



# PiXL Gateway: Progression – Physics

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Year 12-13 Physics

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## I. Physics Vocabulary

### SCIENCE - PHYSICS:

Currently, within the Physics section of the app, we have the following units:

- Mechanics and materials
- Electricity and electrical fields
- Waves
- Particles and radiation

Mechanics and materials Keywords and Definitions

Word	Definition
displacement	The word displacement means distance of an object from its initial position in a specific direction.
instantaneous	Instantaneous means something is occurring instantly.
scalar quantity	A scalar quantity has a magnitude only.
vector quantity	A vector quantity has a magnitude and associated direction.
perpendicular	Perpendicular means at an angle of $90^\circ$ to a given line, plane or surface.
inclined plane	An inclined plane is a slope inclined at an angle to the horizontal.
magnitude	In science, the word magnitude means size.
coplanar	Coplanar forces are forces acting on a single plane.
uniform	In science, the word uniform means remaining the same in all cases and at all times.
projectile	A projectile is an object in motion, following a path determined by gravitational acceleration.
horizontal	The word horizontal means parallel to the plane of the horizon.
vertical	The word vertical means at right angles to a horizontal plane.
trajectory	The trajectory is the path a projectile takes during its flight.
free-body force diagram	A free-body force diagram shows the relative magnitude and direction of all forces acting on an object.
terminal velocity	At terminal velocity, the drag and the force causing the motion are equal and opposite, making the net force and acceleration zero.
momentum	Momentum is the product of mass and velocity.
linear	The word linear means arranged in a straight line or one dimension.
impulse	In science, the word impulse means change in momentum.
equilibrium	In physics, the term equilibrium means zero resultant force and zero moment acting on an object.
moment	In physics, the word moment means a product of the force and the perpendicular distance between the axis of rotation and the force.

density	Density is the mass per unit volume.
Hooke's Law	Hooke's Law states that within a limit of proportionality, the extension is directly proportional to the load.
elastic limit	The elastic limit is the point after which the material does not return to its original shape.
plastic behaviour	Plastic behaviour means the material does not return to its original shape and size.
brittle behaviour	Brittle behaviour means the material breaks without stretching.
tensile	The word tensile means a material is under tension.
strain	In physics, the word strain means extension per unit length.
stress	In physics, the word stress means force per unit cross sectional area.
Young modulus	Young modulus is $\text{stress} \div \text{strain}$ , provided the material is not stretched beyond the limit of proportionality.

#### Electricity and electrical fields Keywords and Definitions

Word	Definition
electric current	The electric current is the rate of flow of charged particles.
resistance	Resistance is the potential difference divided by the current.
Ohm's law	Ohm's Law states that the current is proportional to potential difference under constant physical conditions.
potential difference	Potential difference is work done per unit charge.
thermistor	A thermistor is a component in which the resistance changes with temperature, e.g. decreases with increased temperature.
diode	A diode is a component that allows current to flow in one direction only.
resistivity	The term resistivity quantifies how strongly a material restricts the flow of electrical charge.
coefficient	A coefficient is a multiplier or factor that measures a particular property.
potential divider	A potential divider is a simple circuit, including resistors connected in series, used to supply a variable potential difference.
emf	The emf is the energy provided, by an energy source, per coulomb of charge.
internal resistance	The internal resistance is the resistance encountered by charge moving through a material.
terminal potential difference	The terminal potential difference is the potential difference across the terminals of a power source.
superconductivity	Superconductivity is a property of materials with zero resistivity at and below a specific temperature.

resistor	A resistor is an electrical component which restricts the flow of electrical charge.
field	A field is a region in which a body experiences a non-contact force.
permittivity	The word permittivity means a measure of how easy it is to create an electric field in a material.
farad	The farad is the unit of capacitance.
magnitude	The word magnitude means size.
equipotential	An equipotential surface is a surface with the same electric potential at every point.
capacitance	The capacitance is how much charge a capacitor can store per unit potential difference.
time constant	The time constant is equal to the product of capacitance and resistance of a circuit.
magnetic flux density	The magnetic flux density is the strength of a magnetic field.
tesla	The tesla is the unit of magnetic flux density.
flux linkage	Flux linkage is the product of the turns in a solenoid and the magnetic flux.
solenoid	A solenoid is a wire coiled into a spiral, used to produce a magnetic field.
electromagnetic induction	Electromagnetic induction is the production of emf due to a change in the magnetic field.

