Mid-Term Exam Review

Fall 2019

1. The Origins
2. Eternal is defined as having no beginning and no end.
3. Forever is defined as having a beginning but no end.
4. Genesis 1:1 “In the beginning, when the heavens and earth were made, the earth…” Genesis states that God created the heavens and the earth (or as we call it, the universe).
5. God, therefore, existed *before* the universe, in heaven. God is eternal.
6. Jesus was born on Dec. 25, 0. Therefore he had a beginning and is considered forever.
7. In the Blessed Trinity, The Son is eternal (because The Son is part of God).
8. God had a stopwatch. At the moment he hit “start”, and that is what we call the Big Bang.
9. At that moment of the Big Bang, the entire universe was so small that it fit on the tip of a needle.
10. This moment is called “The Singularity” because it represents the *single* *origin* of space and time.
11. At the moment of explosion, there was heat and light, but no particles (because no planets were made yet.)
12. Einstein’s Theory of Relativity states that space and time are related; you cannot have one without the other.
13. Einstein called that relationship the “Space/Time Continuum” because one cannot exist without the other.
14. Einstein also stated that time is relative to its frame of reference; if you remove yourself from that frame of time, then you are no longer subject to that aging like the rest of the people.
15. At the moment of BB explosion, the light came from the heat, which was plasma (the 4th state of matter which is super-heated gas).
16. At approximately 0.0001s after BB, the plasma started to cool to regular gas.
17. The more cooling that happened, the gases cooled to liquids, and eventually to solids.
18. The solids collided with each other and formed bigger solids, until planets formed.
19. We know that the universe is still expanding.
20. We are still experiencing God’s BB.
21. The universe is about 4.5 billion years old.
22. The universe is not eternal because God started it. The universe is not forever, because it has an end.
23. When God hits the stop button on his stop-watch, the universe will end. This is when Jesus comes back. When that happens, there will be no more time and no more space. That is the end of the universe.
24. At the end of the universe, there will be only heaven or hell.
25. The Atheists
26. If you take God out of the BB, someone who does not believe in God cannot explain how or why the BB happened.
27. They have the “Yo-Yo” theory.
28. The “Yo-Yo” theory states that the expansion we experience today is slowing down. Eventually, it will stop expanding and begin shrinking. This is due to gravity. It will shrink into another singularity. Then it will explode again. This explosion and contraction will go on forever, like a yo-yo going back and forth.
29. Two problems: 1. *How* did the yo-yo start? 2. *Why* did the yo-yo start?

08/19/19

* 1. God speaks to us in 7 different languages.
  2. God’s first language is mathematics.
  3. His second language is physics.
  4. His third language is chemistry.
  5. His fourth language is biology.
  6. His fifth language is psychology.
  7. His sixth language is ecology.
  8. His last language is theology.

08/24/19

1. God uses these languages to construct the material universe to be perceivable by humans.
2. Math is the most fundamental language in the universe.
3. Math is used to describe our universe in terms of physics.

08/25/19

1. Using math, we can decode the physical tangible universe by first understanding forces.
2. Physics is the second language that describes forces and attractions of our tangible universe.
3. The basic and fundamental force across our universe is gravity.
4. Universal gravity was defined by Isaac Newton.
5. Universal Gravity (G) = K(m1)(m2)/r^2.
6. All forces are measured in Newtons. (N)
7. For the surface of the Earth, gravity (g) = 9.8 m/s^2.

08/27/19

1. Escape Velocity is the maximum rate of (g) = 9.8 m/s^2.
2. Earth’s gravity (g) is always pulling objects to the center of the planet.
3. We describe this pulling as F(g) , or Fg, or the force of gravity.
4. The gravitational force that pulls us to the center of the Earth must be matched or overcome by a greater force for us not to be pulled.

