**Summative 3.1, 3.4, 3.5 Study Guide – Isotopes, Radioactivity & Half-Lives**

**Learning Target 3.1**

1. Complete the table for the following ISOTOPES.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Element | Hyphen Notation | Atomic # | Atomic Mass | # protons | # neutrons | # electrons | Nuclear Symbol  |
|  |  | 23 |  |  |  |  |  |
|  | Vanadium-52 |  |  |  |  |  |  |
|  |  |  |  |  |  |  | $\begin{matrix}209\\82\end{matrix}$Pb |
|  |  |  |  |  | 62 | 47 |  |

**Learning Target 3.4**

1. Define Radioactivity.
2. There are 4 types of radioactive decay – you need to memorize the particles! Describe the mass, charge, actual identity, and relative penetration power of the following radioactive particles:
	1. Alpha particles
	2. Beta particles
	3. Gamma particles
	4. Positron particles
3. *For the following problems – write out the entire decay equation.*
	1. Alpha emission by plutonium-239, one of the substances formed in nuclear power plants.
	2. Beta decay by sodium-24, used to detect blood clots
	3. Oxygen-15 undergoes positron emission, used to assess the efficiency of the lungs.
	4. Carbon-14 emits beta particles.
	5. Thorium-232 goes through alpha decay.
	6. Radium-226 emits gamma and alpha particles.
	7. Chlorine-36 undergoes positron emission.
	8. Argon-37 **is produced** by beta decay.
	9. Fermium-257 **is formed** by alpha and gamma emission.
	10. An isotope of rhenium-188 undergoes alpha decay.
	11. A radioactive isotope undergoes beta and gamma decay to produce Chlorine-36.
	12. Radium-226 goes through decay to produce Radon-222.
	13. Lead-208 emits a positron to produce a stable isotope.

**Learning Target 3.5**

*For the following half-life problems, show all work, include units & round appropriately!*

1. One of the radioactive nuclides formed in nuclear power plants is hydrogen-3, called tritium, which has a half-life of 12.26 years. How long before a sample decreases to 1/8 of its original amount?
2. Uranium-238 is one of the radioactive nuclides sometimes found in soil. It has a half-life of 454 years. What percentage of a sample is left after 2270 years?
3. Cesium-133, which is used in radiation therapy, has a half-life of 30 years. What was the size of the original sample if after 120 years you now have 16.0 grams?
4. Phosphorus-32, which is used for leukemia therapy, has decayed to 1/16th of its original amount in 42.9 days. What is the half-life of phosphorous-32?
5. Iodine has a half-life of 8.07 days. Assuming you start with 90.5 grams, how much of the sample (**in mg**) would you have left after 24.21 days?