# Lymm High School- KS3 Life after levels - Science Y9

| | BRONZE | SILVER | GOLD | PLATINUM |
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| | D and below= GCSE 1,2,3 | C= GCSE 4 | C/B= GCSE 5,6 | A/A*= GCSE 7,8,9 |
| **Biology** | Explain that cells are very small and a microscope is needed to see them.<br><br>Describe how the main sub-cellular structures, including the nucleus, cell membranes, mitochondria, chloroplasts in plant cells and plasmids in bacterial cells are related to their functions.<br><br>Describe that chromosomes are made of DNA molecules, that chromosomes contain many genes and that they are normally found in pairs.<br><br>Describe the function of stem cells in embryos and in adult animals.<br><br>State the difference between therapy and surgery.<br><br>State some possible uses for stem cells. | Demonstrate an understanding of the scale and size of cells.<br><br>Describe how the structure of different types of cell relate to their function in a tissue, an organ or organ system, or the whole organism.<br><br>Explain how the main sub-cellular structures, including the nucleus, cell membranes, mitochondria, chloroplasts in plant cells and plasmids in bacterial cells are related to their functions.<br><br>Outline how microscopy techniques have developed over time.<br><br>Explain the need for cells to divide in order for an organism to grow (e.g. human zygote to human adult). | Carry out calculations involving magnification, real size and image size using the formula: magnification = size of image/size of real object.<br><br>Explain how the structure of different types of cell relate to their function in a tissue, an organ or organ system, or the whole organism.<br><br>Give examples of cell differentiation.<br><br>Explain how electron microscopy has increased understanding of sub-cellular structures.<br><br>Understand the three overall stages of the cell cycle but do not need to know the different phases of the mitosis stage.<br><br>Explain the function of stem cells in embryos, in | Carry out calculations involving magnification, real size and image size using the formula: magnification = size of image/size of real object and using standard form if needed.<br><br>Explain the importance of cell differentiation.<br><br>Recognise and describe situations in given contexts where mitosis is occurring.<br><br>Apply knowledge and explain how stem cells can be used to treat diabetes and paralysis.<br><br>Suggest advantages and disadvantages of cloning for rare species, using the cells in medicine and cloning crop plants for disease resistance including evaluation of the ethical and religious objections.<br><br>Explain the need for carbon dioxide and oxygen to |

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| | Describe the process of diffusion and give some of the factors that affect the rate of diffusion. | Describe the function of stem cells in embryos, in adult animals and in the meristems in plants.<br><br>Explain what therapeutic means and explain why it might be a better option than organ transplant or other forms of invasive surgery.<br><br>Suggest uses and benefits of using cloning.<br><br>Define diffusion and know that three factors that affect the rate at which it happens.<br><br>Explain why cells need to be small in order to maximise the rate of diffusion.<br><br>Define osmosis and active transport and give examples of their occurrence in plants and animals. | adult animals and in the meristems in plants.<br><br>Describe some beneficial uses of stem cells in both animals and plants and state the sources of these stem cells<br><br>Describe what therapeutic means and evaluate the risks of organ transplant or other forms of invasive surgery versus therapy.<br><br>Outline advantages of cloning for rare species, using the cells in medicine and cloning crop plants for disease resistance and give some of the risks associated with cloning.<br><br>Explain the need for carbon dioxide and oxygen to diffuse in gas exchange.<br><br>Describe how lungs, gills, intestines and leaves are adapted to maximise diffusion. | diffuse in gas exchange and for urea to diffuse from cells to blood plasma to be excreted at the kidney.<br><br>Explain how cells and organs are adapted to maximise diffusion.<br><br>Define osmosis and explain its importance in living things.<br><br>Define active transport and explain why active transport is needed to absorb sugar in the small intestine for respiration and ions from the soil in root hair cells. |

