Paper 1

Chapter 1 — Energy

Energy

Energy can be t_____ usefully, s_____ or d_____, but cannot be c_____ or d_____.

The higher the t_____ c_____ of a material the higher the rate of energy transfer by conduction through the material.

Convert to SI Units

Quantity	Value	SI Units
Energy	12 kJ	12,000 J
Mass	550 g	
Speed	1 m/hour	
	2 km	
	1 MW	
	2,000 mg	
	2 hours	
Time	250 ms	
	25 minutes	
	100 mV	
	500 kJ	
	10,000 mA	
	1.21 GW	
	10 C	

100J Electrical —> 50J Sound

Which is **NOT** the efficiency of the speaker?

50% 0.5 1:2

Energy Resources

Name and how it works	Advantages x 3	Disadvantages x 3
Fossil Fuels Burnt to make steam to drive a turbine	Reliable	Produce CO_2 causing global warming
Uranium and Plutonium make steam to drive a turbine		Non-renewable
Biofuel	Renewable	
Wind		Expensive to build
Water goes through a dam to drive a turbine		Flood land and destroys habitats
Tidal		
Solar		Unreliable
Volcanic rocks produce steam to drive a turbine		Few suitable locations
Wave		

Calculation Practice

Use the equation to calculate the specific heat capacity of aluminium

change in thermal energy = mass × specific heat capacity × temperature change

Start temperature 20°C

End temperature 60°C

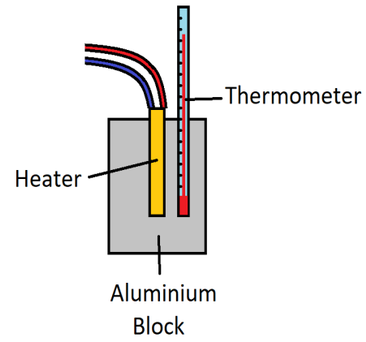
Mass 1000g

Energy added 20kJ

Specific Heat Capacity = ____ (__)

Required Practical

How would you calculate the specific heat capacity of a material? Why is the experimental result usually too high?



HT Only

How can you reduce unwanted energy transfer…

… in a machine with moving parts?

… in a heated building in winter?

Complete the Equations (include units)

kinetic energy (J) =

g.p.e. (J) =

power (W) =

efficiency =

Describe the energy transfer

- an object projected upwards

  Kinetic Energy —> Gravitational Potential Energy
- a moving object hitting an obstacle
- an object accelerated by a constant force
- a vehicle slowing down
- bringing water to a boil in an electric kettle.

Paper 1

Chapter 1 — Energy

Energy

Energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed.

The higher the thermal conductivity of a material the higher the rate of energy transfer by conduction through the material.

Convert to SI Units

Quantity	Value	SI Units
Energy	12 kJ	12,000 J
Mass	550 g	0.550 kg
Speed	1 m/hour	0.00027 m/s
Distance	2 km	2000 m
Power	1 MW	1,000,000 W
Mass	2,000 mg	0.002 kg
Time	2 hours	7200 s
Time	250 ms	0.25 s
Time	25 minutes	1500 s
Voltage	100 mV	0.1 V
Energy	500 kJ	500,000J
Current	10,000 mA	10 A
Power	1.21 GW	1,210,000,000 W
Charge	10 C	10 C

100J Electrical —> 50J Sound

Which is **NOT** the efficiency of the speaker?

50% 0.5 1:2

Energy Resources

Name and how it works	Advantages x 3	Disadvantages x 3
Fossil Fuels Burnt to make steam to drive a turbine	Reliable Cheap to buy Can respond to change in demand (gas)	Produce CO_2 causing global warming Non-renewable Coal produces SO_2 causing acid rain
Nuclear Uranium and Plutonium make steam to drive a turbine	Reliable Powerful No CO_2 contributing to global warming	Non-renewable Nuclear waste/accidents Cannot respond to changes in demand
Biofuel Burn fuel from living materials to make steam to drive a turbine	Renewable Reliable Carbon Neutral	Wastes farmland Deforestation to grow crops Relatively low power
Wind Wind drives a turbine	Renewable No CO_2 contributing to global warming Works well in winter	Expensive to build Unreliable Visual Pollution/Kills birds
Hydroelectric Water goes through a dam to drive a turbine	Renewable Can store energy from other stations No CO_2 contributing to global warming	Flood land and destroys habitats Rotting plants release methane Few suitable locations
Tidal Falling tide drives a turbine	Renewable No CO_2 contributing to global warming Cheap to run	Unreliable Visual Pollution Low power
Solar Light energy converted to electricity	Renewable No CO_2 contributing to global warming Cheap to run	Unreliable Works at wrong times e.g. day/summer Low power
Geothermal Volcanic rocks produce steam to drive a turbine	No CO_2 contributing to global warming Cheap to run Reliable	Few suitable locations Needs volcanic activity
Wave Wave kinetic energy converted to electricity	Renewable No CO_2 contributing to global warming Cheap to run	Unreliable Visual Pollution Low power

Calculation Practice

Use the equation to calculate the specific heat capacity of aluminium

change in thermal energy = mass × specific heat capacity × temperature change

Start temperature 20°C

End temperature 60°C

Mass 1000g

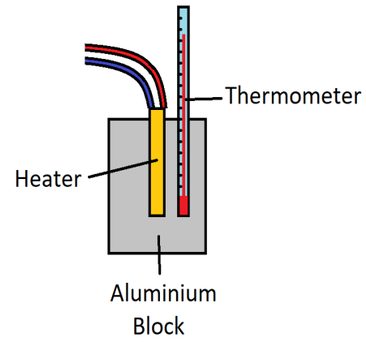
Energy added 20kJ 20,000 = 1kg x ? X 40

20,000 / (1 x 40) = 500

Specific Heat Capacity = 500 J/kg°C

Required Practical

How would you calculate the specific heat capacity of a material? Why is the experimental result usually too high?



Work out energy transferred by heater

current x voltage = power of heater

Power x time = energy transferred

Use equation to calculate specific heat capacity

change in thermal energy = mass × specific heat capacity × temperature change

Result usually too high due to thermal energy dissipated to surroundings

HT Only

How can you reduce unwanted energy transfer…

… in a machine with moving parts?

Use a lubricant to reduce friction

… in a heated building in winter?

Use/increase thermal insulation

Complete the Equations (include units)

kinetic energy (J) = 0.5 x mass (kg) x speed $(m/s)^2$

g.p.e. (J) = mass (kg) x gravitational field strength (N/kg) x height (m)

power (W) = work done (J) / time (s)

efficiency = useful output / total input

Describe the energy transfer

- an object projected upwards

  Kinetic Energy —> Gravitational Potential Energy

- a moving object hitting an obstacle

  Kinetic Energy —> Thermal Energy

- an object accelerated by a constant force (i.e. a ball being thrown)

  Chemical Energy (in muscles) —> Kinetic Energy

- a vehicle slowing down

  Kinetic Energy —> Thermal Energy

- bringing water to a boil in an electric kettle.

  Electrical Energy —> Internal Energy