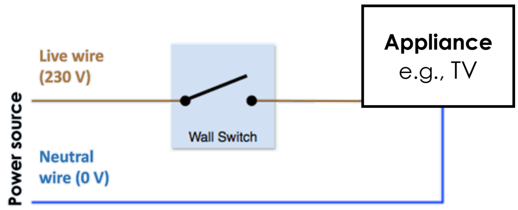
Mains Electricity

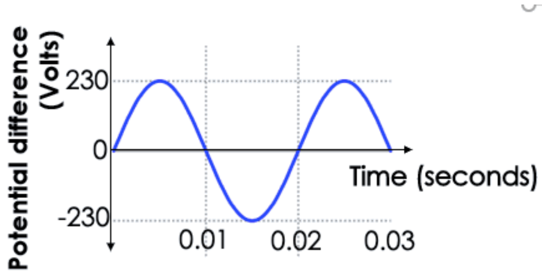
1. Voltage can also be called **potential difference** (p.d.)
2. Potential difference is measured in **Volts** (V) using a **voltmeter**.
3. A simple circuit has two wires - a **live** wire and a **neutral** wire.
4. The live wire (**brown**) goes from the power source to the appliance.
5. The neutral wire (**blue**) goes from the appliance back to the power source to **complete the circuit**.



6. It is important to have a **switch attached to the live wire** so that when an appliance or socket is switched off it is not live.

Direct and Alternating Current

7. **Direct current (d.c.)** travels in one direction only.
8. Cells and batteries supply direct current.
9. **Alternating current (a.c.)** continually reverses direction.
10. A.C. has a potential difference of 230 V and a frequency of 50 Hz.
11. This alternating current can be represented with a wave.



Plugs

12. In the UK, most appliances use a **three-core cable.**
13. The **neutral wire is blue**, the **live wire is brown**, and the **earth wire is green and yellow**.
14. The earth wire is a **safety feature** and is not needed to complete the circuit.
15. **The earth wire connects to the case of the appliance**, so that if a loose wire touches it, the case will not conduct electricity.
16. The earth wire is at a potential difference of 0 V.
17. Plastic is a poor conductor of electricity.
18. If a plus has a **plastic case**, it may not need an earth wire as the electricity cannot travel through the plastic to give you a shock.
19. The live wire is the most dangerous wire, since it has a voltage of 230 V.
20. **The live wire should never touch the earth wire** (unless the insulation is between them, of course!), because this would make a complete circuit from your mains supply to the ground (earth). A shock or fire would be highly likely.
21. Some countries do not have the added safety feature in their plugs of an earth wire (we say they are not earthed), so they have **2-pin plugs** instead of 3.

Power

22. The function of an appliance is to bring about an **energy transfer**.
23. The amount of energy an appliance transfers depends on **how long it is switched on for**, and **the power of the appliance**.
24. **Power is the rate at which energy is transferred or work is done.**

Measured in Watts (W) → $\text{Power} = \frac{\text{Energy}}{\text{Time}}$ ← Measured in Joules (J); ← Measured in seconds (s)

$$P = \frac{E}{t}$$

25. 1 Watt of power = 1 joule of energy transferred each second.
26.

Energy transferred = Power x Time

$$E = P \times t$$

The Cost of Electricity

27. When we say we are 'using electricity', we are using energy which has been transferred electrically.
28. Electricity meters measure the number of units of electricity (energy) used in a home or other building. **The more units used, the greater the cost.**
29. When calculating the cost of electricity, we calculate energy transferred in kilowatt-hours (kWh).
30. kWh is a unit of **energy transferred**.
31.

Energy transferred = Power x Time

Units (kWh) = power (kW) × time (h)

32.