#### Waves Keywords and Definitions

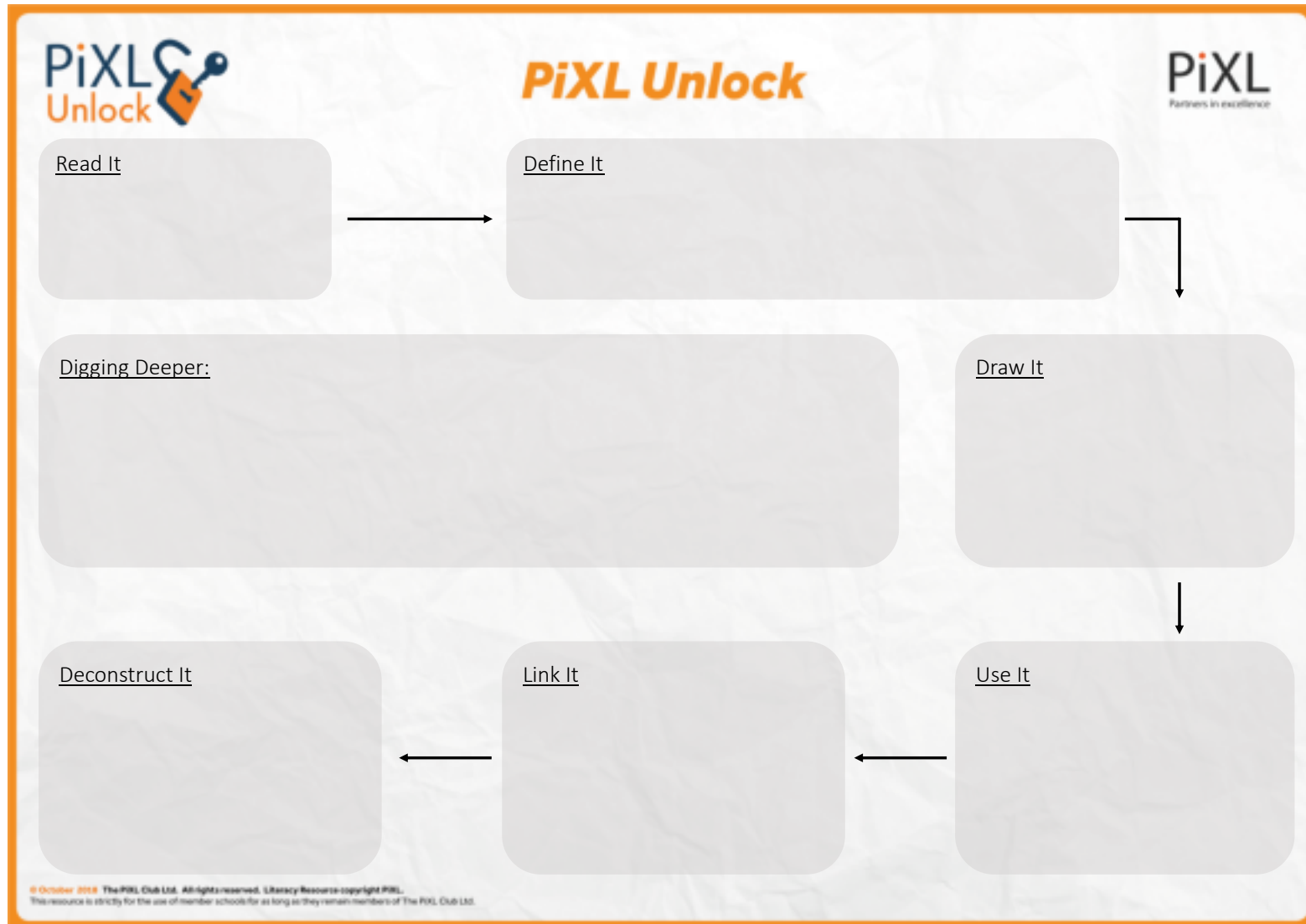
Word	Definition
oscillation	An oscillation is a repeated vibration on the same path, around a fixed equilibrium point.
wavelength	The wavelength is the distance from a point on one wave to the equivalent point on an adjacent wave.
frequency	The frequency is the number of cycles per unit of time, e.g. waves passing a point each second.
hertz	The hertz is the unit of frequency.
period	In physics, the word period means the time taken for one oscillation.
displacement	The word displacement means distance of an object from its initial position in a specific direction.
wave speed	The wave speed is the speed at which the energy is transferred (or the wave moves) through the medium.
phase difference	The term phase difference is the fraction of the cycle between two oscillating particles.
path difference	The term path difference means the difference in the optical paths of two light rays with common initial and terminal points.
radian	The radian is the unit of phase difference.

