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WHAT WOULD JESUS EXPECT OF A CHEMISTRY TEACHER?

by

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Prepared for the
38th International Faith and Learning Seminar
Held at
Loma Linda University
July 2008

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INTRODUCTION

Soon after I graduated with a Bachelor of Science in Chemistry, I was offered a job in a sugar factory that at that time had top-notch facilities. I felt I had the best that the world could offer. However, within the next two years of my service I realized that the seemingly wonderful material world with all its pleasures blocked the way to eternity. I still vividly remember that one particular night after coming back to my residence from a wild party when I poured out my heart to God, crying, "Please take me out of this place; if you don't, thou art responsible for my lost soul." I tell you, there is peace with the Loving God, for He immediately gave me two important things which I always treasure very much: first, the chance to serve at the institutions where His name is being glorified; second, the chance of baptism and the acceptance of the eternal life through faith in the Lord Jesus Christ. I have then served the Seventh-day Adventist (SDA) Church since 1986 in different capacities and mainly as an educator in the field of natural sciences. In most of these years of service, I did not see myself neither my colleagues very different from the secular science teachers having good moral ethics. However, as I continued to work in one of our SDA universities, I joined some free theological classes that provided me with deeper Bible study and expositions of the Holy Scriptures. Since then I started recognizing the spiritual responsibilities that I need to have in the classes I teach by asking a question, "What would Jesus expect of me?"

As I mentioned above, God has been merciful to me in taking me out of the culture of the secular world. He sent me out expecting me to be a representative of His son Jesus Christ through all the works I do, especially in the Chemistry classes that I teach. Am I doing His will? How do I integrate the faith I have in the Living God as well as His words as they are given in the Holy Scripture with learning and teaching, particularly in Chemistry? For genuine Christians, our Lord Jesus Christ should be our role model. Hence, I ask the following question: Suppose Jesus was given a Chemistry class to teach, what would he do? A Christian teacher in any field may represent the Lord in order to lead his students to eternal life. For He said, "you shall be witnesses to me" (Acts 1:8). "You *are* My witnesses," says the LORD (Isaiah 43:10, 12). Our witness must be true and there is only one truth. In John 14:6 Jesus said, "I am the way, the truth, and the life. No one comes to the Father except through Me." John Huss put it as follows: Seek the truth, Listen to the truth, Teach the truth, Love the truth, abide by the truth, and defend the truth – unto death.[1] Hence, I am motivated to join those who witness the truth about the Living God and strive to do what Jesus told us to do as we read in the Holy Scriptures, therefore, I now write this essay with a title, "WHAT WOULD JESUS EXPECT OF A CHEMISTRY TEACHER?" Imagine, what would happen if all instructors of the truth started asking the same question in their respective classes as they mingle with their students.

Before one asks "What would Jesus expect of me?" one should start with the basic

question, "Who is Jesus?" Is Jesus merely a historical hero, just a good man, a good teacher, or one of the prophets? Or is He the living God, Emanuel God incarnate who came to earth about 2,000 years ago to die for my sins and the sins of all mankind so that all who believe in Him may live for eternity? Jesus Himself asked His disciples this very same question. Why? Because He knew that what they believed about Him would have a significant bearing on how they would live their lives for Him (see Matthew 16:13-17). Likewise, if we believe Jesus for who He claims to be (Son of God in flesh, John 1:1-3) and for what He did on earth (free of condemnation John 3:16 & 17), then we can truly acknowledge Him as our Lord and Savior. He will then come into our lives and reveal Himself to us in Spirit, allowing us to imitate Him and genuinely focus on our responsibilities and ask the question "What would Jesus expect us to do in our classes?"

Chemistry is a broad subject and it is not easy to narrow it down in this essay but the chemistry of a single molecule will be accorded as illustration. Thus a water molecule, H_2O, and its component, namely, hydrogen (H) and oxygen (O) as well as the amazing vast properties of this simple molecule will be addressed. In this essay after presenting the facts about each topic of the chemistry of water, illustrations will be given with an idea of what Jesus would expect me to do if I were to teach this particular subject so that my students could be exposed to the ultimate truth. Before we proceed to this molecule, it is crucial to be introduced to the term Chemistry.

PLANNING FOR THE CHEMISTRY LESSON

Definition of Chemistry

What does Chemistry mean to you? The word chemistry came from the Egyptian word (*keme*) *chem* meaning earth.[2] Classically, about a century ago, chemistry was defined as the science that deals with the nature of matter and its transformations. After Earnest Rutherford and Niels Bohr's discovery of the atomic structure in 1912, and Marie and Pierre Curie's discovery of radioactive molecules, scientists drastically changed their viewpoint on the nature of matter. The experience acquired by chemists was no longer pertinent to the study of the whole nature of matter but only to aspects related to the electron cloud surrounding the atomic nuclei and the movement of the latter in the electric field. Chemistry was therefore re-defined as the science of matter that deals with the composition, structure, and properties of substances and with the transformations that they undergo. However, the meaning of matter used here relates explicitly to substances made of atoms and molecules, disregarding the matter within the atomic nuclei and its nuclear reaction or matter within highly ionized plasmas. On the other hand, the field of chemistry is still, on the human scale, very broad and the claim that chemistry is everywhere is precise.

Chemistry does not answer the questions that deal with what life is about; neither does it consider love for our fellow men nor can it express moral principles. It can explain death as decay of living material but it does not consider what will happen to human beings after death. It is ignorant to the observation that any organism known to us on earth strives to continue to have life and does not want to die or decay. What about other questions like: Are there living things in

other places besides this earth and if so, can we communicate with them? Is there such a thing as a non-decaying world and a living Creator God? Yes, the omnipotent, merciful and loving God is a living God and is still in control of all the activities of the universe. He is the God who created the heaven and the earth (Genesis 1:1) and true science can only declare the glory (Psalms 19:1) of His creating as well as His saving power in harmony with the word of God (the Bible). A Christian Chemistry teacher has an obligation to declare the handiwork of God as seen in chemistry as well as to declare the saving power of God. God is dealing with this world through His son, Jesus Christ our redeemer, whose mission and compassion is to save souls. For it is written, "For God so loved the world that He gave His only begotten Son, that whoever believes in Him should not perish but have everlasting life," (John 3:16).

