

Power of Electrical Appliances

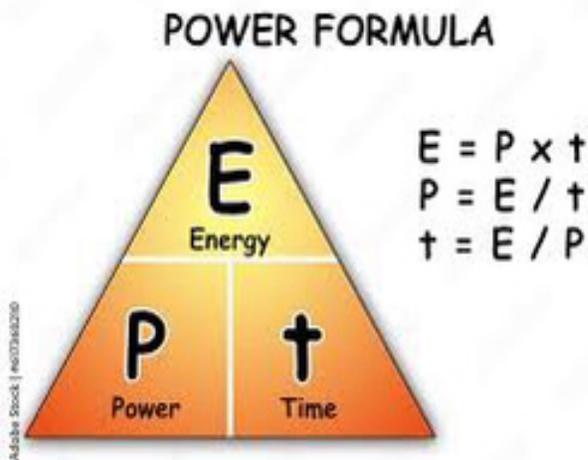
Transferring Energy from Cell and other sources

Everyday Appliances

- ▶ **Appliances can transfer energy.** Everyday electrical appliances in our homes are designed to bring about energy transfers. For example, kettles, microwaves and hairdryers can all convert electrical energy into other forms of energy, which we can then use.
- ▶ **The amount of energy transfer can vary.** Depending on various factors, the energy transferred by an appliance can vary. These are:
 1. **Time** – the length of time an appliance is switched on for is very important. The longer an appliance is switched on for, the hotter it will get. As the appliance tries to cool down, it will convert more of the electrical energy input into a thermal energy output. This **thermal energy** is seen as **‘wasted’ energy**, since it is not our desired output.
 2. **Power** – different appliances will have different **power ratings**. A more powerful appliance will use more electricity than a less powerful appliance. However, we still have to be mindful of efficiency. Even if one appliance is more powerful than another, it might have a less efficient energy transfer (i.e. the energy output will have a lot of thermal energy, which is ‘waste’ energy).

$$\text{Energy transferred} = \text{power} \times \text{time}$$

$$E = Pt$$



Examples of Energy Transfers

1. **Electric motors use kinetic energy.** Electric motors will convert **electrical energy** from batteries into **kinetic energy**. This kinetic energy can be used to spin the blades of a fan or move electric cars. The wasted energy here will be mainly in the form of sound and thermal energy.

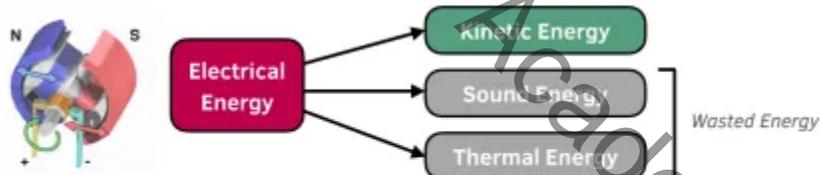


Fig 1. Energy Transfers in Electric Motors.

2. **Heating devices use thermal energy.** Heating devices will convert the **electrical energy** from the mains a/c (alternating current) supply into **thermal energy**. This thermal energy can be used in the heating element of a toaster. The wasted energy here may be in the form of sound energy.

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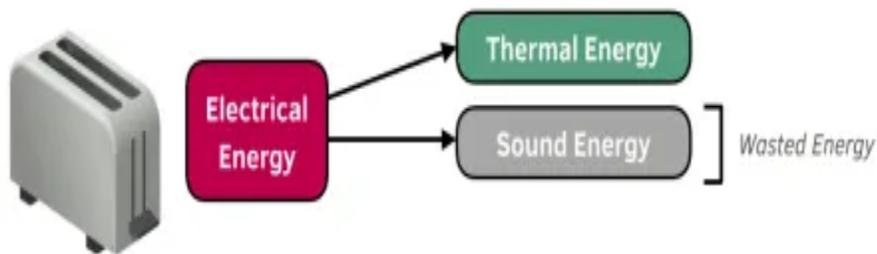


Fig 2. Energy Transfers in Heating Devices.

AQA Physics P1: Electrical Appliances - The Review

Appliances

Appliance	Useful Energy	Wasted Energy
Light Bulb	Light emitted by the glowing filament	Heating the surroundings
Electric Heater	Energy heating the surroundings	Light
Electric motor	Kinetic energy of the object moved by the motor GPE of object lifted by the motor	Heating the object and sound

Appliance	Power in W
Clock	10
Lamp	50
Drill	800
Iron	1,250
Kettle	2,400
Hot water heater	3,000
Electric oven	12,000

Power

- ▶ The **power** of an appliance is the amount of energy (J) that it transfers per second. In other words, **power** is the rate of energy transfer.
- ▶ Power is measured in **Watts (W)**. 1W means 1J of energy transferred in 1 second
- ▶ Power is measured by given 2 formulas, in 1st formula power is calculated with **potential difference** and in other formula power is measured with **resistance**

$$\text{Power} = \text{potential difference} \times \text{current}$$

$$P = VI$$

And

$$P = I^2 R$$

EXAMPLE

Q: A 1 kW hair drawer is connected to a 230 V supply. Calculate the current through hair drawer,?

Solution:

$$\text{As } P = VI$$

To calculate the current rearrange the formula

$$I = P / V.$$

$$1\text{kW} = 1000\text{W}$$

$$I = 1000 / 230$$

$$= 4.34 \text{ A}$$

Energy transferred per charge passed

- ▶ Potential difference is the energy transferred per unit charge as electric charge moves around an electric circuit.
- ▶ A power supply (cell or battery) does work on a charge and transfers energy to the charge to increase its potential difference.
- ▶ When the charge does work in a component, it goes through a potential difference fall (it loses some of its potential difference) and transfers energy to the component.
- ▶ Formula :

$$E = QV$$

Where :

E is energy transferred in joules (J).

Q is charge in coulombs (C)

V is potential difference in volts (V).



Q: A motor in an electric fan is powered by a 3 V battery. How much energy is transferred if 320 C of charge passes through the motor in the fan?

Solution :

$$E = QV$$

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$$= 320 * 3$$

$$= \mathbf{960 \text{ J}}$$

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