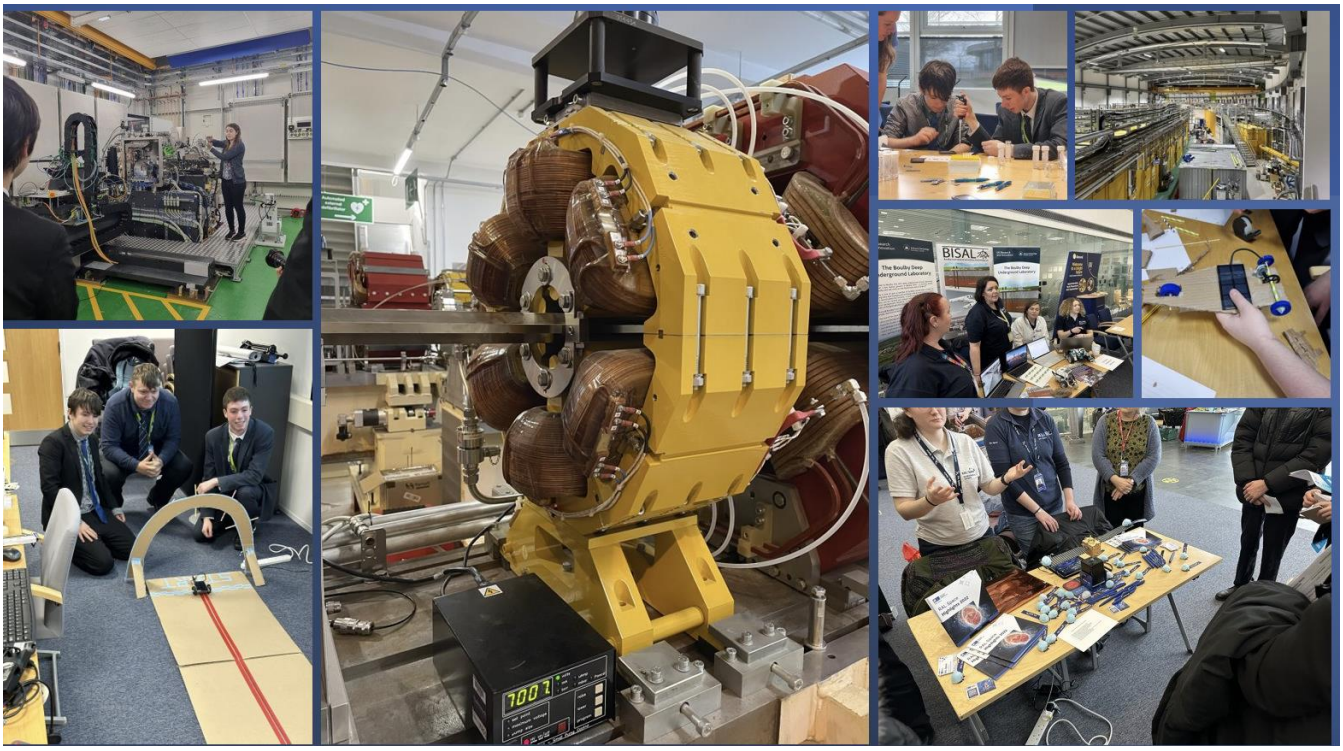
UTC SWINDON



PHYSICS
STUDENT HANDBOOK
2023-2024

Name .....

Table of Contents

1. Foreword

"It is a profound and necessary truth that the deep things in science are not found because they are useful; they are found because it was possible to find them."
— J. Robert Oppenheimer

Dear student of physics,

Welcome to the Science Faculty of UTC Swindon. The staff aim to offer outstanding teaching and training support that will help you develop the knowledge and skills necessary to obtain your A-level qualification and subsequent employment.

This handbook provides helpful information about the school and your course. I hope that it will be useful to you and that it will answer any of your questions.

These days physics is considered to be one of the hardest subjects there is to learn.

