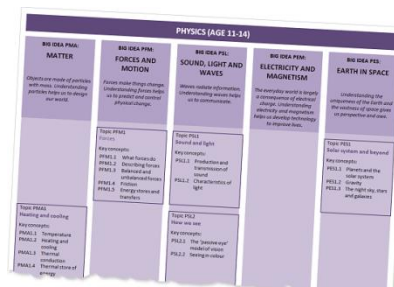


## Key concept map (age 11-16)

### 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](http://www.BestEvidenceScienceTeaching.org)

*This document last updated: September 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

		<b>Topic PSL4</b> <b>Waves</b> Key concepts: PSL4.1 Waves on water and ropes PSL4.2 A wave model of sound	<b>Topic PEM2</b> <b>More electric circuits</b> Key concepts: PEM2.1 Resistance PEM2.2 Parallel circuits	
<b>Topic PMA2</b> <b>Floating and sinking</b> Key concepts: PMA2.1 Floating, sinking and density PMA2.2 Pressure in fluids PMA2.3 Convection			<b>Topic PEM3</b> <b>Magnets and electromagnets</b> 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
- PFM4.2 Acceleration
- PFM4.3 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:

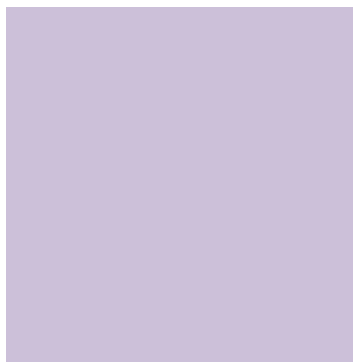
- PEM4.1 Moving charge

### 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 <b>Energy of moving objects</b></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 <b>Measuring waves</b></p> <p>Key concepts:</p> <p>PSL5.1 Visualising waves PSL5.2 Speed of waves</p>	<p>Topic PEM5 <b>Circuit calculations</b></p> <p>Key concepts:</p> <p>PEM5.1 Analysing series circuits PEM5.2 Analysing parallel circuits</p>	
<p>Topic PMA4 <b>Particle explanations</b></p> <p>Key concepts:</p> <p>PMA4.1 Density PMA4.2 Pressure</p>	<p>Topic PFM6 <b>Forces make things change</b></p> <p>Key concepts:</p> <p>PFM6.1 Resultant force in two dimensions PFM6.2 Force, mass and acceleration</p>	<p>Topic PSL6 <b>Wave model of light</b></p> <p>Key concepts:</p> <p>PSL6.1 Refraction and dispersion</p>	<p>Topic PEM6 <b>Circuit components</b></p> <p>Key concepts:</p> <p>PEM6.1 Components with changing resistance PEM6.2 Sensing circuits</p>	
<p>Topic PMA5 <b>Nuclear physics</b></p> <p>Key concepts:</p> <p>PMA5.1 Atomic nuclei PMA5.2 Radioactive decay PMA5.3 Ionising radiation PMA5.4 Radioactive half-life</p>			<p>Topic PEM7 <b>Electromagnetism</b></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