ENERGY

WHAT IS ENERGY?

Energy is the ability to do work.

All moving objects have energy associated with their motion.

Whenever work is done, energy is transformed or transferred from one system to another.

Energy, like work, is measured in Joules

DOES AN OBJECT HAVE TO BE MOVING TO HAVE ENERGY?

Just because an object isn't moving doesn't mean is has no energy.

We call this "Potential Energy"

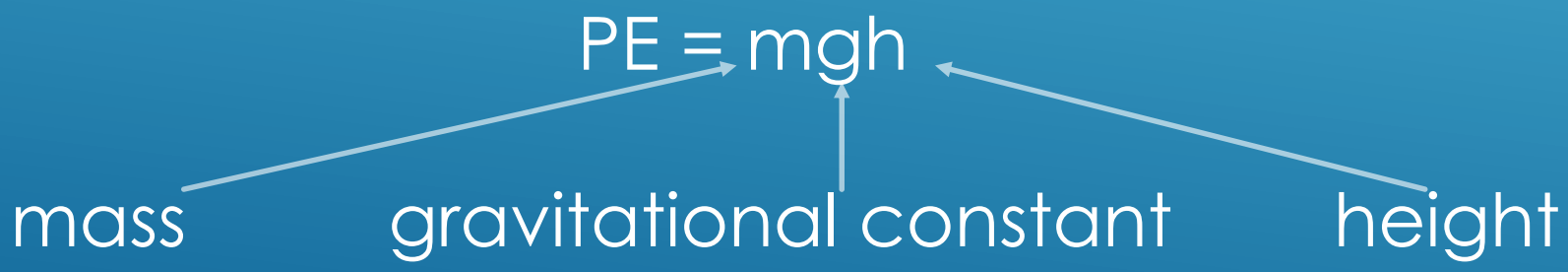
Potential Energy – Energy of position, or stored energy

There are many types of potential energy: elastic, gravitational, chemical…

GRAVITATIONAL POTENTIAL ENERGY

Denoted as either GPE or for us just PE

This is the energy stored due to the height off the ground of an object.



HOW DO WORK AND ENERGY HAVE THE SAME UNITS?

$$W = Fd \qquad PE = mgh$$

$$F_w = mg$$

$$W = PE$$

LET'S TALK ABOUT KINETIC ENERGY

The energy of motion!

KE depends on the mass of the object and it's velocity

$$KE = \frac{1}{2}mv^2$$

Notice that the velocity is squared…

$$KE = \frac{1}{2}mv^2$$

A 5 kg object is moving at a rate of 2 m/s.

$$KE = \frac{1}{2}(5kg)\left(2\frac{m}{s}\right)^2$$

$$KE = 10\ J$$

What if we double the mass?

$$KE = \frac{1}{2}(10kg)\left(2\frac{m}{s}\right)^2$$

$$KE = 20\ J$$

KE doubles

What if we double the velocity?

$$KE = \frac{1}{2}(5kg)\left(4\frac{m}{s}\right)^2$$

$$KE = 40\ J$$

KE quadruples

SO WHAT IS MECHANICAL ENERGY?

The total amount of work an object can do.

