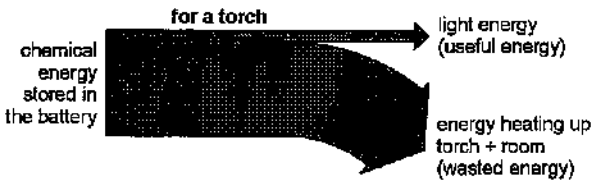
Energy transfer and efficiency

Extension Sheet

An Energy Transfer Diagram (Sankey diagram) shows what happens during an energy transfer:

$$\textbf{Efficiency} = \frac{\textbf{useful energy transferred}}{\textbf{total energy input}} \times 100\%$$



Questions

For each question show all your working clearly.

1. A lot of energy is wasted in a car. For every 100 J of chemical energy in the petrol, only 25 J are transferred to useful kinetic energy. The rest just heats up the engine and the air.
   a) Draw an Energy Transfer Diagram for this, to scale.
   b) Calculate the efficiency.

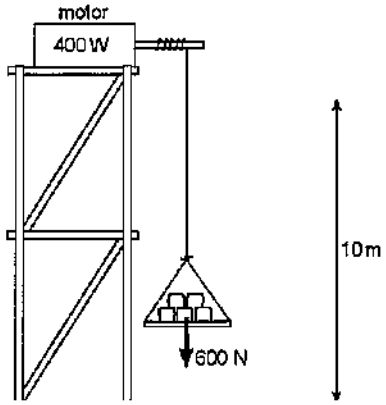
2. The diagram shows the energy transfers for a Bunsen burner heating a beaker of water. What is its efficiency as a water heater?

3. In a solar cell, for every 80 J of solar energy shining on it, only 4 J is transferred to useful energy (as electricity).
   a) What happens to the other 76 J?
   b) What is its efficiency?
   c) Draw a Sankey diagram of this, to scale.

4. A pulley system lifts a load and gives it 6000 J of potential energy. The person pulling on the rope gives it 8000 J of energy. What is the efficiency?

5. An electric kettle has a power rating of 2 kW and is switched on for 100 seconds. While heating up, it loses 60 000 J to the surroundings.
   a) How much energy is supplied to the kettle? (1 kW = 1000 W = 1000 joules per second)
   b) How much is given to the water?
   c) What is the efficiency of heating water?

6. An electric motor on a building site has a power rating of 400 W and lifts a load of bricks weighing 600 N through a height of 10 m in 20 seconds.
   a) How much energy is needed to lift the bricks?



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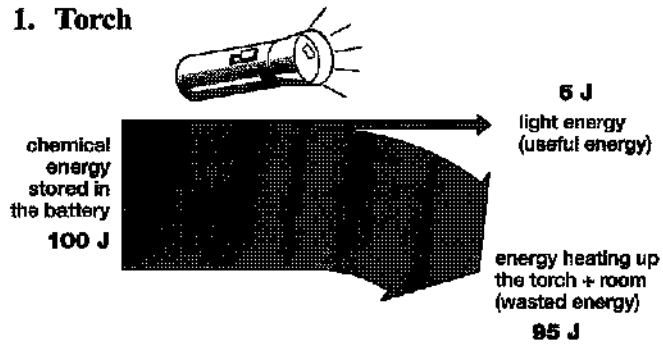
Energy Transfer Diagrams

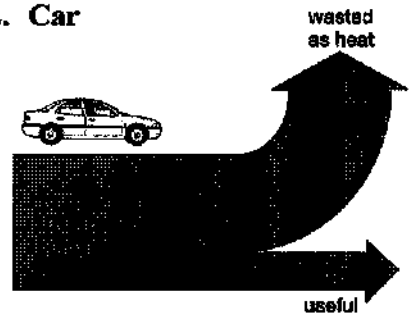
Help Sheet

Here are nsfer Diagrams (also called 'Sankey' diagrams).
For each ... what information it gives you, in as much detail as possible.

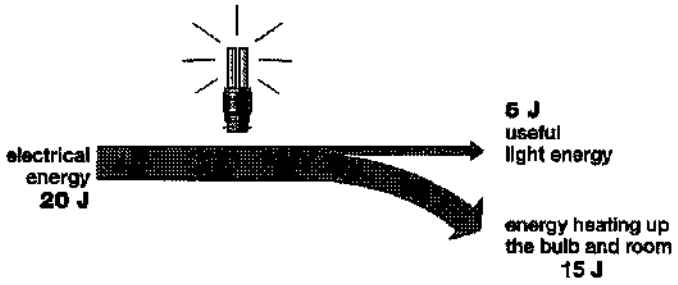
1. Torch



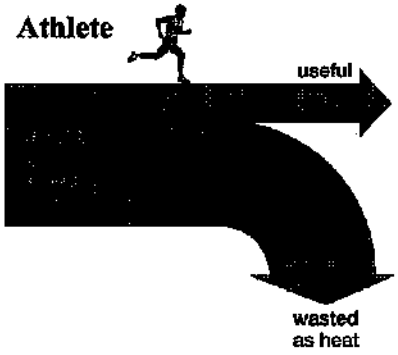
2. Car



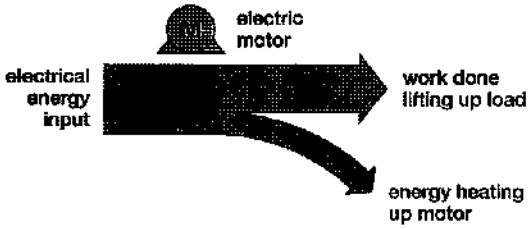
3. 'Energy-saver' light bulb



4. Athlete



5. Electric motor lifting up a load



6. Power station