longitudinal waves	In longitudinal waves, the direction of vibration of the particles is parallel to the direction of energy transfer.
transverse waves	In transverse waves, the direction of vibration is perpendicular to the direction of energy transfer.
stationary wave	A stationary wave is a wave with no net transfer of energy and momentum from one point to another, also called a standing wave.
superposition	The word superposition occurs when two waves meet and the instantaneous displacement is the vector sum of the individual displacements due to each wave at that point.
coherence	The word coherence means the waves have the same frequency and a constant phase difference.
interference	In physics, interference occurs when two waves of the same type occupy the same space.
node	A node is a point on a standing wave with minimum amplitude.
antinode	An antinode is a point on a standing wave with a maximum amplitude.
refractive index	The refractive index is a measure of how much refraction will occur at a boundary.
critical angle	The critical angle is the angle of incidence in a denser medium for which the angle of refraction is $90^\circ$
total internal reflection	Total internal reflection occurs when all of the wave is reflected internally.
focal length	The focal length is the distance between the centre of a lens and the point at which it would focus parallel rays of light.
converging	The word converging means bringing rays of light together.
diverging	The word diverging means causing light rays to move apart from each other.
plane polarisation	The term plane polarisation means a transverse wave vibrating in one plane only.
diffraction	The word diffraction is the spreading of waves when they travel through a small opening or around an object.
real image	A real image is an image which is formed when the light rays coming from an object meet each other after reflection or refraction..
virtual image	A virtual image is an image formed when the outgoing rays from a point on an object diverge.
photon	A photon is a particle representing a packet of electromagnetic radiation.
photoelectron	A photoelectron is an electron emitted from an atom by interaction with a photon.
threshold frequency	The threshold frequency is the lowest frequency of radiation that will result in the emission of electrons from a metal surface.
work function	Work function is the minimum energy required to release an electron from the surface of a metal by the photoelectric effect.
electronvolt	An electronvolt is the energy change of an electron when it moves through a potential difference of 1 volt.
photoelectric effect	The photoelectric effect is the emission of electrons from a metal surface when struck by photons.

Particles and radiation Keywords and Definitions

Word	Definition
nucleon number	The nucleon number is the number of nucleons in a nucleus.
proton number	The proton number is the number of protons in a nucleus.
alpha particle	An alpha particle is a helium nucleus, two neutrons and two protons.
scattering	Scattering is the process by which electromagnetic radiation or particles are deflected or diffused.
thermionic emission	Thermionic emission is the process by which free electrons are emitted from the surface of a metal when an external heat energy is applied.
nucleon	A nucleon is a proton or neutron, part of the nucleus.
antimatter	Antimatter is a material composed of antiparticles.
quark	A quark is a fundamental particle which form hadrons.
baryons	Baryons are hadrons made from three quarks.
mesons	Mesons are hadrons made from a quark and an antiquark.
leptons	Leptons are fundamental particles that interact through weak interactions and electromagnetic interaction.
pions	Pions are exchange particles of the strong nuclear force.
neutrino	A neutrino is an uncharged elementary particle, classified as a lepton.
positron	A positron is the antiparticle of the electron.
annihilation	The word annihilation means complete destruction or obliteration.
antiproton	An antiproton is the antiparticle of the proton.
antineutron	An antineutron is the antiparticle of the neutron.
antineutrino	An antineutrino is the antiparticle of the neutrino.
hadron	A hadron is a particle which is subject to the strong interaction.
interaction	The word interaction describes a way in which matter, fields, atomic and subatomic particles affect one another.