But may I assure you that whilst the path is hard, the journey is very rewarding as you will witness events so profoundly great and walk past mysteries so beautifully attractive that you won't cease to wonder.

The Goal of Man is to survive by conquering the physical universe. Learning about the physical universe and using its laws and principles is therefore a part of that process.

The scope of physics is huge. It deals with things as big as planets and as tiny as subatomic particles. It is applied in many areas of human activity such as medicine, finance, technology and engineering.

We wish you well in your studies and hope that you have an enjoyable and productive time as a student here.

2. Key Staff & Contact Details

Name	Role	Email
Cherise Osolin	Head of KS5	cosolin@utcswindon.co.uk
Helen Curtis	Attendance Officer & Reception	hcurtis@utcswindon.co.uk
Dr Alex Shevchuk	Head of Science & A-level Physics teacher	ashevchuk@utcswindon.co.uk
Ash Olson	A-level Biology teacher	aolson@utcswindon.co.uk
Annabel Ford	A-level Chemistry teacher	aford@utcswindon.co.uk

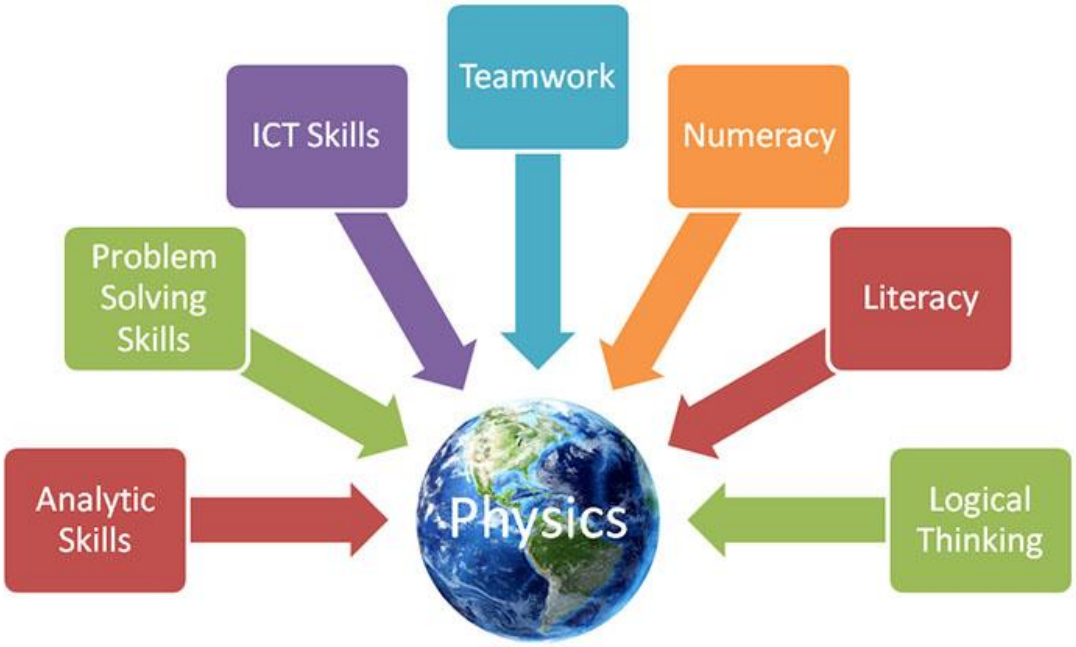
Head of Key Stage 5 (KS5) Cherise Osolin will be able to advise on many issues about general school procedures, as well as those specific for KS5. In the event of absence, general enquiries can be made to your designated year tutor.

The Attendance Officer will be able to help with attendance related issues on the day to day basis.

If you are having a problem, Head of KS5 will be your first point of contact. If you would prefer, you could also always talk to someone in the pastoral team on the first floor.

