# THE SOURCE Workbook



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# The Source Workbook - Answers



# Chapter 3 – DESIGN IN THE CHEMISTRY OF MATTER

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**q-31. What is matter?**

By "matter" we mean atoms and molecules, the forces binding them together, and the laws governing their interactions. However, we should understand that in physics, there is no broad consensus as to an exact definition of matter. Physicists generally do not use the word when precision is needed, preferring instead to speak of the more clearly defined concepts of mass, *invariant mass, energy and particles. See also comments on Page 6; Question 1 (q-6.1d).

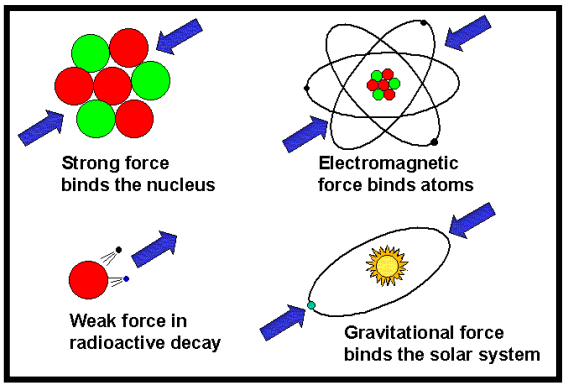


**Figure 3.1:** The "four forces" illustrated.

* ***Invariant*** — Adjective: 1. Unaffected by a designated operation or transformation. 2. Persistent in occurrence and unvarying in nature. Synonyms— changeless; constant; unvarying.

**q-31.2 For simplicity's sake, what can we say composes matter?**

Matter is composed of atoms made up principally of electrons, protons and neutrons. However, these components are themselves composed of even smaller units.

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**q-32.1 What do we call each of the four forces that bind everything together?**

1- The strong force. 2- The weak force. 3- The electromagnetic Force. 4- Gravity. **See Figure 3.1.**

**q-32.2 What is the "strong force," and why is it important?**

The strong force is the atomic glue of the universe. This is the force that holds the atomic nucleus together but doesn't extend any further. The strong force is important because if it were only slightly stronger or weaker, all atoms would either clump together or fly apart.

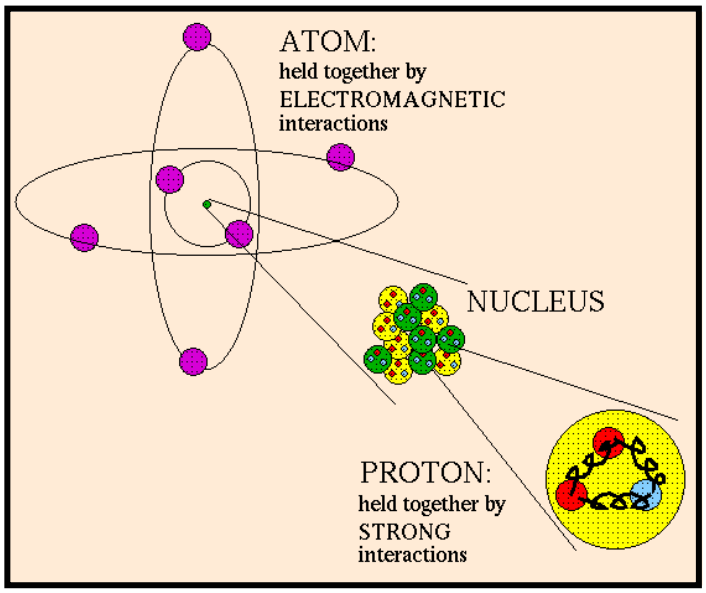


**Figure 3.2:** Simple Illustration of an Atom.

**q-32.3 What does the "weak force" do?**

The weak force also operates within the nucleus of the atom but over even shorter distances than the strong force. It is called "weak" because its field strength is about 10^13 (1 followed by 13 zeros) times less than that of the strong force. When, through normal energetic movements, the particle to particle distance-limit is momentarily exceeded, the already weak binding force instantly reduces even more, allowing the nucleus to lose one of its subatomic components. It is this instability due to the weak force that causes a radioactive Carbon 14 atom to randomly change back into a Nitrogen 14 atom, by encouraging a single neutron to convert into a proton due to the loss of a high energy electron and an antineutrino. This is called "beta decay." " The number of

