Work Done and Energy
1 October

Lesson Aims:

All learners:

1. Understand how Work done is defined in physics.

Most learners:

1. Calculate energy used in doing work.
2. Calculate energy used in lifting objects.

Some learners:

1. Complete all tasks.

What's the Question ??

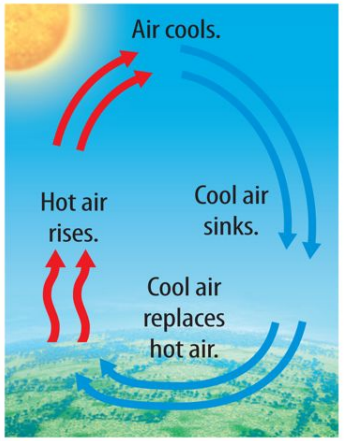
If the following are answers, then what are the questions: ?

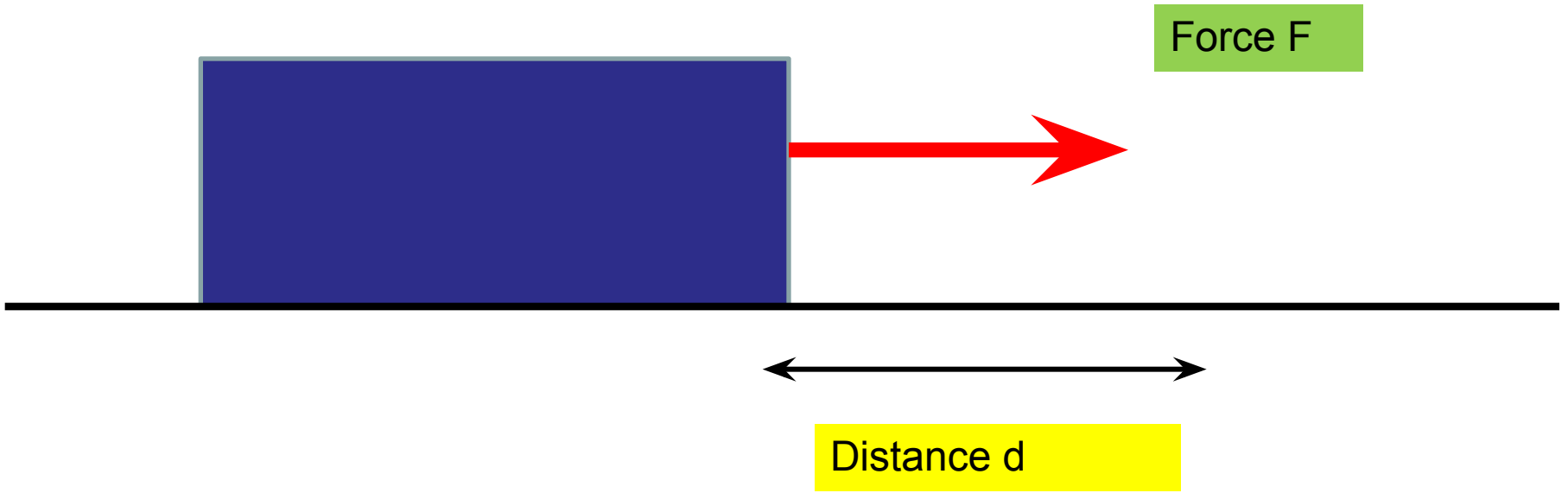
1. Insulator
2. Trapped air
3. Copper
4. Hot air rises.
5. Matt black
6. Shiny silver

Starter !!