Now that we have dealt with the definition of chemistry and what a Chemistry teacher deals with, I am wondering what Jesus Christ would do if He were assigned to teach a Chemistry class and asked to teach about the composition and properties of water. Here I will try to present the facts as we learn some chemistry through the understanding of the properties of water, and then write the spiritual lessons or illustrations that can be reflected upon by Christian teacher as they ask themselves, "What would Jesus want the teacher to do in this lesson?" First, we will deal with the definition and the elemental composition of water and see how these elements interact chemically with each other in order for them to form water. Second, we will analyze in detail the physical and chemical properties of water and in parallel try to draw spiritual lessons out of these properties. That, I believe, will help us to integrate faith and learning.

Characteristics of Water and its Chemical Bonds

Definition of water

Water (H_2O), simply defined as a clear, colorless, odorless, and tasteless liquid, is essential for plant and animal life and the most widely used of all solvents. Some of its characteristics are as follows: freezing point = 0°C (32°F); boiling point = 100°C (212°F); specific gravity (at 4°C) = 1.0000; weight per gallon at 15°C = 8.338 pounds (3.782 Kg).[3] Water is composed of two types of elements, namely, hydrogen and oxygen. Water is the most familiar and most abundant compound on earth. Nearly three-fourths of the earth's surface is covered with water, and an estimated 1.35×10^{24} cm^3 water is present in the oceans.[4]

Chemical bonding in water

The most essential hydride of any element is that of oxygen, as in the case of water (H_2O). Considering the major component of the subatomic particles, neglecting the rare isotopes, hydrogen is composed of one electron and one proton (plus one neutron as in deuterium or plus two neutrons as in tritium) while oxygen contains 8 electrons, 8 protons and 8 neutrons (or 9 – 10 for minor isotopes). At normal conditions, both hydrogen (H_2) and Oxygen (O_2) exist as odorless and colorless gaseous molecules. However, they can't both exist alone at elemental states as H or O. In order for them to form a water molecule the H-atom needs to share the single electron it has (as it needs two electrons at its outer shell) and oxygen needs to gain two more

electrons obtained from the two hydrogen atoms to have a total of 8 electrons at its outermost shell corresponding to the octet rule (See Figure 1). Generally, the electrons at the outermost shell which are also known as the valence electrons are the ones that are responsible for the reaction and the stability of the molecules. Nature shows stability of each element within the molecule because they were able to share with or give electrons to the other. If both H and O refuse to share their electrons, they cannot form a water molecule at all. Hence, one shares or gives what it has and by that receives the blessing of the existence of a useful component at a higher organized core yet complicated state.

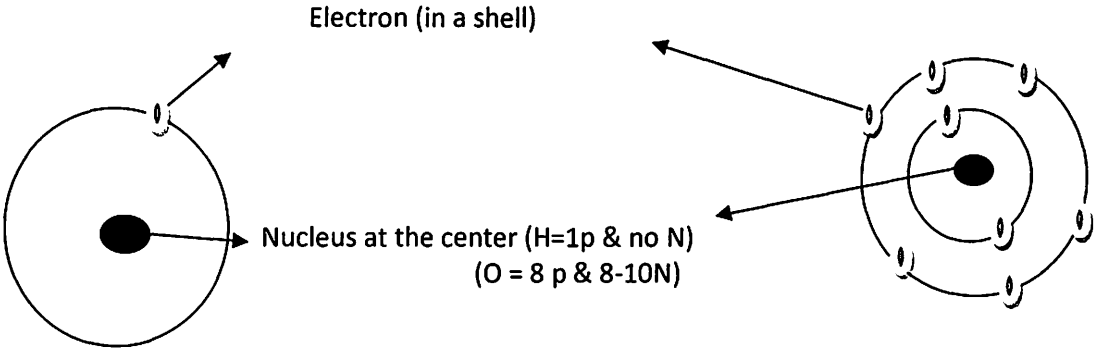

Figure 1. *H & O atoms.*

The oxygen atom is much bigger than a hydrogen atom. Nevertheless it is still quite small compared to those of other common elements, such as sulfur, chlorine, and even carbon and nitrogen. Its small size originates from the strong positive charge of the oxygen nucleus which draws its electron close to the center of the atom. Furthermore, as the electrostatic force is inversely proportional to the distance between them square and oxygen is so small yet possessing a strongly- charged nucleus, an oxygen atom can draw toward itself the electrons of other atoms and is said to be highly electronegative. Hence the central oxygen atom sucks in the electrons of the oxygen-hydrogen links, and thereby it becomes electron-rich (partly negatively charged) and the hydrogen atoms become electron poor (partly positively charged). The resulting distribution of charge-oxygen negative and hydrogen positive-coupled with the small size of the two hydrogen atoms is the basis of water's extraordinary properties.

Shape of water molecule

Another important feature that works together with the distribution of electrons and results in seas and oceans is the shape of the water molecule. Water is V-shaped (with 104.45°) angular molecule with the oxygen atom being exposed at the pinnacle of the V due to the lone pair-lone pair repulsions of the outermost shell electrons on the central oxygen atom (see Figure 2). Now we shall observe how these features simmer out into the real world of phenomena (or observed facts) and concrete properties.