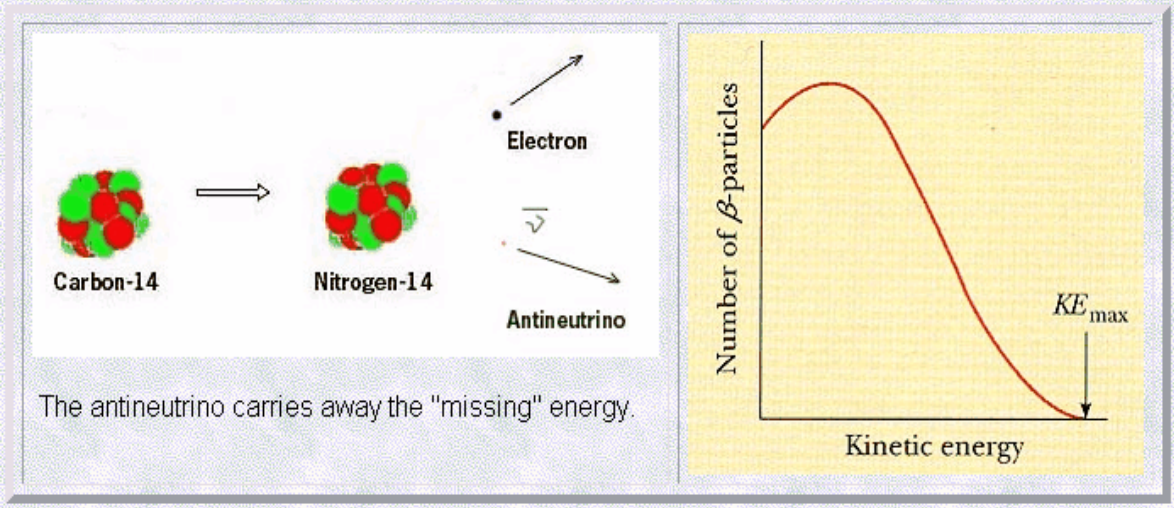


**Figure 3.3:** One half of the Carbon-14 atoms transforms into Nitrogen-14 every 5,730

protons in the nucleus identifies the element and the number of neutrons and protons determines the same element's isotope number. When the number of protons and neutrons differ, an element can become unstable due to random variations in the weak force. The unstable carbon-14 nucleus has 6 protons and 8 neutrons (6 + 8 = C-14) and the stable Nitrogen 14 nucleus has 7 protons and 7 neutrons (7 + 7 = N-14). This feature makes C-14 a good dating isotope. With the exception of hydrogen atoms, which contain only a single-proton, the nucleus of all other atoms are made up of both neutrons and protons.

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**q-33.1 What important thing does the electromagnetic (EM) force do?**

Since unlike charges attract, the electromagnetic force keeps the negatively charged electron orbiting around the positively charged atomic nucleus. Like the strong force, if the EM force was just slightly greater or weaker, electrons would not stay in their orbits and all atoms would cease to exist in a functional way.

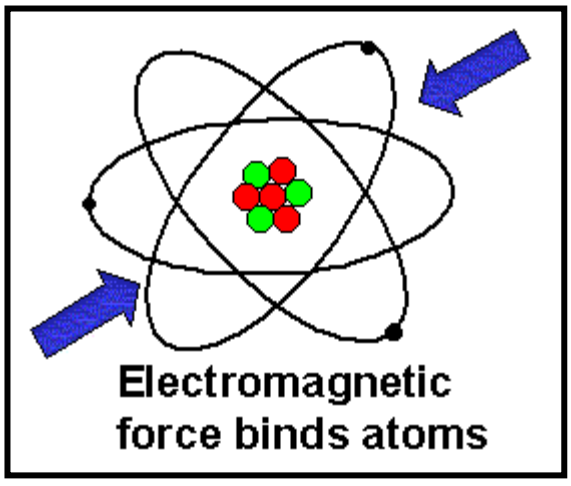


**Figure 3.4:** Electromagnetic force

**q-33.2 What regulates the force of gravity?**

The gravitational attractive force is regulated by the inverse square of the distance between two

body masses. The inverse distance term is defined as the fraction created by dividing the square of the distance into the number 1 or (1/distance^2). The greater the distance, the smaller the inverse ratio i.e. 1/[4^2] is much smaller than 1/[2^2].

That explains why the pull of gravity weakens rather quickly as you travel away from the earth. Another factor affecting gravity is the relative masses of the two bodies. Because of this relationship, planet bodies with less mass than the earth, like Mars and the Moon, will have weaker gravitational force fields at their surface.

