Chestnut Grove Academy

Physics

1. Energy

Revisiting Booklet

Name:

Energy

Topics:

1. Energy stores and systems
2. Changes in energy
3. Energy changes in systems
4. Power
5. Energy transfers in a system
6. Efficiency
7. National and global energy resources

Energy stores and systems

1) Name as many types of energy as possible. Underline those that are types that can be examples of stored energy

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-
-
-
-

2) What are the energy changes in the following situations?

a) A ball thrown upwards
energy at start_____ energy at end_____

b) An object hitting an obstacle
energy at start_____ energy at end_____ ____

c) An object accelerated by a person pushing it
energy at start_____ energy at end_____

d) A moving bike putting on its brakes
energy at start_____ energy at end_____

e) A kettle boiling some water
energy at start_____ energy at end_____

Changes in energy

1) What are the formulas for the following:

The kinetic energy of an object can be calculated using the equation:

Word equation:

Symbol equation:

Units:

The gravitational potential energy of an object can be calculated using the equation:

Word equation:

Symbol equation:

Units:

The Energy stored in a spring of an object can be calculated using the equation:

Assuming _____ _____ is not exceeded

Word equation:

Symbol equation:

Given to you

Units:

Kinetic energy

Calculate the kinetic energy for the following;

a) The energy of a 1200kg car travelling at 20m/s

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..... units .....

b) The energy of a 1200000g car travelling at 40m/s

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..... units .....

c) The energy of a person with a mass of 60kg running at 5 m/s

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..... units .....

d) *Harder* The mass of a tennis ball which has a velocity of 36m/s and an energy of 64.8J

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..... units .....

e) *Harder* The velocity of a bird with a mass of 0.5kg with an energy of 400J

.....

..... units .....

<u>Gravitational potential energy</u>

Calculate the potential energy for the following. Assume gravitation field strength of 10N/kg

a) A person with a mass of 50kg who walks up stairs to a height of 5m high.

.....

..... units .....

b) A plane which has a mass of 10,000kg which travels up to a height of 1000m

.....

..... units .....

c) A rollercoaster car of mass 400kg containing four people with a mass of 250kg which goes up to a height of 80m.

.....

..... units .....

d) A rocket of mass 5 tone travelling to a height of 1500m

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..... units .....

e) Harder what height does a paper plane of mass 20g have if it gains 1J of energy?

.....

..... units .....

f) Harder what mass does a Frisbee have if it is thrown up 20m and gains 4J of energy.

.....

..... units .....

Elastic potential

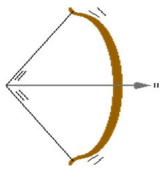
Calculate the following:

a) The elastic potential for a bow with a spring constant of 100 which is pulled back 65cm (think about the unit)

Elastic Potential Energy

- The energy from a spring being altered from its standard shape.

$$E_p = \frac{1}{2}kx^2$$



k: spring constant

x: distance spring is stretched or compressed.

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..... units .....

b) The elastic potential in a bungee jumping cord with a spring constant k=2 which extends 40m

.....

..... units .....

c) *Harder* what is the extension of a slinky with a spring constant of 0.2 when it stores 3J of energy?

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..... units .....

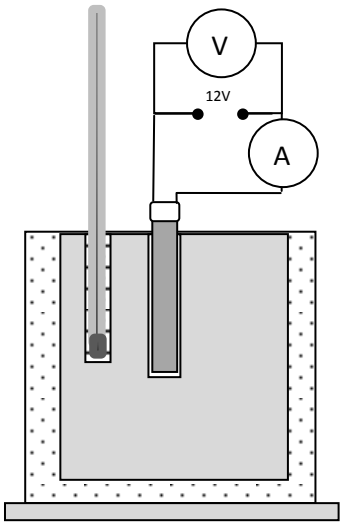
Energy Changes in Systems

Specific heat capacity is the _____

_____

Required practical activity 14: determine the specific heat capacity of a material

Method:



The amount of energy stored in or releases from a system from its temperatures changes can be calculated using the equation:

Word equation:

Symbol equation:

Units:

Given to you

T can be represented as θ

Calculate the energy needed to raise the temperature of a 0.2kg aluminium block from 15^{o}C to 40^{o}C. Aluminium specific heat capacity is 900 J/kg ^{o}C

.....

..... units .....

Calculate the energy transferred when 100g of water is heated from 25^{o}C to 50^{o}C. The specific heat capacity of water is 4.2 J/kg/^{o}C.

.....

..... units .....

Calculate the specific heat capacity of copper. It took 10.78kJ to heat 1kg of copper from 22^{o}C to 50^{o}C.

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..... units .....

Power

What is power?

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What are the two (non-electricity) power equations?

