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**Knowledge Rich Curriculum Plan**

SCIENCE- Physics Year 10

| **Lesson/Learning Sequence**  | **Intended Knowledge:***Students will know that…* | **Prior Knowledge:***In order to know this, students need to already know that…* | **Working Scientifically** | **Tiered Vocabulary and Reading Activity** |
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| **Lesson:** **Energy Stores and Systems** | * Students will know that a system is a group of objects
* Students will know that the different stores of energy are chemical, thermal, kinetic, nuclear, electrostatic, gravitational potential energy, elastic potential energy, magnetic
* Students will know that there are changes in the way energy is stored when a system changes

Students will know how to describe the changes involved in the way energy is stored when a system changes | ***Students need to already know examples of how energy is stored*** |  | *Tier 2**Tier 3****System:*** *A group of objects.****Dissipation:*** *Energy that has been transferred to a non-useful energy store (normally thermal energy)* |
| **Lesson:** **Kinetic Energy** | * Students will know that kinetic energy is energy stored in a moving object
* Students will know that the store of kinetic energy depends on the object's mass and velocity
* Students will know that the equation for calculating kinetic energy is:

Kinetic energy = 0.5 x mass x (speed/velocity squared)Students will know how to use the equation to calculate kinetic energy, mass and speed | * ***Students need to already know that velocity is another term for speed***
* ***Students need to already know how to re-arrange formula***

***Students need to already know that the units for mass are kg, for speed is m/s and energy is J*** |  | *Tier 2**Tier 3****Kinetic Energy****: Energy that is stored within a moving object* |
| **Lesson:** **Gravitational Potential Energy** | * Students will know that gravitational potential energy is the store of energy in any object above a planet's surface
* Students will know that gravitational field strength is a measure of how strong the gravity is on a planet
* Students will know that gravitational field strength is 9.8 N/kg on Earth
* Students will know that the unit for gravitational field strength is N/kg
* Students will know that the equation for calculating gravitational potential energy is:

Gravitational potential energy = mass x gravitational field strength x heightStudents will know how to use the equation to calculate gravitational potential energy, mass, gravitational field strength and height | ***Students need to already know that the units for height are metres, and for mass are kg.*** |  | *Tier 2****Potential:*** *having or showing the capacity to develop into something in the future****Proportional:*** *having a constant ratio to another quantity**Tier 3****Gravitational Potential Energy:*** *The energy stored in an object raised above Earth’s surface* |
| **Lesson:** **Elastic Potential Energy** | * Students will know that elastic potential energy is the store of energy in a stretched, compressed or twisted object.
* Students will know that the spring constant is a measure of the stiffness of a spring
* Students will know that the units for spring constant are N/m
* Students will know that the equation for calculating elastic potential energy is:

Elastic Potential energy = 0.5 x spring constant x (extension squared)* Students will know that extension is the increase in spring length when it has been stretched
* Students will know that the unit for extension is metres

Students will know how to use the equation to calculate elastic potential energy, spring constant and extension |  |  | *Tier 2**Tier 3****Elastic Potential Energy*** *is the energy stored in a stretched or compressed object”* |
| **Lesson:** **Specific Heat Capacity** | * Students will know that the amount of energy stored in/ released from a system as its temperature changes can be calculated using the equation:

change in thermal energy = mass x specific heat capacity x temperature change* Students will know that the unit of thermal energy is Joules
* Students will know that the unit of specific heat capacity is J/kg °C
* Students will know that the specific heat capacity of a substance is the amount of energy required to raise the temperature of one kilogram of a substance by one degree Celsius
* Students will know how to use the equation to calculate change in thermal energy, mass, specific heat capacity and temperature change

Students will know how to practically determine the specific heat capacity of a substance | ***Students will already know that the unit of mass is kg*** |  | *Tier 2**Tier 3****Specific heat capacity****: The energy required to change the temperature of 1kg of a substance by 1oC* |
| **Lesson:** **Power** | * Students will know that power is the rate at which energy is transferred or the rate at which work is done
* Students will know that to calculate power they would use the equation:

