**Name:**

**Pre-AP 8th Grade Science Knowledge Map**

**Woodland Junior High**

**Nature of Science**

**Unit Conversions:**

1. There are 1000 millimeters in a meter.
2. There are 100 centimeters in a meter.
3. A kilometer is 1000 meters.
4. An inch contains 2.54 centimeters
5. One kilogram is 2.2 pounds.
6. One meter is 3.28 feet.

*SKILL:*  Convert between units using conversion factors.

**Knowledge about Experiments:**

1. An inference is a conclusion based on what you observe.
2. The scientific method has the following 7 steps: State the Problem, Research, Hypothesis, Experiment, Analyze Data, Form a Conclusion, Share your Results.
3. In experiments, qualitative and quantitative observations are made.
4. A quantitative observation uses numbers, data and measurements.
5. A qualitative observation is made using the five senses.
6. A controlled experiment has all variables controlled but one.
7. A variable is a factor in an experiment that can affect the outcome
8. A controlled variable is a factor that is not changed
9. A manipulative variable is a factor that is purposely changed by the experimenter
10. A responding variable is a factor that might change as a result of the manipulative variable
11. The manipulated variable is graphed on the x-axis & the responded variable is graphed on the y-axis
12. Data that falls in a straight line can be explained by the equation y = mx + b.
13. The units for the slope of a line of best fit from graphed data is the y-axis variable over the x-axis variable.

*SKILL*: Be able to graph a set of data, draw the line of best fit & find the equation from that line in y = mx+b form.

**Life Science**

**Genetics/Heredity:**

1. Genetics is the study of heredity.
2. Heredity is the passing on of biological characteristics from one generation to the next.
3. Gregor Mendel is the “Father of Modern Genetics”.
4. Genes, or combinations of genes, give living organisms information that controls its traits.
5. For every gene there are two alleles that make it up.
6. Different forms of the same gene are called alleles.
7. Genotype is the gene code for a particular trait.
8. Phenotype is the physical expression of a particular trait.
9. Homozygous (purebred) means a gene pair with the same alleles.
10. Heterozygous (hybrid) means a gene pair with different alleles.
11. Dominant traits are expressed when the dominant allele is present.
12. Recessive traits are only expressed with when two recessive alleles are present.
13. Co-dominance results with two alleles being equally dominant thus both traits show up in the offspring.
14. Incomplete Dominance is when two traits are equally dominant and they “mix” to form a new phenotype.
15. A Punnett Square is a visual way to see possible outcomes of a genetic cross.
16. Inbreeding is breeding between close relatives and leads to a reduction in genetic diversity.
17. Hybridization is the process of combining different varieties to produce an offspring genetically dissimilar from its parents.
18. Cloning is the process of creating a genetically identical copy of an organism.
19. The probability of multiple traits occurring in an organism can be calculated by multiplying the probability of each trait occurring on its own in that organism; P(A and B…) = P(A) x P(B)…

*SKILL:*  Be able to calculate probabilities of genetics crosses given enough information about the parents.

**Basics about Life:**

1. The cell is the basic unit of structure and function in all living things.
2. The characteristics of life are: have cells, reproduce, growth & development, respond to environment, contains the chemicals of life, and use energy.
3. The chemicals of life are: lipids, protein, carbohydrates, nucleic acid, and water.
4. Unicellular organisms consist of one cell.
5. Multi-cellular organisms consist of 2 or more cells working together.
6. Tissues are a collection of interconnected cells that perform a similar function.
7. An organ is a group of tissues that perform a function.
8. Cells that lack a nucleus are called prokaryotic.
9. Cells with a nucleus are called eukaryotic.
10. Robert Hooke is credited with coming up with the name “cell”
11. Anton van Leeuwenhoek is known as the “Father of Microbiology”
12. Cell Theory states that (1) All living things contain cells, (2) Cells are the basic unit of structure and function in all living things, and (3) All cells are produced from other cells.
13. Francis Crick, James Watson and Rosalind Franklin discovered the DNA double helix.