Explain in your own words the following:

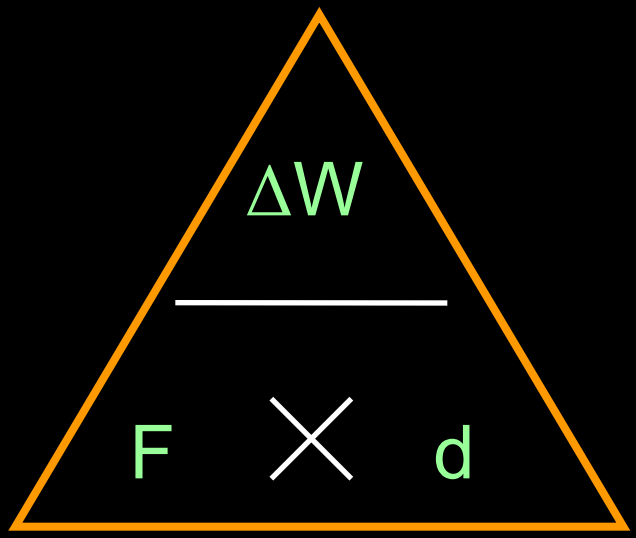
a. House radiators should be painted matt black.
b. Marathon runners wrap themselves in silver blankets.
c. Why a polar bear has fur and is coloured white.
d. Why a polar bear has a black skin.
e. Hot air rises.




Force F
Distance d

Work done (in joules) is simply the force needed to move an object multiplied by the distance moved in the direction of the force:

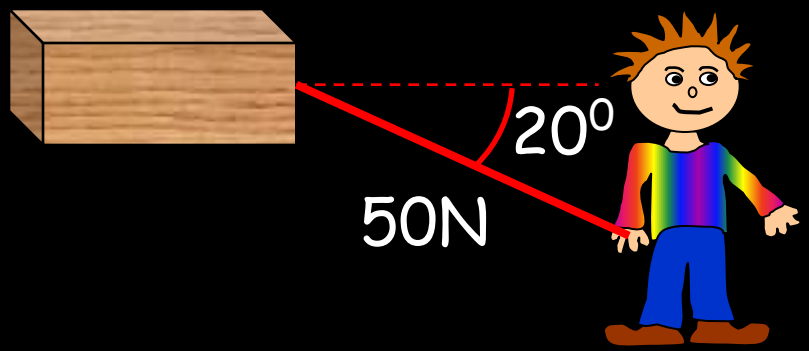
$$\Delta W = F \times d$$



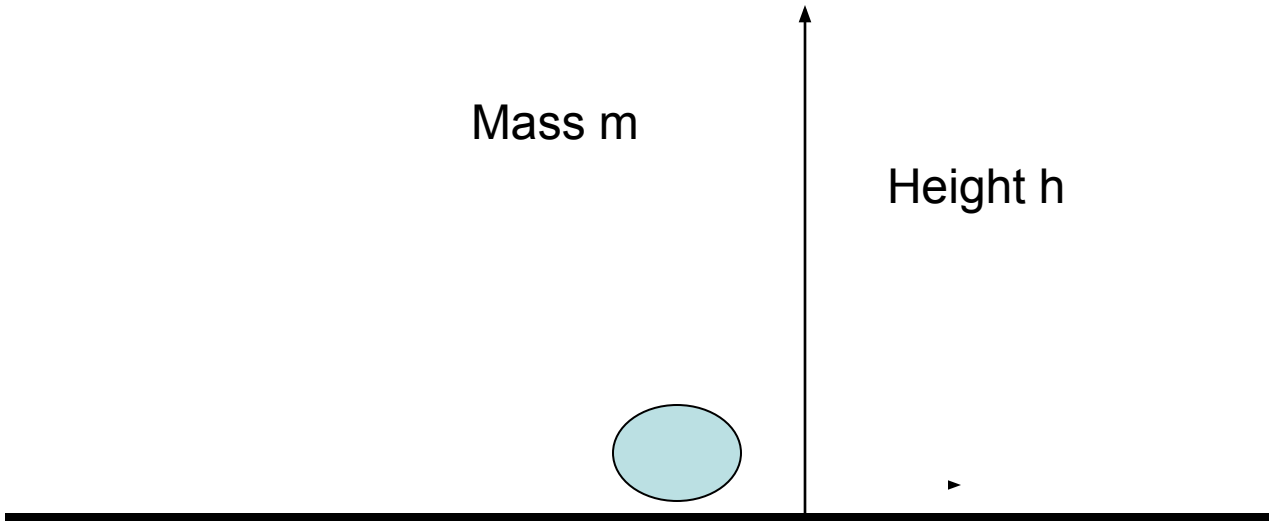
1) Dom pushes Jack in the direction of a cliff. If he uses a force of 40N and he moves Jack 10m in 4s calculate the work done and Dom's power rating.