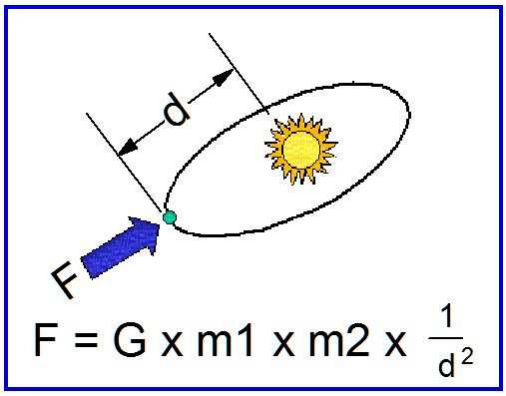


**Figure 3.5:** Distance squared regulates gravity's force.

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**q-34.1 Why doesn't gravity clump everything back together again?**

Because universal expansion exactly balances the force of gravity.

**q-34.2 What is the "unified force" theory?**

Immediately before the "Big bang" expansion began when all matter was compressed into what we have defined as a "singularity," the four fundamental forces were believed to have been "unified" into one "super force." Interestingly, during the last 30 years of his life, Einstein unsuccessfully tried to develop a "unified force theory" based upon this idea. However, with the development of quantum theory (QT) and the discovery of many new subatomic particles, it looked as if relativity and classical physics would not be robust enough to solve the force unification problem. Because Einstein didn't believe in the uncertainty and probabilistic aspects of QT, he all but wasted those final 30 years of his life, scientifically speaking. In 1905 Einstein made significant scientific contributions with regard to the "quantum theory of light." Nevertheless, after the year 1926, he let his somewhat famous edict that "God does not play dice" with reality isolate him from mainstream physics. From 1926 on, Einstein didn't make any significant contribution to science beyond what he had already accomplished. Einstein's experience should be a lesson for us all. We may interpret the Bible in a way that causes us to "assume" what God has or has not done. However, we should never allow our Biblical interpretation or anyone else's, to contradict what science has reasonably proven to be true.

**q-34.3 Of what is a neutron made?**

Simply stated, neutrons can be said to be made up of an electron and proton compressed together. Actually, however, the neutron is more complicated than that. It is really made up of three quarks, and therefore belongs to what is called the baryon group of the hadrons. When situated outside of an atomic nucleus, a free neutron is unstable, decaying with a half-life of 11.6 minutes into a proton, an electron, and an antineutrino. As already stated in q-32.3, this process is called beta decay.

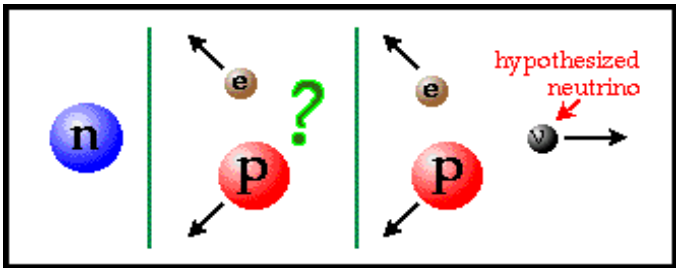


**Figure 3.6:** "n" decomposes to "p" + "e" + "v"

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**q-35.1 In what ways does the development of the universe resemble the development of an Egyptian pyramid?**

The development of the universe over the last 13.7 billion years is very precise and follows a clearly defined timeline. An Egyptian pyramid follows a similar but vastly shorter timeline. Neither of these constructions are in any way "random." Both are the result of careful design and execution.

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**q-36.1 How many other finely-tuned events and characteristics had to occur to make our existence possible?**

As of the year 1999, there were at least 28 known characteristics that required very precise relationships for our existence to have occurred. Many of these and more are listed on Hugh Ross's website. (http://www.reasons.org/)

**q-36.2 What is illustrated by the properties of the water molecule?**

The water molecule illustrates the perfect balance of natural forces that testifies to the existence of a designer God.