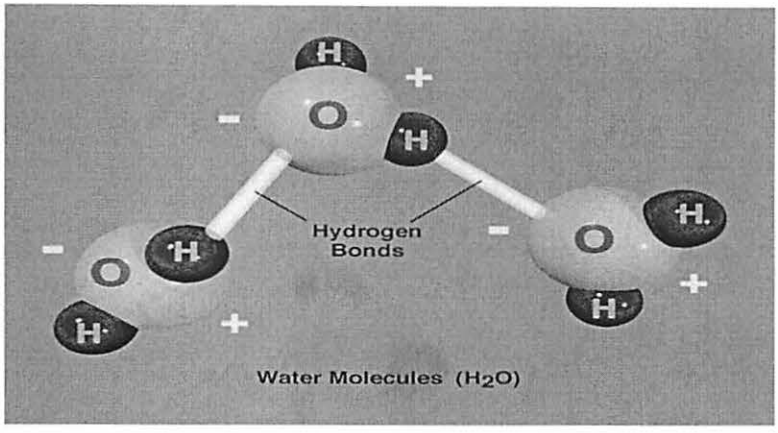

***Figure 2**. Shape of water molecule and the hydrogen bonding.*

Most important of all is the ability of one water molecule to stick to another water molecule. The electron-rich region of the oxygen atom which is partially negative is attracted by electrostatic force to the partially positive hydrogen atom of the other molecule. This special link between the water molecules is known as hydrogen bonding (see Figure 2). It is one of the most significant intermolecular links in the world, for its effects range from the operation of the genetic code (the two strands of the DNA double helix are linked together by hydrogen bonds) to the toughness of wood (for the ribbons of cellulose are clamped rigidly together face-to-face by the sturdy and numerous hydrogen bonds between them, and-the point of our concern-with the properties of water).[5] Water molecule is so light that if it were not for the hydrogen bonds that can form between its molecules, water would be a gas at ambient temperature, and instead of ponds, lakes, and oceans of precious liquid, there would be a humid sky full of gaseous water and barren ground beneath." Next we will consider some points, based on what I believe Jesus would do, or **W**hat **J**esus **W**ould **E**xpect (*WJWE*) of a Chemistry teacher, after observing the facts in combination of H and O to form water molecule.

WJWE: You can give only what you have

The best model teacher, this world ever known, is the Lord Jesus Christ. First, let us consider what Jesus would do if He were to teach a class. I believe, He would begin with pre-class preparation and then would design the whole lesson to teach. Let us consider some verses from scriptures that tell us about what Jesus was doing before he started teaching his disciples and the public as may be mimicked by a Chemistry teacher. The Scriptures tell us that first he would communicate with His Heavenly Father for guidance and wisdom:

- Jesus prayed early mornings before he started teaching for the day.

"Very early in the morning, while it was still dark, Jesus got up, left the house and went off to a solitary place, where he prayed." (Mark 1:35 NIV)

- Jesus prayed all night.
  "Now it came to pass in those days that He went out to the mountain to pray, and continued all night in prayer to God." (Luke 6:12)
- Jesus prayed before starting ministry.
  After He fasted forty days and forty nights, He was hungry and the tempter came to Him saying, "If You are the Son of God, command that these stones become bread." But He answered and said, "It is written, *'Man shall not live by bread alone, but by every word that proceeds from the mouth of God.* "' (Matthew 4:2-4).
- Jesus prayed after teaching.
  And when He had sent the multitudes away, He went up on the mountain by Himself to pray. (Matthew 14:23)
- Because His disciples saw him praying, they asked him to teach them how to pray.
  "Now it came to pass, as He was praying in a certain place, when He ceased, *that* one of His disciples said to Him, 'Lord, teach us to pray, as John also taught his disciples.'" (Luke 11: 1)

The Lord Jesus Christ received power from God through prayer and through the study of the scriptures. It is crucial to ask oneself, "What do I have in order for me to give the best gift to my students and all others in the process of teaching and learning chemistry?" Because I can only give whatever is stored in my mind and my heart, I need to master the subject matter before I can teach it. First of all, a Chemistry teacher has to be equipped in the knowledge of the chemical world, for without that no one will hire him or her. What I mean to say here is that the Chemistry teacher has to excel to his /her best in this field beyond the average. Second, a Chemistry teacher who has accepted the free gift of salvation must share this free gift with his class, for every believer is a priest in the New Testament setting.[6] As explained in the section of chemical bonding in water, the two elements H and O need to give (as in the reaction of their molecular from) or share their electrons (as in their elemental states) in order for them to exist as usefully as a water molecule. The element that has electrons to give away will donate to the element or molecule with fewer electrons to help it become stable. Similarly, a Chemistry teacher who knows his/her subject well and equips himself /herself with the Word of God can effectively impart to his students this knowledge that will be beneficial to them in this world as well as in the world to come.

Jesus was a source of blessing to his own disciples as they took note of how Jesus experienced joy and perplexity. They saw His loving act as he dealt with the darkening powers of sickness, death, and despair throughout the land. The disciples could not forget the mighty demonstrations of his loving, forgiving, and redeeming power. They saw how He treated and set free those who were condemned to death as well as those who were lame, blind, sick, dumb, and deaf, and afflicted with various diseases. They were always amazed at the mystery of His wisdom and mighty power that were divinely manifested in numerous ways, including the

experience on the Mount of Transfiguration. They were forever watching him, being in awe and marveling, asking one another saying, "Who is this? He commands even the winds and the water, and they obey him," (Luke 8:25). After they realized that Jesus did all these with the power of God via prayers, one of them, speaking for all the disciples said to him, "Lord, teach us to pray." (Luke 11:1).