**Natural Selection/Evolution:**

1. Evolution is the changes in inherited traits of a population from one generation to the next
2. The “Theory of Evolution” is the idea that all living things have evolved from simple organisms and changed through the ages to produce millions of species that exist today.
3. Natural selection is a process by which the organisms best suited to their environment tend to leave the most descendants.
4. An adaptation is a change in an organism that helps it to better survive in its environment.
5. Natural selection is often called the "survival of the fittest".
6. Natural selection causes the evolution of a population or a species as a whole, not the evolution of an individual.
7. Darwin's theory (basically)states that all species evolved from a few common ancestors by means of natural selection.
8. Darwin set forth his theory in the book On the Origin of Species (1859).

**Classification:**

1. Taxonomy is the practice and science of classifying and naming organisms.
2. Carl Linnaeus is known as the “Father of Taxonomy”
3. A taxonomic key is any tool that helps to identify an organism by asking a series of “simple” questions.
4. Binomial Nomenclature is the Latin two part name that identifies an organism by its genus and species.
5. A genus is a group of closely related organisms.
6. A species is a group of closely related organisms that can mate for the purpose of producing offspring.

*SKILL:* Be able to classify an organism given a taxonomic key.

*SKILL*: Be familiar with the parts and workings of a microscope.

**Astronomy**

**The Universe:**

1. According to Edwin Hubble, the universe is expanding.
2. The big bang theory states that are the universe was once hot and dense and located at a single point, then underwent a rapid expansion that is still expanding today.
3. Gravity is a pulling force that exists between all bodies in the universe.
4. The strength of gravity depends on two factors: amount of mass and distance from object.

*SKILL*: Be able to calculate the force between two bodies given the formula for gravitational force.

*SKILL*: Determine the speed, mass, or distance, of an object in circular orbit around another body.

**Stars:**

1. A star is a huge, shining “ball” in space that produces a tremendous amount of light and other forms of energy.
2. Supernovae are a brilliant explosion from a rapidly collapsing high-mass star.
3. A star goes through a life cycle of: nebula, proto-star, main sequence, giant :(1) Expands to a planetary nebula, white dwarf remains. (2) Undergoes supernova, black hole or neutron star.
4. A nebula is a massive collection of dust and debris in space.
5. Material in a nebula will pull together under its own gravity to create a proto-star.
6. Main-sequence phase, the longest part of a star's life, is where the star begins converting Hydrogen into Helium through fusion.
7. Red giant phase is when all the hydrogen is “used up” and the star expands enormously.
8. White dwarf stars are the high temperature remains of a giant after a planetary nebula has formed.
9. Neutron stars are the dense core left over from a supernova.
10. A black hole is region of space, created by a supernova, whose gravitational force is so strong that not even light can escape its pull.
11. The five characteristics used to classify a star are: brightness, color, temperature, size, and composition.
12. Parallax is a method used to determine the distance to far away objects, like stars.
13. The most abundant elements in stars are Hydrogen and Helium.
14. A star’s brightness from earth is apparent, while its brightness from a fixed point is absolute.

**The Moon:**

1. The moon travels around the earth in an elliptical (oval shaped) path called an orbit
2. The moon travels around the earth once about every 27 and 1/3 days
3. The moon appears to go through changes only because of our perspective from earth and its position in the sky.
4. The phases of the moon are: new, waxing crescent, first quarter, waxing gibbous, full, waning gibbous, last quarter and waning crescent.
5. When the moon appears to be getting bigger it is waxing.
6. When the moon appears to be getting smaller it is waning.
7. When a full moon passes through the earth's shadow, we see an eclipse of the moon.
8. Solar eclipses occur where the shadow of the moon passes across the earth
9. The moon's gravity pulls up the water and creates tides.
10. Every place along the seashore has two high tides and two low tides daily.
11. Eclipse is the blocking of light by a celestial body.

