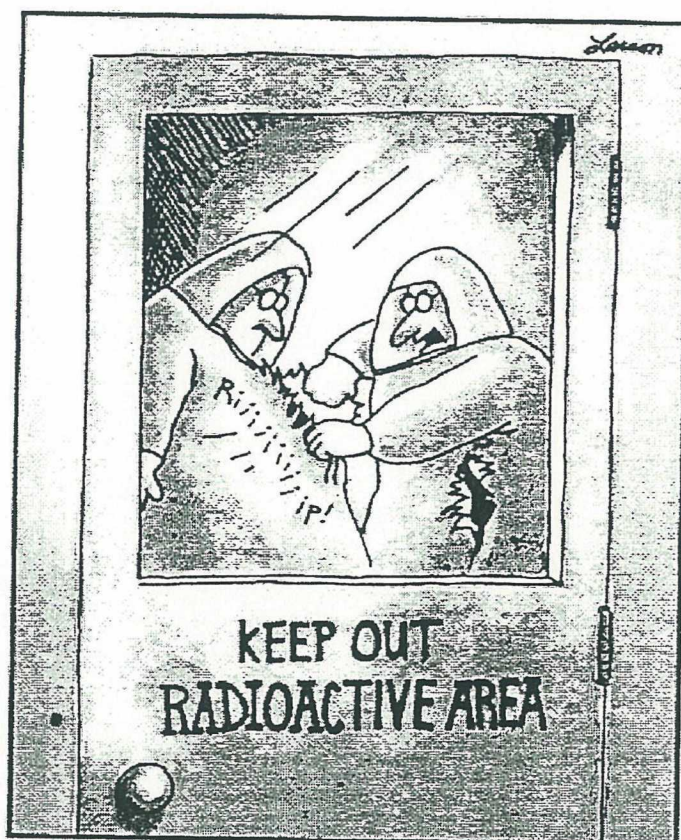


SACRED HEART COLLEGE
PHYSICS 11 2000
NUCLEAR PHYSICS TEST



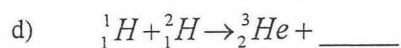
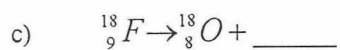
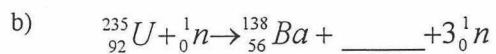
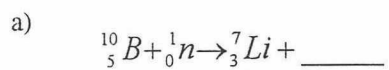
"So, Foster! That's how you want it, huh? ...
Then take *this!*"

Name: _____

TOTAL: (Test 24 marks)

..... (Prac 6 marks)

1. Balance the following equations



(4)

2. Uranium – 238 decays to Lead – 206 via a series of α & β decays. Determine how many of each of these are required to complete the decay series.

(4)

3. What is an isotope?

(2)

4. Carbon – 14 is formed in the upper atmosphere by the interaction of Nitrogen – 14 & cosmic rays. Write the equation of this interaction below.

(2)

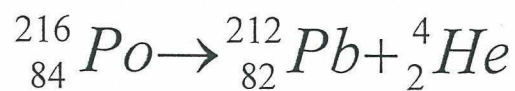
5. Carbon-14 is radioactive and decays with a half life of 5730 years. If a bone found at a dig site is tested & found to have an activity of 13.0 Bq, find the age of the bone if a similar bone, from a new animal is tested and found to have an activity of 25.0 Bq

(4)

6. What is a radioactive tracer & how is it used?

(2)

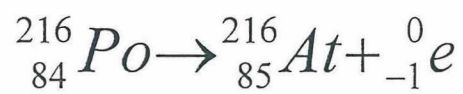
7. How much energy is released or absorbed in the following reaction.



The atomic mass of
Po-216 is 216.0019u
Pb-212 is 211.9919u
He-4 is 4.002603u

(4)

8. If mass & charge must be conserved in a nuclear decay, how can an electron be released in a beta decay and charge still be conserved. Use the following as an example.



(2)

PRAC ASSESSMENT

MacDog is using a Geiger counter to determine the half-life of a sample of a radioisotope. In order to do this he took several readings of the background radiation in the lab & found the average to be

35 in 60 sec

Following this MacDog placed the Geiger counter in front of the radioisotope and let it run for 7 minutes collecting the reading on the Geiger counter every minute. Note the counter reads 000000 counts at $t = 0.00$ s.

Time (minutes)	Reading (total)		
1.00	695		
2.00	1285		
3.00	1787		
4.00	2214		
5.00	2579		
6.00	2892		
7.00	3160		

Given that the radio-isotope is following an exponential decay according to the equation below, find A_o & k

$$A = A_o e^{-kt}$$

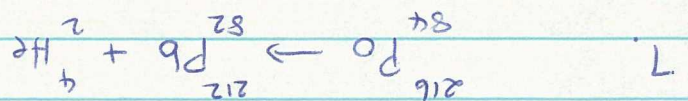
(6)

(7)

6. TRACER - radioactive substance introduced into the circulatory system of the body.

Using a sensitive Geiger tube or radiation counter, or X-ray, scanner, etc to observe the flow. Blackages show up by an increase in the radiation level at the right.

(2)



$$\text{MASS REACTANTS} = 216.0019 \text{ u}$$

$$\text{MASS PRODUCTS} = 211.9919 \text{ u} + 4.002603 \text{ u} = 215.994503 \text{ u}$$

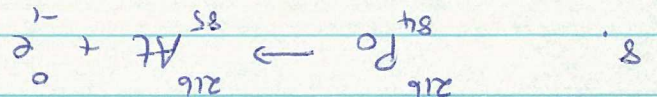
$$\text{MASS DEFECT} = 0.007397 \text{ u}$$

$$\text{Energy released} = (0.007397)(931.4)$$

$$= 6.8896 \text{ MeV.}$$

$$= 6.89 \text{ MeV (3 sig. fig.)}$$

(4)



In the process a neutron changes to a proton + electron.
ie. ${}_0^1\text{n} \rightarrow {}_1^1\text{p} + {}_0^{-1}\text{e}$.

The ~~net~~ charge does not change.

(2)

PRAC QUESTION

Background = 35 counts/min

Time (mins)	READING	CORRECTED	COUNTS / MIN
1-00	695	695	660
2-00	1285	590	555
3-00	1787	502	467
4-00	2214	427	392
5-00	2579	365	330
6-00	2892	313	278
7-00	3160	268	233

$$A = 785 e^{-0.173 t}$$

$$A_0 = 785, \quad K = 0.173$$