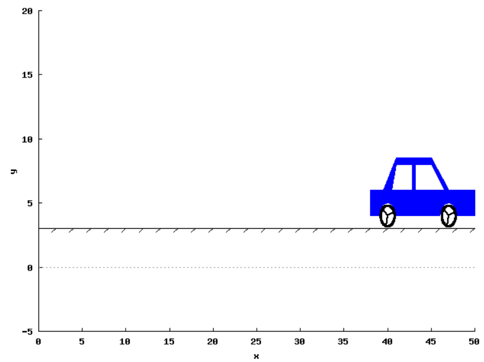
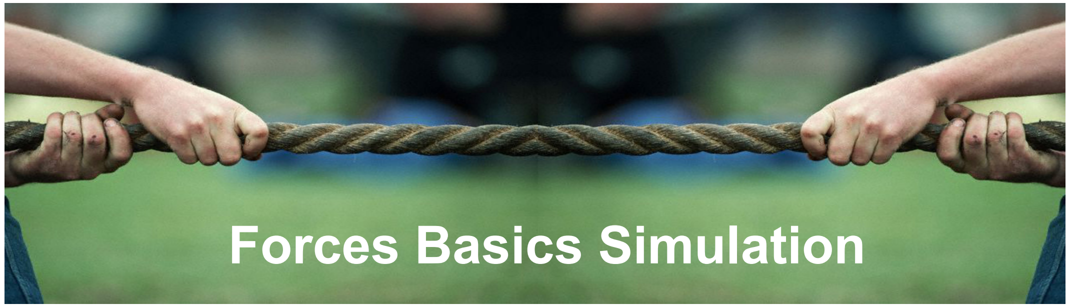
Chapter 36 - Force and Work

A force is something that causes an object to accelerate.



Acceleration can be positve (faster) or negative (slower).



Measuring Force

Force is measured in Newtons (N).

It can be measured using a **spring balance** or a newton meter.

Types of Forces

FORCE	EFFECT	EXAMPLE
Push	Moves or increases speed or changes direction	Pushing a child on a swing
Pull	Causes movement (as above)	Pulling off a boot
Weight	Moves objects towards the centre of the earth	A ball falling
Friction	Slows objects moving over each other	Brakes on a bicycle
Tension	Moves objects on pulleys or stops a body falling	A light suspended from a ceiling
Reaction	Supports or balances weight	A book resting on a table
Stretching	Changes shape of object	Stretching an elastic band
Twisting	Causes rotation	Opening a screw cap on a bottle
Compression	Changes shape of object	Sitting on a cushion
Magnetic	Moves magnetic materials	Picking up iron in a scrap yard
Electric	Moves charged particles	Positive charge attracting negative

Weight

The weight of an Object is the force of Gravity on it.

Gravity on the moon is 1/6th the gravity on Earth.

My mass (what I'm made of) is 84kg on earth.

So on Earth I weigh 84kg.
On the moon I weigh 14 kg as there's less gravity pulling on me.

If I went to Jupiter i would still have 84kg of mass but I would weigh around 214 kg!

Weight Calculations

weight (in newtons)
= mass (in kilograms) × 10

mass → weight
kg → N
(× 10)

Example 1

(a) *What is the weight of a packet of sugar, which has a mass of 400 g?*

(b) *What is the weight of a block of mass 7.5 kg?*

(c) *What is the weight of the same block on the moon, if the pull of gravity on the moon is one sixth of the pull of gravity on earth?*

.4 kg → 4 N

Example 2

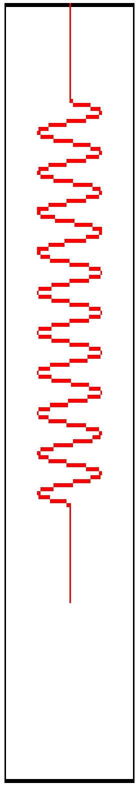
What is the mass of a book that has a weight of 15 N?

