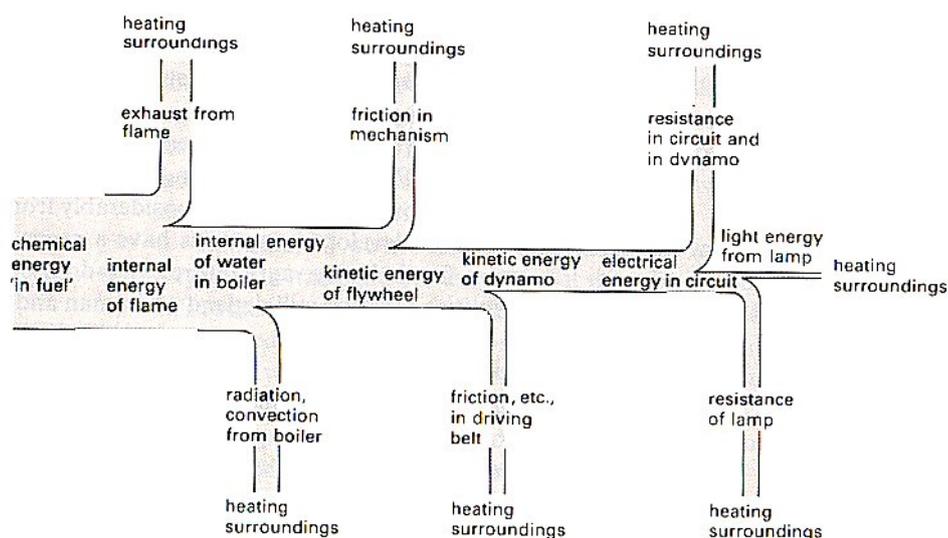


TAP 606- 2: Sankey diagrams

Energy transfers can be complex. Sankey diagrams are a way of representing the situation.

For example: The energy transfer process involved in using a steam engine to light a lamp is represented below.



The transfer is often represented as flowing from left to right with inputs and outputs shown vertically. The width of the line shows the quantity of energy involved at each stage. The diagram above gives a general indication of the energies involved. Data for each situation would be needed to make the lines proportional.

Questions

One litre of petrol produces 10 kWh. A car uses 7 litres per 100 km at a steady 90 km h^{-1} , the power output at the gearbox is 15 kW, and at the wheels 12 kW.

1. (a) Construct a non quantitative Sankey diagram for a car travelling at constant speed.

(Hint: consider, fuel, exhaust, engine, gearbox, wheels, and transfers to the surroundings.)

(b) Now make the Sankey diagram quantitative using the data above. (Hint: First calculate the rate of fuel input in kW)

2. Food, (fuel), is used by a human body in a number of ways, for example: keeping warm, doing external work, keeping parts of the body working, building body parts and inevitably some wastage

Construct a Sankey diagram to show this. (It will be mainly qualitative but remember input must equal output. (If you want to go further consider that in the UK an adult will have a daily intake of about 10 MJ. Consider how much energy is needed to say climb stairs, how much you radiate, [compare to a light bulb], and how efficient the body may be)

Hint

Your diagram could contain the following: 10 MJ input, digestive system, metabolism, output work, [say 3.6 MJ], maintaining body temperature, thermal transfer to surroundings, building body parts, breakdown of body parts and waste food.

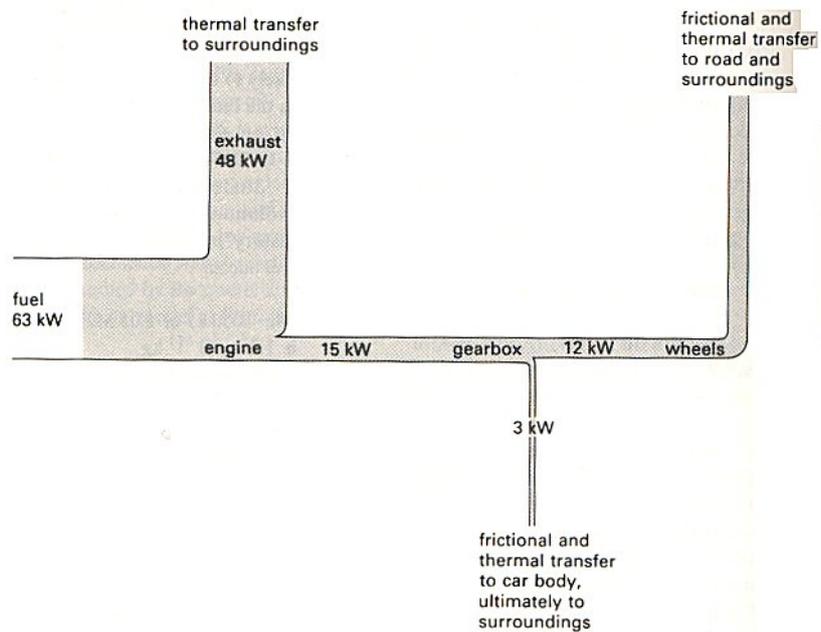
Practical advice

Check to see that your specification requires Sankey diagrams.

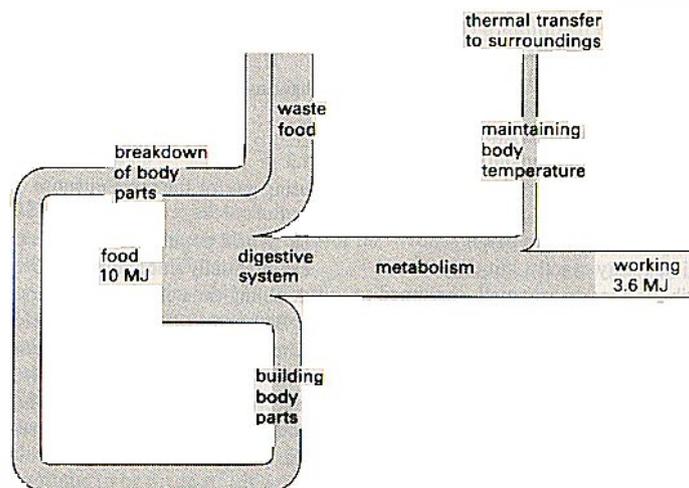
You may wish to discuss the questions or set them as student problems.

Answers and worked solutions

1. Input: 7 litres at 10 kWh / litre = 70 kWh which is used to travel 100 km at 90 km h⁻¹. Thus input per hour is a rate of $70 \times 9 / 10 = 63$ kW



- 2.



External References

This activity is based on Nuffield Revised Physics section G1 and question 2(L) and 3(E)