08/28/19

1. If the object is still, it is said to be in stasis.
2. If the object is in motion, it is said to be dynamic.
3. If the object is static, then the sum of all forces equals ZERO.
4. Mathematically, ∑FN = 0.
5. If the object is dynamic, then the ∑FN ≠ 0.

Sept 01, 2015

1. If (FA + FF) is greater than 0, the object is dynamic.
2. If FN > Fg then the object experiences “lift”.
3. We can add forces together by using arrows as symbols of their direction and magnitude.
4. Forces are called vectors, which have BOTH magnitude AND direction.

Sept 03, 2015

1. Speed is defined as a scalar number with magnitude ONLY.
2. Velocity is defined as a vector number with BOTH magnitude AND direction.
3. Vectors are measured in units of Newtons (metric) and foot/pounds (English).

Sept 05, 19

1. Isaac Newton formulated 3 laws of motion.
2. Every object in a state of uniform **motion** will remain in that state of **motion** unless an external force acts on it.
3. Force equals mass times acceleration.
4. For every action there is an equal and opposite reaction.

09/18/19

1. The nucleus of an atom consists of protons and neutrons.
2. Protons have a +1 electrical charge.
3. Neutrons have a 0 electrical charge, or neutral charge.
4. The nucleus is surrounded by a cloud where electrons may be found.
5. An electron has a -1 electrical charge.
6. This electron cloud has the electrons orbiting the nucleus in distinct orbital paths, simply called orbits.
7. These orbits have an energy level associated with them. For example, the first orbital (called “S”) can be found to be closest to the nucleus and has the lowest energy associated with any orbital.
8. Modern atomic theory suggests that we know where an atom has been, but not know where it is.
9. The forces that keep an atom together are called electromagnetic force, because of an electrical charge, and because of a magnetic charge.

09/19/19

1. Scientists Schrodinger, Heisenberg, and Einstein came up with the Quantum Model of the atom.
2. Schrodinger’s cat… explain it!!!
3. Heisenberg said “HUP” Heisenberg Uncertainty Principal
4. From our physics viewpoint, Schrodinger’ s cat and HUP are the reason why modern atomic theory states that we have electron clouds.
5. Electrons are BOTH within the cloud and not.
6. We’re not certain where they are.
7. All matter has a particle/wave nature. Particles act as alone things in space and time.
8. Waves traverse a long space but may take a lot of time.
9. Visible light (photons) were the first objects to exhibit the particle/wave dual nature, from the big bang.

09/20/19

1. Atoms are held together by an electromagnetic force, by strong nuclear force, and by weak nuclear force.
2. The simplest and most abundant element in the universe is Hydrogen. It has 1 proton, 1 neutron, and 1 electron.
3. When 2 hydrogen atoms crash into each other and create something new, we call that fusion.
4. Fusion is the process of combining 2 atoms into a new one.
5. Fission is the process of taking one atom and breaking it into parts, releasing huge amounts of energy, Δ*E*

09/23/19

1. All of an atom’s e- are found within the e- cloud that surrounds the nucleus.
2. This cloud is actually a blend of different orbitals of e-.
3. The first e- orbital is the “S” orbital, the lowest energy level of all orbitals.
4. The S orbital is spherical and encloses all of the atom’s space.
5. There are 2 S orbitals, because the e- want to be far away from each other as possible.
6. E- are negatively charged, therefore repel each other.
7. VSEPR is valence shell electron pair repultion…fancy way of saying all e- hate each other and want to be far away as possible from each other.
8. The first S orbital only can hold 2 e- and we consider that orbital “full”.
9. The second S orbital, called 2S, only can hold 2e- and then it is considered full.
10. Both S orbitals contain a total of 4 electrons.
11. Next orbital is the P orbital, which is 3D on the x,y,z axes.
12. The Px is on the X-Axis, the Py is on the Y-Axis, and the Pz is on the Z-Axis.
13. On each axis, there are 2 balloons tied together, and each balloon has 2 e-.