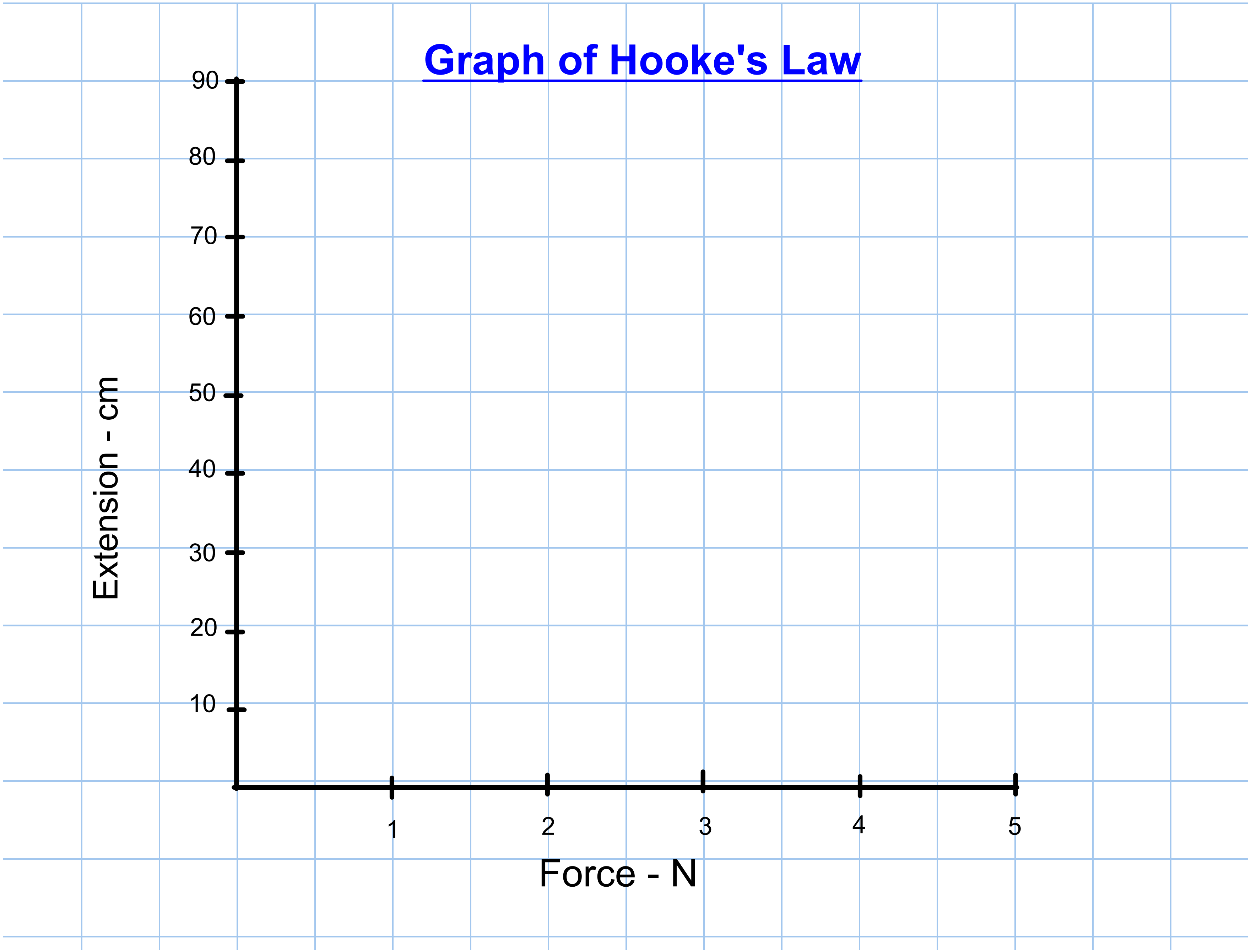
Weight of book = 15 N

$\underline{\underline{1.5}}$ kg ← 15 N

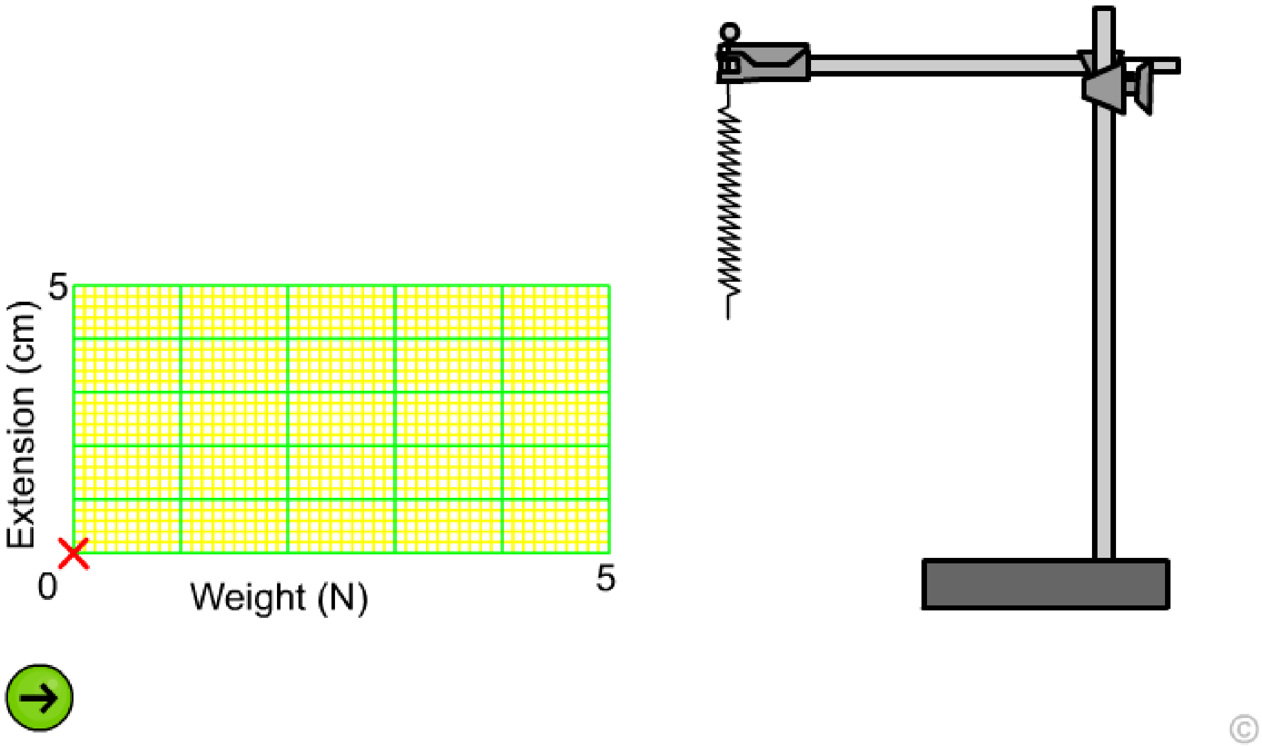
Hooke's Law Experiment

Force (N)	Total Extension (cm)	Extension (cm)
0 N		0
1 N		
2 N		
3 N		
4 N		
5 N		




Graph of Hooke's Law
90
80
70
60
50
40
30
20
10
Extension - cm
1
2
3
4
5
Force - N

