



Super Curriculum – Physics KS3



Reading:

- *Brief Answers to the Big Questions* by Stephen Hawking
- *Hitchhiker's Guide to the Galaxy* by Douglas Adams
- *Why is snot green?* by Glenn Murphy
- *How loud can you burp?* by Glenn Murphy
- *Astrophysics for Young People in a Hurry* by Neil de Grasse Tyson



Watching:

- <https://scienceatschool.co.uk/tag/ks3/>
- <https://www.youtube.com/watch?v=nDN7M0J3HXc>
- <https://www.bbc.co.uk/bitesize/subjects/zh2xsbk>
- <https://www.purposegames.com/playlist-tag/physics>
- TV: Mythbusters, The Sky at Night, Horizon, The Big Bang Theory, Wonders of the Universe, Wonders of the Solar System, Edge of the Universe
- Films: The Martian, Apollo 13, Gravity, Hidden Figures



Listening:

- On Radio 4: In Our Time
- The Life Scientific
- The Infinite Monkey Cage



Doing:

- KS3 Experiments here <https://spark.iop.org/collections/marvin-and-milo>



Academic Enrichment:

- Year 7/ KS3 Physics club



Competitions:

- KS3 Cambridge Physics Experience
<https://outreach.phy.cam.ac.uk/programme/CPE> Y7/8 Mars Rover Mission
26th – 30th April.



Super Curriculum – Physics KS4



Reading:

- A Short History of Nearly Everything by Bill Bryson.
- Big Bang: The Most Important Scientific Discovery of All Time and Why You Need to Know About It by Simon Singh.
- What If?: Serious Scientific Answers to Absurd Hypothetical Questions by Randall Munroe.
- A Brief History of Time by Stephen Hawking.
- The Universe in a Nutshell by Stephen Hawking.
- The Making of the Atomic Bomb by Richard Rhodes.
- Carrying the Fire: An Astronaut's Journey by Michael Collins (the Apollo 11 astronaut).
- 13 Things That Don't Make Sense: The Most Intriguing Scientific Mysteries of Our Time by Michael Brooks.
- Six Easy Pieces: Fundamentals of Physics Explained by Richard P Feynman (or any other book by the same author)
- Genius by James Gleick
- New Scientist
- Physics Review
- Physics World
- Qubit e-newsletter <https://www.iop.org/education/school-and-college-students/Qubit>



Watching:

- <http://www.iop.org/resources/videos/education/>
- <http://www.youtube.com/user/minutephysics>
- <http://research.microsoft.com/apps/tools/tuva/>
- <https://www.bbc.co.uk/iplayer/search?q=physics>
- TV: Mythbusters, The Sky at Night, Horizon, The Big Bang Theory, Wonders of the Universe, Wonders of the Solar System, Edge of the Universe, Chernobyl
- Films: The Theory of Everything, Einstein and Eddington, Infinity, Particle Fever, Hidden Figures



Listening:

- On Radio 4: In Our Time
- The Life Scientific
- The Infinite Monkey Cage

Doing:

- KS4/5 Citizen Science Experiments here
<https://www.zooniverse.org/projects?discipline=physics&page=1&status=live>
- <https://science.nasa.gov/citizenscience>
- Online events: <https://www.rigb.org/whats-on>
- Online MOOCS:
- Evolution of the universe from the Big Bang to Dark Energy
<https://www.coursera.org/learn/big-bang>.
- A Brief Guide to everything: A course on particle physics. This course helps you understand what we do know and the questions that are still to be answered about our universe: <https://iai.tv/iai-academy/courses/info?course=a-brief-guide-to-everything>
- How Things Work: An Introduction to Physics:
<https://www.coursera.org/learn/how-things-work>

Competitions:

- KS4 Physics Olympiad [Junior Physics Challenge](#) Fri 30th April - Wed 19th May 2021.



Super Curriculum – Physics

KS5



Reading:

- **The Feynman Lectures on Physics (Feynman, Leighton, Sands).** A definitive set of text books (three BIG volumes) which pretty much cover a standard university undergraduate course. Clearly way too much to take in during A levels but well worth a dip or two as an introduction to pretty much any advanced subject matter. A classic with many wonderful explanations by a man considered one of the best teachers of physics. 530FEY
<http://www.feynmanlectures.info/>
- **Surely You're Joking Mr Feynman and What Do You Care What Other People Think (Feynman).** A pair of autobiographical books in bite-sized stories. Not much physics but plenty of fun and an insight into the perpetually enquiring mind. 530FEY
- **QED or The Strange Theory of Light and Matter (Feynman).** A very straightforward introduction to quantum electrodynamics, the modern theory of light and electromagnetism. Although greatly simplified, the book is always faithful to the subject, being written by one of the theory's inventors! 537FEY
- **The Character of Physical Law (Feynman).** A more philosophical text on what we mean by a law in physics and how new laws are developed. Good chapters on symmetry principles in physics. 530FEY
- **Genius The life and science of Richard Feynman (Gleick).** Portrayal of his life from childhood to his vital work on the Manhattan Project and beyond. A very interesting read about a very interesting person.
- **A Brief History of Time (Hawking).** A Long Waste of Space. A remarkably bad bestseller full of speculation presented as fact, trusting to the fact that the author is famous for its verisimilitude. 530.11HAW
- **The Planiverse (Dewdney).** Imagine a two dimensional world – that's what Dewdney does in this book, taking up Edwin Abbott's mantle (author of Flatland). Quite fun.
- **Flatland (Abbott).** A book on maths or a satire of Victorian manners? Imagine being enlightened to the limitations of your own space...but then having to convince others. Well worth a read. 823ABB
- **The Great Copernican Chase and Other Adventures in Astronomical History (Gingerich).** A collection of articles on the history of astronomy including Stonehenge, Egyptian and Islamic astronomy all the way up to Hubble, cepheid variables and articles.



- **Gödel, Escher, Bach, the Eternal Golden Braid (Hofstadter).** Superficially an introduction to Gödel's Incompleteness Theorem and how it ties in with the art of M.C.Escher and the canons of J.S.Bach. I found it a complete eye-opener and a wonderful read.
- **Metamagical Themas (Hofstadter).** A collection of Hofstadter's articles from Scientific American covering artificial intelligence, typesetting, self-referentiality and everything else under the sun. A treasure.
- **Fluid Concepts and Creative Analogies (Hofstadter).** A summary of his group's latest research on artificial intelligence and one of the best books on the topic I have seen. But then I agree whole-heartedly with his approach to AI, which is not about hardware or software as such but about the concept of heirarchies.
- **Quantum Physics: Illusion or Reality (Rae).** One of the most approachable books on the implications of quantum mechanics, and the meaning of reality in a quantum world. Mostly non-mathematical.
- **Science In Action (Lenihan and Fleming).** Rather lightweight but occasionally amusing collection of very brief pieces on science and the real world in all kinds of odd ways.
- **In Search of Lost Time (York).** Rather better on the geology of the earth and history of the human race than the other aspects of time (quantum and thermodynamic). Non-mathematical
- **The New Science of Strong Materials (Gordon).** Getting a bit out of date on modern materials but a wonderful book on what is meant by strength, how materials are selected and how historically we have managed to improve on natural substances.
- **Structures (Gordon).** Doing for structures what his other book did for materials. Eminently readable and full of good anecdotes and historical examples.
- **In Search of the Big Bang (Gribbin).** A good basic introduction to the topic, if a little old now. Gribbin is an excellent author, capable of simplifying without sacrificing accuracy.
- **In Search of Schrödinger's Cat (Gribbin).** An introduction to the basic ideas in quantum mechanics. Non-technical and very approachable. 530.4GRI
- **In Search of the Edge of Time (Gribbin).** A beginner's guide to time travel.
- **The Particle Explosion (Close, Martin, Sutton).** A big picture book of modern particle physics but clearly written and as good as any around. 539.7CLO
- **The Cosmic Onion (Close).** Getting a bit old now but an excellent, straightforward introduction to particle physics. Quarks and leptons explained for the layman.