God's natural rule is based on the love of sharing what one has with others. Selfishness and absence of sharing with others seems to be in opposition to the plan and concepts of creation and redemption. To be able to share spiritual truths, the Chemistry teacher must receive Heavenly power through daily prayer and diligent study of the Bible. It is not enough to study chemical knowledge alone; the ultimate truth comes from studying the Word of God because I believe that any kind of knowledge apart from God may become a weapon for evil. E. G. White[7] puts it as follows, "The deepest students of science are constrained to recognize in nature the working of infinite power. But to man's unaided reason, nature's teaching cannot but be contradictory and disappointing. Only in the light of revelation can it be read alright. 'Through faith we understand.' Hebrews 11:3."[7]

Amazing Expansion Characteristic of Water as It Freezes:

Pure water

Water has amazing chemical and physical properties that lead us to acknowledge the truths that come only from the wise Creator. Let us start with one of the peculiar properties of water as it freezes. At normal atmospheric pressure, molecules usually behave in predictable ways as their temperature changes. Molecules fly apart into a gas when heated, condense into a flowing liquid when cooled, and shrink into a frozen solid when chilled still further. The changes in state parallel changes in energy, from high to medium to low. Water starts out behaving normally at higher temperature and normal atmospheric pressure. As its temperature drops, water obediently shrinks together until it reaches 4 degrees Celsius (39°F). Then, amazingly, water reverses course, its volume slowly increasing as it chills. When water finally freezes, at 0°C (32°F), it expands dramatically.

This amazing property is only attributed to the handiwork of our intelligent God. The compounds H_2S, H_2Se, H_2Te are similar in composition to water H_2O as they are from the same family or group in the periodic table. Their molecular weights are 34, 80, and 129 respectively. Their freezing points and boiling points increase with increased molecular weight, as predicted by weak van der Waals forces; and considering similar trends, the freezing and boiling points of water were expected to be -90°C and -68°C, respectively, but in reality water freezes at 0°C and boils at 100°C at sea level. What is happening here? Let us take a closer look at its chemistry. As mentioned in the previous section, just as the hydrogen bonding links water molecules together and confine them to form a liquid at room temperature or at warm everyday temperatures, so they also help to form the rigid solid ice at only slightly lower temperatures. At the time ice forms from liquid water, a rather amazing abnormality happens, an abnormality that is also life preserving. When the temperature is lowered, the hydrogen bonds can form more

extensively and survive longer. As a result, the molecules cease gliding over the neighboring molecule readily as a liquid but then they form a solid. Now the shape of the molecule comes into play.

An oxygen atom in the V-shaped water molecule has room to accommodate two hydrogen bonds, one to each of two neighboring molecules. Each oxygen atom now participates in four bonds (two ordinary oxygen-hydrogen bonds, and two hydrogen bonds to neighbors) and these four bonds point toward the corners of a tetrahedron. This arrangement, which is continued neighbor after neighbor through the solid, results in a very open structure for ice, and the water molecules are held apart as well as held together, like open gallows of atoms and bonds. When ice melts, this open structure collapses and forms a denser liquid and when water freezes, the collapsed structure of the liquid opens up and expands into an open structure. Life is abundant in the ocean and ocean water is salty. Does salt water freeze similarly like pure water?

Salt water

Water is transparent, and thus aquatic plants can live within the water because sunlight can shine on them. Only strong UV light is slightly absorbed. Aquatic life is preserved during winter where snow and ice reach freezing point at very high altitudes, at temperate zones, and near the earth poles because of the amazing freezing characteristic of water. The milder oceanic variety has an average temperature of 0° C (32° F) or above in all months of the year. When moderately salty water freezes, you might expect a uniformly mixed salt and ice crystal to form (after all, the salt and water were homogeneously mixed in the first place); but that's not what happens. First, tiny platelets and needles of ice form over the surface of the liquid. The ice crystals incorporate water, but leave the salt behind, so the solution becomes saltier and saltier as the freezing continues. Finally, the flat ice crystals grow together, trapping small pockets of concentrated brine inside. A cloudy brittle frozen slush forms. Some trapped brine drains over time, leaving behind trapped air bubbles that can dramatically lower the overall density. The density of pure ice is about 0.92 g/mL. The bubbles and pores in salty ice can make its density significantly less dense than pure ice (perhaps 0.8-0.9 g/mL). If you cool the slush below typical freezer temperatures, the trapped brine eventually becomes completely saturated with salt. Since sea water is salty, it freezes at about -2°C (28.4°F). At that temperature (called the "eutectic point"), the salt begins to crystallize out of solution (as $NaCl \cdot 2\ H_2O$) along with the ice until the solution completely freezes. The frozen solid is a heterogeneous mixture of separate $NaCl \cdot 2H_2O$ crystals and ice crystals, *not* a homogeneous mixture of salt and water. If this "eutectic mixture" were completely air-free, it would be slightly denser than pure ice. In practice, the eutectic mixture is likely to be very porous and probably will be slightly less dense than pure water ice.[8]

Suppose the solidification of water in forming ice follows a normal trend and ice becomes denser like any other materials and the ice settles down to the bottom of the ocean every winter; what do you think will happen in few years? As the ice settles down in the ocean the water at the surface will be exposed to the cold air and freeze into ice. Eventually the animals in the ocean will be trapped to death in ice. Then life will be no more after a few years and although the warm wind current circulates from the equator, it would be difficult to

reach the settled ice to melt it. But God designed the structure of water molecules in ice to be hexagonal sheet of layers connected with a hydrogen bond that leads to its expansion and hence lower its density and as a result it helps the ice to float on the surface of the ocean. As the winter becomes intense due to the location of the sun from part of the earth's pole, the floating ice will act as a shield and insulator and life continues in water. Because ocean water is 3-3.7% salt and the presence of salt reduces the freezing point further; hence, the water in the ocean remains liquid winter after winter and life is preserved in the ocean.