10/30/19

1.       The molecular vibrations of all matter send waves out into the environment.

2.       Waves are a part of our universe since the big bang.

3.       All waves exhibit similar properties.

4.       There are 2 kinds of waves, transverse and longitudinal.

5.       Sound is longitudinal and light is transverse.

6.       Each wave has a wavelength, which can be measured by the distance between wave peaks(transverse) or the distance between wave compressions (longitudinal).

7.       Each wave has an amplitude, which is a measurement from base line to peak (transverse) or the entire measurement of the compression (longitudinal).

8.       Each wave has a frequency, determined by how many peaks pass a point per second (transverse) or how many compressions pass a point per second (longitudinal).

9.       All frequencies are measured in units called Hertz, or cycles per second.

10.   A cycle is one complete wave.

11.   Waves travel thru different things at different rates.

12.   A medium (singular, *media* plural) is the substance in which waves travel.

13.   Sound needs a medium to travel, and it is usually air.

14.   Sound is distorted, or changed, when it travels in water or thru a solid door.

15.   There is no sound in space, since space is a vacuum.

16.   Light waves travelling thru water will *bend* the light.

17.   Waves have 3 characteristics: initiation, propagation, and termination.

10/31/19

1.       The speed of sound in air is 343 m/s.

2.       We call this speed Mach 1.

3.       When the speed of sound is achieved, there is a sonic boom that happens, like a small bomb exploding.

4.       The speed of sound is different thru different media.

5.       Sound travels in longitudinal waves.

6.       Sound waves can bounce off solid objects and travel in another direction, thus causing an echo.

7.       In a longitudinal wave, there are compressions and rarefactions INSTEAD of wave peaks and valleys.

8.       The normal, healthy human ear can detect a range of 20 Hertz to 20k Hertz. Below 20 is bass that can be felt but not heard, and above 20k hertz is dog and animal hearing.

9.       A wave’s speed can be calculated by multiplying wavelength and frequency.

10.   To be faster, we need either a large wavelength, or large frequency, or both.

11.   To make a sound loud, we simply need to increase the amplification of the wave, or compression band.

12.   Our ability to hear depends on 3 tiny bones inside our ear that vibrate from the sound waves.

13.   These tiny bones are the inchus, malleys, and stapes.

11/04/19

1.       Sound waves are extremely useful in medicine by using ultrasound.

2.       By using ultrasound waves, we can determine the look of a structure based on reflection of the waves.

3.       And by increasing the energy, or frequency of the ultrasound waves, we can break up structures, like kidney stones.

4.       Sound waves also can be weaponized for defense systems.

5.       Sound waves, therefore, can be used to either heal, or hurt.

6.       Animals, like dolphins and bats, shoot out sound waves from their bodies and then listen to the echoes to navigate. This is echo-location.

11/08/19

1.       The electromagnetic spectrum is the system of transverse waves, all having the same characteristics of longitudinal sound waves.

2.       Radio waves have the longest wavelength and lowest frequency.

3.       The spectrum begins on its left side with radio waves.

4.       Examples of these waves are radios and televisions.

5.       Microwaves have shorter wavelengths and higher frequencies than radio waves.

6.       The next shortest is called infrared.

7.       After infrared is the visible light span.

8.       Even shorter wavelength is ultraviolet.

9.       The shortest wavelengths belong to x-rays and gamma rays.

10.   Visible light is composed of color wavelengths, ROY G BIV.

11.   A continuous spectrum shows all of the colors of light without any gaps.

12.   An emission spectrum shows the colors of light of a heated substance.

13.   An absorption spectrum shows colors that is absorbed thru the substance.

11/15/19

1.       The electromagnetic spectrum is partially magnetic because the amplitude, frequency, and wavelength are all influenced under large magnetic fields.

