Physics

Aims and objectives

IB

Curriculum model

SL	Total teaching hours		150
Theory			110
	Core	80	
	Options	30	
Practical work			40
	Investigations	30	
	Group 4 project	10	
HL	Total teaching hours		240
Theory			180
	Core	80	
	Additional higher level (AHL)	55	
	Options	45	
Practical work			60
	Investigations	50	
	Group 4 project	10	

Physics is one of the group 4 subjects.

Through studying any of these subjects, you should aware **of** :

- how scientists work and communicate with each other;
- The "scientific method" involves the formation, testing and modification of hypotheses through observation and measurement;
- What distinguishes the experimental sciences from other disciplines

Aims

- To apply and use a body of knowledge, methods and techniques which characterize science
- Develop an ability to analyze, evaluate and synthesize scientific information
- Develop experimental and investigative scientific skills

Aims

- Raise awareness of the moral, ethical, social, economic and environmental implications of using science and technology
- Develop an appreciation of the possibilities and limitations associated with science and scientists

You should achieve:

- Demonstrate an understanding of: scientific facts and concepts, scientific methods and techniques, scientific terminology;
- Apply and use: scientific facts and concepts, scientific methods and techniques, scientific terminology;

You should achieve:

- **Construct, analyse and evaluate:** hypothesis, research questions and predictions, scientific methods and techniques, scientific explanations;
- **Demonstrate the personal skills of** cooperation, perseverance and responsibility appropriate for effective scientific investigation and problem solving

Syllabus of Pre-IB course

- Physics and physical measurements
- Mechanics
- Thermal physics
- Electric field
- Electric current
- Practical work

Some physical concepts

- **Quantity** – 1)the aspect or property of anything that can be measured, weighed, counted, etc; 2) a specified magnitude or amount;
- **Magnitude** - a number assigned to a quantity, such as weight, and used as a basis of comparison for the measurement of similar quantities
- **Value** - a particular magnitude, number, or amount

Some physical concepts

- **Unit -** a standard amount of a physical quantity, such as length, mass, energy, etc., specified multiples of which are used to express magnitudes of that physical quantity
- **Physical phenomenon** – any change in nature

Action verbs

- **Define** – give the precise meaning of a word or phrase as concisely as possible
- **Draw** – represent by means of pencil lines
- **List** – give a sequence of names or other brief answers with no elaboration, each one clearly separated from the others

Action verbs

- **Measure** – find a value for a quantity
- **State** – give a specific name, value or other brief answer
- **Annotate** – add brief notes to a diagram, drawing or graph
- **Distinguish** – give the differences between two or more different items

Action verbs

- **Estimate** – find an approximate value for an unknown quantity, based on the scientific knowledge
- **Identify** – find an answer from a number of possibilities
- **Outline** – give a brief account or summary

Action verbs

- **Deduce** – reach a conclusion from the information given
- **Derive** – manipulate a mathematical equation to give a new equation or result
- **Evaluate** – assess the implications and limitations

Action verbs

- **Solve** – obtain an answer using algebraic and/or numerical methods
- **Suggest** – propose a hypothesis or other possible answer
- **Explain** – give a clear account including causes, reasons or mechanisms

What is Physics?

Universal:

Some sciences study specific objects or phenomena, for example

- The fish is an animal (biology)

- The stone consists of granite (geology)

- The battery is a source of electric voltage (engineering)

Physics studies properties which These have in common (universal phenomena)

-The stone/ fish/battery weighs 50 g (physics)

- The stone/ fish/battery falls down because of gravity (physics)

-

The stone/ fish/battery consists of atoms (physics)

What is Physics?

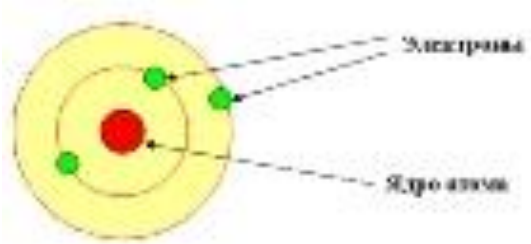
- *Experimental:*

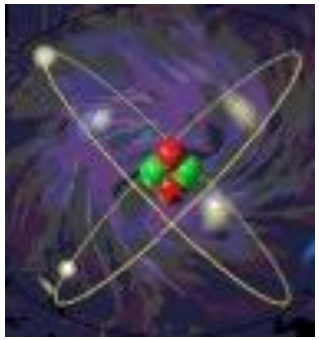
This means that what is ultimately true is decided by experimental tests.