Dissolving power of water

Another extraordinary feature of water is its ability to dissolve and its natural abundance. Without going into the enormous usage of water for household usage from drinking to cleanliness let us consider briefly its usage as a solvent with regards to supporting life. For example, the properties of water affect the binding abilities of bio-molecules. Weak interactions are the key means by which molecules interact with one another, i.e. enzymes with their substrates, hormones with their receptors, and antibodies with their antigens where the medium of their interaction takes place in water. Two properties of water are especially important biologically: water is a polar solvent, and water is highly cohesive.[9] These, characteristics stem also from the peculiar arrangement of electric charges and atoms in a water molecule. Many compounds consist of ions, or electrically charged atoms. The common salt, sodium chloride (NaCl), for instance, consists of positively charged sodium ions and negatively charged chloride ions.

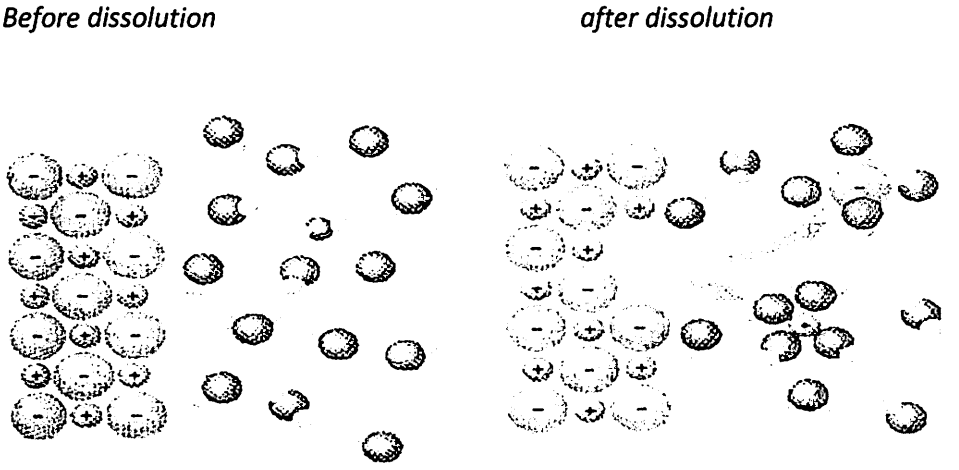

Figure 3. *Dissolved ions are stabilized by layers of water molecules.*

In the solid, each positive ion is surrounded by negative ions, and each negative ion is surrounded by positive ions with high columbic interaction having high melting point (800.8 °C (1473.4 °F). Water, though, with its system of positive and negative charges, can pursue both types of these surrounding ions and dissolve it at room temperature easily with a solubility factor of 30 g/100 mL water. Thus, when exposed to water, the sodium ions of a crystal can become surrounded by oxygen side oriented water molecules that present their negatively

charged oxygen atoms toward them, and thereby emulate chloride ions (see Figure 3). Similarly, chloride ions can become surrounded by the positively-charged hydrogen side of the water molecules, which purse the effect of sodium ions in the original crystal. The sodium ions float off surrounded by water molecules emulating chloride ions, and the chloride ions float off surrounded by water molecules using their hydrogen atoms to emulate sodium ions.

Water has a peculiarly strong ability to act in this way, which is why it is such a high-quality solvent. It is this ability of water that carves landscapes. The essential minerals, that comprise more than 20 different elements in the form of ions like ammonium, nitrates, phosphates, sulfates, etc. in the soil are dissolved in water and transported into plants. Water encompasses every animal's body and, through its ability to support the free motion of ions and other molecules that it dissolves, provides an environment for life.

Specific heat capacity and latent heat of vaporization

Specific heat capacity of water ($c = 4.184\ J\ g^{-1}\ K^{-1}$) is the measure of the heat energy required to increase the temperature of a gram of water by 1 °C; which originated primarily through the work of Scottish physicist Joseph Black using different substances. This is another product of the hydrogen bonding. Water has the second highest specific heat capacity of any known chemical compound after ammonia; it has also a high heat of vaporization (40.65 kJ mol^{-1}), both of which are a result of the extensive hydrogen bonding between its molecules. These two unusual properties allow water to moderate earth's climate by buffering large fluctuations in temperature. The high heat of vaporization of water is useful to cells and organisms because it allows water to act as a "heat buffer," keeping the temperature of an organism relatively constant as the temperature of the surroundings fluctuates and as heat is generated as a byproduct of metabolism. Furthermore, some vertebrates exploit high heat of vaporization of water by losing body heat to evaporate sweat.[10]

Surface tension and capillary action

Water drops or raindrops are stable, due to the high surface tension (force per unit length) of water, 72.8×10^{-3} N/m, which is the highest of the non-metallic liquids; second to mercury of all commonly occurring liquids.[11] This can be seen when small quantities of water are put on a surface, such as glass, where they stay together as drops. This property is important for life. For example, when water is carried up the stems through the xylem in plants-forests, the strong intermolecular attractions hold the water column together. Strong cohesive properties hold the water column together, and strong adhesive properties stick the water to the xylem, and prevent tension rupture caused by transpiration pull. Other liquids with lower surface tension would have a higher tendency to "rip," forming vacuum or air pockets and rendering the xylem water transport inoperative. As we noted earlier, water readily dissolves most salts. However, water is a poor solvent for proteins and other large organic molecules in living cells. This means that liquid water can transport nutrient elements to and within living cells without dissolving and

destroying the organic molecules of which cells are made from. Water also transports waste elements away from cells in support of pure life.

In general, water has peculiar properties and it is the only substance that exists naturally in the solid, liquid, and gaseous states (see Figure 2) within the narrow temperature range found in the earth's environment and is the only conducive medium where life-sustaining chemical reactions occur within an organism. We can draw or illustrate spiritual lessons from these water properties as shown below.

WJWE: Convey the lesson that Jesus Christ is the only source of our existence.