2) George runs up some stairs and has a power rating of 600W while he does so. If he does it in 5 seconds and his weight is 750N calculate how high the stairs are.

3) A man pulls a block of wood at an angle of 20^0 to the horizontal and uses a force of 50N. If the distance travelled horizontally is 5m calculate the work done by the man and his power if the journey lasted 10 seconds.



Gravitational Potential Energy



When an object is lifted up close to the Earth's surface, work is done against the gravitational force:

$$GPE = Fh = mgh$$

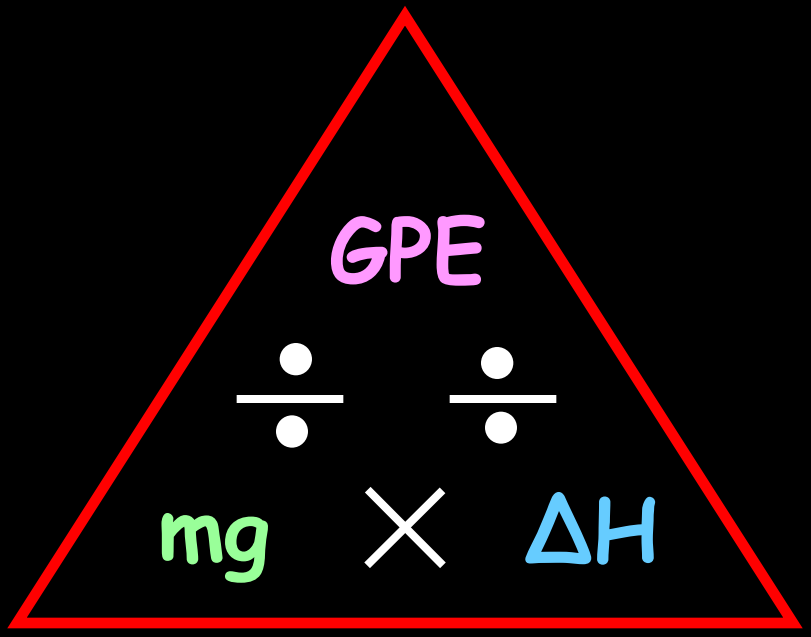
This energy is stored in the field.

To work out how much gravitational potential energy (GPE) an object gains when it is lifted up we would use the simple equation…

GPE = Weight x Change in height

(Joules) *(newtons)* *(metres)*

(Remember - W=mg)



GPE Questions

1 Goods in a warehouse are stored on shelves. Table **A** shows the changes in gravitational potential energy as different items are put onto their shelves.

Calculate the missing values in the table.

	Change in GPE	Mass	Change in height
a		4 kg	2 m
b		2.5 kg	3 m
c		500 g	2.5 m
d	800 J		2 m
e	1125 J	75 kg	
f	1.5 kJ	50 kg	
g	50 J		50 cm

A

2 **a** Calculate the change in GPE when an astronaut lifts a 2 kg hammer onto a shelf 1.5 m above the floor in a base on the Moon. The gravitational field strength on the Moon is 1.6 N/kg.

b The same hammer is lifted onto a shelf of the same height on Mars. It gains 11.1 J of GPE.

Calculate the gravitational field strength on Mars.

c A space probe with a mass of 400 kg lands on Titan (one of the moons of Saturn). When it is 500 m above the surface it stores 280 kJ of GPE.

Calculate the gravitational field strength on Titan.

