Year 9 Spring 1 Homework booklet

Energy stores and transfer- Mastery Matrix

Topic	Course	Learning statement
Energy stores	**All**	**Describe the different stores of energy**
Energy transfers	**All**	**Explain energy transfers from one store to another in different objects**
Energy transfers and Sankey diagrams	**All**	**Calculate the efficiency of an energy transfer using equations and Sankey diagrams**

Key knowledge

State the law of conservation of energy.	Energy can be transferred or stored, but cannot be created nor destroyed
State the units of energy.	Joules (J)
State the eight stores of energy.	Chemical, kinetic, gravitational, elastic, thermal, magnetic, electrostatic, nuclear
State the four ways by which energy can be transferred.	Mechanically → when a force is applied and moves through a distance Electrically → through an electric current By heating → if there is a temperature difference By radiation → if a wave is used to transfer the energy e.g. light and sound

What happens when a system changes	There can be changes in the way energy is stored
Name the 8 ways energy can be stored	Chemical, Kinetic, Gravitational potential, Elastic potential, Thermal, Magnetic, Electrostatic and Nuclear
Name the 4 ways that energy can be transferred	Mechanically, Electrically, Heating and Radiation
Name the units for energy	Joules (J)

State what energy transfer diagrams show	Where energy is transferred to and from and the type of energy transfer
Name the four ways energy can be transferred	mechanically (when a force moves through a distance) electrically (when a charge moves through a potential difference) by heating (because of a temperature difference) by radiation (e.g. light, microwaves, sound)
Name the two types of energy transferred	Useful and wasted
State the law of the conservation of energy	Energy cannot be created or destroyed only transferred

Define Efficiency	A measure of the amount of energy that is usefully transferred
State the equation used to calculate efficiency	Efficiency = $\frac{useful\ energy\ output}{total\ energy\ input}$
Name the two ways efficiency can be written	A decimal or a percentage (by multiplying x 100)
Name the wasted energy transferred to the surroundings	Dissipated.

Name the energy that goes into a Sankey diagram	**Input energy.**
State where the input energy is drawn	**On the left hand side.**
Name the energy that comes out of a Sankey diagram	**Output energy (useful or wasted).**
Sate where the useful output energy is drawn	**On the right hand side.**
Sate where the wasted output energy is drawn	**At the bottom of the diagram.**

Define Efficiency	**A measure of the amount of energy that is usefully transferred**
State the equation used to calculate efficiency	**Efficiency =** $\frac{useful\ energy\ output}{total\ energy\ input}$
Name the two ways efficiency can be written	**A decimal or a percentage (by multiplying x 100)**
Name the wasted energy transferred to the surroundings	**Dissipated.**

Homework	*Topic*	*Mark*	*Mark with extension*	*RAG*
1	**Energy stores**	*/8*	*/14*	
2	**Energy transfers**	*/24*	*/28*	
3	**Sankey diagrams and efficiency calculations**	*/21*	*/33*	

Homework 1

Energy stores

Complete the table below of energy from the following key words:
Kinetic, Gravitational, Thermal, Elastic, Chemical, Nuclear, electrostatic, magnetic

Type of Energy Store	Description
	Stored in fuel, oxygen and chemicals
	Stored in a moving object
	Stored in an object due to the position of the object in a gravitational field
	stored in a stretched or compressed spring
	stored in a warm object or cold object
	stored in two separated magnets that are attracting, or repelling
	stored in two separated electric charges that are attracting, or repelling
	stored and released through radioactive decay, fission or fusion

(8)

Extension

1. **State the law of conservation of energy (1)**
2. **What is energy measured in? (1)**
3. **State the 4 ways in which energy can be transferred (4)**

Homework 2- Energy stores and transfer

State the energy transfer for each energy store change.

E.g

An object thrown upwards:

Kinetic store → gravitational store

Via mechanical transfer

1) A gas cooker –
   The energy transfer here is: chemical → thermal

   _____

2) An elastic band –
   The energy transfer here is: elastic → kinetic

   _____

3) A moving object hitting an obstacle – eg the train hitting the buffers on the track
   The energy transfer here is: Kinetic → elastic
   → thermal
   _____ Hint: there are two energy transfers
4) Bike at the bottom of a steep hill, moving up the hill–
   The energy transfer here is: kinetic → gravitational potential

   _____

(4)

