

Exercises for Unit 7: Astrophysics

Lesson 1: Particle Physics Exercises

1. All visible matter is made up of...?
2. What is a quark?
3. What's the charge on an electron, proton, and neutron?
4. What keeps the quarks together inside a proton?
5. Are free neutrons or protons more stable?
6. What forces are the 79 protons together inside a gold atom feeling?
7. Why does an electron stick around to orbit a nucleus?
8. Where can you find anti-matter on Earth?
9. What's the difference between fusion and fission?
10. Where can you find radiation?

Answers to Particle Physics Exercises

1. All visible matter is made up of electrons, protons and neutrons.
2. A quark makes up the nucleus of an atom. A proton is made up of two up quarks and one down quark. A neutron is made up of one up quark and two down quarks.
3. An electron has a negative charge, a proton has a positive charge, and a neutron has no charge.
4. The gluons hold the quarks together to form neutrons and protons.
5. Free neutrons flip into a more stable proton within 15 minutes.
6. The protons are feeling an electromagnetic 'repulsive push' force, as they are all the same charge. (Think of how two north sides of a magnet don't like each other.) However, the residual strong force is much stronger at the atomic scale and overcomes the repulsive force and pions bind the protons together.
7. An electron has a negative charge, which is attracted to the positive charge of the protons inside the nucleus.
8. A PET scan is a way of imaging using positrons. Patients ingest anti-matter and a machine takes pictures of the puffs of energy given off by the colliding matter (electrons) and anti-matter (positrons).
9. Fission is splitting atoms apart, and fusion is smooshing them together. An atomic bomb uses fission, and the sun uses fusion.
10. When an atom spontaneously undergoes fission (splitting), it's called fission. Uranium 235 is an example of an element that does this.