Power - energy transferred / timePower = work done / time* Students will know that the unit for power is Watts (W)
* Students will know that the unit of work done is Joules
* Students will know that the equivalent units of Watts is Joules per second (J/s)

Students will know how to use the equations to calculate power, energy, time and work done | * ***Students need to already know that the unit of energy is Joules***
* ***Students need to already know that the unit of time is seconds.***

***Students need to already know how to convert time into seconds*** |  | *Tier 2**Efficient: achieving maximum productivity with minimum waste**Tier 3**Power: a measure of how much energy is transferred each second**Work Done: Transfer of energy from one store to another* |
| **Lesson:** **Conservation of energy** | * Students will know that energy can't be created or destroyed
* Students will know that energy that has dissipated has been transferred into a non-useful energy store, normally thermal energy of the surroundings
* Students will know that energy can be transferred usefully
* Students will know that when energy is transferred in a closed system, there is no net change in the total energy

Students will know that there are methods for reducing unwanted energy transfers, such as through the use of lubrication | ***Students need to already know the different stores of energy*** |  | *Tier 2**Tier 3****Mechanical Energy****: Energy stored by an object depending on its position and motion****Closed system:*** *A system where no matter can transfer in or out of****Lubricant:*** *A substance used to reduce friction* |
| **Lesson:** **Reducing energy loss in a building** | * Students will know that thermal energy can be transferred through conduction, convection and radiation
* Students will know that the higher the thermal conductivity, the higher the rate of energy transfer
* Students will know that the rate of cooling of a building is affected by the thickness and the thermal conductivity of its walls
* Students will know that insulation can be used to slow down the rate of cooling, as insulation is a poor thermal conductor

Students will know that methods used to reduce energy loss in a home include using double glazing, installing cavity-wall insulation, installing insulation in the roof and through draught proofing | ***Students will already know that some materials are better at conducting heat than others*** | *Interpreting data* | *Tier 2**Insulation: Material used to insulate something**Cavity: a hole or empty space between two materials**Tier 3**Convection: the transfer of heat by the circulation or movement of the heated parts of a liquid or gas* |
| **Lesson:** **Efficiency** | * **Students will know that efficiency is a measure of how much energy is transferred usefully**
* **Students will know that efficiency is calculated using the equation:**

**efficiency = useful output energy transfer / total input energy transfer****or****efficiency = useful power output / total power input*** **Students will know how to calculate energy efficiency, energy input and energy output using the equation**
* **Students will know that efficiency doesn't have a unit**

**Students will know that efficiency can also be given as a percentage** | ***Students need to know that some energy transfers are useful*** |  | *Tier 2**Tier 3**Efficiency: A measure of the amount of energy transferred usefully**Conservation of energy: Energy cannot be created or destroyed, only transferred from one type to another* |
| **Lesson:** **Energy Resources** | * **Students will know that the main energy resources available on Earth include fossil fuels, nuclear fuel, biofuel, wind, hydroelectricity, geothermal, tidal, solar and wave power**
* **Students will know that non-renewable resources are resources that can't be replenished as it's used**
* **Students will know that fossil fuels and nuclear fuel are examples of non-renewable energy resources**
* **Students will know that the fossil fuels are coal, oil and gas**
* **Students will know that renewable energy resources are resources that will replenish as they're being used**
* **Students will know how to distinguish between different energy resources**
* **Students will know how to compare between different energy resources**
* **Students will know how the describe environmental impacts from the use of different energy resources**

**Students will know how to explain patterns in trends of use of fuels** |  | *Interpreting data* | *Tier 2****Replenished:*** *Fill something up again****Reliable:*** *Can be trusted to work well****Predictable:*** *Behaving in a way that is expected**Tier 3****Non-Renewable:*** *Resources that can’t be replenished whilst being used****Renewable:*** *Resources that will be replenished as they are being used up* |