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| | | | Define osmosis give an example of its use in living things.<br><br>Define active transport and explain how active transport is used to absorb sugar in the small intestine and ions from the soil in root hair cells. | |
| **Chemistry** | Define the terms element and atom, they will understand that the periodic table lists all of the elements and use the periodic table to find the symbols for the elements.<br><br>Know that filtration, crystallisation, distillation and chromatography are used to separate mixtures.<br><br>Describe the structure of an atom and identify the subatomic particles.<br><br>Know that the modern periodic table was first proposed by Mendeleev.<br><br>State some differences between the modern | Explain the difference between a compound and a mixture; recognise substances as elements, compounds or mixtures from particle diagrams.<br><br>Outline the methods for crystallisation, distillation, filtration and separation.<br><br>Describe the plum pudding model for the atom and how it I different to the modern model of the atom.<br><br>Know the masses, charges and locations of the subatomic particles.<br><br>Calculate the numbers of protons, neutrons and | Explain that filtration allows an insoluble solid to be separated from a liquid and crystallisation allows a soluble solid to be separated from a liquid.<br><br>Explain how that chromatography is used for separation of mixtures of coloured compounds.<br><br>Explain how distillation allows for the separation of two liquids with different boiling temperatures.<br><br>Describe the scattering experiments performed by Rutherford and outline the discoveries of other subatomic particles and | Suggest appropriate separation techniques for different mixtures based on the physical properties of the compounds in the mixture.<br><br>Explain how and why the atomic model has developed as a result of the discoveries of the subatomic particles.<br><br>Explain the conclusions drawn from Rutherford's scattering experiments.<br><br>Explain why the overall charge on an atom is neutral. |

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| | periodic table and Mendeleev's periodic table.<br><br>State some typical properties of metals and non metals.<br><br>Identify metals and non metals based on the position of elements in the periodic table.<br><br>Know what an ion is.<br><br>Know that group 0 elements are unreactive.<br><br>Define a covalent bond.<br><br>Know that diamond and graphite are giant covalent structures.<br><br>Describe what a polymer is. | electrons in an atom. Work out the electron configuration for different atoms.<br><br>Outline developments in the structure of the periodic table and know how Mendeleev arranged the elements.<br><br>State the differences between the modern periodic table and Mendeleev's periodic table.<br><br>Describe the structure and bonding of metals.<br><br>Identify group 1 and transition metal and describe some differences between them.<br><br>Describe the reactions of group 1 metals with water and the displacement reactions of group 7 elements.<br><br>Describe how metals and non metals form ions and | their arrangement in the atom.<br><br>Calculate the numbers of protons, electrons and neutrons in different atoms, give the definition of isotopes and calculate the relative atomic masses for different elements given the % abundance of their isotopes.<br><br>Explain how Mendeleev ordered and grouped the elements and why he needed to leave gaps.<br><br>State and give reasons for the differences between the modern periodic table and Mendeleev's periodic table.<br><br>Explain the properties of metals based on their structure and bonding.<br><br>Describe the differences between the physical and chemical properties of group 1 and transition metals. | Explain the link between period or group number and electron configuration.<br><br>Explain why different isotopes still have the same chemical properties.<br><br>Suggest how Mendeleev convinced people to accept his periodic table.<br><br>Suggest how Mendeleev predicted the properties of the missing elements.<br><br>Suggest how Mendeleev's periodic table developed with our understanding of the subatomic particles in an atom.<br><br>Explain how the reactivity of group 1 & 7 elements changes as you go down the groups, by considering their electron configurations, and give examples of their reactions to exemplify these trends.<br><br>Predict reactions of fluorine and astatine based on |

