3.1: CONSERVATION OF ENERGY

Conservation

- Systems
  - In a closed system with no energy transfers in or out, the total energy is constant
- Law of Conservation
  - Energy cannot be created or destroyed, only transferred from one form to another

Energy Transfers

- Kinetic Energy
  - KE = ½ x Mass x Velocity²
  - Doubling speed quadruples KE
  - Moving objects have KE
- Gravitational Potential Energy
  - GPE = Mass x Gravitational Field Strength x Height
  - Objects at a height have GPE
- Bungee jumper
  - GPE → KE as jumper falls
  - As cord stretches, KE → Elastic Potential Energy, slowing down the jumper
- Electric kettle
  - Electrical energy → heat energy
  - Energy wasted as sound & heat to surroundings
- Vehicle braking
  - KE → heat energy by friction in the brakes
  - Vehicle slows down

Efficiency

- Thermal conductivity
  - Higher thermal conductivity means greater rate of energy transfer
- Insulation
  - Reduces heat loss to surroundings
- Lubrication
  - Reduces heat loss due to friction
- Waste Energy
  - Some supplied energy transformed into non-useful forms
- Efficiency =

$$\frac{\text{Useful Energy Transferred}}{\text{Total energy supplied}}$$

- Less waste energy means a more efficient appliance

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3.2: CONSERVATION OF ENERGY: ENERGY SOURCES

Non-Renewable Energy Sources

Fossil Fuels

Coal, oil and gas

- Coal
  - + Large amounts of energy per kg of fuel
  - + Cost-effective and generation all the time
  - Global warming
  - Carbon Dioxide
  - – Greenhouse emissions
  - Sulphur Dioxide
  - Acid rain
- Gas
  - +Lower greenhouse emissions
  - +Quick-start up times allow for flexible generation

Nuclear Fuels

- + No greenhouse gases
- + Large amounts of energy per kg of fuel
- – harmful nuclear waste, must be stored for years
- – Risk of nuclear disasters

Renewable Energy Sources

- Solar Power
  - + Relatively cheap, can be used in remote areas
  - – Only possible in daylight
- Bio Fuels
  - + Quickly & locally grown (renewable)
  - – Needs a lot of land which could be used for food production
- Wind Power
  - + Cost-effective and abundant source of energy
  - – Restricted by wind speeds
  - Visual & sound pollution
- Hydroelectricity
  - + Provides large quantities of energy in a short time (power surges or outages)
  - – Affects water life
  - – Only a limited number of suitable sites for water dams
- Tidal Power
  - + Renewable & predictable
  - – Relatively new so costly to install & maintain

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