## II. The PiXL Unlock Template





### III. Summer Reading list

- The Physics of the Impossible and Parallel Worlds (Kaku)
- Hyperspace (Khan)
- Smashing Physics: inside the World's Biggest Experiment (Butterworth)
- Seven Brief Lessons on Physics (Rovelli)
- Chaos (Gleich)
- Quantum (Kumar)
- How to Teach Quantum Physics to your Dog (Orzel)
- 50 Physics Ideas You Really Need To Know (Baker)
- The Ele.g.ant Universe (Greene)
- Just Six Numbers (Rees)
- About Time (Frank)
- The Wonders of the Solar System (Brian Cox - anything by him is good)
- An Astronaut's Guide to Life on Earth (Hadfield)
- A Space Traveller's Guide to the Solar System (Thompson)
- Ripples in Spacetime (Schilling)
- Calculating the Cosmos (Stewart)
- The Ascent of Gravity (Chown)

## IV. Links to TED Talks/Articles/Documentaries/Books/Journals

### 1. TED talk - Inside the black hole image that made history.

Learn about the Event Horizon Telescope and how it captured the first direct image of a black hole.

[https://www.ted.com/talks/sheperd\\_doeleman\\_inside\\_the\\_black\\_hole\\_image\\_that\\_made\\_history?language=en#t-39680](https://www.ted.com/talks/sheperd_doeleman_inside_the_black_hole_image_that_made_history?language=en#t-39680)

### 2. TED talk – Why do hospitals have particle accelerators?

How doctors use injected radioactive drugs that circulate through the body and act as a beacon for PET scanners.

[https://www.ted.com/talks/pedro\\_brugarolas\\_why\\_do\\_hospitals\\_have\\_particle\\_accelerators?language=en](https://www.ted.com/talks/pedro_brugarolas_why_do_hospitals_have_particle_accelerators?language=en)

### 3. BBC Sounds – Will Artificial Intelligence kill development?

Will artificial intelligence lead to a more unequal world?

<https://www.bbc.co.uk/sounds/play/m0003qyd>

### 4. BBC Sounds – Tech tent - The promise of smart cities.

Do people want to live in places full of sensors linking them to their surroundings?

<https://www.bbc.co.uk/sounds/play/w3csyms4>

### 5. Article in Nature – A closer look at lightning.

A radio telescope has been trained on lightning to better understand its structure and explain why lightning flickers.