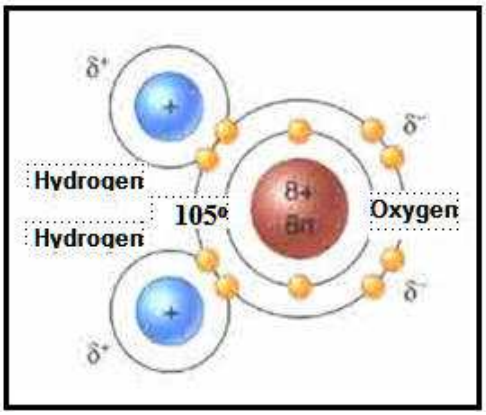


**Figure 3.7:** 105° angle in water molecule.

**q-36.3 In the water molecule, what causes the 105-degree angle between the two hydrogen atoms to develop?**

This asymmetrical arrangement is caused because of the difference in size between the hydrogen and oxygen atoms. The greater mass of the oxygen atom causes it to share electrons from both of the hydrogen atoms, which creates an imbalance of force that results in the 105-degree angle shown in Figure 3.7 and 3.8.

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**q-37.1 What is the arrangement of atoms in the water molecule called, and why is it important?**

The distribution of atoms within the water molecule is called a "polar arrangement." This name comes from the concept of "polarization," which means "to cause to concentrate about two conflicting or contrasting positions." Polarization results in the water molecule displaying an asymmetric attraction feature because one of its ends is positively charged, with the other end being negatively charged, as shown in Figure 3.8.

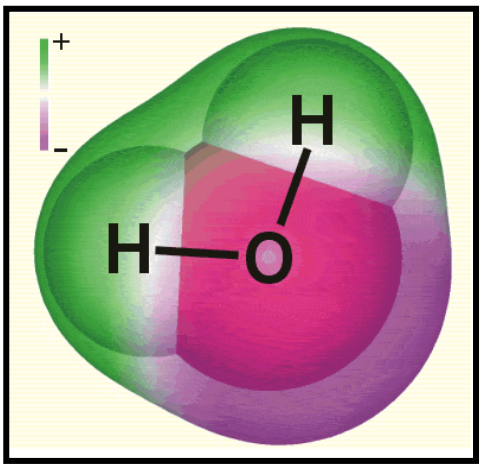


**Figure 3.8:** Plus and minus polarity of water.

This arrangement enables the water molecules to literally tear *solute molecules into separate parts and then

surround the individual parts and carry them away. This happens when a solute molecule is attracted to the ends of the water molecules with the same charge. At the same time oppositely charged ends of other water molecules are pulling the solute in another direction until it rips apart. This unusual asymmetry makes water a very versatile solvent. In general, solvents are known for their ability to dissolve things by dismantling them.

* ***Solute*** **(solyoot) -** 1. The dissolved substance in a solution; the component of a solution that changes its state. With these properties in mind, it should be no surprise to us that God instructed the Israelites to purify things by washing them in water. Because He created water, God knows about its unique ability to clean things. It is significant that the term "wash" and "water" are found together in 21 verses of the Bible book of Leviticus. Here water is always used within the context of washing to stand purified before God and the members of the nation of Israel.

*Leviticus 17:15-16: And every soul that eateth that which died of itself, or that which was torn with beasts, whether it be one of your own country, or a stranger, he shall both wash his clothes, and bathe himself in water, and be unclean until the even: then shall he be clean. (16) But if he wash them not, nor bathe his flesh; then he shall bear his iniquity.*

It is also equally significant that God used Jesus to identify baptism in water as a physical demonstration before witnesses that one can now stand before God as a purified, adopted son or daughter.

*Acts 2:38: Then Peter said unto them, Repent, and be baptized every one of you in the name of Jesus Christ for the remission of sins, and ye shall receive the gift of the Holy Ghost.*

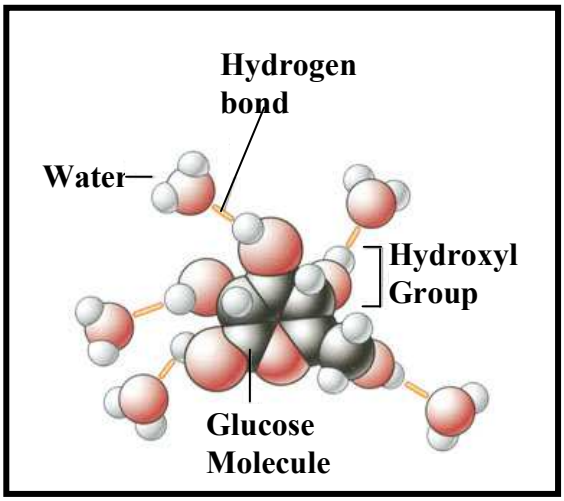


**Figure 3.9:** Water molecules detach a group of Glucose Molecules and then isolate and carry them away in suspension.

**q-37.2 Why is water's dissolving ability important for plants?**

Water extracts various minerals from the ground, suspending them within its liquid matrix. Plants, through their roots, feed on these nutrients dissolved in the water.

