Energy

1. Energy cannot really tell us how things work.
2. Energy can only tell us if things are possible to do.
3. Energy is measured in **joules** (symbol J).
4. One joule is quite a small amount of energy.
5. One **kilojoule**, 1 kJ = 1000 J (one thousand joules)
6. One **megajoule**, 1MJ = 1000 kJ = 1,000,000J (one million joules)

Energy Stores

7. Energy can be stored in different ways, including:

- Moving things have a **kinetic** energy store
- High up things have a **gravitational potential** energy store
- Stretched, twisted or bent things have an **elastic potential** energy store
- Hot things have a **thermal** energy store
- Certain chemicals, like fuels or batteries, have a **chemical** store

Energy Transfers

8. Energy can be **shifted** from one store to another by physical processes (like forces or electric currents).
9. When energy shifts from store to store, useful work may be done (like speeding things up or moving things from place to place).
10. Energy can be transferred a) **electrically**, b) **by heating**, c) **mechanically**, d) **by radiation**
11. As energy is transferred, it may be carried:

- Electrically in circuits
- By heating
- Mechanically
- By radiation (including light)

Energy in food

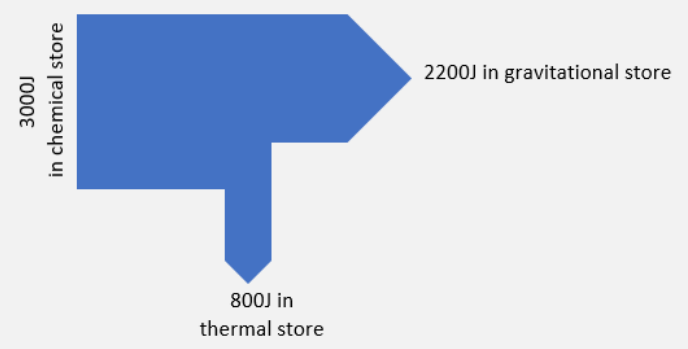
12. Different tasks in daily life require different amounts of energy.
13. Food energy content is often measured in **calories** instead of joules – different units for the same thing.
14. 1 food calorie is approximately 4 200J.
15. Different foods contain different amounts of energy – **food labels** can tell us how much.

Wasted energy

16. A **system** is just a group of one or more objects.
17. When energy is transferred, the total amount of energy in a system always stays the same.
18. **Energy is always conserved and cannot be created or destroyed**. This is the law of conservation of energy.
19. Some energy gets spread out or "**dissipated**" whenever a process transfers energy.
20. When energy becomes dissipated, it is **not useful** and so is wasted.

Energy efficiency

21. We can calculate the amount of energy wasted by subtracting the energy usefully shifted from the total amount of energy at the start of a process.
22. The amount of energy wasted is often represented as the fraction (Useful energy output) / (Total energy input) which is called the efficiency.
23. Efficiency is often calculated as a **percentage**.
24. Wasted energy can be illustrated using a **Sankey diagram**.



Heat, temperature and thermal energy

25. **Heat** is the name we give for thermal energy shifting from one store to another. How quickly it shifts is measured in watts (W).
26. **Temperature** tells us how hot or cold something is and is usually measured in degrees Celsius (°C)
27. **Thermal energy** is the amount of energy stored in an object because of the movement of its particles. Like all other energy stores, it is measured in joules (J).
28. Heat will flow naturally from **hot objects to cold objects**.
29. The rate of heat flow is faster the bigger the difference in temperature between the objects

Temperature and particles

30. Particles in a solid **vibrate more** when they are heated.
31. Particles in a liquid **move faster** when heated.
32. Particles in a gas **move faster** when heated.
33. The increased vibration or speed of the particles makes the **particles take up more space**.
34. Solids, liquids or gases will **expand when heated** because their particles are taking up more space.

Conductors and insulators

35. **Thermal conductors** are materials that allow heat to flow through them easily.
36. **Thermal insulators** are materials that do not allow heat to flow through them easily
37. Metals tend to be good conductors.
38. Non-metals tend to be good insulators.