<https://www.nature.com/articles/d41586-019-01178-7>

### 6. Careers – Institute of Physics - Next steps with physics

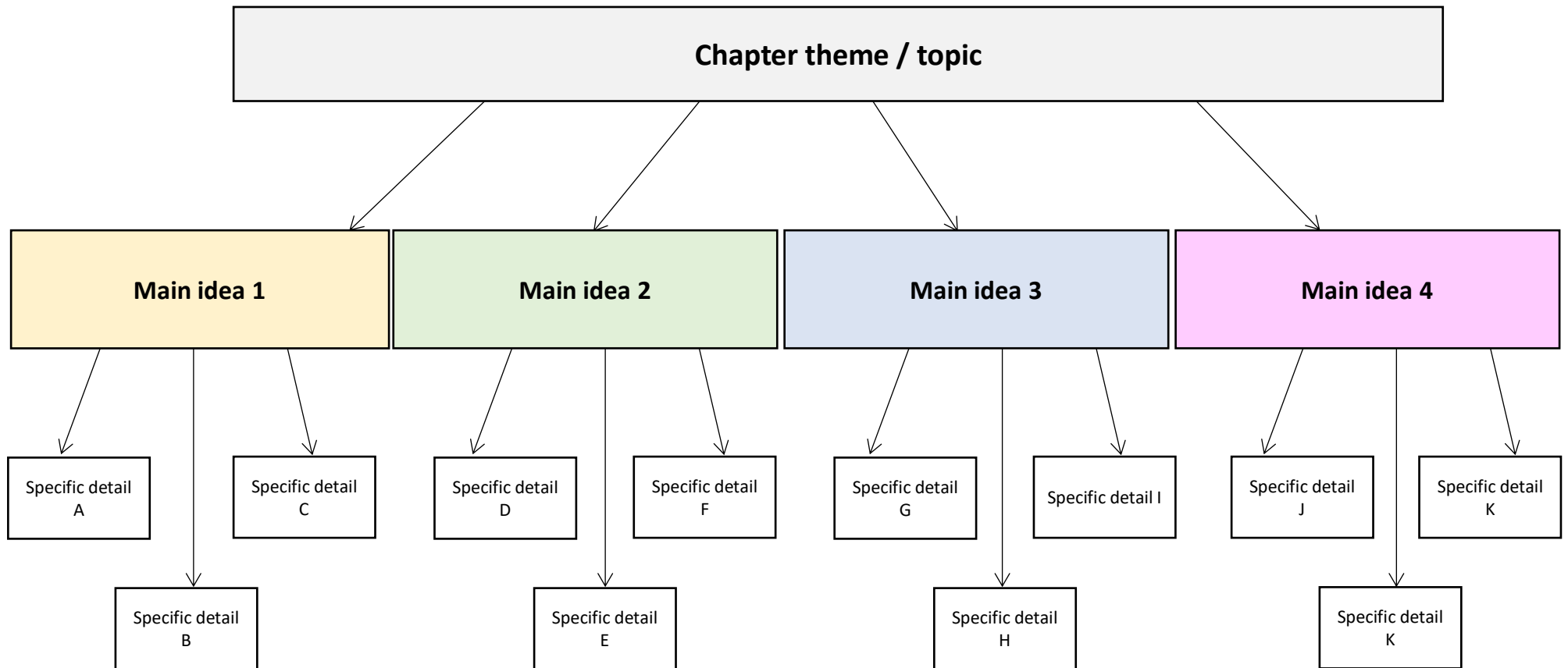
Wondering where to go next? This site contains a number of different resources showcasing careers available to those studying physics to A-Level.

