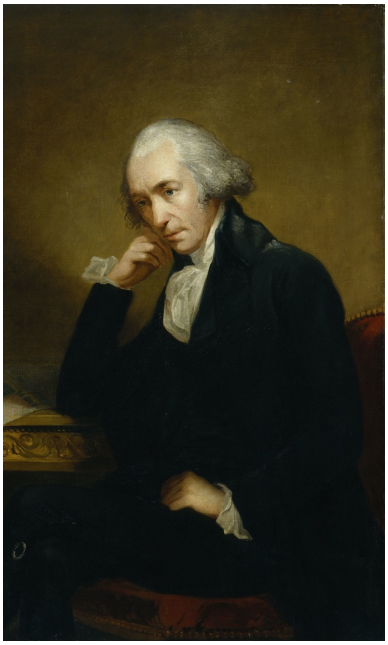
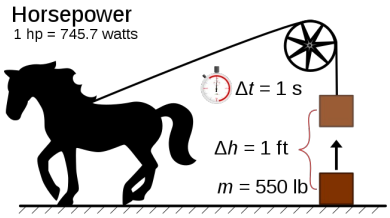
James Watt & the unit of power

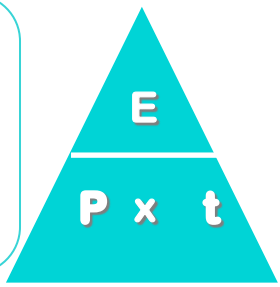


James Watt was a mechanical engineer and inventor. It was while he was making instruments at Glasgow University that he became fascinated by the early steam engine. He developed the engine to be more powerful and more efficient. However, his early attempts to commercialise his invention were fruitless when his partner went bankrupt. Matthew Boulton, the Birmingham entrepreneur, became Watt's new partner in the Boulton and Watt company in 1776. Together they patented the most successful invention that powered the industrial revolution across the world. Birmingham became known as the 'workshop of the world' and the steam engines were made at the Soho Foundry there. Watt adopted the concept of horsepower and subscribed that definition to other engines, consequently, his name is given to the SI unit of power, a watt.



Power is the amount of energy transferred or work done per second.

$$\text{Power (watts, W)} = \frac{\text{energy transferred to an appliance, E (joules, J)}}{\text{time taken for energy to be transferred, t (seconds, s)}}$$



Question:

An electrical heater uses 600,000J of energy in 5 minutes. What is its power output?

Example:

An electrical heater uses 600,000J of energy in 5 minutes. What is its power output?

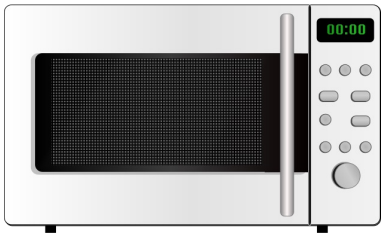
$$P = \frac{E}{t} \qquad P = \frac{600{,}000}{300}$$

$$= 2000\text{W}$$

$$= 2\text{kW}$$

Practice

1. Calculate the power of a digger that performs 12000J of work in 6 seconds.



2. How long does it take a microwave of power 0.2kW to use 10 000J of energy?

3. Calculate the work done by a lorry of power 6MW in 2 hours.

4. How long does it take an aeroplane of power 900,000W to use 2 800 000J of energy?

From	To
1,000W	1kW
1,000,000W	1MW
1,000kW	1MW

Convert the quantities

Reading examination questions

Always be careful when reading examination questions. Look at the SI units that are written down and what form the solution needs you to record.

Quantity	Convert to…	No.
750W	kW	1
2.4kW	W	2
0.04kW	W	3
35kJ	J	4
3225.6kW	MW	5
1170J	kJ	6
0.005MW	kW	7
0.75kW	W	8
9990J	kJ	9
18.3MW	W	10