

Nuclear Notes

1. Nuclear Chem is about the _____, not the _____.
2. The _____ NUMBER is the number of _____.
3. Atomic MASS in high school is measured in _____, and since each proton and each neutron has mass of 1 AMU each,
the atomic mass = the number of protons PLUS neutrons (in AMU)

4. Example...

Mercury has mass

5. If you are an atom with 12 protons, you MUST be _____.
6. If you have 29 protons, you're _____.
7. With exactly 92 protons, your name is _____.
8. Every atom has a certain number of neutrons, but there are many _____.
9. Isotopes are atoms with the same number of protons but a different number of _____.
10. How many protons, neutrons and electrons are in lithium from the Periodic table?

11. Determine protons, neutrons and electron count for C-12 & C-14 (radioactive carbon)

12. Determine protons, neutrons and electron count for P-31 & P-30 (radioactive phosphorous)

13. ☺

14. Of the 118 known elements, there are about 1500 known ISOTOPES. There are 3 different isotopes of even tiny HYDROGEN. Every atom has _____.

15. Of these 1500 isotopes, about _____ of them are _____.

16. Stable means that the _____ falls into a “zone of stability”.

17. About _____ isotopes are UNSTABLE. Their $n^{\circ} : p^{+}$ ratio is funky, and they need to FIX this ratio to become stable.

18. FIXING this neutron to proton ratio means they will _____, parts of their nucleus.

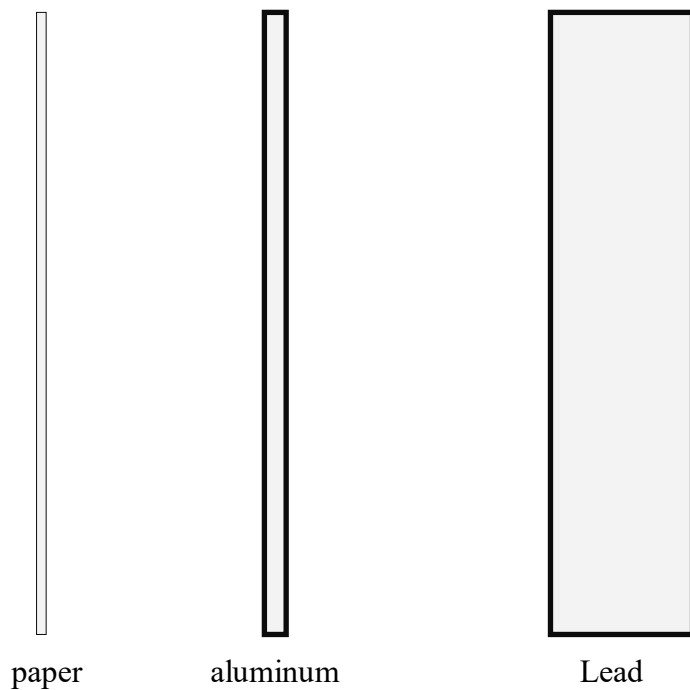
19. Emitting radiation means emitting a variety of nuclear particles and/or energy, which will change _____ ratio.

20. The Neutron to Proton Ratios for Small atoms: is about: _____, and fo

Larger atoms it's about _____

21. Table O	Mass	Charge	Symbols	Penetrating power
ALPHA				
BETA				
GAMMA				
NEUTRON				
PROTON				
POSITRON				

22. Can you be protected from RADIATION? What stops different kinds of radiation? (draw)



23. What can stop neutrons? _____

24. What stops gamma radiation? _____

Ionizing power means that the radiation has sufficient energy to shake loose electrons from atoms, turning them into ions. That makes them susceptible to reacting or dissolving into water, disrupting the biochemistry that was normal in the body just previously. (it's generally bad for the body)

25. _____ is emitted by unstable isotopes in an attempt to obtain a more stable neutron to proton ratio in the nucleus.

