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**Knowledge Rich Curriculum Plan**

Science – Physics

Year 12



| **Science**  **Year 12 Physics** | **Unit: Measurements and Their Errors** |  |  |
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| **Lesson/Learning Sequence** | **Intended Knowledge:**  *Students will know that…* | **Tiered Vocabulary** | **Prior Knowledge:**  *In order to know this students, need to already know that…* |
| **Lesson:**  **Use of SI Units** | * Students will know that the fundamental units are mass (kg), length (m), time (s), amount of substance (mol), temperature (K) and current (A) * Students will know that fundamental units can't be further derived * Students will know how to derive other units, such as N, into the fundamental units * Students will know how to use the prefixes:   T (x 10^12)  G (x 10^9)  M (x 10^6)  k (x 10^3)  c (x 10^2)  m (x 10^-3)  μ (x 10^-6)  n (x 10^-9)  p (x 10^-12)  f (x 10^-15)   * Students will know that to convert from eV to J you need to multiply by 1.6 x 10^-19 * Students will know that to convert from kWh to J you need to multiply by 3.6 x 10^6 |  |  |
| **Lesson:**  **Uncertainties and Errors** | * Students will know that random error is caused by unpredictable circumstances, and that they can’t be corrected * Students will know that to mitigate random error more measurements need to be taken and a mean calculated * Students will know that systematic error is caused by equipment, and means that measurements differ from the true value by a consistent amount of time * Students will know that systematic errors can be corrected by using a different technique to take measurements * Students will know that precision refers to how close measurements are to each other and the mean * Students will know that accuracy refers to how close a measurement is to the true value * Students will know that repeatable means that when the experiment is repeated using the same method and equipment the same results are obtained * Students will know that resolution refers to the smallest change in a quantity being measured that gives a perceptible change in the reading * Students will know that reproducible refers to when somebody else repeats the investigation using different equipment or techniques and the same results are obtained * Students will know that uncertainty is the interval within which the true value can be expected to lie * Students will know that absolute uncertainty is no smaller than plus or minus half of the smallest division. * Students will know that the absolute uncertainty of a measurement where two readings are required is twice the absolute uncertainty of one reading. * Students will know that the absolute uncertainty of multiple readings is half the range * Students will know that percentage uncertainty is calculated by: * absolute uncertainty / mean value x 100 * Students will know that when data is added or subtracted, absolute uncertainties are added together * Students will know that when data is multiplied or divided, the percentage uncertainties are added * Students will know that when data is raised to a power, the percentage uncertainty is multiplied by the power * Students will know how to calculate percentage error for a number of different scenarios |  | * ***Students need to already know equipment that is used for measuring mass (balance), length (ruler), Force (Newton meter), Current (ammeter), potential difference (voltmeter)*** |
| **Lesson:**  **Graphs and Uncertainty** | * Students will know that to calculate gradient on a graph with a curve, a tangent need to be drawn * Students will know that errors are represented on a graph through using error bars. * Students will know that absolute uncertainties of a gradient can be calculated from the worst-case lines of best fit * Students will know that it is possible to work out some quantities from the area under the graph * Students will know that the percentage uncertainty of a gradient is calculated by: * (best gradient - worst gradient)/ best gradient x 100 * Students will know that the percentage uncertainty of a y intercept can be calculated by: * (best y intercept - worst y intercept) / best y intercept x 100 |  | * ***Students need to already know that the equation for a straight line graph is y = mx + c*** * ***Students need to already know that to calculate gradient it is:*** * ***change in y/ change in x*** |
| **Lesson:**  **Estimation of physical quantities** | * Students will know that order of magnitude refers to a system of classification determined by size, in powers of 10 * Students will know how to estimate approximate values of physical quantities to the nearest order of magnitude * Students will know how to use estimates together with their knowledge or physics to produce further derived estimates also to the nearest order of magnitude. |  | * ***Students need to already know the order of the prefixes*** |