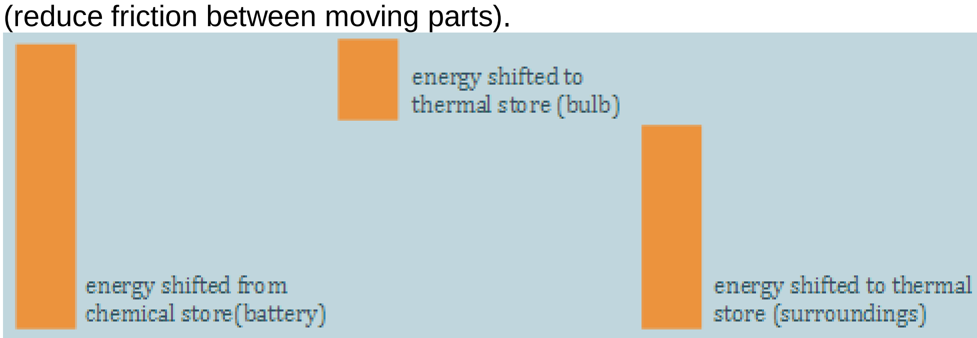
P1 - Energy		
1	**Types of energy** *Most* *Kids* *Hate* *Learning* ***G*** ***C*** ***S*** ***E*** *Energy* *Names*	**Magnetic** – energy within a magnetic field - store **Kinetic** – energy of moving object. The faster the object the greater the store of kinetic energy – store. **Heat** – energy of an object due to its internal energy (temperature) - store. ***Light** – energy transfers through light waves - transfer* **Gravitational potential energy** – energy of an object due to its height above the ground - store. **Chemical** – energy stored in a fuel (battery, food), released when chemical reactions take place - store. ***Sound** – energy transferred due to sound waves - transfer* ***Electrical** – energy transferred by an electrical current - transfer.* **Elastic potential** – energy stored in an object when it is stretched or compressed - store. **Nuclear** – energy stored within an atoms nucleus such as in the sun - store.
2	**Energy stores**	Energy cannot be created or destroyed – the amount of energy within a system is always the same – it is conserved. Energy is “shifted” between stores – as one store decreases the other store increases. **Example. A student lifting a book onto a shelf.** Chemical energy (from food) store within the student → *shifted* → gravitational potential energy store in the book.  Chemical energy store decreases.  Gravitational potential enrgy store increases. The total energy in the system is the **same** before and after (conserved).
3	**Energy transfers (shifting)**	1. Take a snapshot (before). 2. Take a snapshot (after). 3. Identify the stores. 4. Produce an energy description based on this analysis. **Example: Burning a fuel.** **Before**:  Fuel (wood) is a chemical energy store. **After:**  The surrounding air will be hotter and some of the fuel will be used up. **Energy description**: The chemical energy store in the fuel decreases, the internal heat energy store of the surrounding air increases. Light is given out during the shifting of energy stores. **Examples:** **Burning a match**: Chemical store shifted to heat store in internal energy of surrounding air, light is given out. **A car:** Chemical energy store in fuel shifted to kinetic energy store in moving car, sound is given out, and internal heat energy store of surrounding air also increases.

4	**Calculating energy**  	The amount of energy required to achieve a task can be calculated using the formula: $E_k = \frac{1}{2} \times m \times v^2$ Kinetic energy = 0.5 x mass x (velocity)^2 $E_e = \frac{1}{2} \times k \times e^2$ Elastic energy = 0.5 x spring constant x (extension)^2 $E_p = m \times g \times h$ GPE = mass x gravitational field strength x height **Example**: If asked to calculate the energy required to climb a mountain. Mass of climber x gravitational field strength on earth x height of the mountain.
5	**Specific heat capacity**	The specific heat capacity of a substance is the amount of energy required to raise the temperature of one kilogram of the substance by one degree Celsius. $\Delta E = m \times c \times \Delta\theta$ Change in thermal energy = mass x specific heat capacity x temperature change
6	**Power**	Power is defined as the rate (speed) at which energy is transferred or the rate at which work is done. (Work is done when a force is applied to an object causing it to move over a distance). Power of a device is the amount of energy it uses every second, measured in Watts. $P = \frac{E}{t}$ Power = $\frac{energy}{time}$ $P = \frac{W}{t}$ Power = $\frac{work\ done}{time}$ If two machines both lift the same object but one does it faster the faster one is more powerful.
7	**Useful and wasted energy**	When energy is transferred between stores some may be transferred to a less useful store, we say this energy is wasted. In most systems energy is usually wasted when heat energy is emitted that increases the internal heat energy of the surrounding air. Amount of energy wasted can be reduced through insulation (reduce heat energy emitted) and lubrication (reduce friction between moving parts).  Example: **Turning on a torch.** In this example the chemical energy store in the battery is shifted to a heat (thermal) energy store in the bulb (this will produce light waves – useful) and a heat energy store in the surrounding air (this is less useful for the purposes of a torch).
8	**Efficiency**	Efficiency is a measure of how much of the original energy or power is transferred (shifted) into a useful form. It can be written as a decimal or as a percentage (decimal x 100). $\text{Efficiency} = \frac{useful\ output\ enrgy}{total\ input\ energy}$ $\text{Efficiency} = \frac{useful\ output\ power}{total\ input\ power}$ The more efficient an object is the lower the amount of energy / power that is wasted. Efficiency can be increased through lubrication or reducing heat loss (insulation) – HT only.

