**SUBJECT**

**YEAR 9**

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| **SOW** | **Waves****(Autumn term)** | **Space**  | **Cellular Biology****(Spring term)** | **Particles –**  | **Atomic Structure & Periodic Table****(Spring Term)** |
| **Knowledge** | **To know:*** The definitions and give an example of a longitudinal and transverse wave.
* What is meant by wavelength, amplitude and frequency.
* The wave equation including the units of each quantity.
* How to draw a normal correctly.
* The law of reflection (angle of incidence = angle of reflection).

That light refracts when it enters a different medium. | **To Know*** **The planets of the solar system in order.**
* **To identify the gas and rocky planets**
* **The life cycle of the sun and larger stars**
* **The orbital motion of the moon and the forces keeping it in motion.**
* **The seasons and why they occur.**
* **The models of the solar system and how they have developed over time.**
* **The types of satellites that orbit the Earth.**
* **The phases of the moon and how they occur.**
* **What SETI means.**
 | **To know:*** The similarities and differences between eukaryotic and prokaryotic cells and estimate their relative size or area.
* How the structure of different types of cells relate to their function in a tissue, an organ or organ system.
* The importance of cell differentiation in both animals and plants and how it leads to specialised cells.
* How microscopy techniques have developed over time how to carry out calculations involving magnification, real size and image size.
* That an electron microscope has a much higher magnification and resolution than a light microscope.
* How bacteria divide (binary fission), how they can be grown and how to prepare an uncontaminated culture using an aseptic technique.
* That the nucleus contains chromosomes (in pairs) made of DNA. Each chromosome contains many genes.
* How to describe how cells divide via mitosis and knowing how it fits within the stages of the cell cycle.
* The function of stem cells in embryos, in adult animals and in the meristems of plants.

That substances move in and out of cells across the cell membrane by diffusion, osmosis and active transport. | To Know:* Describe the particle arrangement in solids, liquids and gases
* Identify the three states of matter
* Carry out safely the required practical for both density of regular and irregular objects
* Carry out safely the required practical for specific heat capacity.
* Describe what is meant by specific latent heat of both vaporisation and fusion
* Explain how the motion of the molecules in a gas is related to both its temperature and its pressure
 | **To know:*** The difference between atoms, elements and compounds.
* How mixtures can be separated by physical processes such as filtration, crystallisation, distillation and chromatography.
* How the model of the atom has changed over time – the difference between the plum pudding and nuclear models of the atom.
* The relative masses and charges of the sub-atomic particles in an atom and how this is linked to isotopes.
* How to calculate the number of protons, neutrons and electrons in an atom or ion given the atomic and mass numbers.
* How to calculate the relative atomic mass of an element given the relative abundancies of its isotopes.
* How to represent the electronic structures of the first 20 elements by numbers (2.8.1 for Na) or by diagram; circles (shells) and electrons (x).
* That the position of an element on the periodic table is linked to its atomic number and number of electrons in its outer shell.
* The steps that were taken to develop the periodic table.
* The difference between metals and non-metals.
* The properties of the elements in Group 1 (alkali metals), 7 (halogens) and 0 (noble gases) and how their reactivity is linked to their electron structures and position in the periodic table.
* That the transition elements are metals with similar properties which are different to those of the elements in Group 1.
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| **Skills**  | To be able to:* Label the wavelength and amplitude of a transverse wave.
* Compare two waves with similar/different wavelength and amplitude.
* Calculate the wave speed using the wave equation.

Using a protractor to measure angles of incidence, reflection and refraction. | To be able to:* Label the solar system.
* To label the different phases of a star’s lifecycle.
* To label the forces of orbital motion.
* To identify heliocentric and geocentric models from diagrams.
* Demonstrate an understanding of centripetal force.
* Identify natural and artificial satellites..
 | To be able to:* Demonstrate an understanding of the scale and size of cells and make calculations with the use of standard form.
* Recognise, draw and interpret images of cells using a light microscope and a magnification scale.
* Convert and use prefixes centi, milli, micro and nano.
* Calculate the number of the number of bacteria in a population or the cross-sectional area of a colony using πr2
* Use models or analogies to develop explanations about how cells divide and recognise contexts when mitosis is occurring.
* Evaluate the practical risks, benefits, social and ethical issues of the use of stem cells in medical research and treatments.
* Recognise, draw and interpret diagrams that model diffusion and osmosis.
* Calculate and compare surface area to volume ratios
* Use percentages and to measure the rate of water uptake. and calculate percentage gain/loss of mass in plant tissue

Plot, draw and interpret appropriate graphs. | To be able to:* Recall and apply the equation for density
* Apply the equation for specific heat capacity
* Apply the equation for specific latent heat
* Recall the units for density, mass volume
* Recall the units for specific temperature, specific heat capacity and mass
* Recall the units for specific latent heat
 | To be able to:* Complete word and balanced symbol equations where appropriate.
* Safe use of a range of equipment to separate chemical mixtures.
* Understand why and how scientific theories develop over time using the development of the model of the atom.
* Relate the size and scale of atoms to objects in the physical world – use SI units, the prefix nano and standard form (radius of an atom/nucleus)
* Visualise and represent 3D structures in 2D (structure of an atom)
* Predict possible reactions and probable reactivity of an element from its position in the periodic table.
* Explain how testing a prediction can support or refute a new scientific idea in terms of the development of the periodic table.
* Predict properties from given trends down a group in the periodic table.
* Use liquids and solids safely, including careful mixing of reagents under controlled conditions, using appropriate apparatus to explore chemical changes and/or products.

Safe use of heating devices and techniques such as a Bunsen burner and a controlled-temperature water bath. |
| **Vocabulary** | Wavelength, frequency, amplitude, hertz, longitudinal transverse, wave speed, reflection, refraction, normal, incidence | Satellite, geocentric, heliocentric, phases, orbit, orbital, centripetal, Red giant, black hole, supernova, nebula, protostar, planet, neutron star, main sequence | Eukaryotic, prokaryotic, organelles, nucleus, cell membrane, cytoplasm, mitochondria, ribosome, cell wall, vacuole, chloroplast, differentiation, specialisation, microscopy, magnification, resolution, binary fission, aseptic, chromosomes, gene, mitosis, embryo, meristem, diffusion, osmosis, active transport |  | Atom, element, compound, molecule, ion, mixture, evaporation, filtration, distillation, chromatography, crystallisation, proton, neutron, electrons, nucleus, isotopes, relative atomic mass, abundance, periodic table, alkali metal, universal indicator, halogen, displacement, reactivity, noble gas, dissolving, soluble, insoluble, exothermic, transition metal, catalyst |
| **Does the knowledge above marry up with KO? If not, what needs to be amended?** |  |  |  |  |  |
| **How does this knowledge link to/build on prior knowledge?** |  |  |  |  |  |
| **Is knowledge embedded consistently across the SOW?** |  |  |  |  |  |
| **Is all of the vocabulary embedded throughout the SOW?** |  |  |  |  |  |
| **What (if any) additional vocabulary is needed to access this SOW?** |  |  |  |  |  |
| **What grammatical knowledge is required to access this SOW? Is this embedded across the SOW?** |  |  |  |  |  |
| **Does remembering the knowledge help students to develop the skill? If not, what is missing?** |  |  |  |  |  |