

RDCH 702

Last Name: _____

Quiz 1

Assigned 10-Sep-18

Due 17-Sep-18, 2nd due date 20-Sep-18

First Name: _____

Chart of the nuclides

Use the chart of the nuclides, the readings on the chart of the nuclides, table of the isotopes, and web links to answer the following questions. Use the PDF form to input the answers. Use additional pages to show your work and submit separately.

1. (10 Points) Select the isotope where the metastable state is longer lived than the ground state.

^{34}Cl

^{200}Au

^{118}Sb

^{102}Rh

^{11}C

^{262}Sg

^{243}Pu

^{212}Po

^{242}Am

^{239}Pu

^{144}Ce

^{95}Zr

2. (5 Points) How is ^{14}C naturally produced

3. (10 Points) Which elements have a relatively large number of metastable isotopes

O

Ni

Yb

Nb

Mo

Tc

Ru

Rh

Pd

Ag

Sn

Sb

Tm

Y

Lu

Hf

3.1. Are there any trends in the population of isotopes with metastable states? Consider the number of neutrons and protons and location of the isotopes on the chart of the nuclides

4. (10 Points) Provide the cumulative fission yields for the A isobars listed below for ^{233}U , ^{235}U , and ^{239}Pu .

A	^{233}U	^{235}U	^{239}Pu
116	_____	_____	_____
95	_____	_____	_____
72	_____	_____	_____
160	_____	_____	_____

5. (15 Points) Provide the ratio of ^{235}U cumulative fission yield to ^{239}Pu cumulative fission yield for the following A values.

90	_____	91	_____	92	_____	94	_____	96	_____
98	_____	100	_____	101	_____	103	_____	105	_____
135	_____	137	_____	139	_____	142	_____	144	_____
146	_____	147	_____	148	_____	149	_____	150	_____

5.1. What are the differences between the higher ($135 \leq A \leq 150$) and lower ($90 \leq A \leq 105$) A set?

5.2. What accounts for any differences?

6. (10 Points) Describe the cross section data presented for ^{130}Te .

Te130	^{113}Te	Te131	$^{131\text{m}}\text{Te}$
34.08 6E20 a	1.36 d	25.0 m	
$\beta^- \beta^-$ $\alpha_\gamma (0.0106 + 0.186),$ (0.042 + 0.3)	$\beta^- 0.42, \dots$ $\gamma 773.7,$ 852.2, ...	$\beta^- 2.1, \dots$ $\gamma 149.7,$ 452.3, ...	
129.906224	IT 182.4 e^-	E 2.235	

6.1. What is the cross section for producing $^{131\text{m}}\text{Te}$ with thermal neutrons?

6.2. What is the cross section for producing ^{131}Te with thermal neutrons?

6.3. What is resonance integral cross section for producing $^{131\text{m}}\text{Te}$ with neutrons?

7. (10 Points) Provide the main gamma decay energy (from the Chart of the Nuclides) and the gamma decay intensity for the listed energy for the following isotopes.

Isotope	Main gamma decay energy (keV)	Gamma Intensity (%)
^{56}Ni	_____	_____
^{60}Co	_____	_____
^{127}Sb	_____	_____
^{183}Re	_____	_____
^{241}Am	_____	_____
^{128}Cd	_____	_____

8. (5 Points) Where was the location of the first man-made reactor, when was it made, who was the primary investigator, and what were some of the reactor characteristics?

8.1. Reactor Location _____

8.2. Primary Investigator _____

8.3. Reactor Characteristics

9. (5 Points) How were Es and Fm first produced and identified?

10. (10 Points) Provide the spin, parity, decay mode, energy from decay and half-life for the isotopes below

Isotope	Spin	Parity	Decay Mode	Energy from Decay (MeV)	Half-life
^{208}Pb	_____	_____	_____	_____	_____
^{104}Rh	_____	_____	_____	_____	_____
$^{99\text{m}}\text{Tc}$	_____	_____	_____	_____	_____
$^{148\text{m}}\text{Pm}$	_____	_____	_____	_____	_____
^{162}Dy	_____	_____	_____	_____	_____
^{256}Fm	_____	_____	_____	_____	_____
$^{195\text{m}}\text{Hg}$	_____	_____	_____	_____	_____
$^{200\text{m}}\text{Au}$	_____	_____	_____	_____	_____
^{111}In	_____	_____	_____	_____	_____

11. (10 Points) Provide the number of naturally occurring isotopes for the elements below. This includes long lived radioactive isotopes with a half-life greater than 5E8 years.

Element	Number of Stable Isotopes
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Re	_____
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V	_____
---	-------

K	_____
---	-------

La	_____
----	-------

Sn	_____
----	-------

Sb	_____
----	-------

In	_____
----	-------

H	_____
---	-------

Pm	_____
----	-------

Lr	_____
----	-------

Ni	_____
----	-------

Tc	_____
----	-------

Eu	_____
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