- **God, Chance and Necessity (Ward).** An excellent book, not about physics at all, but about how believing in God (specifically, the Judeo-Christian God) is a sensible, logical option. A more refined version of the cosmological debate for the existence of God (the Clarke-Leibnitz correspondance and all that). Very readable introduction to philosophy of theology and science.
- **God and the New Physics (Davies)** An excellent introduction to the problems in modern cosmology and the philosophy of science and religion. Tends to be rather more naive on the religious philosophy side (unsurprising, given the author's background) but a very comprehensive reading list and the writing style, which provokes and stimulates rather than preaches more than compensates.
- **The Arrow of Time (Coveney and Highfield).** Attempts to be a complete review of the problems defining time's arrow. Not half bad either.
- **Time's Arrow and Archimede's Point (Price).** A very difficult book. No punches pulled, it uses mainly philosophical arguments combined with modern science to discuss the meaning of time. Worthwhile, but the approach is more suited to philosophers than physicists, so be prepared to be made to think.
- **Relativity (Adams).** An introduction to the theory of relativity. About as approachable a book as you'll find which actually teaches you the theory rather than just the results and a few implications.
- **The Quark and the Jaguar (Gell-Mann).** A more philosophical book on simple and complex systems. A very enjoyable read ranging from the development of particle physics to the stability of ecosystems and economics. Not a technical book on the theory of anything, but definitely worthwhile and substantial in content and a very personal tour of the author's work. 530GEL
- **Dreams of a Final Theory (Weinberg).** Why build bigger particle accelerators? Read this book and see why. By one of the inventors of electro-weak theory, a very erudite discussion of where exactly we are in modern physics, and how much further we might have to go. 539WEI
- **The First Three Minutes (Weinberg).** Weinberg is easy to read, perhaps less easy to understand. This is perhaps the definitive cosmology book, and the latest edition has been updated as it is getting a bit old hat. 523.1WEI
- **The Elegant Universe (Greene).** Meant to be the first readable book on superstring theory. An excellent introduction to relativity and quantum mechanics, and very good on why exactly the two theories are incompatible. Not so good on superstrings, oddly enough but about the only approachable book so worth reading. 539.7 GRE
- **The Fabric of Reality (Deutsch).** An interesting book about what a theory of everything could be, covering the study of knowledge and many-worlds theory of quantum mechanics, all in a non-technical way. 530 DEW



- **Longitude (Sobel).** Again, not really physics, but the fascinating story of how the clockmaker John Harrison developed modern watchmaking techniques in order to solve the longitude problem – how to tell how far west a ship was. 681.118
- **Cosmos (Carl Sagan).** A well written and lavishly illustrated series of essays on physics, astronomy, the history and philosophy of science, space travel and much more. The author gives a deeply personal view of the scientific developments that have and will shape human civilisation and political thinking. One word: inspirational.
- **An Instance of the Fingerpost (Ian Pears).** Fictional account of goings on in 1660s England all circling around instances of scientific philosophy, and the work of Robert Boyle.
- **The Man Who Mistook His Wife For A Hat and An Anthropologist on Mars (Oliver Sacks).** If you want to know how the mind works, ask how it goes wrong. In these case studies, which are also beautifully written essays of human nature, Sacks explores problems which arise in the brain both naturally and due to accidents. Totally fascinating.
- **Fermat's Last Theorem (Singh)** A very readable book on Andrew Wiles and his successful efforts to solve one of mathematics' biggest challenges. A good insight into the links in maths, but disappointingly basic at times.

At Home in the Universe (Kauffman) Kauffman is a biologist at the Santa Fe Institute which encourages cross-disciplinary research. This book is an excellent introduction to the power of such techniques and shows how, although unguided evolution is indeed an unlikely process, nature may have another trick up its sleeve, which is self-organisation.

How Nature Works (Bak) An excellent book, readable at every level by the man who first formulated the concept of self-organised complexity. His examples of complex systems include extinctions, economics, earthquakes and sand piles. Read in parallel with Kaufmann's "At Home in the Universe" it gives an insight into how scientists collaborate and talk about each other's work.

- **Bully For Brontosaurus (Gould)** An entertaining, readable and enlightening book on many aspects of biology. Gould writes about people and events, leading to a joyful discovery of fact and opinion. Always worth a look.
- **Cats' Paws and Catapults (Vogel)** Very informative myth-buster about how nature and man use materials and structures in different ways. Why do animals and plants not use metal except in salts? Are nature's materials superior to man made ones? Vogel explores the reasons and produces tales of inspiration from nature and many examples of simple, pure human cleverness.



- **Seeking Ultimates - An Intuitive Guide to Physics (Landsberg)** Full of interesting anecdotes, this book attempts to sweep across the entire physics landscape in 250 pages so is rather short on explanations. It is maths-free so so definitely lo-cal, lo-fat physics lite stuff, but not too bad as an intro to all the stuff that's out there but not on the syllabus.
- **Impossibility (Barrow)** A deep look into what limits science from many different aspects. Quite scholarly but very readable with lots of interesting quirks and corners about religion, philosophy and so forth.
- **Nature and the Greek and Science and Humanism (Schrodinger)** A fascinating pair of texts exploring the history of western scientific thought, and the role of science in society. Topics such as the meaning of the atomic theory, the role of free will in classical and quantum worlds and the origins of the way we think are elegantly elucidated.

