COLLEGE PREP **LESSON 1 CHEM**

MATTER: WATER

Ready Answer

Vol 1: Lesson 1a - **Level 4**
Chemistry: Elements & Molecules/Water
Devotion 1: Genesis 1:1-3 In the Beginning, God…

COLLEGE PREP

College Prep: 1) Why is water called a universal solvent? 2) Why is "follow-the-water" a theme for astrobiology? And 3) Why assume naturalism if evidence and known science point to supernatural?

INSTRUCTIONS
1. Complete Lesson 1 Chem Levels 1-3
2. Challenge – Use Apologetics & Applications in Class
3. Be Prepared to Give an Answer/Evidence for your Hope In Christ – How You Know He Can Be Trusted

FOUNDATIONS

GENESIS 1:1-2[1]*In the beginning, God created the heavens and the earth.* [2]*And the earth was without form, and void; darkness was upon the face of the deep. And the Spirit of God moved upon the face of the waters.*
2 Peter 3:5b …*earth was formed out of water and by water.*

1. **CREATED:** The Hebrew word used in verse 1, "*bara*" indicates a NEW CREATION, *ex nihilo*. Whenever the word *bara* is used, it is always associated with God's actions. In the Bible, if man makes or creates, other verbs are used (*asah* and *yatzar*). In addition, Genesis1:26 uses the word *asah* (to make or fashion) in this context, "*Let us make man in our image.*" Immediately following, verse 1:27 says God created (*bara*) man… Does using *bara* seem purposeful in Genesis 1:1-2? **Why?**

2. **THE DEEP:** The Hebrew word *tehom* is translated as deep, abyss, or chaotic mass of elemental water. Whether water existed in God's abode previously, or came about "In the beginning…," we may not know. In Revelation 22:1-2, "*He showed me a pure river of water of life, clear as crystal, proceeding from the throne of God and of the Lamb. In the middle of its street, and on either side of the river, was the tree of life, which bore twelve fruits, each tree yielding its fruit every month.*"

The Apostle John describes a river flowing from the throne of God (described in Rev. 22:1-2). There, in what is often called the third heaven, a river flows that is known as the "water of life." Ezekiel has a vision of the "river of life" flowing out from the Temple (Ezekiel 47). It's also revealed in scripture, that out of water, the earth was formed (2 Peter 3:5), and out of water the heavens were separated.

Water symbolizes new birth in John 3:5. New life in the womb is surrounded by an envelope of water. Once this water bursts forth, new life is imminent. Read John 3:5, 8 and Titus 3:5. **What other NEW CREATION is symbolized by water?**

3. The **SPIRIT MOVED:** The Hebrew word *ruach* for Spirit is also translated life giving power, wind or breath and *rachaf* for moved is also translated hover, flutter, or shake. It's clear that God's creative power is about to be released. **What two entities are all creation, all-natural physical existence, formed from?** (Hint: $e = mc^2$ contains these entities)

_____ _____

APOLOGETICS



2 COR 10:5 We demolish arguments and every pretense that sets itself up against the knowledge of God, and we take captive every thought to make it obedient to Christ.

Matter and energy make up our physical universe. Everything that exists, outside the spiritual realm, is either matter or energy (or both). The **1st Law of Thermodynamics** demonstrates that the total matter and energy of our universe hasn't changed since the beginning. **Matter and energy can be, neither created nor destroyed, only transformed. Einstein illustrates this and more in the equation E (energy) = m (mass/matter) x c (speed of light)^2** – more about that in our next lesson**.** Conservation of matter and energy is also written as: $KE_i + PE_i = KE_f = PE_f$ Kinetic + Potential Energy initial = Kinetic + Potential Energy final.

LOGIC/REASONING

This suggests that in the beginning:

1. Something/Someone violated the known laws of physics (supernaturally)
2. *Whatever/Whoever* created the universe, a "closed system," was outside the system/universe because within the system, it would alter the laws.
3. Everything that exists has existed since the beginning of the universe.
4. Light energy is vested into all matter E (energy) = m (mass/matter) x c (speed of light)^2 And God said, *"Let there be light! And there was light*!"
5. The Bible got all these scientific understandings 100% right!

Science utilizes the same tools we/humans use daily in our observations, research or "googling," and interactions to draw conclusions (**LOGIC & REASONING**). We may test these ideas by trying something new in our diet, changing how we do something, or working with the new ideas to solve a problem. What we're doing is testing the claims or theories to determine if they're true.

Our conclusions are usually **TENTATIVE** – meaning, they may change at some point in the future. Science explores ideas similarly, but with a more measured approach. In both cases, however, the conclusions are TENTATIVE and they are not FACTS. FACTS are data and observations, but the conclusions made remain theoretical. Over time, testing, and observing, better answers may be discovered. This is why science is TENTATIVE.

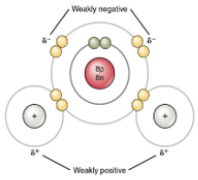
Science is one way of knowing. God's Word is another – a higher way of knowing. Modern science insists that theories about causes be limited to physical, natural/material causes, meaning that science can't point to anything supernatural. See 1 Corinthians 3:19 and Proverbs 2:6.

This requirement (naturalism/materialism), however, demands that scientists wear blinders to any action of God, such as creation, origin of life, or intelligent design. Their theories can invoke alien life, imagined long ages, unobserved chance happenings, or something outside our universe (like multiverses) but not God. In all these instances the cause is UNOBSERVABLE. Therefore, the cause should remain suspect and subject to open debate.