3. Recommendations

Before I came here, I was confused about this subject.
Having listened to your lecture I am still confused.
But on a higher level.
Enrico Fermi



Key things on the route to success in Physics:

1. Use past papers and marking scheme.
2. Read the examines report.
3. Use variety of paper & digital resources → part of your independent learning to support the content delivered as part of lessons.
4. Maths skills are essential.
5. Pay attention during the physics practicals, spend time interpreting and analysing the results.

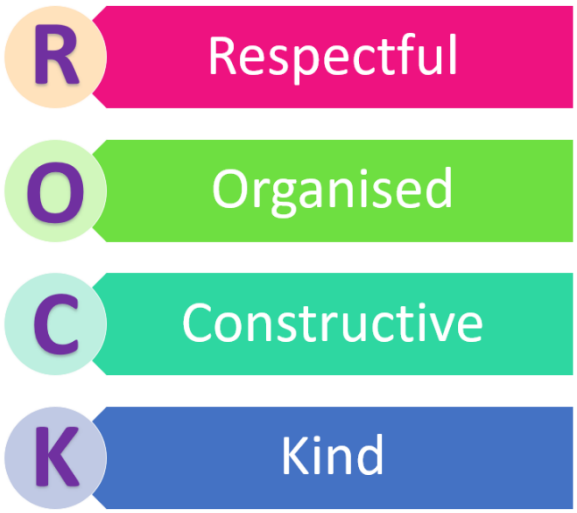
Misunderstood words:

Most difficulties in study stem from the simple fact that people don't fully understand meanings of words. If you pass by a misunderstood word in the text you read or a lecture you hear or a problem you try to solve then it is very likely that you will fail in this activity. Therefore, you should be careful with how you read and use dictionaries to clear up any unknown definitions.

4. Expectations

What we observe is not nature itself,
but nature exposed to our method of questioning.
Werner Heisenberg

1. Punctuality.
2. Acceptable Classroom Conduct.
3. Good Organisation.
4. Homework.
5. Independent Work.



OUR VISION

Transforming lives through learning

OUR MISSION

To 'transform lives through learning' by igniting confidence, expanding opportunities, energising the community and generating prosperity.
Through **our Learning Philosophy** and core values of empowerment, enterprise, connectedness and transformation, we will provide our students and staff with a safe and supportive environment in which to thrive and become independent learners.

OUR VALUES

Empowerment, enterprise, connectedness, and transformation.

5. Curriculum Outline

UTC Swindon Physics Department follows the **AQA Physics A Specification (7407/7408)**.

In Y12 you will study advanced areas of physics such as Particle and Quantum Physics alongside traditional Electricity, Mechanics and Materials. These topics will be taught separately and independent of each other. Practical skills will be assessed in written papers and as part of Laboratory experiments.

In Y13 we will deliver Thermal Physics, Fields and Further Mechanics and an **optional** topic from: Astrophysics, Turning Points in Physics, Medical Physics, Engineering Physics and Electronics.
Practical skills will be assessed in the written papers.

The A level exam will cover the whole of the two-year course examined in 3 papers.

Table below shows the breakdown of topics over the course of two years.

Code	Description
3.1	Measurments and their errors
3.21	Particles
3.22	Electromagnetic radiation and quantum phenomena
3.31	Progressive and stationary waves
3.32	Refraction, diffraction and interference
3.41	Forces, energy and momentum
3.42	Materials
3.51	Current electricity
3.61	Periodic Motion
3.62	Thermal physics
3.71	Fields
3.72	Gravitational fields
3.73	Electric fields
3.74	Capacitance
3.75	Magnetic fields
3.81	Radioactivity
3.91	Telescopes
3.92	Classificatino of Stars
3.93	Cosmology

You can also view the detailed steps of your learning journey in the diagram below.