Just as water is the very base of physical existence on this planet earth, Jesus Christ is the base of our spiritual existence. Without water there is no physical life and without Christ there is no spiritual existence. The Lord Jesus Christ is our spiritual water and unless we drink from this water we have no eternal life. Jesus is the source and sustainer of life. Jesus said, "I am the way, the truth, and the life. No one comes to the Father except through Me." John 14:6. "I have come that they may have life, and that they may have it more abundantly." (John 10:10). In the gospel of John, Jesus clearly compares the life sustaining property of water to eternal life as it is given in John 4:10, 13-14: "Jesus answered and said to her, 'If you knew the free gift of God, and who it is who says to you, give Me a drink, you would have asked Him, and He would have given you living water;' Jesus answered and said to her, 'Whoever drinks of this water will thirst again, but whoever drinks of the water that I shall give him will never thirst. But the water that I shall give him will become in him a fountain of water springing up into everlasting life.'" Likewise, God in ages seeks his children to preserve lives, as in the example of Joseph when he said to his brothers in Genesis 45:5, "For God sent me before you to preserve life." It is a long tradition in the ministry of healing that the physician is to be a co-worker with Christ in order to preserve life. Should we not do the same in other ministries like teaching?

"Christ reads beneath the surface, for he revealed to the woman of Samaria her soul thirst which the water from the well of Sychar could never satisfy. He himself lost all sense of hunger, thirst, and weariness. His thirst was satisfied in seeing her drink of the water of life. He was rejoicing in spirit that His words had aroused her slumbering conscience and quickened her spiritual perceptions. Christ understands the needs of the world and through Him alone can the Father supply them. He is thirsting to give the needy souls the water of life freely. Christ is thirsting for the recognition of those for whom He left the courts of heaven, His honor, His glory, His royal throne, His high command. He is thirsting for the love, the cooperation that must be given Him as their personal Savior. He would have them come unto Him, taking hold of his grace by faith, partaking of him, the Living Water."[12]

We educators who serve in the Seventh-day Adventist schools, as sincere teachers and servants of the Lord Jesus, need to have special characteristics that will help our fellowmen as well as all other creations to continue to sustain life. Believers in the theory of evolution have no purpose and no hope for this life or for the life to come but all who believe in the Creator and

Sustainer God do. "Today there are thirsting souls sitting close by the living fountain. The problem is that they are looking far away from the well that contains the refreshing water, and, though told that the water is close by, they will not believe."[13]

The Relevance of the Triple Point of Water

The concept of the trinity is challenging but may be illustrated from the triple point of water. One God in three persons (God the Father, God the Son, and God the Holy Spirit) is not easy to explain but the only thing that the Bible left for us is to simply accept it by faith. The phase of water depends on the value of temperature and pressure within a given system. Consider the following phase diagram of water:

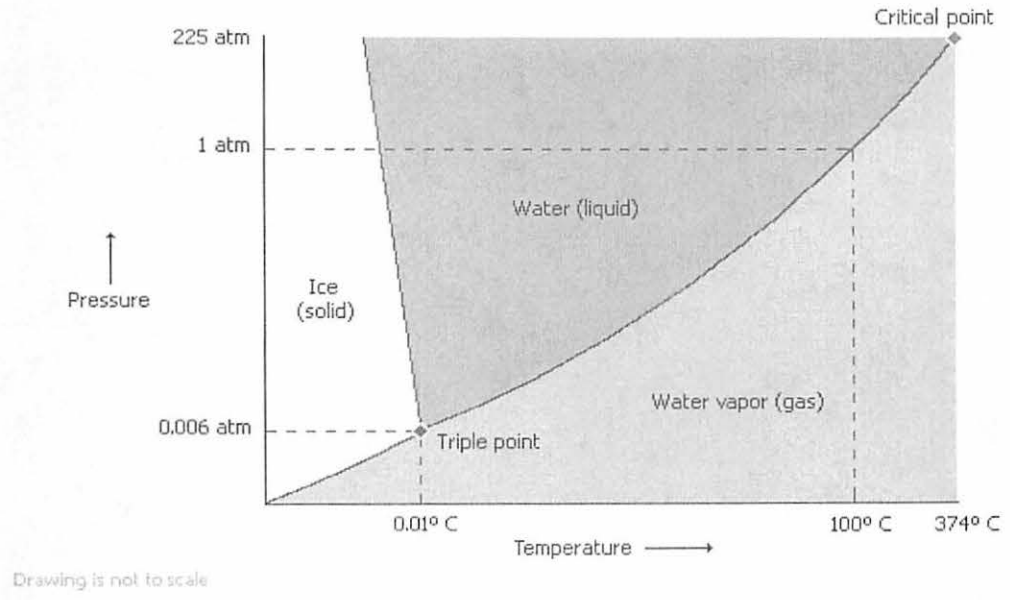

Figure 4. *The triple point of water.*

The temperature and pressure at which solid, liquid, and gaseous water coexist in equilibrium is called the triple point of water. At the point called triple point, water exists either as gas or liquid or solid simultaneously. This natural phenomenon, as can be seen from the picture taken from Encarta Encyclopedia at 0.01 ^{o}C and 0.006 Atmospheric Pressure is somewhat amazing in that the same matter (water) exists simultaneously in three different states. At this particular point called the triple point, where the same material coexists in different states: solid, liquid, and gaseous, with the same chemical formula (H_2O) is a very good illustration for explaining the existence of three forms of entity in one person. It may be quite sacrilegious to draw an illustration to explain what the Bible says regarding the Almighty, Omnipresent and Omnipotent one God in three heads. However, I will leave the reader to search further in this regard.

