Nuclear Physics Name _____

A.1

Gold, silver, and carbon are all examples of elements. They are listed on the periodic table of elements. If you had a golden ring and an amazing machine, you could break it down into tiny pieces called atoms.

Isotope	**Atomic Symbol**	**Number of Protons**	**Number of Neutrons**
Uranium-238	U	92	146
Radium-226	Ra	88	138
Lead-206	Pb	82	124
Hydrogen-3	H	1	2
Sodium-22	Na	11	11
Argon-39	Ar	18	21
Radon-222	Rn	86	136
Carbon-12	C	6	6
Carbon-13	C	6	7
Carbon-14	C	6	8

Carbon-12, Carbon-13, and Carbon-14 are all different isotopes of carbon.

B.1. $^{23}_{11}\mathrm{Na}$

B.2. $^{16}_{8}\mathrm{O}$

B.3. $^{1}_{1}\mathrm{H}$

B.4. $^{124}_{52}\mathrm{Te}$

B.5. $^{40}_{18}\mathrm{Ar}$

Nucleus	Element	Number of Protons	Number of Neutrons
$^{14}_{7}\mathrm{N}$	Nitrogen	7	7
$^{1}_{1}\mathrm{H}$	Hydrogen	1	0
$^{222}_{86}\mathrm{Rn}$	Radon	86	136
$^{238}_{92}\mathrm{U}$	Uranium	92	146
$^{14}_{6}\mathrm{C}$	Carbon	6	8

C.1 $^{238}_{92}\mathrm{U} \rightarrow {}^{234}_{90}\mathrm{Th} + {}^{4}_{2}\mathrm{He}$

C.2 $^{222}_{88}\mathrm{Ra} \rightarrow {}^{218}_{86}\mathrm{Rn} + {}^{4}_{2}\mathrm{He}$

C.3 $^{208}_{84}\mathrm{Po} \rightarrow {}^{204}_{82}\mathrm{Pb} + {}^{4}_{2}\mathrm{He}$

D.1 gamma ray

D.2 alpha particle

D.3 beta particle

D.4 beta particle

D.5 alpha particle

D.6 alpha particle

D.7 beta particle

Draw an alpha decay for each nuclide.

	Nuclide		Decay Reaction
D.8	$^{256}_{103}\text{Lr}$		$^{256}_{103}\text{Lr} \rightarrow {}^{252}_{101}\text{Md} + {}^{4}_{2}\text{He}$
D.9	$^{231}_{91}\text{Pa}$		$^{231}_{91}\text{Pa} \rightarrow {}^{227}_{89}\text{Ac} + {}^{4}_{2}\text{He}$
D.10	$^{225}_{89}\text{Ac}$		$^{225}_{89}\text{Ac} \rightarrow {}^{221}_{87}\text{Fr} + {}^{4}_{2}\text{He}$
D.11	$^{211}_{87}\text{Fr}$		$^{211}_{87}\text{Fr} \rightarrow {}^{207}_{85}\text{At} + {}^{4}_{2}\text{He}$
D.12	$^{185}_{79}\text{Au}$		$^{185}_{79}\text{Au} \rightarrow {}^{181}_{77}\text{Ir} + {}^{4}_{2}\text{He}$

Draw a beta decay of each nuclide

	Nuclide		Decay Reaction
D.13	$^{6}_{2}\text{He}$		$^{6}_{2}\text{He} \rightarrow {}^{6}_{3}\text{Li} + {}^{0}_{-1}\text{e}$
D.14	$^{24}_{11}\text{Na}$		$^{24}_{11}\text{Na} \rightarrow {}^{24}_{12}\text{Mg} + {}^{0}_{-1}\text{e}$
D.15	$^{201}_{79}\text{Au}$		$^{201}_{79}\text{Au} \rightarrow {}^{201}_{80}\text{Hg} + {}^{0}_{-1}\text{e}$
D.16	$^{52}_{26}\text{Fe}$		$^{52}_{26}\text{Fe} \rightarrow {}^{52}_{27}\text{Co} + {}^{0}_{-1}\text{e}$
D.17	$^{42}_{19}\text{K}$		$^{42}_{19}\text{K} \rightarrow {}^{42}_{20}\text{Ca} + {}^{0}_{-1}\text{e}$

Isotope	Atomic Symbol	Number of Protons	Number of Neutrons
Uranium-238			
Radium-226			
Lead-206			
Hydrogen-3			
Sodium-22			
Argon-39			
Radon-222			
Carbon-12			
Carbon-13			
Carbon-14			

Answers;

1. 11
2. 8
3. H
4. 18
5. 7 protons 7 neutrons
6. 1 proton, 0 neutrons
7. 86 protons, 136 neutrons
8. 92 protons, 146 neutrons
9. 6 protons, 8 neutrons
10. $^{234}_{90}\mathrm{Th}$
11. $^{218}_{86}\mathrm{Rn}$
12. $^{204}_{82}\mathrm{Pb}$

first big activity--- determining the number

----- issues that must be corrected::::
- define the term nuclide
- introduce the structure of an atom (again)
- include more conceptual questions on the nature of atoms and nuclides

(I need an assessment for the term isotope)