$	$^{28}_{14}Si(???,n)^{28}_{15}P$ $1\ 0n$	$^{1}_{1}p$	$^{1}_{1}p$

3. What is the kinetic energy of the alpha particle that ^{208}Po (m = 207.981222 u) gives off becoming ^{204}Pb (m = 203.973020) in MeV? (5.216 MeV)

$^{208}P \rightarrow {}^{204}Pb + {}^{4}_{2}He$
$207.981222 \rightarrow 203.973020 + 4.002602$
$207.981222 \rightarrow 207.97566$

$207.981222 - 207.97566$
$= .0056$
$(.0056)(931.5)$
5.2164 MeV

4. Find the Q value for this nuclear reaction: $^{7}_{3}Li(p,n)^{7}_{4}Be$. Label the reaction as either energy requiring (endoergic) or energy releasing (exoergic) Li-7 = 7.016003 u, Be-7 = 7.016928 u (Endoergic – Q = -1.644 MeV)

$^{7}_{3}Li + {}^{1}_{1}p \rightarrow {}^{1}_{0}n + {}^{7}_{4}Be$
$7.016003 + 1.007825 \rightarrow 1.008665 + 7.016928$
$8.023828 \rightarrow 8.025593$
$8.023828 - 8.025593 = (-.001765)(931.5) = -1.644$ MeV
endoergic

5. The activity of a sample with a half-life of 23.5 minutes is 3.412×10^{6} counts/second. What will it be in 6.00 hours? (83.5 counts/sec)

$\lambda = \frac{\ln 2}{T} = \frac{\ln 2}{23.5(60)} = 4.9159E-4$

$N = N_0 e^{-\lambda t}$
$= (3.412E6)e^{(-4.9159E-4)(600)(u)}$
$= 83.468$ counts/sec