The Tremendous Abundance of Water

The other special properties of water that are available everywhere would be very interesting, even starting from the creation. God said, "Let there be a firmament in the midst of the waters, and let it divide the waters from the waters. And God made the firmament, and divided the waters which were under the firmament from the waters which were above the firmament: and it was so. And God said, Let the waters under the heavens be gathered together unto one place, and let the dry land appear; and it was so." Genesis 1:6, 7 and 9. Today scientists estimate that there are about 1.4 billion cubic kilometers of water on our planet. Water accounts for over 85% of the mass of most marine organisms.[11] The Bible tells us that at the time of flood the water fountains were opened and water from heaven covered the face of the earth totally, this abundance of water must be just as it was in the creation week. "Fifteen cubits upward did the waters prevail; and the mountains were covered." Genesis 7:20. The oceans, which cover well over two-thirds of the earth's surface, also contain about 97% of all its water with 3% soluble salts. However, there are also substantial quantities of fresh water in various forms and locations. Almost 90% of this fresh water is locked up in polar icecaps and glaciers.

The Bible also gives this account: "And God remembered Noah, and all the beasts, and all the cattle that were with him in the ark: and God made a wind to pass over the earth, and the waters assuaged; the fountains also of the deep and the windows of heaven were stopped, and the rain from heaven was restrained." Genesis 8:1,2. Only about 0.3% of all water on earth is currently available fresh water, and almost all of this is located in natural underground reservoirs or rivers and fresh lakes. Less than 1 of every 5,000 liters of water on earth can be found as either surface or atmospheric fresh water. However, this minute fraction still represents an estimated total volume of more than 200,000 cubic kilometers--what abundance.

It is not merely its awesome abundance and the variety of its forms that are so delightfully inspiring, or even its essential role in the outline of the life in our planet and the progress of life. For us, the amazement is that the wise and creator God made water in such abundant availability and peculiarly so special that tremendously rich properties can appear from such a simple structure (H_2O).

WJWE: Convey the lesson that the wise Creator God is behind the intricate structure of water and its abundance.

God Reveals His Handiwork in the Design of the Components of Water

Evidence of God as creator in the field of chemistry can be illustrated here from two perspectives: one, from the chemical nature and properties of water; and two, from the application of water in nature. God is omnipresent and omnipotent, so are all the facts that describe Him. As we consider the tremendous amount of water present in our planet earth, we

need to let these texts echo in the minds of believers: "And God said, Let there be a firmament in the midst of the waters, and let it divide the waters from the waters. And God said, Let the waters under the heavens be gathered together unto one place, and let the dry land appear: and it was so." Genesis: 1:6 and 9. I ask myself, "if I had not read these texts, does the chemistry of water tell me about its Creator?" This question may take us back to section that deals with the fundamental components of water molecule. Starting from H atom which is the smallest element known, it is interesting to see the uniformity of nature after its designer. The uniformity I see is the uniform relative movement in that the lighter (electrons) rotate on their axis and also revolve, in general, around the nucleus which is the heavy part. This property is uniform as we go from lighter elements to the heaviest elements like Uranium. This uniformity of revolving of lighter entity around the massy part of its system is seen in the solar system that all the elements revolves around the massive sun, as accepted by the science community. Researchers have recorded more than 8,500 accurately determined orbits which provide a natural laboratory in which to study the consequence of regular and chaotic motion.[14]

This trend does not stop there because it is seen that each star with its system form the dense site within its system and form accumulated starts called galaxy. The central regions of active galaxies are believed to contain very massive black holes. They probably range from a few thousand to a few billion times the mass of our sun. These black holes grow by pulling in matter from the surrounding regions.[15] God is an awesome God and so is His creation. The Psalmist says in Psalm 19:1,4-6, "The heavens declare the glory of God; and the firmament shows His handiwork. Their line is gone out through all the earth, and their words to the end of the world. In them hath He set a tabernacle for the sun, which is as a bridegroom coming out of His chamber, and rejoices as a strong man to run his course. His going forth is from the end of the heavens, and His circuit unto the ends of it."

Applications of Water in Nature Display its Maker

I want to mention only a few of water's numerous applications. The main component of living matter on this planet earth is water (H_2O) or its component elements (H and O). Wherever there is abundance of water, there will be life in abundance. Plant and animal cells need water molecules in order to function as designed by nature. The universal need for water as a source for sustenance is similar to our need to rely on God as Creator and Sustainer. Cars are designed to work with petroleum fuels and similarly the natural world relies on water as part of their existence and functioning. Plants use this amazing but very simple molecule composed only of two simple elements to produce very complicated molecules that become bases for tissues and finally higher complicated structures of organs. The following reaction is well established to show how orderly God used just two simple molecules namely carbon dioxide and water to produce food (glucose) using chlorophyll and light as catalyst.

$$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$$

The byproduct of this important chemical reaction, oxygen is not made by man and its design is not a result of man's intelligence. It is one of the important molecules provided by the creator God in order to support life. Do you know that you would drop dead in just a few minutes if this God who created water stops the supply of oxygen? What foolishness it is to say that there is no creator God yet the existence of all life depends on Him including those who blindly try to reject His handiwork. I say they try but the time will come that every knee shall bow down to Him.

All the evidences are clearly available like cosmological arguments of cause and effect, theological arguments as are given in the Bible, nature declares the glory of God (Psalms 19:1-4), and there is sufficient evidence that all living things work towards continuous living and struggle for existence as given in Ecclesiastes 3:11, " He has made everything beautiful in its time. Also He has put eternity in their hearts, except that no one can find out the work that God does from beginning to end." But the Word of the Lord tells us that no matter what efforts are exerted to save souls still there are some who support the Devil who is the father of lies. Romans 1:18-25 states, "the wrath of God is revealed from heaven against all ungodliness and unrighteousness of men, who suppress the truth in unrighteousness, because what may be known of God is manifest in them, for God has shown it to them. For since the creation of the world His invisible attributes are clearly seen, being understood by the things that are made, even His eternal power and Godhead, so that they are without excuse, because, although they knew God, they did not glorify Him as God, nor were thankful, but became futile in their thoughts, and their foolish hearts were darkened. Professing to be wise, they became fools, and changed the glory of the incorruptible God into an image made like corruptible man and birds and four-footed animals and creeping things. Therefore God also gave them up to uncleanness, in the lusts of their hearts, to dishonor their bodies among themselves, who exchanged the truth of God for the lie, and worshiped and served the creature rather than the Creator, who is blessed forever. Amen."