26. Emitting different types of radiation changes that _____ in different ways.

27. Some isotopes make _____, or emit radiation once, and they become stable.

28. Some isotopes make two or more different radioactive particle emissions before they get stable.

29. The types of emissions, and the amount of time it takes is very well known to scientists.

30. Nothing can _____ this process, or _____ down.

31. It happens on its own, _____.

32. When a nucleus emits radiation, and changes its neutron to proton ratio, it "becomes" a different kind of atom, it _____ into a new type of atom.

33. This process is called NATURAL TRANSMUTATION, or _____.

34. Unstable radioisotope nuclei literally spit out parts of themselves, to change the ratio of n° : p^{+} in their nuclei, to get stable.

35. Doing this changes them from one kind of an atom to another, which is called transmutation.

36. ^{238}U is really...

A lot of things just happened, let's look at them all.

Radioactive U-238 emits a beta particle in an attempt to _____.

With 2 less p^+ , and 2 less n^0 , the uranium has _____ into thorium-234

The numbers on the top make sense: _____

The numbers on the bottom make sense too: _____

This is called natural transmutation, or alpha decay, or slightly more vaguely, a type of

_____.

38. Write the decay equation for C-14

39. C-14 emits...

40. Determine the decay mode for Ca-37, then write the decay reaction for calcium 37.

41. Radioactive Ca-37 emitted...

write out these three decay equations

42.

43.

44.

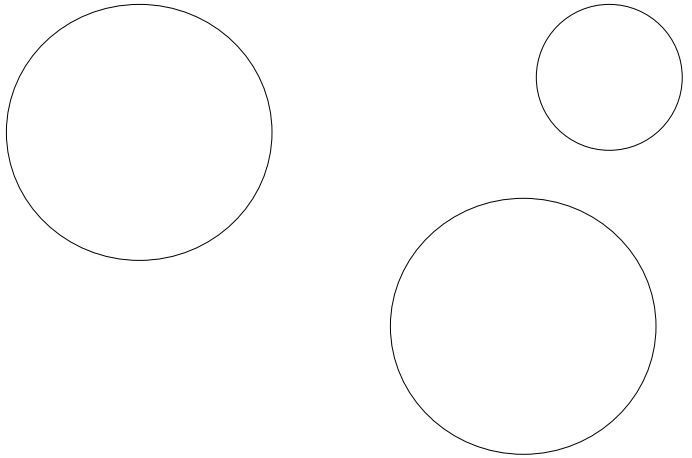
Write out these three (more) decay equations

45.

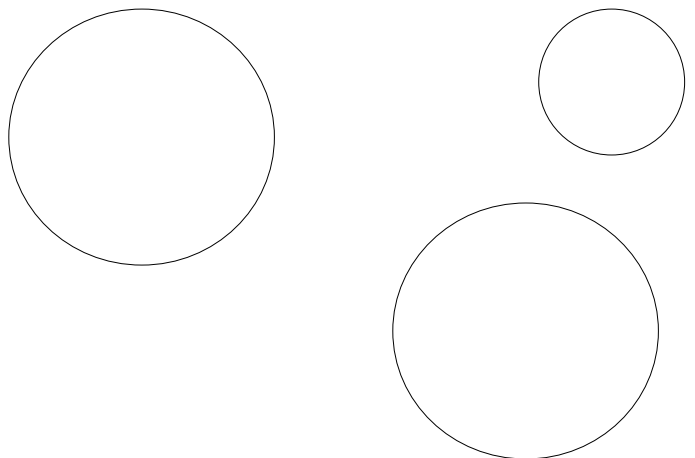
46.

47.

