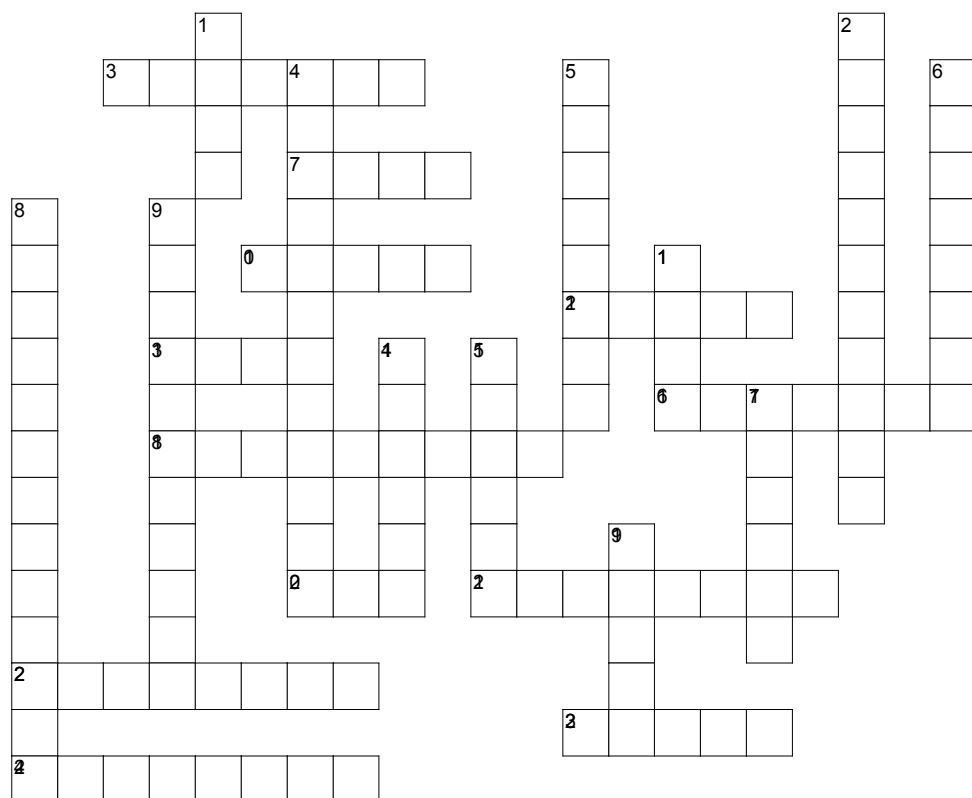


Across

- 3 A nuclear ____ controls fission chain reactions to produce useable energy
- 7 One danger of nuclear reactors is the breakdown of cooling systems to allow ____ - down.
- 10 ____ nuclei, with mass numbers over 82, are always unstable.
- 12 reaction occurring when neutrons produced in fission reaction strike other nuclei



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- 13 electron emitted when neutron changes into proton in nucleus
- 16 splitting of a heavy nucleus
- 18 When electrical ____ between protons is greater than strong forces, the nucleus will be unstable.
- 20 Fusion occurs on the -
- 21 protons and neutrons
- 22 atoms of the same element with different masses
- 23 emission with no mass or charge
- 24 nuclear bullets used in fission reactions

Down

- 1 The nucleus makes up almost all the ____ of the atom.
- 2 Unstable nuclei are -
- 4 Fusion reactions only occur at extremely high -
- 5 Minimum mass required for chain fission reaction is ____ mass.
- 6 the fuel for fusion reactions
- 8 changing into another element through radioactive decay
- 9 Man-made elements are by ____ of an isotope with nuclear "bullets".
- 11 The time it takes half the mass of a radioactive isotope to decay is called ____ life.
- 14 combination of two nuclei into one
- 15 Large nuclei need a neutron to ____ ratio of over 1:1 to be stable.
- 17 force of attraction between nearest neighbor nucleons
- 19 emitted particle identical to helium nucleus

Matching: *Answers can be used more than once.*

- | | |
|---|------------|
| _____ 1. can penetrate paper, but not thick aluminum | a. alpha |
| _____ 2. can penetrate thick aluminum, but not concrete | b. beta |
| _____ 3. cannot penetrate paper | c. gamma |
| _____ 4. ${}^4_2\text{He}$ | d. neutron |
| _____ 5. ${}^0_{-1}\text{e}$ | e. proton |
| _____ 6. Z number of an element is number of these | |
| _____ 7. a reactant and a product of nuclear fission | |
| _____ 8. repel each other in the nucleus | |
| _____ 9. has no mass and no charge | |
| _____ 10. 2 isotopes of same element have number of these in common | |
| _____ 11. 2 isotopes of same element have different number of these | |

Complete these reaction equations, using the periodic table to identify any elements:

