Energy Stores

1. The different energy stores are: **kinetic**, **elastic** potential, **chemical** potential, **gravitational** potential and **thermal**
2. Energy can be transferred between stores through: **heating**, **mechanically**, by **waves** or by **radiation**
3. A **system** is an object or group of objects.
4. Energy changes can be calculated when energy is transferred by heating, work done by forces or work done when a current flows.
5. The amount of energy stored in or released from a system as its **temperature changes** can be calculated using the equation:
   Change in thermal energy = mass × specific heat capacity × temperature change
   $$\Delta E = mc\Delta\theta$$
   with change in thermal energy, ΔE, in Joules, J; mass, m, in kilograms, kg; specific heat capacity, c, in Joules per kilogram per degree Celsius, J/kg °C; temperature change, $\Delta\theta$, in degrees Celsius, °C
6. 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.
7. The **kinetic** energy of a moving object can be calculated using the equation:
   kinetic energy = 0.5 × mass × speed^2
   $$E_k = \frac{1}{2}mv^2$$
   with kinetic energy, E_k, in Joules, J; mass, m, in kilograms, kg; speed, v, in metres per second, m/s
8. The amount of **elastic potential** energy stored in a stretched spring can be calculated using the equation:
   elastic potential energy = 0.5 × spring constant × extension^2
   $$E_e = \frac{1}{2}ke^2$$
   with elastic potential energy, E_e, in Joules, J; spring constant, k, in Newtons per metre, N/m; extension, e, in metres, m
9. The **extension** of a spring is the **difference** between its **original length** and its new **stretched length**
10. The amount of **gravitational potential** energy gained by an object raised above ground level can be calculated using the equation:
    g.p.e. = mass × gravitational field strength × height
    $$E_p = mgh$$
    with gravitational potential energy, Ep, in Joules, J; mass, m, in kilograms, kg; gravitational field strength, g, in Newtons per kilogram, N/kg; height, h, in metres, m
11. The gravitational field strength on Earth is 10 N/kg
12. The **total energy store** of a system remains **constant**. This is the **Law** of **Conservation** of **Energy**.

Efficiency and Power

13. Power is defined as the **rate** at which **energy** is **transferred** or the rate at which **work** is **done**.
    Power = energy transferred/time
    $$P = \frac{E}{t}$$
    Power = work done/time
    $$P = \frac{W}{t}$$
14. Power, P, in Watts, W; Energy transferred, E, in Joules, J; time, t, in seconds, s; work done, W, in Joules, J
15. An energy transfer of 1 joule per second is equal to a power of 1watt.

16. An appliance with a **higher power** rating will transfer energy **faster** than an appliance with a lower power rating
17. Energy can be transferred **usefully**, **stored** or **dissipated**, but cannot be created or destroyed.
18. In all system changes, energy is dissipated, meaning that it is wasted rather than being stored in useful ways
19. Efficiency is a measure of how much useful energy is transferred
20. Efficiency can be calculated using the equation:
    efficiency = useful energy ouput/total energy input
21. *The **efficiency** of different energy transfers can be increased in different ways.*
22. Some unwanted energy transfers can be reduced by using **lubrication** or thermal **insulation**
23. The rate of cooling of a building or object is affected by the thickness and thermal conductivity of its walls
24. Efficiency may also be calculated using the equation:
    efficiency = useful power output/total power input
25. Efficiency values can be decimals or percentages.

Energy Resources

26. The main energy resources available for use on Earth include: **fossil fuels** (coal, oil and gas), **nuclear** fuel, **bio-fuel**, **wind**, **hydroelectricity**, **geothermal**, the **tides**, the **Sun** and **water** waves.
27. The uses of energy resources include: **transport** (buses, trains etc), **electricity generation** for public services (machinery and buildings), **factories** and **farms** and for **homes** (heating, cooking and other appliances).
28. The use of **non-renewable** resources contributes to **global warming** and other environmental impacts such as acid rain.
29. Nuclear energy is a non-renewable resource.
30. A **renewable** energy resource is one that is being (or can be) **replenished** as it is used.
31. Some renewable energy resources may be **unreliable** in different conditions or at times of peak demand.
32. There are different energy requirements at different times of year and times of day.
33. More renewable resources are being invested in but there are political and economic reasons for countries to continue using fossil fuels.
34. Developed countries are increasing their use of nuclear power stations.