

Climate 1

1. Define the *energy density* of a fuel.

Solution: The energy density of a fuel is the total energy released per kg burnt, and it is measured in $\text{J}\cdot\text{kg}^{-1}$

2. Number the fuels listed below in order of highest (1) to lowest (5) energy density.

Coal

Oil and Gas

Wood and Biomass

Nuclear Fuel

Fusion Fuel

Solution:

4. Coal

3. Oil and Gas

5. Wood and Biomass

2. Nuclear Fuel

1. Fusion Fuel

3. When a car is driving at 80km/h, it is doing work against air resistance at a rate of 40kW.

A. How far will the car travel in 1 hr?

B. How much work does the car do against air resistance in 1 hr?

C. If the engine of a modern diesel car is 75% efficient, how much energy must the car get from the fuel?

D. If the energy density of diesel is 45.8 MJ kg^{-1} , how many kg of diesel will the car use?

E. If the density of diesel is 0.9 kg/litre, how many litres will the car use?

F. Calculate the litres of fuel used per kilometre.

Solution:

A. 80km

B. $1.44 \times 10^8 \text{ J}$ C. $1.92 \times 10^8 \text{ J}$

D. 4.2 kg

E. 4.7 litres

F. 0.06 litres/km

4. A coal-fired power station gives out 1000 MW of power.

A. How many joules will be produced in one day?

B. If the efficiency is 40%, how much energy goes in?

C. The energy density of coal is $32.5 \text{ MJ}\cdot\text{kg}^{-1}$. How many kg are used?

D. How many rail trucks containing 100 tonnes each are delivered per day?

Solution:

A. $8.64 \times 10^{13} \text{ J}$ B. $2.16 \times 10^{14} \text{ J}$ C. $6.65 \times 10^6 \text{ kg}$

D. 67 truckloads