

## Physics at home 14-16

For students working remotely because of school closures, these ideas are divided by physics topic. We hope this saves time right now, along with the [Physics at home 11-14](#) links and [CLEAPSS advice for practicals at home](#).

### Forces

- Types – **Marvin and Milo** [Loop the loop](#), [Head hanger](#), [Unbalanced balloons](#)
- Gravity – **Veritasium** [Misconceptions About Falling Objects](#)
- Hooke's law – **PhET** [Hooke's law](#); [Masses and Springs: Basics](#) – 'Stretch' tab
- **PhET** [Under Pressure](#) and/or use **PhyPhox** ([free download](#)) and the [pressure sensor](#) to show atmospheric pressure changing with height by lifting phone up and down.
- Moments **PhET** [Balancing Act](#), Vectors **IOP Quick** [Static crate](#)

### Forces & Motion

- **Careers clips** [Forces and Motion in Games Programming](#)
- Balanced forces – [Does a Falling Slinky Defy Gravity?](#) **Marvin & Milo** [Slinky drop](#)
- Graphs – **PhET** [Moving man](#) – Charts tab and PDF instructions; [PASCO SPARKvue](#) - uses phones as sensors
- Newton's laws – 1st Law **PhET** [Forces and Motion: Basics](#), 2nd Law ( $F = ma$ ) – **PhET** [Forces in 1 Dimension](#); 3rd law – **Veritasium** [Best Film on Newton's Third Law. Ever](#)
- Momentum – **Marvin and Milo** [Bouncing balls](#), [Hovercrafty](#); **TAP** Episode 222 [Egg and sheet](#); [PhET Collision Lab](#)
- Circular motion – [Circular Motion Demonstration with Sparkler](#)

### Waves in matter

- **Careers clips** [Ultrasound in Physiotherapy](#) and [Ultrasound scans](#)
- Free software [https://www.zeitnitz.eu/scope\\_en](https://www.zeitnitz.eu/scope_en) computer sound card oscilloscope, compare with **Quick Slink-o-Scope** to explain why a transverse graph is drawn to show displacement for a longitudinal sound wave.
- **Practical Physics** [Measuring the speed of sound using echoes](#)
- **Classroom Physics** [Sound pull-out](#)
- Mechanical waves – **IOP Physics** [A simple wave machine](#); **PhET** [Wave on a String](#)
- Speed of waves on water **BBC Bitesize** – [required prac method 2 with baking trays/dishes](#)

### Light and EM Waves

- Visible spectrum – **Marvin and Milo** [Garden Rainbow](#)
- E-M waves – **PhET** [Radio Waves & Electromagnetic Fields](#)
- Black body radiation **PhET** [Blackbody radiation](#)
- Refraction – **PhET** [Bending light](#); **Marvin and Milo** [Pouring light](#), [Lighting a home with water bottles](#)
- Lenses – **PhET** [Geometric optics](#) (select principal rays)
- Colour addition – **Marvin and Milo** [Deceptive CD](#)

### Electricity

- Current – [Kung Fu circuit symbols](#); circuits **PhET** [Circuit Construction Kit: DC](#)
- The **Sci-Tunes** video ['We Are Electrons'](#) is a useful summary of current electricity
- **The Universe and More** – [Crack the circuit](#) building circuits game
- Static – [Dancing Oobleck streams with a static charge](#) **Marvin and Milo** – [Forceful Comb](#), [Static Spinning Straw](#), [repulsion with 2 straws](#)

## Magnetism and Electromagnetism

- Fridge magnets and toys e.g **Marvin and Milo** Moody magnets
- Field due to current in a wire – **Khan Academy** Magnetic effect of an electric current;
- **IOP Physics** electric motor demonstration film; **School Physics** DC electric motor
- E-M induction – **PhET** Faraday's law; animation AC generator; video Electromagnetic induction; **Veritasium** Levitating barbeque; **Veritasium** First Electric Generator
- Transformers – Demo How transformers work; interactive The transformer;

## Energy

**Best used after teacher-led introduction to the energy topic to avoid confusion.**

- Shifting between stores – **Exploratorium** Coupled pendulums; **Sixty symbols** Coupled pendulums; **PhET** Energy Skate Park: Basics (uses bar charts for stores emptying and filling, useful model for students)
- **Marvin and Milo** Conduction Melting race and SHC Flame Balloons, asking student to explain the effects in terms of energy transfers at a particle level
- The **SciTunes** video 'Energy!' is a useful summary

## Particles

- Density – **Marvin and Milo** Sinking sugar and Cartesian ketchup sachet diver
- Particle model – **Exploratorium** Gas model
- Anomalous behaviour of water – **IOP Quick** Ice-water-oil
- Evaporation – **Marvin and Milo** Drinks cooler
- Gas laws – **PhET** Gas Properties; **Baby brains in a vacuum**; **The Naked Scientists** Cool coin launcher

## Atomic Structure

- Alpha scattering – **PhET** Rutherford Scattering
- Marie Curie short story & her story continued
- Videos of experiments **IOP Spark** Teaching radioactivity - select as needed
- **xkcd** Radiation dose infographic showing dose from 'sleeping with someone' up to 'fataldose'; video of the most radioactive places on Earth
- Background radiation – **IOP worksheet** Measuring your annual dose
- **Practical Radioactive Decay simulation** – use coins, M&Ms or Lego bricks, plot a graph for the number decaying against 'throw number' (effectively time).

## Space

- **PhET** My Solar System
- Free fall – **Marvin and Milo** Marvin and Milo Water fall
- Planet separation to scale – Toilet paper solar system (can use string if you are short!)
- **IOP videos** Models of the Solar System - Earth, Sun and Moon; The Life Cycle of Stars, Life Cycle of a Star; Star formation; How Big is the Universe?; The Expanding Universe and the Big Bang
- Scale of the universe, Powers of ten videos; Interactive Solar system tour; Magnifying the universe simulation
- Doppler effect – **NSO** Redshift; **Marvin and Milo** Doppler spin
- **NSO** Expansion of the Universe – balloon model **NSO** Big Bang Demo, PDF instructions for washers/elastic expanding universe with data analysis

Collated by the IOP's Professional Practice Group. Contact [Education-PPG@iop.org](mailto:Education-PPG@iop.org) for more information. Visit [spark.iop.org](http://spark.iop.org) and [talkphysics.org](http://talkphysics.org) for more support for teaching physics.