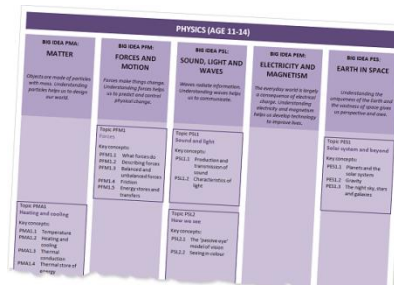


Key concept map (age 11-16)

Physics

The **Best Evidence Science Teaching (BEST)** resources can be incorporated into your existing scheme of work, if desired. However, we have used research evidence on learning pathways and on effective sequencing of ideas to develop maps that can help with curriculum planning.

This map shows how understanding of five **big ideas** of physics education can be developed through a series of **key concepts**, organised into teaching topics. It presents a possible route for progression through a five-year curriculum in physics for age 11-16.



The numbering and placement of key concepts in the map gives some guidance about teaching order based on our review of the research and teaching experience.

In general:

- key concepts that appear earlier in the map need to be understood before progressing to key concepts that appear later
- topics that appear in the same row can be taught in any order.

However, the teaching order can be tailored for different classes as appropriate.

Publication of resources

Best Evidence Science Teaching (BEST) resources are developed based on careful consideration of the best available research evidence on learning pathways, common student misunderstandings, and effective teaching approaches.

The research and writing work for key concepts at age 11-14 is complete, and all resources have been published. Resources for age 14-16 will be published on a topic-by-topic basis throughout 2021 and 2022.

Therefore, the key concept map for age 14-16 is a working draft that will be updated during the process of researching and writing resources for the key concepts.

To find out when new topics have been published, please follow @BestEvSciTeach on Twitter or check the BEST web pages at www.BestEvidenceScienceTeaching.org

This document last updated: January 2021

PHYSICS (AGE 11-14)

BIG IDEA PMA:

MATTER

Objects are made of particles with mass. Understanding particles helps us to design our world.

BIG IDEA PFM:

FORCES AND MOTION

Forces make things change. Understanding forces helps us to predict and control physical change.

BIG IDEA PSL:

SOUND, LIGHT AND WAVES

Waves radiate information. Understanding waves helps us to communicate.

BIG IDEA PEM:

ELECTRICITY AND MAGNETISM

The everyday world is largely a consequence of electrical charge. Understanding electricity and magnetism helps us develop technology to improve lives.

BIG IDEA PES:

EARTH IN SPACE

Understanding the uniqueness of the Earth and the vastness of space gives us perspective and awe.

Topic PFM1
Forces

Key concepts:

- PFM1.1 What forces do
- PFM1.2 Describing forces
- PFM1.3 Balanced and unbalanced forces
- PFM1.4 Friction
- PFM1.5 Energy stores and transfers

Topic PSL1
Sound and light

Key concepts:

- PSL1.1 Production and transmission of sound
- PSL1.2 Characteristics of light

Topic PES1
Solar system and beyond

Key concepts:

- PES1.1 Planets and the solar system
- PES1.2 Gravity
- PES1.3 The night sky, stars and galaxies

Topic PMA1
Heating and cooling

Key concepts:

- PMA1.1 Temperature
- PMA1.2 Heating and cooling
- PMA1.3 Thermal conduction
- PMA1.4 Thermal store of energy

Topic PSL2
How we see

Key concepts:

- PSL2.1 The 'passive eye' model of vision
- PSL2.2 Seeing in colour

Topic PFM2
Moving by force

Key concepts:

- PFM2.1 Describing speed
- PFM2.2 Motion graphs
- PFM2.3 Changing motion
- PFM2.4 Drag

Topic PSL3
Making images

Key concepts:

- PSL3.1 The ray model of light to explain images
- PSL3.2 Refraction and lenses

Topic PES2
Earth and sun

Key concepts:

- PES2.1 Days and seasons

Topic PFM3
More about force

Key concepts:

- PFM3.1 Mass and weight
- PFM3.2 Hidden forces
- PFM3.3 Turning effects

Topic PEM1
Simple electric circuits

Key concepts:

- PEM1.1 Making circuits
- PEM1.2 Electric current
- PEM1.3 Voltage
- PEM1.4 Static electricity

		Topic PSL4 Waves Key concepts: PSL4.1 Waves on water and ropes PSL4.2 A wave model of sound	Topic PEM2 More electric circuits Key concepts: PEM2.1 Resistance PEM2.2 Parallel circuits	
Topic PMA2 Floating and sinking Key concepts: PMA2.1 Floating, sinking and density PMA2.2 Pressure in fluids PMA2.3 Convection			Topic PEM3 Magnets and electromagnets Key concepts: PEM3.1 Magnetic fields PEM3.2 Electromagnets	

Where's energy?