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**q-38.1 What is unusual about the way water freezes?**

Water is different from most other liquids when it freezes. Almost everything on earth except freshwater, gets more dense it becomes cold. Take alcohol for instance. If we were to fill up a 1-liter container with pure alcohol at 30 degrees Celsius (86 Fahrenheit) and then take another 1 liter container and fill it with pure alcohol at 10 degrees Celsius (50 Fahrenheit) the cooler container of alcohol would weigh more. This is because the cooler alcohol molecules are packed closer together allowing more of them to fit in the same container. Up to a point, this densification also happens to freshwater as it cools.

However, at about 4 degrees Celsius (40 Fahrenheit) water reaches, on average, its densest state.

Amazingly, as deeper water cools further, it actually becomes less dense or lighter than the water above it. Being less dense, the cooler water slowly begins rising to the surface. If its temperature drops to below freezing, it will rise to the surface more rapidly and turn into ice. When it turns into ice, it becomes like an insulation blanket that shields the water below from the colder air temperatures above. This feature is very important because it protects all things living in water by setting a limit on how cold their environment can ever become. Ice has a stiff crystal-like structure due to cold hydrogen bonding (see Figure 3.10). Liquid water does not have such an orderly stiff structure, because its molecules are free to almost touch one another as shown in the Figure 3.9. Consequently, not only is the ice less dense, it also has more air-trapping voids within its structure that allows it to float like a heavy piece of wood.

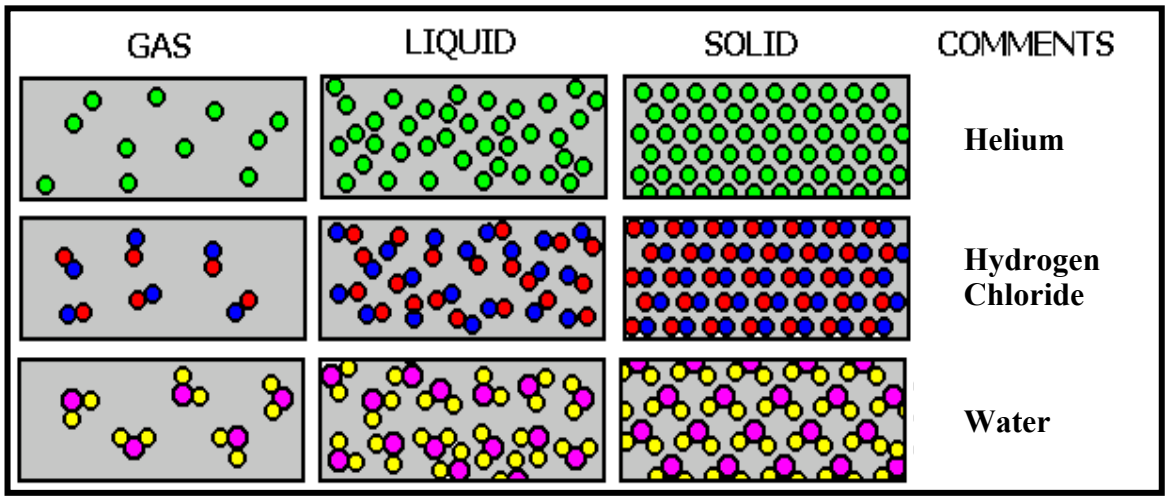


**Figure 3.10:** With the exception of fresh water, all other materials that experience phase changes from gas to a solid, get more dense. Water changing to ice, however, becomes less dense due to the development of an open crystalline structure. The openness is caused by "cold hydrogen bonds" which stop the heavier random molecular movement of the water molecules, as shown above.

q-38.2 What are some of the consequences we would have to deal with if ice didn't float?

The most serious consequence would be that rivers and lakes would freeze from the bottom up, thereby killing most of the animals caught within their icy grip. Rivers frozen solid could no longer transport water as usual, which would cause tremendous flooding in the cold regions, with almost no water reaching the warmer regions during the winter months. In fact, if ice didn't float, life, as we know it, couldn't exist on the earth.

