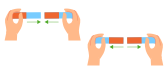
Store	Description	Examples
_____ 	Energy when repelling poles are pushed together or attracting poles are separated.	Two magnets, fridge magnets, Maglev trains
_____ (internal) 	Total kinetic & potential energy of particles (energy stored due to the temperature of an object.)	Human bodies, hot objects
_____ 	Energy stored in chemical bonds.	Food, fuel, battery
_____ 	Energy an object has when it is a moving object.	Moving objects, runners, buses
_____ 	Energy when repelling charges are pushed together or attracting charges separated.	Thunderclouds, two charges
_____ _____ 	Energy when objects are stretched or compressed.	Catapults, springs, balloons
_____ _____ 	Energy of an object raised above ground level	Raised mass, kites, mugs on a table
_____ 	Energy stored in the nucleus of atoms.	Nuclear fuel

Illustrate the transition from initial to final states of a system

Boxes: Energy _____ (Gravitational Potential Energy)

Arrows: Energy _____

Transfer diagrams

Representing Energy Transfers

Example: A falling object which hits the ground

Gravitational Potential Energy store (object) → Transfer of energy by force of _____ → Kinetic energy store (object) → Transfer of energy by sound waves or _____ → Energy store of surroundings (thermal energy store and soundwaves)

As a ball falls, its gravitational potential energy store _____ while kinetic energy store _____. Upon hitting the ground, the kinetic energy store _____, transferring energy to the surroundings, _____ their _____ energy store and creating sound waves.

Sankey Diagrams

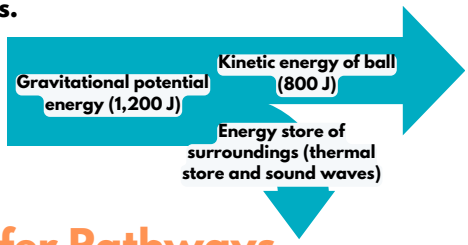
A diagram used to show how energy _____ through a _____.

A large arrow represents total energy input, splitting into smaller arrows for useful and wasted outputs.

Arrows are drawn to scale for easy comparison of energy distribution.

Conservation of Energy
Energy can be usefully transferred to other stores or wasted/dissipated into the surroundings. However, it cannot be created or destroyed.

P1.1.1 Energy Stores and Systems



An _____ or group of _____

Changes within systems result in energy being _____.

Systems

_____ system = no net energy transfer in or out

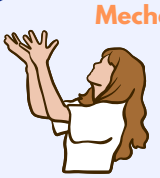
_____ energy in a closed system never changes

Energy Transfer Pathways

Pathway	Description	Example
Mechanical	Force moves an object through a distance (work done by _____)	Boat accelerating due to engine
Electrical	Charges moving due to a potential difference when a _____ flows	Electric kettle heating water
_____	Energy is transferred from an object with a higher temperature to one with a lower temperature.	Stove heating a pan
_____	Energy transferred by waves (e.g., infrared radiation)	Sun heating the Earth

Examples

Mechanical



Object projected upwards

Throwing a ball into the air

_____ store decreases (human)

_____ store increases (ball)

_____ potential store increases (ball)

Mechanical & heating

Moving object hitting an obstacle

A ball colliding with an stationary ball

Kinetic store _____ (ball)

Kinetic store _____ (obstacle)

_____ or sound store (dissipated) (ball & obstacle)

Electrical & heating

Bringing water to a boil in an electric kettle

_____ store (mains supply) → _____ store (heating element) → _____ store (water)

Mechanical

Object accelerated by constant force

A car accelerating

_____ store decreases (fuel)

_____ store increases (vehicle)

Mechanical

Vehicle slowing down

Kinetic store _____ (vehicle)

Friction

Thermal store increases (_____ in brakes and to surroundings)

Changes in Gravitational Potential Energy Stores

Lifting an object - some energy from the chemical store in muscles is transfer to the _____ store of the object, __p

Work done depends on:
1. Change in _____
2. _____

$$E_p = w\ h$$

Gravitational field strength is different on different planets and celestial objects. Since weight is equal to the gravitational field strength and mass:

$$E_p = m\ \_\_\ h$$

Gravitational potential energy, ***Ep***, in _____, J
Mass, ***m***, in kilograms, __
Gravitational field strength, ***g***, in newtons per kilogram, __/___
Height, ***h***, in _____, m

E_p = mass * _____ * height

The force needed to lift an object at a constant velocity = Ep of the object = the object's weight

Upward movement - Ep _____, equal to work done by person lifting to overcome gravitational force

Downward movement - Ep _____, equal to work done the gravitational force acting on it

Changes in Kinetic Energy Store

Kinetic Energy - The energy stored in _____ objects

The kinetic energy store of the ball _____ if speed increases

Height drop relates to speed's square; quadrupling height _____ speed. Kinetic energy store of falling objects is also _____ to the square of their speed.

P1.1.2 Changes in Energy

Elastic Potential Energy Store

The force needed to stretch depends on the extension

$$E_{\_\_} = \frac{1}{2}\ k\ e^2$$

Elastic potential energy, *Ee*, in _____, J
Spring _____, *k*, in newtons per metre, _/_
Extension, *e*, in metres, _

$E_e = \frac{1}{2}$ * spring constant * extension^2

Exam Tip:
Questions may involve linking multiple energy transfers. For instance, when calculating the gravitational potential energy of a ball on a slope, the law of the conservation of energy indicates that a decrease in gravitational potential energy corresponds to an equal increase in kinetic energy.

Therefore, kinetic energy depends on mass and speed

$$E_k = \frac{1}{2}\ m\ \_\_^2$$

Kinetic energy, *Ek* , in _____, J
Mass, *m*, in kilograms, ___
Velocity, *v*, in metres per second, __/__

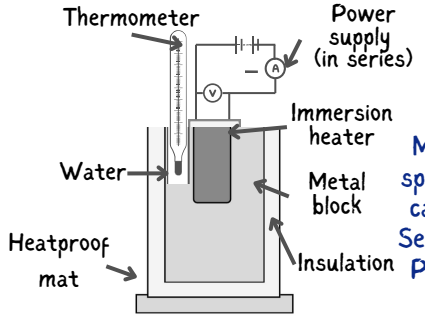
$E_k = \frac{1}{2}$ * mass * _____^{2}

An energy transfer of 1 joule per second = power of 1 watt.

Thermal Energy Changes in a System

It takes a different amount of energy to heat up different materials. The amount of thermal energy added, thus temperature rise, depends on:

- **The amount of _____ supplied to it**
- **The _____ of the substance**
- **_____ the substance is**



Measuring specific heat capacity - See Required Practical 1

Change in thermal energy = mass × SHC × temperature change

$$\_\_ = \_\_\_\_\_$$

Change in thermal energy, **ΔE**, in _____, J
Mass, **m**, in kilograms, ___
Specific heat capacity, __, in joules per kilogram per degree Celsius, J/kg °C
Temperature change, **Δθ**, in degrees Celsius, °__

Rearranged to calculate specific heat capacity

$$c = \frac{\Delta E}{m\ \Delta\theta}$$

Specific Heat Capacity (SHC):

Energy needed to raise the temperature of __ kg of a substance by __˚C

Typical SHC values include:
- **Water: _____ J/kg˚C**
- **Aluminium: 900 J/kg˚C,**
- **Concrete: 880 J/kg˚C**

For example, heating 1.0kg of water by 6˚C involves a transfer of 25,200J because: 1 x 4200 x 6 = 25,200