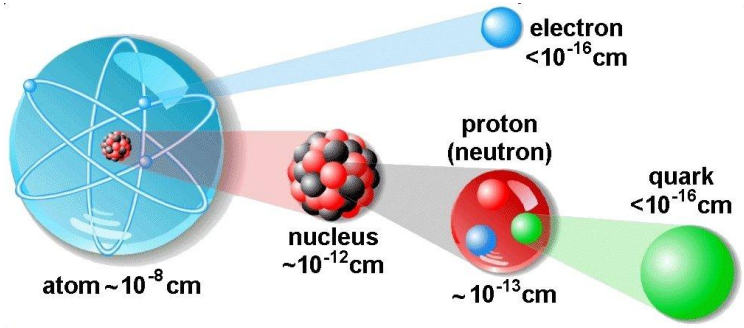
Mathematical:

Both experiments and theories in physics often involve mathematical descriptions and analyses.

The realm of Physics



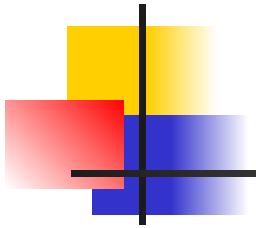




Diameter of solar system – 10^{13} m

Diameter of Universe – 10^{26} m

Physical quantity -the aspect or property of anything that can be measured, weighed, counted, etc



Physical quantity

Definition	**Formula** (math definition)	**Magnitude** (numerical value)	**Unit**
Speed is a quantity equaled to the ratio of a distance moved to time taken	$v = \frac{s}{t}$	10	ms^{-1}

Physical quantity –

is a physical property that can be quantified. This means it can be measured and/or calculated and expressed in numbers.

- Example:
- The value of power is written as

$$P = 45.3 \times 10^3 \text{ W} = 45.3 \text{ kW},$$

Then

P represents the physical quantity of power

45.3 x 10^3 is a numerical value

K is the SI prefix kilo, representing 10^3

W is the symbol for unit of power [P], the watt

The SI system

- Fundamental (basic)

Mass	Kilogram	kg
Length	Meter	m
Time	Second	s
Electric current	Ampere	A
Amount of substance	Mole	mol
Temperature	Kelvin	K
Luminous intensity	candela	cd

The SI of units (*derived*)

Physical Quantity	Symbol	Name and Symbol SI Unit	Fundamental Units Involved	Derived Units involved
frequency	*f* or *v*	hertz (Hz)	s^{-1}	s^{-1}
force	*F*	newton (N)	kg m s^{-2}	kg m s^{-2}
work	*W*	joule (J)	kg m^2 s^{-2}	Nm
energy	*Q*, *Ep*, *Ek*, *Eelas*	joule (J)	kg m^2 s^{-2}	Nm
power	*P*	watt (W)	kg m^2 s^{-3}	J s^{-1}
pressure	*P*	pascal (Pa)	kg m^{-1} s^{-2}	N m^{-2}
charge	*Q*	coulomb (C)	A s	A s
potential difference	*V*	volt (V)	kg m^2 s^{-3} A^{-1}	J C^{-1}
resistance	*R*	ohm (Ω)	kg m^2 s^{-3} A^{-2}	V A^{-1}
magnetic field intensity	*B*	tesla (T)	kgs^{-3} A^{-1}	NA^{-1} m^{-1}
magnetic flux	*Φ*	weber (Wb)	kg m^2 s^{-2} A^{-2}	T m^2
activity	*A*	becquerel (Bq)	s^{-1}	s^{-1}
absorbed dose	*W/m*	gray (Gy)	m^2 s^{-2}	J kg^{-1}

Units in accepted SI format

Note the use of the accepted SI format.

For example, the unit for acceleration is written as $m\ s^{-2}$ and not $m/s/s$ or m/s^2.

No mathematical denominators are used but rather inverse numerators are the preferred option.

Prefixes

Submultiple		
pico	p	10^{-12}
nano	n	10^{-9}
micro	μ	10^{-6}
milli	m	10^{-3}

Multiple		
kilo	k	10^{3}
Mega	M	10^{6}
Giga	G	10^{9}
Tera	T	10^{12}

Scientists tend to use **scientific notation** when stating a measurement rather than writing lots of figures.

$1.2 * 10^6$ is easier to write and has more significance than 1 200 000.

In order to minimise confusion and ambiguity, all quantities are best written as a value between one and ten multiplied by a power of ten.

For example, we have that, 0.06 kg = $6 * 10^{-2}$ kg