**The Seasons:**

1. Seasons are caused by the tilt in the Earth's axis.
2. Winter occurs on the hemisphere tilted away from the sun, while summer occurs on the hemisphere tilted towards the sun.
3. When it is winter in the northern hemisphere, it is summer in the southern hemisphere and vice versa
4. The Equinox is when the sun is directly over the Equator.
5. Around March 21th is the spring equinox and marks the beginning of spring in the northern hemisphere
6. Around September 22nd is the fall equinox and marks the beginning of fall in the northern hemisphere
7. The solstices occur when the sun is as far north and as far south as it will go on the horizon.
8. The winter solstice- around December 21st -marks the beginning of winter in the northern hemisphere and is the shortest day in the year.
9. The summer solstice- around June 21st – marks the beginning of summer in the northern hemisphere and is the longest day in the year.

**Physical Science**

**Atomic Theory:**

1. Know the first twenty elements and symbols, in addition know: Iron (Fe), Copper (Cu), Silver (Ag), Gold (Au), and Lead (Pb)
2. Atomic number is the number of protons in an atom's nucleus.
3. Mass number is the total number of protons and neutrons in an isotope
4. Atomic Mass number is the average mass of all the isotopes of that element.
5. A neutral atom has the same number of electrons as there are protons in the nucleus.
6. An element is determined by the number of protons it has.
7. An atom is the smallest part of matter.
8. According to E. Rutherford, an atom is mostly made of empty space.
9. There are three basic sub atomic particles: protons, neutrons and electrons
10. The nucleus is in the center of the atom, containing both protons and neutrons.
11. Protons are positively charged particles, electrons are negatively charged, while neutrons posses no charge.
12. Isotopes are atoms with the same atomic number, but different atomic weights due to a different number of neutrons
13. J.J. Thompson discovered the electron.
14. Rutherford discovered the positively charged nucleus is filled with “protons”.
15. The neutron was discovered by James Chadwick.
16. N. Bohr stated that electrons are found in energy levels.
17. The electrons are arranged in levels called electron shells, according to how much energy the electrons have.
18. The outer shell electrons control the chemical behavior of the atom.
19. Electrons fill into shells. The first shell holds 2, second holds 8, and third holds 18.
20. There are 4 orbital’s: *s* holding 2 electrons, *p* holding 6, *d* holding 10 and *f* holding 14.
21. The first shell only has a *s* orbital, second shell holds a *s* and *p* orbital, third holds a *s* *p* and *d*, fourth holding an *s p d* and *f*.
22. Valence electrons are the outer electrons which form a bond
23. The Octet rule states that atoms seek to have 8 electrons in their outer shell or none, except H and He.
24. Physical properties of matter are what we can observe without changing the substance.
25. Chemical properties of matter are the ways in which a substance reacts with other substances.
26. Exothermic reactions give off heat and leave the product warmer
27. Endothermic reactions absorb heat and leave the product cooler
28. A physical change has occurred when there is a change that does not change the identity of the substance
29. A chemical change has occurred when both the physical and the chemical properties have changed
30. Indications of a chemical change include: change of temperature, release of a gas, change of color or other changes in physical properties

*SKILL*: Be able to draw the Lewis Structure of some basic Compounds/Molecules

**Charge Movement (Circuits):**

1. Like charges repel while opposite charges attract.
2. The strength of the electric field attraction/repulsion depends on the amount of charge and distance from the charge.
3. Static electricity/charge is charges that are not moving.
4. Charge is generated by friction, induction, or conduction.
5. The flow of charge through a material is known as electric current.
6. The rate of flow of charge is measured in amperes (A).
7. The ability to produce a current is known as voltage measured in volts (V)
8. The resistance to current is known as resistance measured in ohms (Ω)
9. Ohms law relates Voltage (V) , Current (I) and Resistance (R) as V = I × R.
10. A electrical circuit is a complete unbroken path through which electric current can flow.
11. An open circuit is a circuit in which the pathway for current is broken.
12. A closed circuit is a circuit in which the pathway for current is allowed to travel.
13. Resistance in a wire is determined by the length of wire, thickness, material, and temperature.
14. A switch is a device used to toggle between an open and closed circuit.
15. A series circuit is a circuit in which there is only one path for the electrical current to flow.
16. In a series circuit, if one component is removed, the entire circuit is broken.
17. Adding components in series increases the total resistance of the circuit.
18. A parallel circuit is a circuit in which there are multiple pathways for current to flow.
19. In a parallel circuit, if one component fails, other components may still work.
20. Adding resistors in parallel decreases the resistance of the circuit.
21. A standard home electrical socket supplies 120 volts.
22. Electrical Power is the rate at which energy transfers from electrical energy into another form.
23. Electrical Power is measured in Watts (W) according to the formula Power = V × I.
24. A kilo-watt is the standard unit of measure for electrical power.
25. The electric energy used by an appliance is the electric power the appliance provides multiplied by the time it was used: E = P × T. (Units being kilowatt-hours)