Word equation: Symbol equation: Units:

Word equation: Symbol equation: Units:

A motor transfers 4.8kJ of energy in 2 minutes. Find its power.

.....

..... units .....

How long does it take for a 550W motor to do 110J of work?

.....

..... units .....

A powerful machine is one which can transfer a lot of energy in a shorter time (not necessarily one which exerts the most force).

It takes 8000J of work to life a stunt performer to the top of a building. Moto A can lift the stunt performer to the correct height in 50s. Motor B would take 300s to life the performer to the same height. Which motor is more powerful. Calculate the power.

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..... units .....

Energy transfers in a system

Energy can be _____, _____ or _____ but cannot be _____ _____ or _____. This means that in a closed system (where nothing can enter or exit) the net energy change would be _____.

Dissipated energy is energy that is often describes as _____.

Unwanted energy transfers can be reduced. For example to reduce heat loss from a kettle it is _____. The higher thermal conductivity of a material the higher the rate of _____ _____. To reduce energy being used to overcome friction in a turbine _____can be used.

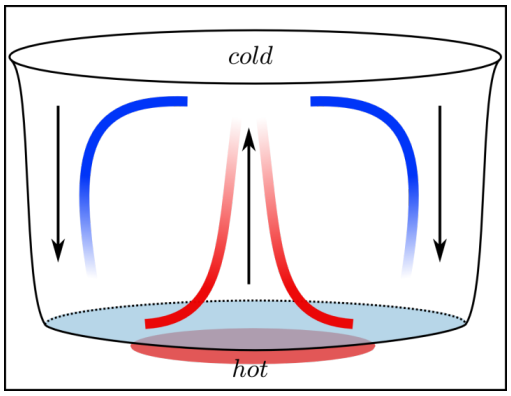
List 6 ways to insulate a home

1.
2.
3.
4.
5.
6.

What are the three methods of energy transfer by heating?

- …….
- …….
- …….

Use the diagram and describe the process of convection.



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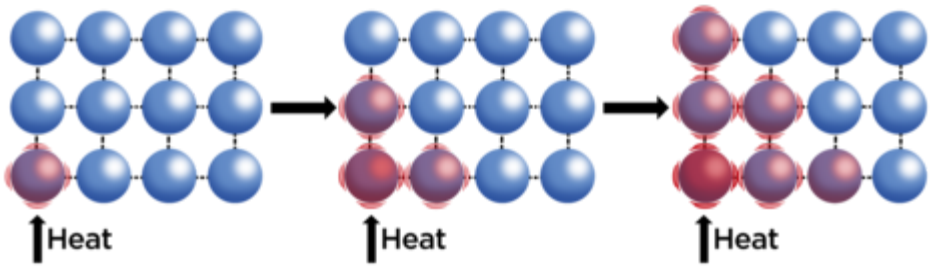
Use the diagram and describe the process of conduction.



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Required practical activity 2: Thermal conductivity

There are two parts to this investigation:

1. **Investigating factors that may affect the thermal insulation properties of a material.**
2. **Investigating the effectiveness of different materials as thermal insulators.**

The equipment list is:

- 100 ml beaker (×5)
- 250 ml beaker (×5)
- 800 ml beaker (×5)
- thermometer (×5)
- kettle to heat water
- piece of cardboard
- scissors
- stopwatch
- insulating material, eg newspaper, corrugated cardboard, bubble wrap, sawdust, polystyrene granules

Write a method for each practical

1. **Investigating factors that may affect the thermal insulation properties of a material.**

Investigating the effectiveness of different materials as thermal insulators.

What would happen to your results if the insulating material (e.g. newspaper) became wet?

Efficiency

Efficiency can be calculated by using 1 of two equations:

Equation 1:
Equation 2:
Efficiency can be left as a decimal or x100 to convert into a percentage.

An electric fan is supplied with 2000kJ of energy. 600kJ of that is transferred to useless thermal energy stores. What is the efficiency of the fan as a percentage?

.....

..... units .....

A lamp with an efficiency of 0.740 is supplied with 350J of energy. How much energy is usually transferred by the lamp?

.....

..... units .....

A motor is supplied with 250W of power and outputs 120W of useful power. What is the efficiency of the motor? Give your answer as a decimal.

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..... units .....

(HT only) Describe two ways to increase the efficiency of an intended energy transfer.

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National & global energy resources

List the main energy resources used on Earth & underline the renewable ones

1.
2.
3.
4.
5.
6.
7.
8.
9.

A renewable energy resource is _____

What are the main uses of energy sources?

1.
2.
3.

Method of generating electricity	How does it work?	Advantages	Disadvantages
Solar			
Wind			

Geothermal			
Waves / Tidal			
Fossil fuels			
Nuclear			