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**q-39.1 What should this brief review of the properties of water teach us?**

It should make us aware of how dependent all life on earth is on such simple things. Whoever would have imagined the benefits we derive from the shape of the water molecule? Is this just a coincidence, or does it teach that God designed the water molecule with us in mind?

## End of Chapter 3

# Natures Four Forces

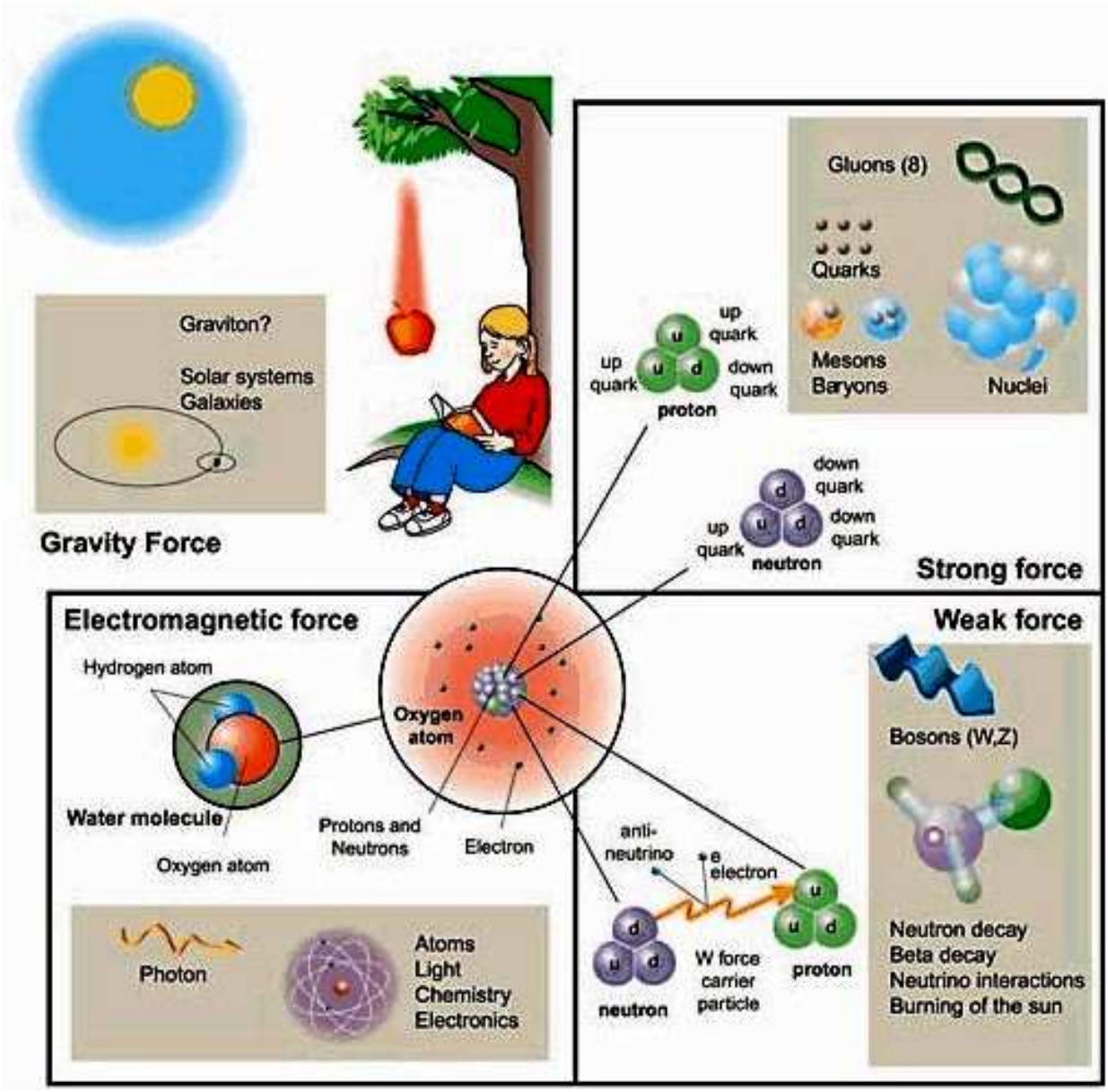


**Figure 3.11:** These are the four forces (interactions) of Nature and their force carrying particles along with their decay particles. The three interactions that govern the micro-cosmos (atomic world) are all much stronger than gravity and have been unified through the Standard Model.