48. Explain what beta decay is...



49. Explain what positron decay is...



50. A half life is...

	Nuclide	Half Life	Units mean
51	Au-198		
52	Carbon-14		
53	Calcium-37		
54	U-238		
55	Plutonium-239		

56. The half life of radioactive gold-198 is 2.695 days. That means... (draw the whole T-chart)

57. Wait for the BLUE text on the next slide to put UNDER the t-chart

58. You accumulate 22.0 grams of the radioisotope carbon-14. How long before only 5.50 grams of the C-14 remains unchanged?
59. The doctor wants to inject you with some radioactive I-131 to measure your thyroid uptake. She injects you with 2.00 grams. How long until you have just 0.125 g left in you?
60. You put 400.0 grams of Fe-53 in your pocket. How long until you have 12.5 grams of this iron left? What has the other 387.5 grams become?

OLD REGENTS QUESTIONS

61. If a scientist purifies 1.0 gram of radium-226, how many years must pass before only 0.50 gram of the original radium-226 sample remains unchanged?
62. Based on Reference Table N, what fraction of a radioactive Sr-90 sample would remain unchanged after 58.2 years?
1. $\frac{1}{2}$ 2. $\frac{1}{4}$ 3. $\frac{1}{8}$ 4. $\frac{1}{16}$
63. What is the half-life and decay mode of Rn-222?
1. 1.910 days, alpha decay 2. 1.910 days, beta decay 3. 3.823 days, alpha decay 4. 3.823 days, beta decay
64. What is the half-life of Na-25 if 1.00 gram of a 16.00-gram sample of sodium-25 remains unchanged after 237 sec?
1. 47.4 s 2. 59.3 s 3. 79.0 s 4. 118 s

Write out These three are all decay reactions... all are natural transmutations.

65.

66.

67.

68. Artificial transmutation...

Write out all of the artificial transmutation equation and the text.

69.

70.

71.

72. _____ which means...

In a “_____” like the splitting of U-235 by inserting a neutron into it, causes the SPLITTING of the Uranium-236 atom into Kr, Ba, and 3 more neutrons.

These 3 neutrons...

Each cycle releases...

73. The splitting of atoms by artificial...

74

MASS DEFECT is....

Copy the “top” fission reaction.

75. In a fission reaction, a larger nucleus is bombarded, usually by neutrons, which forms an even larger and much more unstable nucleus which splits apart

(the splitting of the atom is called _____). This is NOT NATURAL, it was forced by a scientist. It is one kind of artificial transmutation.

76. The daughter nuclei that form are usually radioactive as well, and will undergo

_____ themselves.

77. In addition, extra neutrons are released, along with energy. The extra neutrons will crash into other larger nuclei, setting off a bigger reaction than that _____.

78. That repeats, and even more neutrons are released, making the _____ larger and more energetic.

79. If sufficient fuel is available, the cycles get bigger and bigger, releasing more & more energy per cycle, until a _____ (nuclear bomb level) occurs.

80. In a nuclear power plant, this reaction can be _____, and slowed down, so that the explosion is much smaller, but lasts for years at a time, generating heat to make _____ . In a bomb, all of the energy can be released in a few seconds.

81. Another type of artificial transmutation reaction is _____.

82. It's the squishing together of smaller atoms and making larger ones. There is a loss of energy during this process as well called _____, and fusion releases even more energy than fission reactions.

83. The _____ is powered by _____

write out these two fusion reaction:

On the Sun:

On Earth:

86.

87. How does a power plant make electricity?

88. How does a nuclear power plant work?

89. There are a fair number of steps listed here, please know them all.

Draw a nuclear power plant schematic diagram. Go back through the slides to get more details.

90. List some “pros” for nuclear power

91. List some “cons” for nuclear power

92. Where do we store “hot” nuclear waste now?

93. How does radioactive carbon-14 dating work?
First, show the equation of how C-14 is formed

94. What kind of animal doesn't eat? Why does this affect the C-14 level?

95. The longer that animal is...

Draw that graph, with X and Y labels.



96. What about the LaBrea Tar Pits near Los Angeles?

Nuclear Medicine....

97.

98.