Our main problem in modern science is that these realms (origins, history and long ages, unobserved chance happenings, things outside the universe, or eyewitness accounts of events recorded in the Biblical record) science rejects anything that points to God as forbidden, unscientific, naïve, or immaterial to the argument. If you're fighting a court battle where a judge bans any evidence that proves your case, you've lost before your case even goes to court.

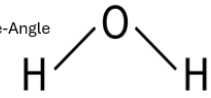
ATOMIC STRUCTURES USED IN CHEMISTRY (WATER)

Find Examples of These in Your Lab



1. **Structural Formulas** - 2-D atom drawings, shells, electrons and bonding (note **2 electrons** complete the inner shell, **8 electrons** fill the outer shell)
Both oxygen & hydrogen have filled their outer shells.

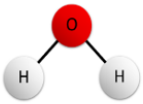
2. **Skeletal Formulas** (Line-Angle Formula) - the standard in organic chemistry.



3. Lewis **Structures**  - Dots and Element Symbols

Lewis structure

4. **Ball & Stick Models** – 3-D models use spheres for atoms, sticks for bonds

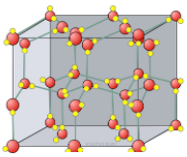




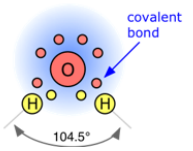
5. **Space-Filling Models** – Fused spheres (no space)

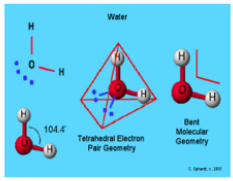
6. **Perspective Drawings** – specialized 2-D models with projections/perspectives

ICE



WATER





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ILLUSTRATION #1

CHEMISTRY OF MATTER/WATER

A water molecule is a compound with a fixed ratio (2:1) 2 hydrogen H and 1 oxygen O. For review, use the atomic structure drawings (left) to count electrons and determine bonds.

1. **ELECTRONS:** If each hydrogen has 1 electron, how many electrons does a neutral oxygen atom have? (Use the first illustration – structural formula – to count the remaining number, include the inner shell gray ones.)

2. **FULL SHELL**: How many electrons fill a shell?

Outer Shell # _____

Inner Shell # _____

3. **DRAW each of the 3 STRUCTURAL FORMS** of a water molecule (1-3) on a separate page.

a) Structural Formula
b) Skeletal Formula
c) Lewis Structure

4. **FILL IN THE BLANKS** about a water molecule's structure. Use the images above in Illustration #1 and the Periodic Table of Elements as needed.

TIPS:
Polarity suggests that one end/side of a molecule will have a slight negative charge while the other end will have a slight positive charge. With H_2O, the hydrogen is losing a little negativity while the oxygen atom is gaining a little negativity.

HYDROGEN	OXYGEN	BONDS
1. What is the measure of the angle of 2 H's to the O atom? _____ o 2. Which end of the H_2O molecule (O or H) is more negative?	1. What is O's Atomic # (aka Z)? Z =_____ 2. What is O's atomic mass or average **amu**? _____ (Z + # of neutrons)	1. How many additional electrons are needed to fill O 's outer shell? 3. How many bonds?

AMAZING WATER

The properties of water were carefully designed by God to be JUST RIGHT for life, for Earth's inhabitation, for carrying minerals, for hydrating, for dissolving and cleaning, for evaporation and condensation at Earth temperatures. The list of JUST RIGHT properties will continue to grow as a chemist investigates deeper. This amazing substance reveals the glory and majesty of God – but only if a person is willing to seek it out. It's important to delve into the "scientific" knowledge, but it's even more important to use the process of science to see how incredible our DESIGNER IS!

1. On a **Periodic Table of Elements,** locate hydrogen and oxygen then answer the following:
   a) Does the atomic weight number equal the total number of protons + neutrons? Y / N
      Why or why not?
   b) Why does atomic weight vary from element to element? Y / N
      Why or why not?
   c) Since each element is different, with unique characteristics, what can you conclude about the proton count (write out your answer on a separate piece of paper)?

2. Note all the various methods used to illustrate atoms and molecules in Illustration #1. Below is a Lewis Structure. Based on what you know about water, what type of bonds exist inside the water molecule have (ionic or covalent)? _____ Substances existing as liquids and gases are often covalent while metals combined with non-metals are frequently ionic substances.



Lewis structure

Columns 1 & 2 (IA & IIA) on the Periodic Table are commonly metal **cations** Column 17 (VIIA) are commonly **anion** nonmetals – forming **ionic** bonds.

COLLEGE PREP

CHEMISTRY is considered a HARD/OBSERVATIONAL science. Rarely do you find Chemistry class time devoted to theoretical science (SOFT or historical science). Therefore, virtually everything you study is "good science." Chemistry serves as a prerequisite for multiple science fields, including medical, chemical, farm/industry, environmental, and even home/service/restaurant fields. What you won't often hear, however, is how incredibly organized our microscopic, atomic, elemental world is! It has to be for us to understand it and organize it – such as the Periodic Table of Elements – and that's just a starting point.

TIPS:

1. Hone/sharpen your math and calculator skills prior to taking chemistry.
2. Know measurement conversions well – changing units such as grams, meters, seconds, liters
3. Familiarize yourself with volume, weight, and metric measures (review/repeat)

RESEARCH CHEMICAL VERSES PHYSICAL CHANGE:

a) What's the difference between a chemical change and a physical change in a substance?

b) Was creating salt water from freshwater a chemical or physical change? (be sure to research)

c) Is burning wood a physical change or a chemical change? (be sure to research)

d) Does adding baking soda to vinegar cause a chemical change? Why or why not?