*SKILL*: Be able to calculate Voltage, Current, Resistance using Ohm’s Law

*SKILL*: Be able to calculate the total resistance of a series and/or parallel circuit.

*SKILL*: Be able to calculate power and energy usage.

**Magnetism:**

1. A magnet has a north and a south pole.
2. Like poles repel, unlike poles will attract.
3. A magnet is any material that attracts iron.
4. A magnet is created by the movement of charge, such as en electron moving around the atom or electric current moving in a wire.

**Waves:**

1. The electromagnetic spectrum from the least energetic to the most energetic, are: radio waves, infrared rays, visible light, ultraviolet rays, X rays, and gamma rays.
2. The combined range of all six bands of wave lengths is known as the electromagnetic spectrum.
3. Astronomers can tell what a star is made of by analyzing the electromagnetic spectrum emitted by the star.
4. Light behaves as a wave and a small particle.
5. A particle of light is called a photon.
6. Light travels in straight lines.
7. The speed of light in empty space is 186,282 miles (299,792 kilometers) per second.
8. Light waves have wavelength, frequency, and amplitude.
9. The wavelength is the distance along a straight line from one crest (peak) of the wave to the next (λ).
10. The frequency of a wave is the number of times each second that crests pass a stationary checkpoint (f).
11. The amplitude of a wave is the greatest distance of a crest or trough (low point) from the ray.
12. The higher the frequency, the shorter the wavelength.
13. The greater the amplitude, the more energy the wave has.
14. The visible spectrum in order of decreasing length of the wave is Red, Orange, Yellow, Green, Blue, Indigo and Violet.
15. White light is a mixture all the visible spectrum of light.
16. Black “light” is known as the absence of light.
17. Waves that have wavelengths too short to be seen are called Ultraviolet rays, X rays and Gamma rays.
18. Waves with wavelengths to long to be seen are called infrared rays, microwaves and radio waves.
19. Colors are the way the retinal cells of the eye react to different wavelengths of light when they enter the eye.
20. Colors are different because each is a different wavelength of light.
21. Sound travels in waves as it moves through the air or some other medium.
22. The waves are produced by a vibrating object.
23. Sound waves must travel through a medium.
24. A medium is a substance though which something travels.
25. The nature of a particular sound can be described in terms of frequency and pitch, intensity and loudness, and quality.
26. The number of condensations or rarefactions produced by a vibrating object each second is called the frequency of the sound waves.
27. The more rapidly an object vibrates, the higher will be the frequency.
28. A unit called the hertz is used to measure frequency.
29. One hertz equals one cycle (vibration) per second.
30. As the frequency of sound waves increases, the wavelength decreases.
31. Wavelength is the distance between any point on one wave and the corresponding point on the next one.
32. The speed of light is equal to the wavelength times the frequency of the light ( c = λf).
33. Amplitude is the distance that a vibrating object moves from its position of rest as it vibrates.
34. The larger the amplitude of vibration is, the more intense will be the sound.
35. Sound waves lose intensity as they spread outward in all directions from their source.
36. The speed of sound depends on the medium through which the sound waves travel.
37. The speed of sound is much slower than the speed of light.