UTC SWINDON

AQA

A-LEVEL PHYSICS LEARNING JOURNEY

EXAMS

The Big Bang

Evolution of the Universe

Energy Levels and Spectra

Life Cycle of Stars

Carbon Dating

Exponential Decay

Nuclear fusion

Einstein's mass-energy equation

Cosmology

ASTROPHYSICS

NUCLEAR PHYSICS

Astronomical Distances

Doppler Effect

HR Diagram

Analysing Stars

Half-life

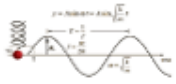
Nuclear fission

Binding Energy

Nuclear decay

Damping

Resonance



Gravitational Fields

Kepler's Laws

Coulomb's Law

Electric Potential

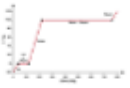
Charged Particles in a Magnetic Field

Radio- activity

Transformers

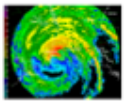
Nuclear Physics

Kinetic Theory of Gases



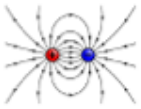
THERMAL PHYSICS

FIELDS



Specific Latent Heat

Circular and SHM



Electric Fields

Gravitational Potential

Newton's Law of Gravitation

Charged Particles in an E-Field

Magnetic Fields

EM Induction

Specific Heat Capacity

Thermal Physics

Resistivity

Analysing Circuits

Kirchhoff's First Law

Combining Resistors

Resistance

Momentum

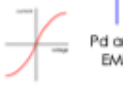
Year 13

ELECTRICITY

Electrical Energy

Potential Divider

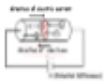
IV Characteristics



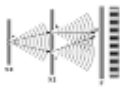
Pd and EMF

Electrical Current

Using excel and spreadsheets to analyse data



Superposition of waves

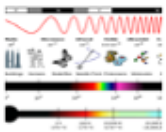


Stationary waves

Conservation of Energy

Power

Hooke's Law and Young's Modulus



Density and Pressure

WAVES

FORCES & MATERIALS

Total Internal Reflection

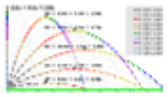
Young's Double Slit Experimentt experiment

Kinematics and the motion of bodies

Newton's Laws of Motion

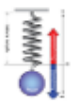
Archimedes' Principle

Deforming Materials



Diffraction and polarisation

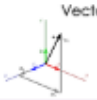
Waves



Quantum Physics

Quarks

The nucleus



Scalars & Vectors

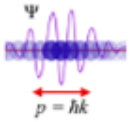
Induction tasks

Reflection and refraction

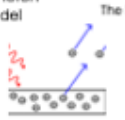
Wave-Particle Duality

PARTICLES & RADIATION

Year 12



The Photon Model

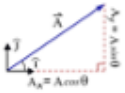


The Photoelectric Effect

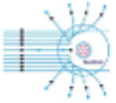
Anti-particles, hadrons and leptons

Alpha Particle Scattering

Particle Physics



Foundations of Physics



6. Evidence of Work

It doesn't matter how beautiful your theory is,
it doesn't matter how smart you are.
If it doesn't agree with experiment, it's wrong.
Richard P. Feynman

Class Work and Independent Work

Theory
You will organise your notes in a folder that you will keep in either an electronic folder or a paper folder. It's your responsibility to keep the notes and have them organised. Good organisation involves such information as **dates**, **titles** and **subtitles**, **deadlines** and sources of information.

Problem Solving
This is a crucial part of your work. Solving problems is an application of theory into practice. You are expected to solve problems in class and at home. You are expected to follow certain guidelines and structure and communicate your solution clearly with good English. Again, you can keep your solutions, worksheets & notes in a folder or have them in your exercise book.

Practical Work
This is the core of scientific method. As a student, you must organise your practical (laboratory) work and store it in a Practical folder. There you must keep your final analysis and write ups and all worksheets together. The front page of the folder will contain a check sheet so when the experiment is done it's ticked on the check sheet and feedback given by the teacher.

Study Time
It is recommended that for every hour in the classroom you spend an hour outside the classroom. You are expected to complete the end of chapter summary questions from your textbook independently. Asking for help when issues arise that can't be resolved through review of class notes or referring to the textbook is a must. In addition, you will be set independent tasks which need to be completed to deadline and will be marked and returned to you.