1) Draw an energy transfer diagram for a vehicle slowing down

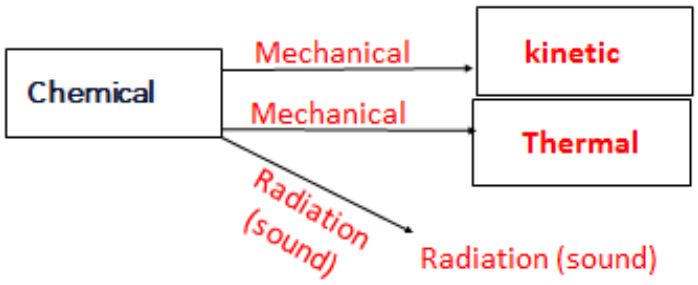
_____ → _____ via _____

(3)

Energy transfer diagrams

Example

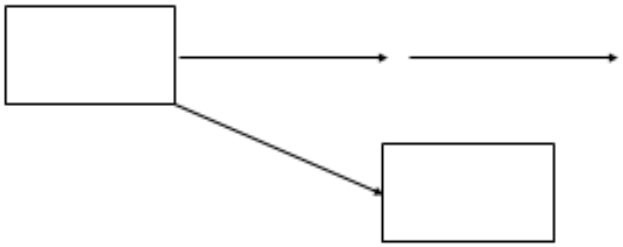
Example 1:
Draw an energy transfer diagram to show how the energy is transferred in a car.



Use the example above to answer the following questions

Question 1:

Draw an energy transfer diagram to show how the energy is transferred in an electric radio.



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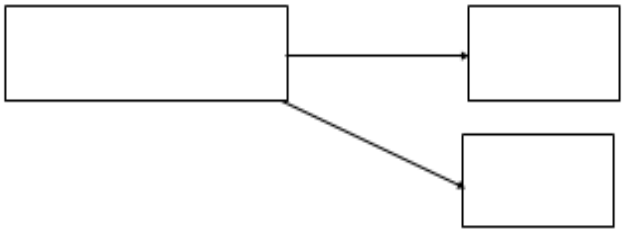
Question 2

Draw an energy transfer diagram to show how the energy is transferred in a ball at the top of a slope that rolls down



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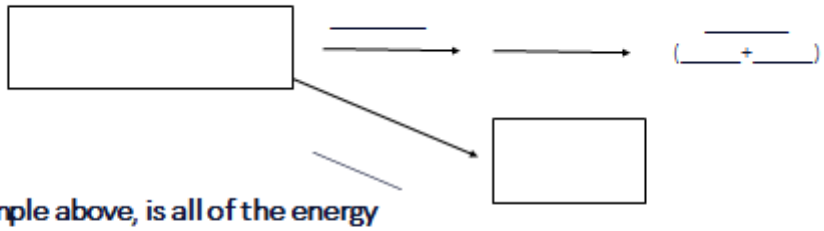
Question 3

1) Draw an energy transfer diagram to show how the energy is transferred in a TV



2) In the example above, is all of the energy transferred useful? Name one waste energy which is released.

(7)

Extension task- Energy transfers:

Draw energy transfer diagrams for each example:

1. electric drill
2. Bunsen burner
3. Candle
4. desk lamp

(4)

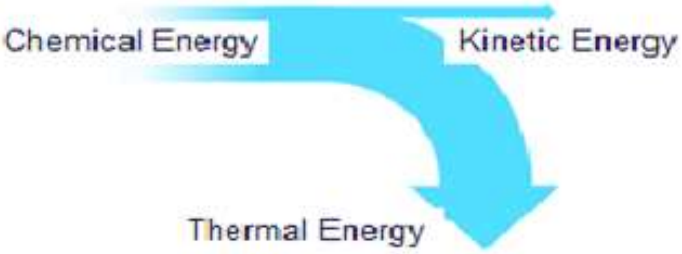
Homework 3- Sankey diagrams and efficiency calculations