Total cost = number of units × cost per unit

Units (kWh)

33. We can also calculate power if we know the current flowing through an appliance and the p.d. across it.
34.

Measured in Amps (A)

Power = Current x Potential Difference

Measured in Watts (W)

Measured in Volts (V)

$$P = IV$$

35. We know that

$$E = P \times t$$

and..

$$P = IV$$

Putting these together we see that..

$$E = I \times V \times t$$

Which can also be written as..

$$E = ItV$$

36. To calculate the energy transferred by an appliance we use the equation:

Energy (Joules) = Power (Watts) x time (seconds)

E (J) = P (W) x t (s)

37. We can also use the equation:

Energy (Joules) = Charge flow (Coulombs) x Potential difference (Volts)

E (J) = Q (C) x V (V)

Energy Resources

38. Fossil fuels are **non-renewable** energy resources.
39. Examples of fossil fuels include **coal**, **oil** and **natural gas**.
40. Fossil fuels can be burned to heat water, which produces **steam**.
41. The steam turns a **turbine**, which powers a **generator** (to generate electricity).
42. **Nuclear energy** is obtained by the splitting up of atomic nuclei.
43. Examples of nuclear fuels are uranium and plutonium.
44. Nuclear energy does not produce carbon dioxide (or sulfur dioxide) in the reaction, meaning that it does not have the same contribution to global warming.
45. The use of nuclear energy is high risk, as accidents can damage the health of anyone in the area for a long time, if radioactive material is released.

46. A **renewable energy resource** is one that is being (or can be) replenished as it is used.
47. Examples of renewable resources are **biofuels**, **wind**, **hydroelectricity**, **geothermal**, **tidal**, **solar power** and **waves**.

Resource	Advantages	Disadvantages
Fossil fuels	• Reliable (can always be used to meet demand) • Release lots of energy	• Non-renewable (will eventually run out) • Release greenhouse gases
Nuclear	• Release lots of energy • Do not release greenhouse gases	• Expensive to store and dispose of material • Accidents are dangerous
Biofuels	• Renewable (new crops can be grown) • Lower emissions	• Large areas of land needed
Wind	• Renewable • No emissions	• Unreliable (not always windy) • Noisy, ugly and expensive
Hydroelectricity	• Reliable (can be used to meet surges in demand) • No emissions • Renewable	• Expensive to build • Can cause damage to local environment

Resource	Advantages	Disadvantages
Geothermal	• Renewable • No emissions • Less damage to environment	• Expensive to drill far enough underground
Tidal	• Renewable • Reliable • No emissions • Low running costs	• Expensive to build
Solar	• No emissions • Renewable	• Unreliable (not always sunny) • Expensive to build
Water waves	• No emissions • Reliable (there will always be waves)	• Expensive (large numbers needed) • Can be damaged by storms

The National Grid

48. The **national grid** is a system of **cables**, **pylons** and **transformers** which transfers electrical power from power stations to people's homes.
49. The national grid does not include power stations or peoples' homes, only the things in between that are used to transfer the electrical power
50. **Pylons** hold the cables up.
51. **Step up transformers** increase the potential difference to make electricity cheaper to transfer.
52. **Step down transformers** decrease the potential difference to make the electricity safe to use.

Static Electricity

53. **Everything of made of atoms**, and atoms themselves are made up of protons, neutrons and electrons.
54. Protons are **positively charged** and electrons are **negatively charged**.
55. Opposite charges **attract**.
56. Like charges (charges that are the same) **repel**.
57. Electrons can be transferred between atoms, unlike protons or neutrons.
58. When electrons are lost from an atom or object, the atom or object overall becomes positively charged.
59. A **static charge** is an electric charge that cannot move.
60. Static charge can build up on materials that are poor conductors of electricity (**insulators**).
61. Rubbing a balloon against a jumper or piece of clothing (or hair) for a few seconds **transfers electrons** from the jumper to the balloon.
62. The balloon is then negatively charged, and the jumper positively charged.
63. When the balloon is placed near the wall, the wall is now more positively charged than the balloon, so they attract each other.