**Earth Science**

**Soil:**

1. Soil is comprised of minerals, organic particles, organisms, air and water.
2. Water and air occupy the spaces between the particles in soil.
3. Particles called sands, silts, and clays make up most of the mineral content of soils.
4. Decomposers break down dead plants and animals in the soil.
5. Decaying organic material releases nutrients into the soil, combines with mineral particles, forms organic soil particles called humus
6. Soil forms when environmental conditions break down rock and debris at the surface of the earth.
7. Soil forms in layers called horizons
8. The upper two horizons, called the A and B horizon.
9. The A horizon is also known as topsoil
10. The lowest horizon, called the C horizon or the subsoil, is exposed to little weathering
11. The C horizon’s composition resembles that of the parent material
12. Soil conservation is a set of management strategies for the prevention of soil being eroded from the earth’s surface or becoming chemically altered by overuse.
13. The main approaches of soil conservation are vegetative cover are erosion prevention.
14. The main types of vegetative cover are crop rotation, cover crops, and planted windbreaks
15. Crop rotation is the alternation of crops on a given field, so that nutrient depletion is avoided from repetitive chemical uptake/deposition of single crop growth
16. Cover crops are plants that are planter to cover the soil
17. Cover crops protect the soil from erosion, weed establishment, and help in vital soil replenishment.
18. Windbreaks are rows of planted trees or shrubs that prevent wind from blowing soil away.
19. Erosion prevention can be done through mulching, contour farming and terracing.
20. Mulching is putting a protective cover over the soil, to modify the effects of the local climate.
21. Contour farming is the plowing across a slope following its contours to slow water run-off during rainstorms.
22. Terracing is the practice of creating nearly level layers on a hillside setting for planting crops.

**Mapping:**

1. Lines of latitude run east to west across the globe.
2. Lines of longitude run north to south across the globe.
3. The equator divides the Earth into northern and southern hemisphere.
4. The prime meridian (runs through Greenwich, Britain) divides the Earth into eastern and western hemispheres.
5. Any location on a map can be marked using both latitude and longitude.
6. Topographic map is a map that shows elevation, relief and landforms of an area.
7. Elevation is the height above sea level.
8. Relief is the difference in elevation between two locations.
9. Landforms are distinct shapes of the earth’s surface, such as plains, mountains and plateaus.
10. Topographic maps contain contour lines which display points of equal elevation.
11. The contour interval is the distance in elevation between two contour lines.
12. The contour interval for a given topographic map is the same throughout the map.
13. Contour lines close together represent a steep slope, while contour lines spaced out represent a gentle slope.
14. Contour lines that form a “V” represent a valley or mountain ridge.

**Weathering/Erosion:**

1. Deflation is the lifting and removal of fine sediment by wind
2. Erosion is the movement of material from one place to another.
3. There are two kinds of weathering, physical disintegration and chemical decomposition
4. Physical disintegration is caused by animal actions, ice, plant actions, abrasion and pressure release.
5. Chemical decomposition is when the rock's chemical structure breaks down.
6. Some main forms of Chemical decomposition are Water, Oxygen, Carbon Dioxide, Living Organisms and Acid Rain.
7. Climate, type of rock and surface area affect the rate at which chemical decomposition occurs.
8. Abrasion is the grinding and wearing down of rock by other rock or sand particles
9. Mass movement is the movement of any material down a slope
10. Rapid mass movement occurs when a mass of material moves quickly down slope, such as a landslide or mudflows.
11. The angle of repose is the steepest angle which loose material will not slide down
12. A landslide is the sudden rapid movement of a large amount of material down a slope
13. A slump is a kind of landslide where material shifts downward.
14. A mudflow is a rapid movement of a large amount of mud.
15. Extremely slow movement down a slope is called a creep.

**Rivers:**

1. A youthful stream erodes deeper instead of wider
2. A mature river erodes it's channel wider than deeper
3. An old river has a low gradient and low erosive power.
4. A gradient is a measure in the change of elevation over a certain distance
5. The higher the gradient, the more energy a stream has and the more erosion will take place
6. Deposition is when materials carried by water are deposited in slower moving water to form sandbars, deltas and alluvial fans
7. Alluvial fans are fan shaped deposits that form on dry land
8. A stream's load is rock and soil carried in a streams water
9. A delta is a fan shaped alluvial deposit where a stream reaches a large body of water