The Genome: An Autobiography of the Species in 23 Chapters (Ridley) One of the most entertainign popular science books I have read. Whilst aimed at the lay audience - it is easily accesible to students in the lower school, it contains much of interest and value to those studying biology up to the highest level. Ridley addresses facianting issues such as nature versus nurture, sex wars and learning in a most approachable way. 576.8RID

- **The Man Who Loved Only Numbers (Hoffman)** A biography of the mathematician Paul Erdős (pronounced Airdish). An entertaining romp through the life of a man who lived, breathed and (rarely) slept mathematics, although I rather felt it failed to give an idea of why he was brilliant, more why he was so prodigious. Good fun anyhow.
- **Antimatter: The Ultimate Mirror (Fraser):** The story of antimatter. The historical bits are good, the physics varies from ok to excruciatingly bad. Occasionally wrong, often such a hodgepodge of mixed metaphors as to be incomprehensible. In the end he cannot decide whether antimatter is a mirror, or an image in a mirror so his metaphors are as much use as a chocolate kettle.
- **The Dancing Wu Li Masters (Zukav)** Not as bad as it sounds from the title! A book by a layman for laymen about modern physics. A bit out of date, and tends to the vague a little in places but some excellent discussion of ideas in QM and relativity.
- **The Third Policeman (O'Brien)** What on earth is a comic novel by an Irish civil servant doing in this list? Read it and find out. Political satire, but also a poke at atomic theory, relativity, science and the Dublin Institute for Advanced Studies all in one neat little bundle. Treat yourself.
- **The Search for Infinity (Fraser, Lillestol and Sellevag)** Glossy, polished and well illustrated volume in double page spreads. Easily accessible and readable, an absolutely essential read for those looking for a broad sweep of



'Big Science'. Fits well in A2 Advancing Physics. A must for the school/science library.

- **Secret Knowledge (Hockney) and Vermeer's Camera (Steadman)** What a fascinating pair of books. It is now accepted that many artists used optical devices such as the *camera obscura* and the *camera lucida* (a prism which lets you see both the subject and the pencil on paper) to aid them in their work. Hockney examines mainly the visual evidence of accuracy, optical distortions and use of light and perspective to extend the idea much further back in time (to the 15th century, using focussing mirrors) and to show how wide the influence of these devices, and the style they produced, is. Steadman's book looks very scientifically at the evidence for Vermeer using a *camera obscura* for his interior paintings. Both books are compelling, with an engaging mix of science and art history. Steadman's is more rigorous, Hockney's more immediate. A wonderful, thought-provoking contrast in styles of production, argument and approach.
- **Doctor Copernicus (Banville)** A novel based around the life of Copernicus. Makes a nice change from science books and gives a great flavour of a complex man living in a changing world.



Watching:

- <http://www.iop.org/resources/videos/education/>
- <http://www.youtube.com/user/minutephysics>
- <http://research.microsoft.com/apps/tools/tuva/>
- <https://www.bbc.co.uk/iplayer/search?q=physics>
- TV: Mythbusters, The Sky at Night, Horizon, The Big Bang Theory, Wonders of the Universe, Wonders of the Solar System, Edge of the Universe, Chernobyl
- Films: The Theory of Everything, Einstein and Eddington, Infinity, Particle Fever, Hidden Figures



Listening:

- On Radio 4: In Our Time
- The Life Scientific
- The Infinite Monkey Cage



Doing:

- KS4/5 Citizen Science Experiments here
<https://www.zooniverse.org/projects?discipline=physics&page=1&status=live>
- <https://science.nasa.gov/citizenscience>
- Online events: <https://www.rigb.org/whats-on>
- Online MOOCS:
- Evolution of the universe from the Big Bang to Dark Energy
<https://www.coursera.org/learn/big-bang>
- A Brief Guide to everything: A course on particle physics. This course helps you understand what we do know and the questions that are still to be answered about our universe.
<https://iai.tv/iai-academy/courses/info?course=a-brief-guide-to-everything>
- How Things Work: An Introduction to Physics
- Learn about some of the questions that have been answered in physics over the past 2000 years: https://www.udacity.com/course/intro-to-physics--ph100?irclickid=VmD3bpxbLxyLRrxwUx0Mo3EHUkE2iA3bl3rk0Q0&irgwc=1&utm_source=affiliate&utm_medium=&aff=315774&utm_campaign=786224
- <https://www.coursera.org/learn/how-things-work>
- <https://nustem.uk/eveninglectures/>



Academic Enrichment:

- KS5 Oxbridge Physics/Maths club Monday lunchtimes L13
- KS5 Student review panel for *Physics Review* magazine
- <https://outreach.phy.cam.ac.uk/programme/cpc>
- <https://nustem.uk/physics-experience-week/>



Competitions:

- KS5 Physics Olympiad Senior Physics Challenge Friday 5th March 2021.