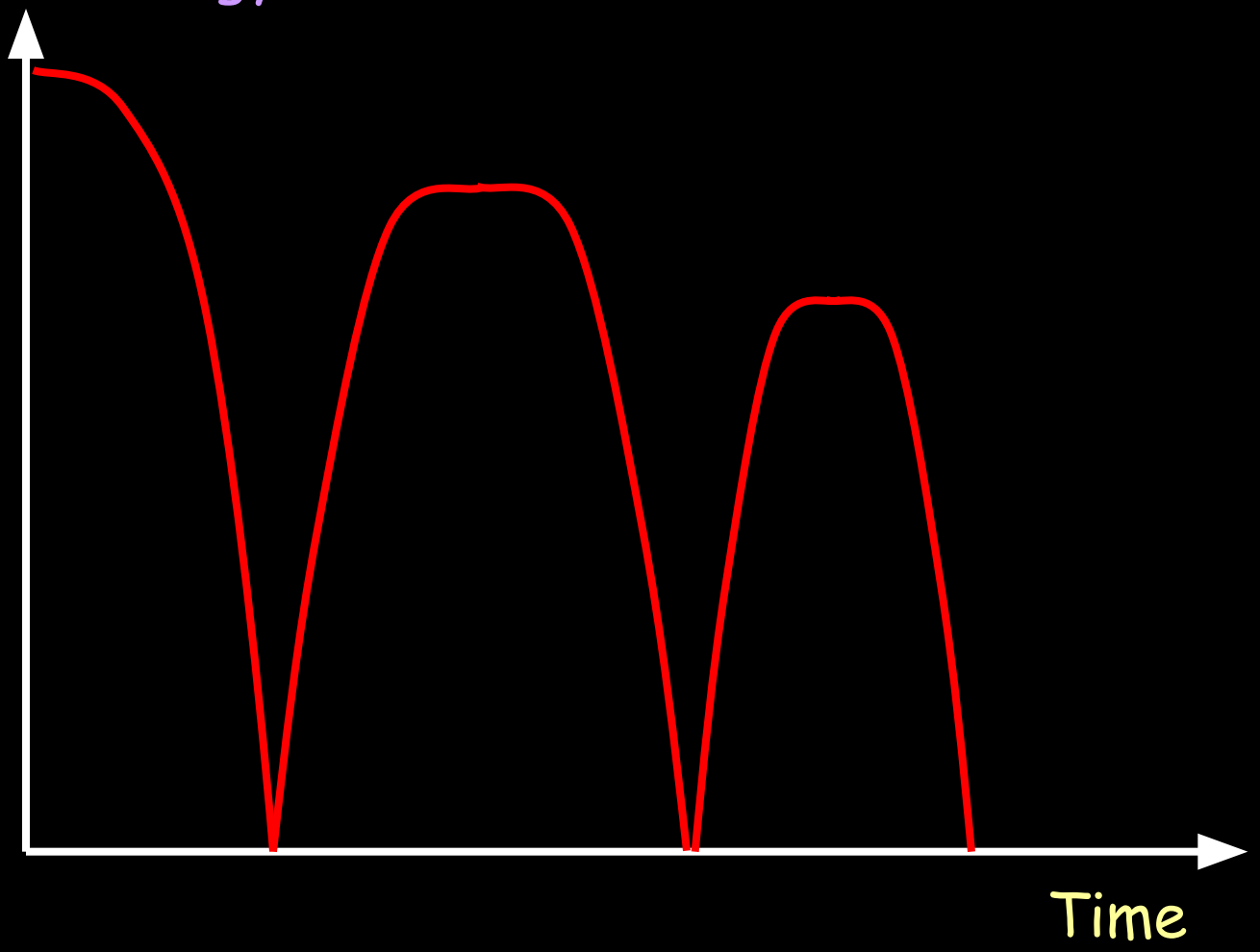
How much gravitational potential energy have the following objects gained?:

1. A brick that weighs 10N lifted to the top of a house (10m),
2. A 1,000kg car lifted by a ramp up to a height of 2m,
3. A 70kg person lifted up 50cm by a friend.

How much GPE have the following objects lost?:

1. A 2N football dropping out of the air after being kicked up 30m,
2. A 0.5N egg falling 10m out of a bird nest,
3. A 1,000kg car falling off its 200cm ramp.