<http://www.iop.org/education/teacher/student/index.html>

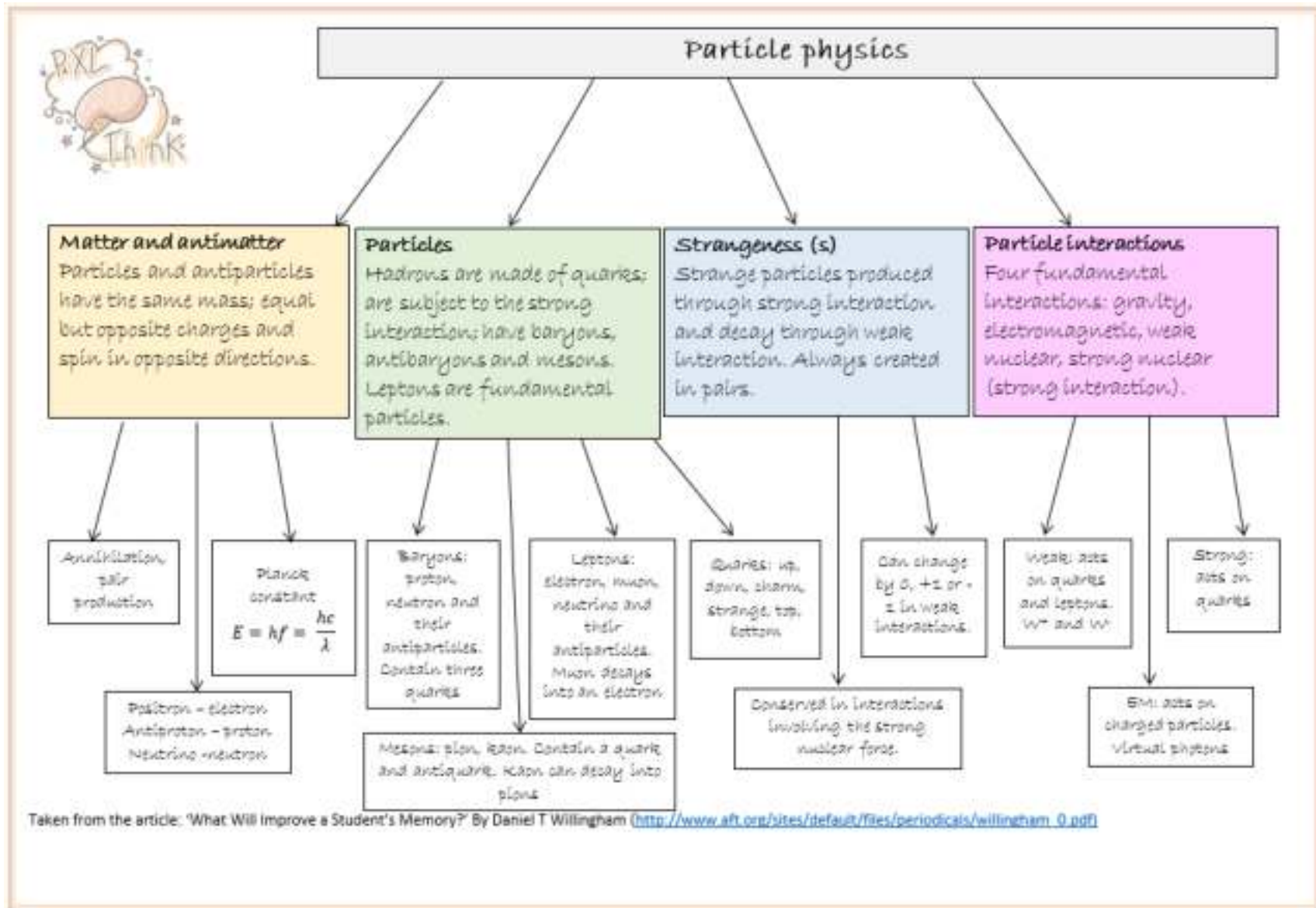
## V. Knowledge Organiser Template

## VI. Thinking Hard Revisit Template



## VII. A Model of the Thinking Hard Revisit document



## VIII. Cornell Notes Template

Name

Date

Topic

Subject

Main Ideas


Notes

Summary

## IX. A Model of the Cornell Notes document

**Cornell Notes** notes from crash course physics #11

Name <u>A. Student</u>	Date <u>Yesterday</u>
Topic <u>rotational motion</u>	Subject <u>Physics</u>

<p><b>Main Ideas</b></p> <p>angular velocity = <math>\omega</math></p> $\omega = \frac{\Delta\theta}{\Delta t}$ <p>Tangential velocity = <math>\omega r</math></p> <p>angular acceleration <math>\alpha = \frac{\Delta\omega}{\Delta t}</math></p> <p>analogy between rotational and translational dynamics.</p>	<p><b>Notes</b></p> <p><math>\Delta\theta</math> radians = <math>\frac{\text{degrees}(\pi)}{180}</math> angle of rotation -</p> <p>rotational velocity - measure of an object's change in angle <math>\rightarrow</math> angular velocity <math>\omega</math> - lower case omega.</p> <p><math>\omega = \frac{d\theta}{dt}</math> rate of change of angular displacement with respect to time.</p> <p><u>Tangential velocity</u> = <math>\omega r</math> The further an object is from the centre the greater its tangential velocity </p> <p><math>f = \frac{1}{T}</math> <math>\omega = \text{radians per second}</math>  <math>f</math> revolutions per second <math>2\pi f = \omega</math></p> <p><u>angular acceleration</u> <math>\alpha = \frac{d\omega}{dt}</math>  how angular velocity changes over time</p> <p><math>a_r</math> radial acceleration <math>\rightarrow</math> centripetal  <math>= \omega^2 r</math></p> <p><u>tangential acceleration</u> <math>a_{tan} = \alpha r</math></p>
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**Summary**

linear speed =  $v$ ; angular speed =  $\omega$   
acceleration =  $a$ ; angular acceleration =  $\alpha$

$$v^2 = v_0^2 + 2a\Delta x \quad \rightarrow \quad \omega^2 = \omega_0^2 + 2\alpha\Delta\theta$$



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