The other observation is that, in addition to supporting life, water gives beauty to our planet earth. God is a God of order and beauty. The flowers, trees, shrubs, grass, or any form of flora and fauna show splendor and beauty when living things are supplied with all components of things that support life including water. Here I will limit my observation to the beauty of our planet earth considering its surface feature. The SSI (solid state imaging system) camera took images in six different signal channels. A natural–color view of earth was constructed using the red, green and violet filters, which correspond to wavelengths of 670, 558, and 407 mm, respectively. The image reveals that the earth's surface is covered by enormous blue expanses that spectacularly reflect sunlight which is easiest to explain if the surface is liquid.[16] God reveals himself in every field of studies as the creator God and chemistry happens to be one of them. I hope as a reader you also see the beauty that God provides every day to your body as you enjoy drinking the clean water and the beauty that surrounds you as a result of the free gift of water.

Limited time prevents me from talking about other applications of water as a source of and controller of climates and weather or about the important role that water plays in the mechanisms of biochemistry, industry, nuclear power station water as coolant and moderator of

enormous nuclear power energy plant, in dams as a source of electric power, in agriculture and every disciplines, etc. I will just leave it for the reader to pursue its other applications.

CONCLUSION

Integration of Faith and Learning is Crucial

"The man, Christ Jesus, gave himself as a ransom for all" (1 Tm 2:5-6). However, many people have not yet heard this free gift of salvation, especially those in the natural sciences. On the other hand, many Christian students have been warned by well-meaning friends before coming to the Christian universities, "Do not get too much into science education that you lose your faith." There is sometimes an assumed tension or even conflict between learning and faith." And it is not only some members of the Christian subculture who suffer from such a perceived notion because many academics on secular campuses appear to believe that faith and learning are incompatible also, to such a degree that they take it upon themselves to attempt to "liberate" new students from their faith in the creator God. Faith is often represented by these people as an obstacle to the modern world of "facts" (by which they often mean secularized interpretations of facts). All these challenges can be tackled if a Christian teacher asks oneself: "What are the things I may be able to provide so that faith may be integrated in the process of teaching and learning?"

Christian Teachers Need to Excel in the Field of Science Teaching

A Chemistry teacher should know his subject matter very well. Equivalently, if not more, a Christian chemistry teacher must excel in the study of the word of God as it is given in the Holy Scriptures – the Holy Bible. Let a teacher who stands in front of his class consider some verses from the Holy Scriptures that expound on what Jesus did before He started teaching his disciples and the public. The Bible tells us that Jesus first communicated His heavenly father for guidance and wisdom. Christ is the greatest educator this world ever knew, so should His followers be. When he was on this earth He taught all aspects of life. He covered such thinking and processes as the inclusion of the whole person—heart, soul, and mind—in all activities, worship, work, thinking, feeling, studying, deciding, interpreting, etc. Accordingly, the teacher of Chemistry needs to imitate the Lord Jesus Christ; needs to excel in the sciences from Christian point of view in order to integrate faith and learning.

Power of the Word: Christian Teachers Must Excel in the Study of God's Word

A Chemistry teacher must know the whole word of God in depth as it is given both in the old as well as in the new testaments. "The creative energy that called the world into existence is the word of God. This word imparts power and begets life," (E.G. White, Education p.126). A Chemistry teacher can be a blessing to his or her class by imparting knowledge that leads to eternity, by representing the Lord Jesus Christ, and by asking himself or herself, "What would Jesus expect me to do in a Chemistry class?" For the Lord Himself has prayed for us saying, "Sanctify them by the truth; your word is truth." John 17:17.

Water with a Simple Chemical Formula (H_2O) is the Very Base of Life

Water is the very base of life on this planet earth yet it has simple chemical structure with vast amazing properties. Our Lord Jesus Christ is our spiritual water and unless we drink from this basic life providing water we have no eternal life. Jesus is the source and sustainer of life. Jesus said, "I am the way, the truth, and the life. No one comes to the Father except through Me." John 14: 6. I have come that they may have life, and that they may have *it* more abundantly (John 10:10). As I teach my students about chemical bond energy, I perceive a massive nuclear power that is stored within simple molecules that if unleashed will demonstrate such a power that can destroy the whole world or if used wisely can provide useful energy to millions. Similarly sin can destroy the whole earth but the word of God is life. All things were made by him [God]; and without him was not anything made that was made." John 1:3. God's way leads to Life.

The Ultimate Call of a Christian Chemistry Teacher is not only to teach the Chemical Composition and Properties of Matter (Water) but also God's truth

Therefore, "The Lord is soon coming – talk it, pray it, believe it, and make it part of your life." (Testimonies, Vol. 7, p.243). Teach Chemistry in the way Jesus the Savior would expect you to teach and work hard to see that the life of your students being transformed in order to meet the soon coming Lord. Then the good Lord will complement you by saying, "Well done, good and faithful servant: thou hast been faithful over a few things, I will set thee over many things; enter thou into the joy of thy lord." Matthew 25:21.

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Acknowledgements

I am indebted to many, but I especially wish to acknowledge the efforts and encouragement I received from Dr. Humberto M. Rasi; my wife Tringo and my family; Drs. Bill and Patricia Mutch; Dr. David Nowack, Chair of the Chemistry Department, Andrews University; Dr. Keith Mattingly, Dean of the College of Arts and Sciences, Andrews University; and Cynthia Helms, Librarian at Andrews University, for editing this document. Above all let the name of the Creator God be glorified. Amen.