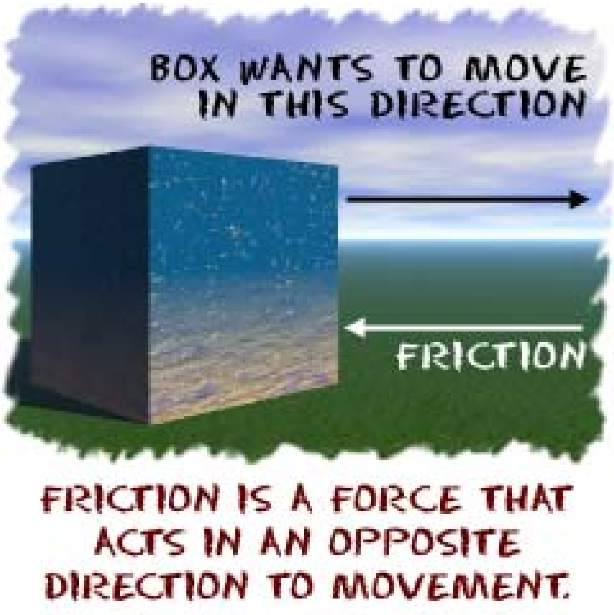
Hookes Law - The extension of a spring is directly proportional to the force that is stretching it.



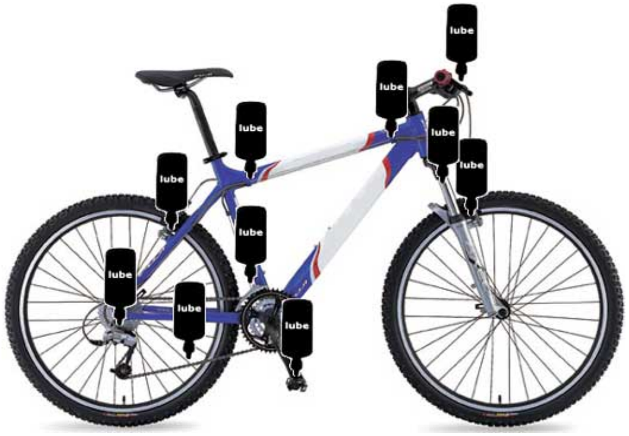
Conclusion from our experiment - The spring extends the same amount each time a 1 Newton force is added.

Friction

Friction is a force which opposes motion between two objects in contact



Friction causes heat - which can light matches



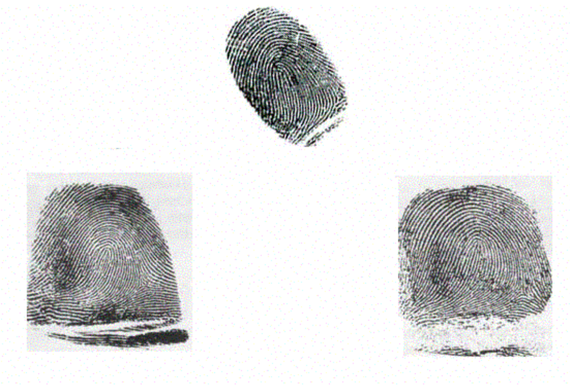
Oil on a bike reduces friction - easier to cycle

Friction

Disadvantages	Advantages
Slows things down	Slows things down - brakes on car
Wastes Energy - as Sound and Heat	Needed for grip - on roads
Wears away surfaces - brake pads	Fingers need friction to grab things

1

2



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1- koala 2- human 3 - chimp

Work and Power

Work done = Force x distance moved

The work is Newtons x Metres = **Joule (J)**

(a) Find the work done when a force of 6 N moves a glass a distance of 0.5 m across a counter.

(b) Find the work done by the weightlifter, Fig. 36.11, who lifted 90 kg from the floor to a height of 1.6 m.

$W = F \times D$

Work = Force x distance

$6N \times .5m$

$= 3J$

Work = force x distance

$90kg \times 10 \rightarrow 900N$

$W = 900N \times 1.6$

$= 1440 J$

Energy

Energy - is the ability to do work

Power

Power is the work done per unit time.

or $$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

Watt is the unit of Power?

A boy used a force of 25 N to push a lawnmower a distance of 20 m across a lawn. If this task took 8 seconds, what was the average power developed by the boy?

W = Force x distance

25N x 20m

work = 500 J

$$\text{Power} = \frac{\text{work}}{\text{time}} = \frac{500\,J}{8\,s} = 62.5\ W$$

Attachments

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