Or…

The total energy of system

TE = PE + KE

An object can have all PE, all KE, or some of both

OTHER FORMS OF ENERGY

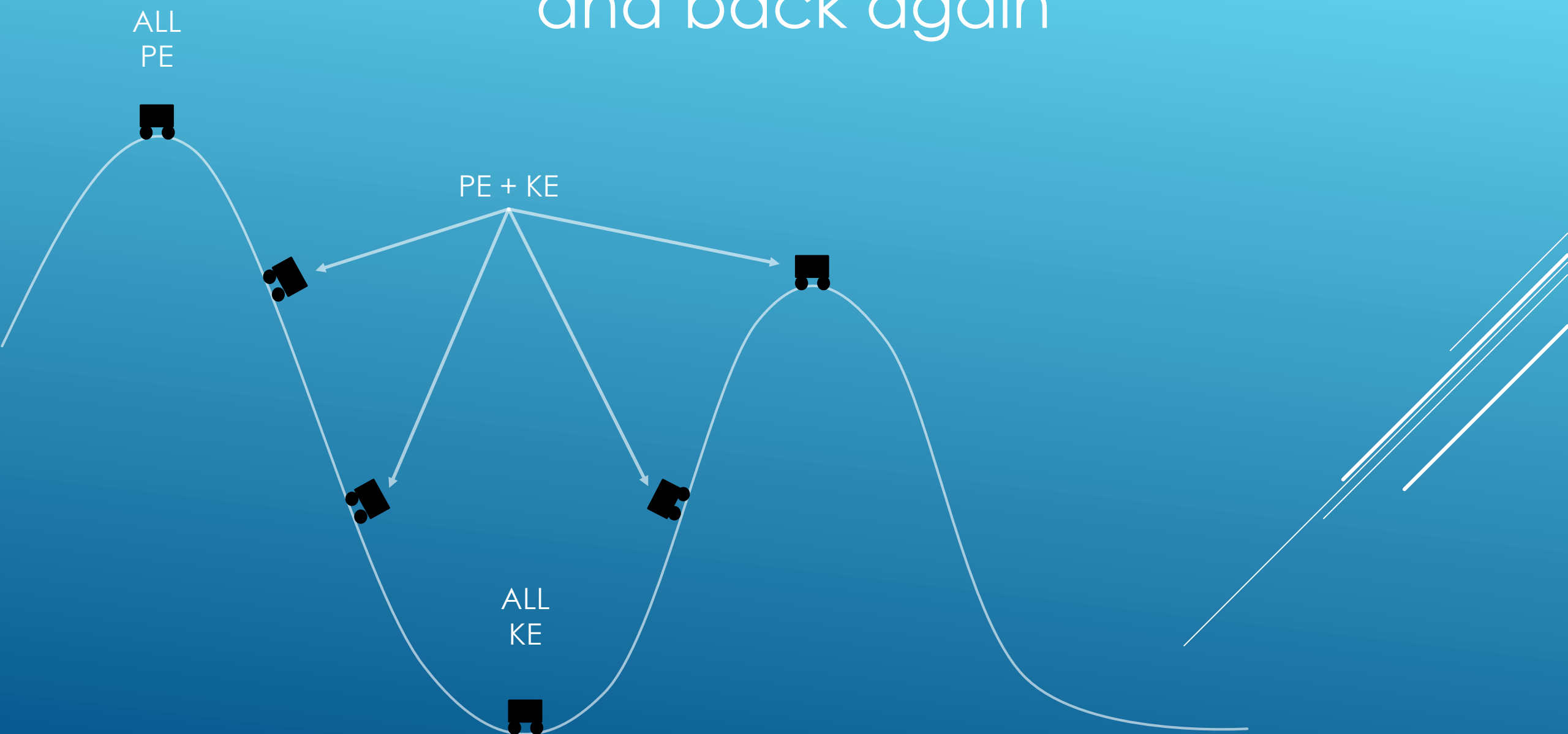
Chemical Energy: energy due to the relative position of the atoms in a substance.

Nuclear Energy: energy created by the fusion or fission of radioactive elements

Our sun is a constant Nuclear Energy reaction

Field Energy: Electric energy and magnetic energy

Transformation of Energy: Potential to kinetic and back again



CONSERVATION OF ENERGY

As an object falls, the PE become KE, and as it rises it goes from KE to PE. But this doesn't always occur in real life does it?

Energy does not just 'disappear' but is converted into other forms of non-mechanical energy.

Non-mechanical energy: Light, heat and sound

THE DIFFERENT TYPES OF SYSTEMS

Open System : energy and matter are exchanged with the surroundings (Boiling water)

Closed system: only energy is exchanged with the surroundings (Our Earth)

Isolated System: no energy or matter is exchanged with the surroundings (Yeti cooler…supposedly)

LAST BUT NOT LEAST… EFFICIENCY

We know that when we put in work on a machine it puts out work, but is it the same amount?

Not usually.

Efficiency of a machine: the measure of how much ***useful*** work a machine can do.

$$Efficiency = \frac{W_{out}}{W_{in}} * 100$$

It is not possible for a machine to be 100% efficient