Read the power point on Sankey diagrams

Circle the correct answer on the following questions

1) Name the useful energy
a) Chemical
b) Kinetic
c) Thermal

2) Name the wasted energy
a) Chemical
b) Kinetic
c) Thermal



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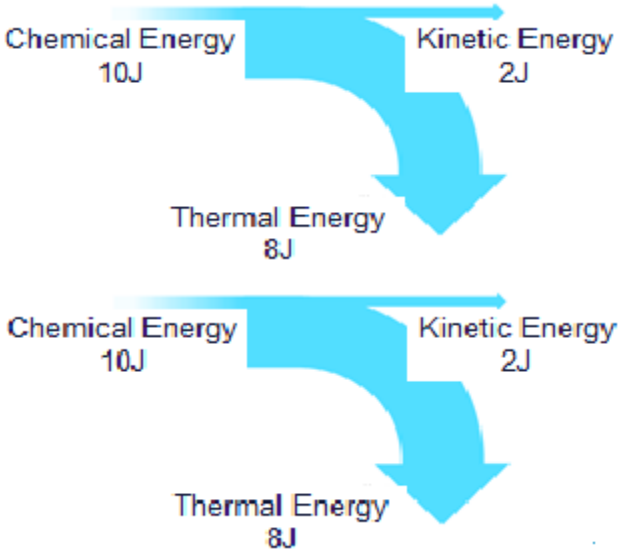
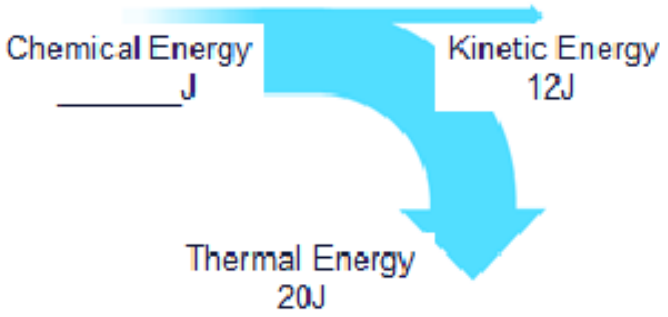
3) How much energy was inputted into the system
a) 10J
b) 2J
c) 8J

4) How much energy was wasted
a) 2J
b) 8J
c) 12J



5) How much energy was inputted into the system
a) 12J
b) 32J
c) 240J



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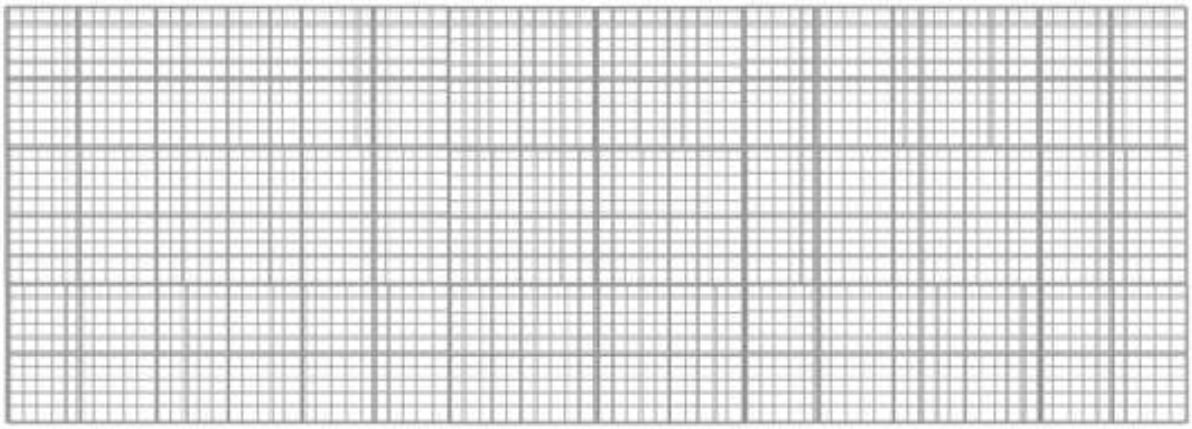
Question 6

Look at the example below and using a pencil and ruler draw sankey diagrams for the following questions

Example
A food mixer converts 400J of energy into 180J of useful energy and 220J of wasted heat and sound energy.

1.

A kettle uses 500J of energy and converts it to 150J of useful energy. How much is wasted?