Consider a bouncing ball:



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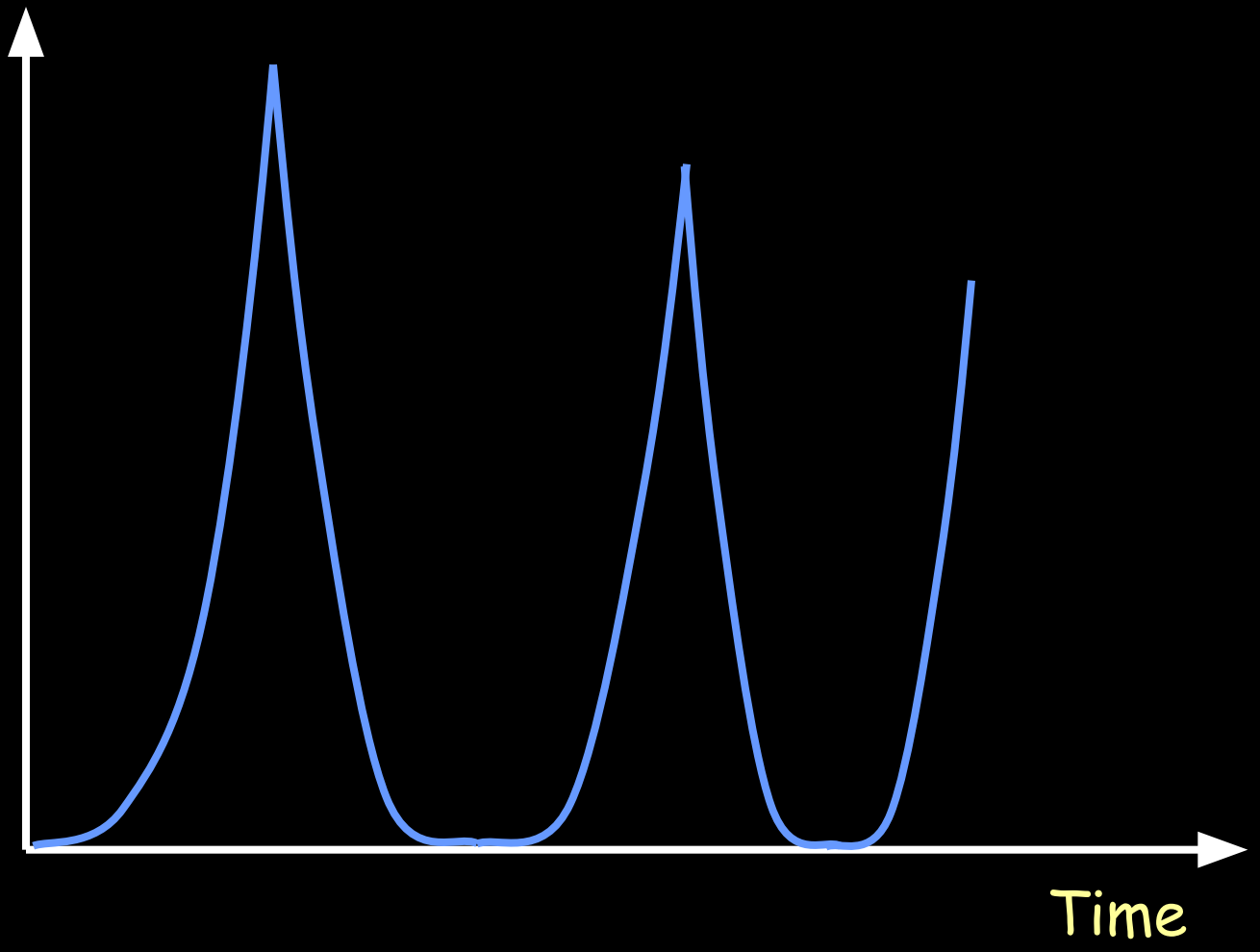
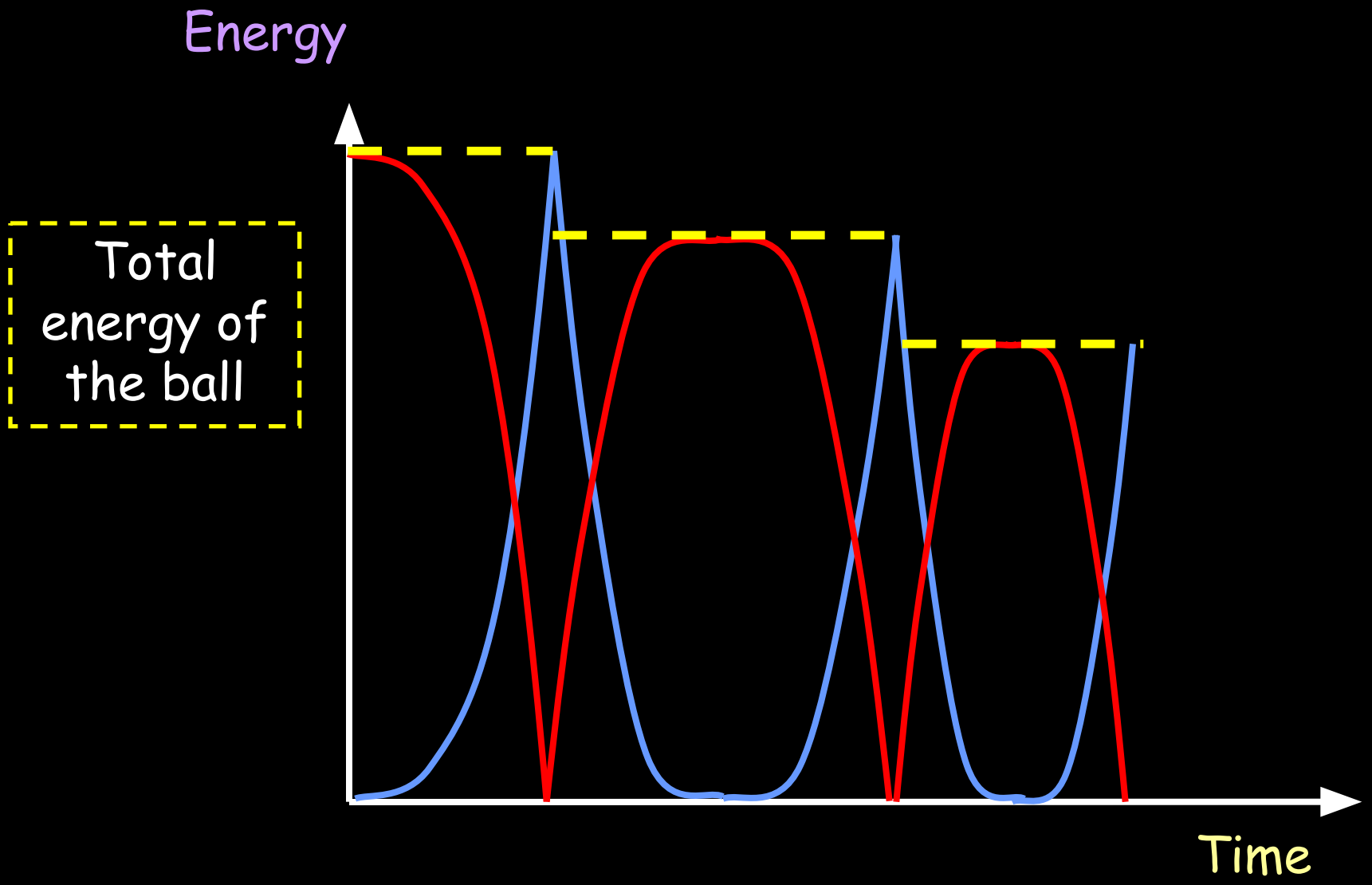


Now put these graphs together:



Mind Map

Produce a mind map of your learning. This could be done using concept branches, key words, 3 things you have learnt etc.