2.       On a radio in the car or house, the FM stands for “frequency modulation”.

3.       On a radio in the car or house, the AM stands for “amplitude modulation”.

4.       These modulations are changed by using a small magnet that change your radio station.

12/02/19

1. The amount of energy in the universe is fixed; it doesn’t change.
2. This is known as the Law of Conservation of Energy.
3. Energy cannot be created nor destroyed; it just changes forms.
4. The light energy from the sun is transformed into chemical energy into leaves, then eaten by the cows as food, then we eat the cows for hamburgers. Yum!
5. Therefore, the energy of the universe is fixed and immutable.
6. There are different forms of energy in the universe, including solar, pneumatic (wind), chemical, hydro (water), and mechanical (human).
7. All energy is distributed throughout the universe as transformative (changeable) energy.
8. We have covered that energy can travel in waves, as in electromagnetic spectrum.
9. Every form of energy works in conjunction with all other forms to become changeable.
10. The source of our energy on Earth is our sun.
11. The sun sends electromagnetic radiation to our seas, which warms the air, and creates both nautical and pneumatic currents.
12. These currents drive our weather pattern.
13. Solar energy is reliable for more than another billion years, and therefore is considered renewable.
14. Non-renewable energy includes coal, gas, and petroleum (oil), because these energy sources come from the earth and will eventually run out.

12/03/19

1. The non-renewable energy sources are slowly contributing to the declination of the Earth’s stability and climate.
2. They remain powerful energy resources because of political greed.
3. There is much money to be made in the oil and gas energy fields. Colleges award degrees in petroleum engineering, natural gas exploration, and chemical engineering.
4. Most of the Earth’s oil is in Venezuela, South America, and the Middle East, UAE.
5. America has much oil underneath the continent, but in smaller quantities than the middle east.
6. We use a technology called fracking to explode the ground (FRACture) and collect the oil that seeps out.
7. To escape the impending doom of the oil and gas industry, we MUST get away from these non-renewable energy sources.
8. We look to solar power as the ultimate way to electrify the global needs of energy.

12/04/19

1. Solar energy is the most abundant energy on Earth.
2. We can program solar cells to absorb all of the sunlight exposed to the cell, or parts of the visible light spectrum exposed to the cell, and transfer the light energy into electricity.
3. The cell is called a photoelectric cell, and is relatively cheap.
4. The photoelectric cell transfers the electric energy to a motor or distributor.
5. Solar power is considered a renewable energy source.
6. It is inexpensive for a house, but gets very costly for a large metropolitan area.
7. One of the limitations of solar power is that the sun isn't shining all 24 hours in a day, therefore you need a battery for night use.
8. Another limitation for a large scale solar powered area is that you need lots of land to construct and use these photocells.
9. But meteorology explains to us that the sun drives our weather.
10. Our winds are created by the sun warming the ocean at the equator of the Earth.
11. The warmer waters slightly expand in volume and create a flow (current) that pushes cooler water out of its way to migrate northwards.
12. The heat from the water also warms the air above the water and transfers the heat to the air.
13. The air rises and pushes the cooler air downwards, creating air mass movement, or wind.
14. If we can harness the energy of the wind, like windmills, then we can transfer a moving blade from the windmill into rotating a shaft that cranks a generator to create electricity.
15. The problems with pneumatic (wind) energy is that sometimes, it isnt windy at all.

12/09/19

1. Hydroelectric power takes the movement of water to turn a turbine to generate electricity.
2. This turbine can be done via dams, tidal wave motion, natural stream flow, and gravitational flow.
3. Hydroelectric energy is considered renewable and a safe alternative to pneumatic energy, but still presents itself w dangers.
4. Hydroelectric energy also encompases steam energy, since the water is boiled into steam to rise in a contained atmosphere to turn a turbine to generate electricity.
5. Hydroelectric is also employed in municipal water towers. The water is pumped up into a storage tank. The water is then released under gravity to flow downwards, turning a turbine, and generating MORE electricity than was required to pump up the water.