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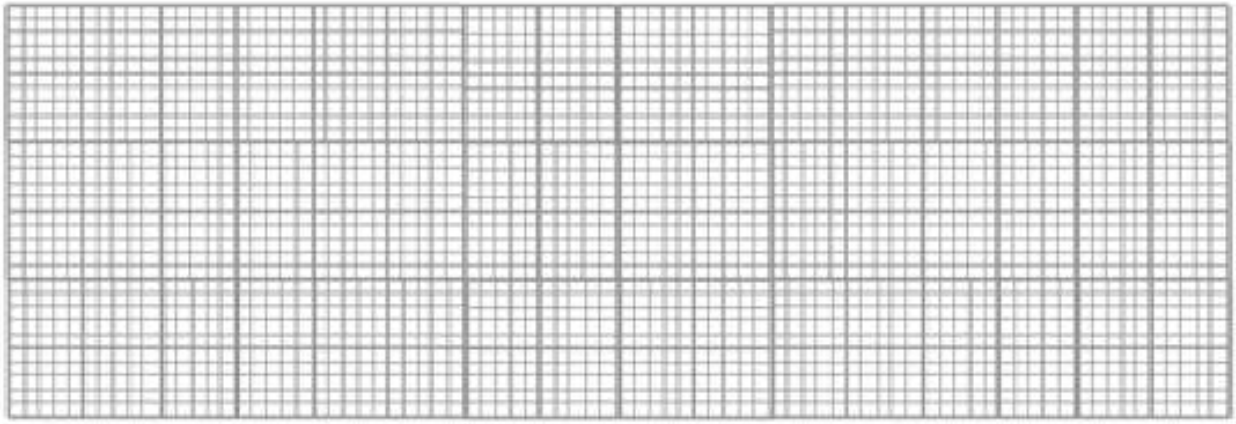
2.

In one second, a lightbulb uses 25J of electricity. It produced 10J of light and the rest is wasted as heat.



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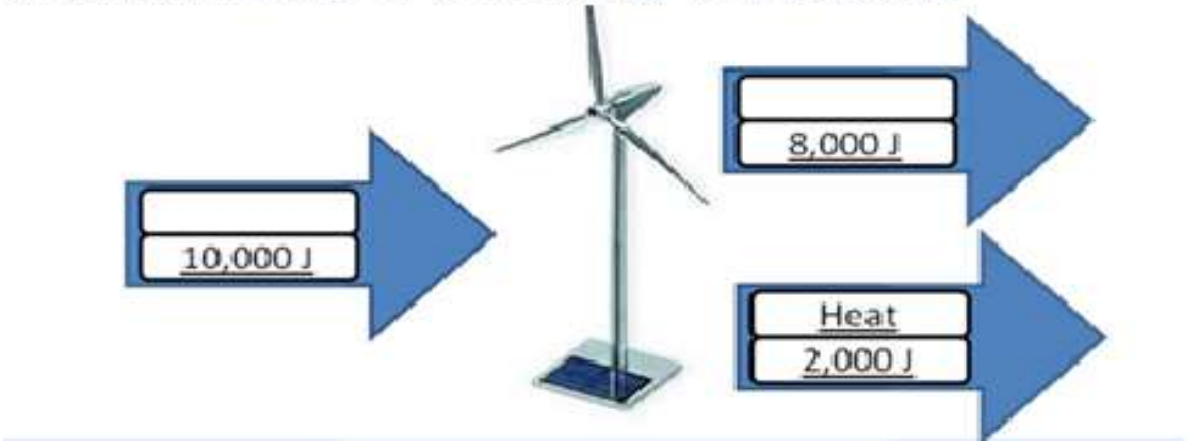
Efficiency calculations

Read the PowerPoint on efficiency and answer the following questions

1.

The wind turbine is an (*efficient/ inefficient*) energy source. 10,000 Joules of kinetic energy goes in and 8,000 Joules of energy is transferred to electrical and therefore only .....Joules of heat energy is dissipated.



(4)

Efficiency equation and how to work out

Example

Calculate the efficiency, as a decimal, of a speaker that uses 300 J which it radiates as 96 J of sound energy.

1. Annotate with Symbols

2. Write the EQUATION

Efficiency = $\frac{\text{usefully energy output}}{\text{total energy input}}$

3. Check the Units

4. Rearrange if needed

$= \frac{96}{300}$

5. Sub in

$= 0.32$

6. ANSWER WITH UNITS

2.

100J of energy is transferred electrically to a filament bulb, of which 45J are radiated usefully as light. Calculate its efficiency as a percentage.

1. Annotate with Symbols

2. Write the EQUATION

3. Check the Units

4. Rearrange if needed

5. Sub in

6. ANSWER WITH UNITS

(3)

3.

250J of energy is transferred electrically to a filament bulb, of which 150J are radiated as light and 100J stored thermally in the filament. Calculate its efficiency as a percentage.

1. **Annotate with Symbols**
2. Write the EQUATION
3. Check the Units
4. Rearrange if needed
5. Sub in
6. ANSWER WITH UNITS

(3)

Extension

Complete extension worksheet on Sankey diagrams