Energy is an important idea in all of the sciences because it provides a way of looking at events and processes across a very wide range of contexts. Energy ideas can enable us to say whether something can happen, though not to predict it will happen, and to calculate specific outcomes of events. Energy ideas do not, however, help to explain how or why an event happens.

Energy features in each of the 'big ideas' of physics and ideas about energy are developed in each of them at age 11-14.

PHYSICS (AGE 14-16)

BIG IDEA PMA:
MATTER

Objects are made of particles with mass. Understanding particles helps us to design our world.

Topic PMA3
Energy of moving particles

Key concepts:
PMA3.1 Transfer of energy by conduction
PMA3.2 Specific heat capacity
PMA3.3 Specific latent heat

BIG IDEA PFM:
FORCES AND MOTION

Forces make things change. Understanding forces helps us to predict and control physical change.

Topic PFM4
Measuring and calculating motion

Key concepts:
PFM4.1 Velocity and acceleration
PFM4.2 Velocity – time graphs

BIG IDEA PSL:
SOUND, LIGHT AND WAVES

Waves radiate information. Understanding waves helps us to communicate.

BIG IDEA PEM:
ELECTRICITY AND MAGNETISM

The everyday world is largely a consequence of electrical charge. Understanding electricity and magnetism helps us develop technology to improve lives.

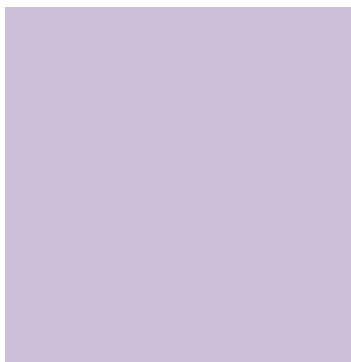
Topic PEM4
Electric fields

Key concepts:
PEM4.1 Moving charge

BIG IDEA PES:
EARTH IN SPACE

Understanding the uniqueness of the Earth and the vastness of space gives us perspective and awe.

	<p>Topic PFM5 Energy of moving objects</p> <p>Key concepts:</p> <p>PFM5.1 Doing work PFM5.2 Energy of objects with mass and height or speed PFM5.3 Energy of springs</p>	<p>Topic PSL5 Measuring waves</p> <p>Key concepts:</p> <p>PSL5.1 Visualising waves PSL5.2 Speed of waves</p>	<p>Topic PEM5 Circuit calculations</p> <p>Key concepts:</p> <p>PEM5.1 Analysing series circuits PEM5.2 Analysing parallel circuits</p>	
<p>Topic PMA4 Particle explanations</p> <p>Key concepts:</p> <p>PMA4.1 Density PMA4.2 Pressure</p>	<p>Topic PFM6 Forces make things change</p> <p>Key concepts:</p> <p>PFM6.1 Resultant force in two dimensions PFM6.2 Force, mass and acceleration</p>	<p>Topic PSL6 Wave model of light</p> <p>Key concepts:</p> <p>PSL6.1 Wave properties of light PSL6.2 Different colours</p>	<p>Topic PEM6 Circuit components</p> <p>Key concepts:</p> <p>PEM6.1 Components with changing resistance PEM6.2 Sensing circuits</p>	
<p>Topic PMA5 Nuclear physics</p> <p>Key concepts:</p> <p>PMA5.1 Excited atoms PMA5.2 Stable nuclei PMA5.3 Radiation damage PMA5.4 Random nuclear decay PMA5.5 Energy of the nucleus.</p>			<p>Topic PEM7 Electromagnetism</p> <p>Key concepts:</p> <p>PEM7.1 Motor effect PEM7.2 Generator effect</p>	



Topic PSL7
Electromagnetic waves

Key concepts:

- PSL7.1 More than colours
- PSL7.2 Interacting with EM waves

Topic PEM8
Mains electricity

Key concepts:

- PEM8.1 Electrical safety
- PEM8.2 Paying for electricity
- PEM8.3 Transmitting electricity

Topic PES3
Gravity in space

Key concepts:

- PES3.1 Stellar evolution
- PES3.2 Orbital motion