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| | | the charges on the ions formed.<br><br>Explain why group 0 elements are unreactive.<br><br>Describe the structure of ionic compounds.<br><br>Define and recognise covalent bonding. Identify simple molecules.<br><br>Recognise giant covalent structures from diagrams showing their bonding and structure.<br><br>State properties of diamond and graphite and give some uses of these compounds.<br><br>Know that graphite is similar to metals in that it has delocalised electrons.<br><br>Know that graphene and fullerenes are also structures made of carbon.<br><br>Recognise polymers from diagrams showing their bonding and structure. | Give the electron configurations for group 1 and 7 elements and use them to explain why these elements are grouped together.<br><br>State how the reactivity of group 1 & group 7 elements changes as you go down the group.<br><br>Give the electron configurations for ions formed from group 1, 2, 6 & 7 elements and their charges.<br><br>Draw dot and cross diagrams for the formation of compounds between group 1 & 7 elements and describe the electron transfers taking place as they form.<br><br>Students should be able to recognise common substances that consist of small molecules from their chemical formula.<br><br>Draw dot and cross diagrams for the molecules | knowledge of the other halogens.<br><br>Relate the charges on ions to the position of elements in the periodic table.<br><br>Draw dot and cross diagrams for ionic compounds formed by metals in Groups 1 and 2 with non-metals in Groups 6 and 7.<br><br>Work out the empirical formula of an ionic compound from a given model or diagram that shows the ions in the structure.<br><br>Use the idea that intermolecular forces are weak compared with covalent bonds to explain the bulk properties of simple molecular substances and giant covalent structures.<br><br>Explain the uses of diamond and graphite in relation to their properties. |

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| | | | of hydrogen, chlorine, oxygen, nitrogen, hydrogen chloride, water, ammonia and methane.<br><br>Explain the properties of diamond and graphite in terms of their structure and bonding.<br><br>Recognise graphene and fullerenes from diagrams and descriptions of their bonding and structure and give examples of the uses of fullerenes, including carbon nanotubes. | Explain the properties of graphene and fullerenes in terms of their structure and bonding.<br><br>Outline the limitations of using dot and cross, ball and stick, two and three-dimensional diagrams to represent molecules or giant structures. |
| **Physics** | State the law of conservation of energy.<br><br>Give the units for energy, mass, height, force, power, speed, temperature and work done.<br><br>Give the relationship between force and extension using a force - extension graph.<br><br>Interpret Sankey diagrams to find total input, useful output and wasted energy. | Define energy as the capacity of a system to do work.<br><br>Describe energy transfers and draw energy flow diagrams.<br><br>Use equations to calculate work done, energy stored in a spring, gravitational potential energy, kinetic energy and heat energy transferred.<br><br>Describe the relationship between the extension of a | Rearrange equations to calculate work done, energy stored in a spring, gravitational potential energy, kinetic energy and heat energy transferred.<br><br>Outline a practical to investigate the heat energy transferred to a substance.<br><br>Explain the relationship between the extension of a spring and the force applied. | Explain what the internal energy of a system is.<br><br>Explain how doubling velocity affects the kinetic energy of a moving object.<br><br>Calculate spring constant from a graph of force vs extension.<br><br>Calculate the energy stored in a spring using a force - extension graph.<br><br>Outline how specific heat capacity can be investigated |