Generating electricity

9	**Fossil fuels**	Coal, oil and natural gas. Not able to be replenished in a human lifetime. Will run out.
10	**Renewable energy**	Solar, wind, hydroelectric, tidal, wave, geothermal and biofuels (biogas and biomass). These can be replenished as they are used, will not run out.
11	**Nuclear energy**	Released from the nucleus of an atom during nuclear fission (power stations) and nuclear fusion (solar energy from the sun). Not renewable, but will not run out for a very long time.

You need to be able to compare the different ways that energy resources are used as well as the advantages and disadvantages of using them.

Method of generating electricity	**Advantages**	**Disadvantages**
Geothermal 1. Cold water is pumped below the ground. 2. Hot rocks heat the water, turning it into steam. 3. The steam turns a turbine to generate electricity.	• Does not release carbon dioxide so doesn't contribute towards global warming. • Renewable.	• Can only be built in certain places where hot rocks are near the surface of Earth. • Costs a lot of money to drill deep into the ground
Hydroelectric 1. Rivers have kinetic energy. 2. Kinetic energy turns a turbine to generate electrical energy.	• Does not release carbon dioxide so doesn't contribute towards global warming. • Renewable	• Costs a lot of money to build a dam • The dam can ruin the local environment, because it changes where the water naturally flows. Some animals and plants may die.
Tidal 1. The sea's waves have kinetic energy. 2. Machines bob up and down in the waves. 3. Kinetic energy can be turned into electrical energy.	• Does not release carbon dioxide so doesn't contribute towards global warming. • Renewable	• Only two tides a day so doesn't provide energy all day long.
Wind 1. The wind has kinetic energy. 2. This kinetic energy turns a turbine to generate electrical energy.	• Does not release carbon dioxide so doesn't contribute towards global warming. • Renewable	• The wind is not always blowing so will reliably produce electricity. • Turbines are ugly (visual pollution) and noisy (noise pollution).
Solar 1. The suns emits nuclear energy as light waves. 2. This is taken in by a solar panel and stored as electrical energy.	• Does not release carbon dioxide so doesn't contribute towards global warming. • Renewable	• Will not provide energy at night or if cloudy (not reliable). • Solar cells and solar panels are expensive.
Biofuels 1. Biomass (plants and trees) and biogas (gas produced by living / decomposing organisms) contain a chemical energy store. 2. This is burned to release heat energy.	• Cheap to grow. • Carbon neutral – although they release CO_2 when burned they absorb CO_2 by photosynthesis when growing. • Can be burned to produce electricity all day long (reliable). • Renewable.	• Loss of habitat and space to grow crops due to a large amount of land needed. •

3. Heat energy warms water and produces steam. 4. Steam turns a turbine. 5. This produces electricity.		
Coal 1. Coal is a chemical energy store, heat energy is released when burned. 2. Heat energy warms water and produces steam. 3. Steam turns a turbine. 4. This produces electricity.	• Can be burnt to produce electricity all day long (reliable).	• Does release carbon dioxide so does contribute towards global warming. • Non Renewable
Oil 1. Oil is a chemical energy store. heat energy is released when burned. 2. Heat energy warms water and produces steam. 3. This steam turns a turbine. 4. This produces electricity.	• Can be burnt to produce electricity all day long (reliable).	• Does release carbon dioxide so does contribute towards global warming. • Non Renewable
Gas 1. Gas is chemical energy store, heat energy is released when burred. 2. Heat energy warms water and produces steam. 3. This steam turns a turbine. 4. This produces electricity.	• Can be burnt to produce electricity all day long (reliable).	• Does release carbon dioxide so does contribute towards global warming. • Non Renewable
Nuclear 1. Atoms are a nuclear energy store. They emit heat energy during (nuclear fission). This heats a reactor. 2. This turns water into steam. 3. This steam turns a turbine. 4. This produces electricity.	• Does not release carbon dioxide. • Can be used to produce electricity all day long (reliable).	• Releases radioactive waste which needs to be stored safely. • Non Renewable