Energy Stores

Energy allows things to happen, it **does not make** things happen - just like money allows you to buy food, but it doesn't buy the food.
The energy of an object is stored in an energy store. Energy can be transferred from one energy store to another.
Energy has units of Joules (J). Here are some energy stores:

Gravitational potential energy
Elastic potential energy
Kinetic energy
Nuclear energy
Electrostatic energy
Magnetic energy
Chemical energy
Thermal energy

1 Link the energy stores with the correct sentences.

The energy store linked to height.		chemical energy
The energy store linked to temperature.		gravitational potential energy
The energy store linked changing shape.		kinetic energy
The energy store linked food and chemical reactions.		magnetic energy
The energy store linked to magnets.		elastic potential energy
The energy store linked to electric charges.		thermal energy
The energy store linked to movement.		electrostatic energy

2 Which of these have energy in an energy store?

(a) A book on a table

(b) Person reaching the top of Ben Nevis

(c) A hot bath

(d) A banana

3 Link each situation with the right energy store.

A nest in a tree		gravitational potential energy
Two magnets close together		elastic potential energy
A charged battery		magnetic energy
A compressed spring		chemical energy

4 Which energy store is the energy moved from and to which one(s) does it go to? Fill in the sentences with the energy stores given.

(a) A brake slowing down a wheel. (**kinetic, gravitational potential, thermal, magnetic**)
Energy is transferred from the _____ energy store to _____ energy store.

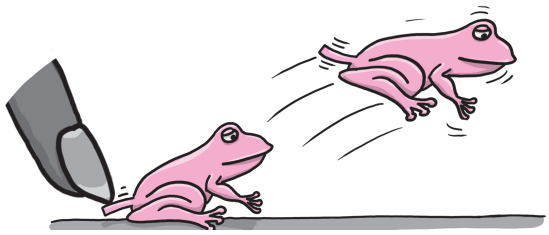
(b) A ball rolling up a slide. (**kinetic, gravitational potential, thermal, electrostatic**)
Energy is transferred from the _____ energy store to the _____ _____ energy store.

5 Which energy store is the energy moved from and to which one(s) does it go to?

(a) A bird gliding down from the nest.

(b) A battery moving a toy train.

(c) A pop-up toy that jumps into the air.



The **total energy** of a system is conserved. Energy can not be made or lost. This is the **Law of conservation of energy.**

Total energy stored at start $=$ total energy stored at the end

6 First, a compressed spring has an elastic potential energy store of 20 J. A large ball sits on top of the spring.

(a) Complete the sentence: Before being released the spring has $\square$ J of energy in its energy store.

(b) The spring is released and all of its energy is transferred to make the ball move upwards. The ball will have a store $\square$ J of kinetic energy.

(c) The ball moves upwards until it reaches the highest point and pauses. The ball now has $\square$ J of gravitational potential energy.

(d) The total energy equation can be written as:

total energy at the start (J)	$=$	total energy at the end (J)
elastic potential energy (J)	$=$	gravitational potential energy (J)
$\square$	$=$	$\square$

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7 An electric toy train moves up a ramp. When it gets to the top of the ramp, it is still moving. The train's battery had 3.0 J of chemical energy at the start.

(a) To what stores has the energy transferred to?

(b) At the top of the ramp, its chemical energy store is now at 0.3 J. If 1 J of energy went to the gravitational potential energy store of the train, how much is in the other store? Fill in the equation.

total initial energy (J)	$=$	total final energy (J)						
chemical energy	$=$	chemical energy	$+$	gravitational potential energy	$+$	_____ energy		
3.0	$=$	0.3	$+$	1.0	$+$	$\square$		

8 A ball rolls up a ramp and comes to a stop at the top. At the bottom of the ramp, it had a kinetic energy store of 1 J.

(a) To what store has the energy transferred to?

(b) How much is in the new energy store of the ball?

(c) The ball has rolled half way down the ramp. Which stores is the energy in? How much is in each?

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9 A bank of batteries is used to power a hot plate to heat up cup of water. Every time the water's temperature increased by 1 °C, the amount of energy left in the battery was measured. This was recorded in the table below.

Chemical energy left in batteries (J)	5000	4000	3000	2000	1000	0
Thermal energy of water (J)	1000	2000	3000	4000	5000	6000

(a) How much chemical energy did the battery bank have at the start?

(b) How much energy is needed to increase the water's temperature by 1 °C?

(c) How much energy would you need to increase the water's temperature from 6 °C to 10 °C, that is increase its thermal energy from 6000 J to 10000 J?

Energy can be transferred from the system to its surroundings. This energy is **dissipated**. It is stored in a useless store.

10 The brakes stop a bicycle when the cyclist comes to a red light. Before putting on the brakes, the cyclist had a kinetic energy store of 270 J.

(a) How much energy is in the thermal energy store of the brakes once the bike has stopped?

(b) Can this store usefully be used by the cyclist?

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11 When a football is kicked, it changes shape and makes a noise before moving away.

(a) Which energy stores does the ball have when it is being kicked by the foot?

(b) The foot has a kinetic energy of 100 J. One tenth of this is dissipated by sound waves and heat. How much of the useful kinetic energy store is left?