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| | Name most of the different circuit symbols.<br><br>State the symbol and units for current, charge and time.<br><br>State the quantities and units of voltage, current and resistance.<br><br>State that the longer a wire the greater the resistance.<br><br>Draw the I-v graph for an ohmic conductor and bulb.<br><br>Draw the R-T graph and R-Light intensity graph for the two components.<br><br>State that the more resitors in a series circuit the greater the total resistance.<br><br>Explain that the more resistors in parallel the lower the resistance.<br><br>Draw the structure of an atom.<br><br>State what the plum pudding model was. | spring and the force applied.<br><br>Describe what specific heat capacity is.<br><br>Define power.<br><br>Draw and interpret Sankey diagrams.<br><br>Define efficiency and calculate it as a percentage or decimal.<br><br>Build a simple series circuit using a circuit diagram as a guide.<br><br>Draw a simple series circuit using circuit symbols.<br><br>Explain what current and charge are.<br><br>Use the V=IR equation to solve problems.<br><br>Explain why the resistance increases with increased length.<br><br>Draw the I-V graph for a diode. | Recall the equation to calculate power and rearrange and use it to calculate the power of different systems, energy transferred or time.<br><br>Explain the meaning of the term efficiency.<br><br>Build a parallel circuit using a circuit diagram and can draw a parallel circuit from looking at it.<br><br>Explain how we are able to measure electrical current and use the Q=It equation.<br><br>Explain the relationship between V, I and R.<br><br>Can explain why the alternative units for volts are J/C.<br><br>Explain the importance of keeping the temperature constant when measuring resistance in terms of the oscillations of ions.<br><br>Draw the V-I graphs for diodes, thermistors, LDRs | and factors that may affect the reliability of the results.<br><br>Compare the efficiency of different systems and suggest ways to improve their efficiency based on reducing the “waste” energy.<br><br>Explain to others how to build a series and parallel circuit but without just telling them what to do.<br><br>Use different models to explain what an electrical current is and what is flowing around<br><br>Calculate the resistance of a component using the gradient of an I-V graph by taking the reciprocal<br><br>Suggest how changing the area would affect the resistance along with sound reasoning why<br><br>Explain the physics behind the shape of the diodes graph |

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| | State that radioactive decay is random.<br><br>State the units of activity.<br><br>State the three types of radiation.<br><br>Calculate the mass number and proton number when given a nuclear equation with the alpha and beta particles already written out.<br><br>State what the half life of a radioactive source is.<br><br>State what radioactive contamination is and the associated hazards. | Explain why increasing heat increases the resistance.<br><br>Calculate the resistance of a series circuit.<br><br>Calculate the total resistance for simple whole integer answers for resistance.<br><br>State what the numbers on a chemical symbol represent and can therefore state the number of protons and electrons in a neutral atom.<br><br>Explain how the discovery of the electron led to the plum pudding model.<br><br>State the device used for detecting radiation.<br><br>Explain what it means to be ionising.<br><br>Complete nuclear equations when given all the products but not their masses and proton numbers. | and filament bulbs and explain the difference and reason for the alternative scales.<br><br>Can explain the shape of the filament graphs<br><br>Explain how these components would be used to design practical circuits.<br><br>Calculate the resistance of parallel resistors.<br><br>Calculate the number of neutrons in an atom and explain why the calculation works.<br><br>Explain what happens to the charge of the atom if it loses or gains electrons.<br><br>Explain how the gold scattering experiment led to the current atomic model.<br><br>State the penetration power and ionising properties of the three types of radiation. | Explain what an I-V graph would look like for a thermistor.<br><br>Explain why adding resistors in series increases the total resistance but adding them in parallel reduces the total resistance.<br><br>Explain what isotopes are and how they are similar and different they are.<br><br>Explain why the different forms of radiation are best for different purposes.<br><br>Identify the daughter nuclei from completed nuclear equations.<br><br>Explain why gamma decay does not result in a mass change.<br><br>Calculate the net decline expressed as a ratio in a radioactive emission after a given number of half-lives.<br><br>Explain the importance of studies into the effects of radiation on humans and |

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| | | Use a graph to find the halph life of a source.<br><br>Calculate the passage of time using a change in activity and knowledge of the half life.<br><br>State what irradiation is and isn't.<br><br>Compare the hazards associated with contamination and irradiation.<br><br>State suitable precautions to take when using radioactive substances. | Select the best type of radiation for different uses.<br><br>Complete a nuclear equation if told that an atom decays with alpha, beta or gamma decay.<br><br>Use data of penetration and half life to identify a radioactive source.<br><br>Explain why the precautions suggested would be effective in terms of the penetrating and ionising properties of the radiation. | how and why peer review is an important aspect of any study into issues like this. |