Name KEY Date _____ Period _____

Study Guide: Quiz 4 – Atomic Structure and Isotopes

Part A: Periodic Table and Atomic Structure

1. Using your periodic table, draw the "box" for **titanium** and include all the information that you can get from the periodic table. **LABEL EVERYTHING!!!**

22
Ti
Titanium
47.90

a. **EXPLAIN how to you calculate the number of**

- protons: 22
- electrons: 22
- neutrons: 48-22=26

2. Fill in the following chart with the missing information

	Charge	Location	Approximate Mass
Protons	+	nucleus	1
Neutrons	0	nucleus	1
Electrons	−	outside nucleus	0

3. Complete the following table for neutral atoms using your periodic table:

Element Name	Symbol	Atomic Number	Atomic Mass	Number of Protons	Number of Electrons	Number of Neutrons
Hydrogen	H	1	1	1	1	0
Nitrogen	N	7	14	7	7	7
Zinc	Zn	30	65	30	30	35
Sulfur	S	16	32	16	16	16
Chlorine	Cl	17	35	17	17	18
Potassium	K	19	39	19	19	20
Cobalt	Co	27	59	27	27	32

3. What is the overall charge of the nucleus of an atom? positive

Explain WHY: nucleus has p^+ & n^0 ∴ positive charge

4. What is the overall charge of an atom? neutral

Explain WHY:

an atom has the same # of e^- as p^+ so is neutral.

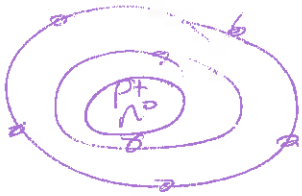
6. Draw a sketch of a carbon atom using a Bohr Model. **MAKE SURE** you include the correct number of subatomic particles based on the periodic table. LABEL ALL THE PARTICLES!!!!!

p^+ = protons
n^0 = neutrons
• = electrons

7. Describe the difference between J.J. Thompsons "plum pudding" model of the atom and Neils Bohr's "solar system" model of the atom.

Plum Pudding

no nucleus
no organization



Bohr

+ nucleus at center.
e^- organized around the outside.

Part B: Isotopes

8. Explain the difference between elements and isotopes in a FULL COMPLETE THOUGHT

an element is a pure substance & the smallest piece of identifiable matter, an isotope is a different structure/form/version of an element (different #s of neutrons)

9. a. Explain how Carbon – 12, Carbon – 13, and Carbon – 14 are the SAME (Be specific):

they have the same # of p^+ & e^-

b. Explain how they are DIFFERENT (Be specific):

they have different # of n^0

10. Give the number of protons, neutrons, and electrons using the following atomic symbols:

$^{14}_{6}C$	P^+ 6	N^0 8	e^- 6
$^{37}_{17}Cl$	P^+ 17	N^0 20	e^- 17
$^{238}_{92}U$	P^+ 92	N^0 146	e^- 92
$^{235}_{92}U$	P^+ 92	N^0 143	e^- 92
$^{17}_{8}O$	P^+ 8	N^0 9	e^- 8
$^{3}_{1}H$	P^+ 1	N^0 2	e^- 1

11. What is the difference between the average atomic mass given on the periodic table and the mass of an atom? the mass of one atom depends on the number of p^+ & n^0 it has. the average atomic mass is the average of the masses of all the isotopes of the element.

12. An alien element from the universe Zorg, has two isotopes ^{28}Q and ^{30}Q. Its average atomic mass is 28.98. Which isotope is more abundant?

^{28}Q : WHY? – average is closest to it.

13. There are two different isotopes of copper. The isotope names and symbols are given below:

$^{63}_{29}$ Cu (Copper-63) and $^{65}_{29}C$ (Copper-65)

a. Explain why both symbols have 29 as the bottom number:

Copper always has 29 protons.

b. Explain how the two isotopes are different from each other: one has 34 n° the other has 36 n°

c. Scientists have found the natural abundance of each isotope: 69% copper-63 and 31% copper-65. Calculate the average atomic mass based on this data. SHOW YOUR WORK!!!!!!!

Avg = (0.69)(63) + (0.31)(65) = 63.62

d. What if in the universe of Zorg, these isotopes were found in equal percentages. What would the average atomic mass be? WHY?

$\frac{63+65}{2} = 64$

17. What is a radioactive isotope? What does radioactive decay mean? AND GIVE THREE EXAMPLES of radioactive isotopes:

a radioactive isotope is unstable. radioactive decay is the process of emiting radiation & becoming a stable isotope.

$^{227}_{89}Ac$, $^{239}_{90}Th$, $^{238}_{92}U$

18. What is a stable isotope?

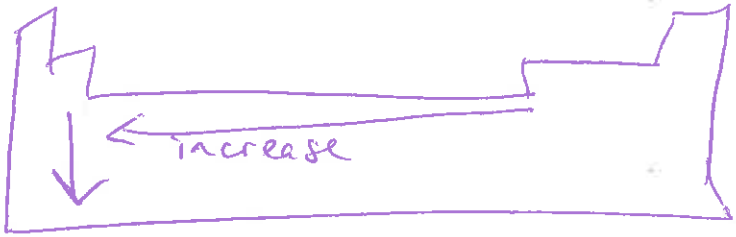
one in which the # of p^+ & n^0 in the nucleus are stable & not radioactive.

19. Draw a quick picture of the periodic table and add arrows and lables showing the trend for:

a. ionization energy

b. electronegativity

c. atomic radius



20. Describe the trend for ionic radius.

Atom → cation

the more positive a cation the smaller it will be

atom → anion

the more negative the anion the larger it will be.

Table 2: Common Radioactive half-lives, their daughter isotopes.

Parents	Daughter	Half-life
Carbon-14	Nitrogen-14	5730 years
Uranium-235	Lead-207	704 million years
Uranium-238	Lead-206	4,470 million years
Potassium-40	Argon-40	1,280 million years
Thorium-232	Lead-208	14,010 million years
Rubidium-87	Strontium-87	48,800 million years

Total Time = Number of Half-lives × Time for one Half-life

SHOW YOUR WORK !!!

1. A rock contains 25% of its parent material. How many half-lives have passed?

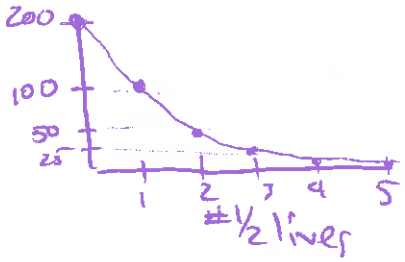
100% → 50% → 25%
1½life 2½life

2

3. A fossilized tree originally containing 200 grams of Carbon-14 now only contains 25 grams of Carbon-14.

a. How many half-lives have passed?

3



b. How many years did this take?

3(5730yrs) = 17190yrs

4. One of the oldest rocks on Earth was found to contain half of the original amount of Uranium-238.

a. How old is the rock? 1 ½ life U-238

4,470 my

b. If this rock is the same age as the earth itself, how old is the earth? 4,470 my

Nuclear Reactions.

1) $^{241}_{95}Am \rightarrow ^{237}_{93}Np + \alpha$ type of decay: Alpha

2) $^{234}_{90}Th \rightarrow ^{234}_{91}Pa + \beta$ type of decay: Beta

3) $^{3}_{1}H \rightarrow ^{3}_{2}He + \beta$ type of decay: Beta

4) $^{12}_{6}C \rightarrow ^{4}_{2}He + ^{8}_{4}Be$ type of decay: Alpha