7. Assessment

There are two possible outcomes: if the result confirms the hypothesis, then you've made a measurement. If the result is contrary to the hypothesis, then you've made a discovery.
Enrico Fermi

Interim
Theory has many sources – teacher's lecture in the class, textbook or Internet – so you must be able to learn it with a required degree of understanding. It is the main principles, laws and relationships that we as teachers want to see you understand. Here the ultimate test would be your ability to apply the knowledge. Solving problems and answering exam-style questions is the application. Therefore, our day-to-day assessment could be in the form of a mini-test made up of three questions: one theory, one problem requiring a structured solution, and one exam-style question. A problem should already be known to you or be similar to a known one. The exam-style question is there to develop a habit of the method and look of the exam question as well as to give a teacher an idea if the student is on target or not.

Official External
Exams are taken once a year in May/June. You must ensure that you have sufficient time for revision at home.

Paper 1

What's assessed
Sections 1 to 5 and 6.1 (Periodic motion)

Assessed
- written exam: 2 hours
- 85 marks
- 34% of A-level

Questions
60 marks of short and long answer questions and 25 multiple choice questions on content.

Paper 2

What's assessed
Sections 6.2 (Thermal Physics), 7 and 8

Assumed knowledge from sections 1 to 6.1

Assessed
- written exam: 2 hours
- 85 marks
- 34% of A-level

Questions
60 marks of short and long answer questions and 25 multiple choice questions on content.

Paper 3

What's assessed

Section A Compulsory section: Practical skills and data analysis

Section B: Students enter for **one** of sections 9, 10, 11, 12 or 13

Assessed

- written exam: 2 hours
- 80 marks
- 32% of A-level

Questions

45 marks of short and long answer questions on practical experiments and data analysis.

35 marks of short and long answer questions on optional topic.

Official Internal

Internal Assessment is in the form of past paper questions and will occur periodically.

Evidence of Assessment

Independent work will be set and marked on point mark basis (e.g 36/47).

Laboratory work has a focused assessment and those will be marked against CPAC criteria.

Exams are the external indication of success of a student.

8. Guidance on Practicals

Practical work is at the heart of Physics and practical assessments have been divided into those that can be assessed in written exams and those that can only be directly assessed whilst students are carrying out experiments.

A-level grades will be based only on marks from written exams.

A separate endorsement of practical skills will be taken alongside the A-level. This is assessed by teachers and will be based on direct observation of students' competency in a range of skills that are not assessable in written exams.

The assessment of practical skills is a compulsory requirement of the course of study for A-level qualifications in physics. It will appear on all students' certificates as a separately reported result, alongside the overall grade for the qualification. These arrangements will include:

- A minimum of 12 practical activities to be carried out by each student.
- Teachers will assess students against Common Practical Assessment Criteria (CPAC).
- Each student will keep an appropriate record of their practical work, including their assessed practical activities.
- Students who demonstrate the required standard across all the requirements of the CPAC will receive a 'pass' grade.
- There will be no separate assessment of practical skills for AS qualifications.
- Students will answer questions in the A-level exam papers. These questions may draw on, or range beyond, the practical activities included in the specification.

Here is the list of Physics experiments that you will be completing as part of your course:

Code	Topic	Description
RP1	3.3.1.3	frequency of standing waves
RP2	3.3.2.1	Youngs Slits
RP3	3.4.1.3	Determine g by free fall
RP4	3.4.2.2	Determine Young modulus
RP5	3.5.1.3	Restivity of a wire
RP6	3.5.1.6	Investigate EMF
RP7	3.6.1.3	SHM in a spring system
RP8	3.6.2.2	Boyles & Charles's Law
RP9	3.7.4.4	Investigate charging and discharging capacitors
RP10	3.7.5.1	Force acting on a wire in a magnetic field
RP11	3.7.5.3	Magnetic flux linkage
RP12	3.8.1.2	Inverse square law of gamma radiation

9. Independent Learning

Even if there is only one possible unified theory, it is just a set of rules and equations. What is it that breathes fire into the equations and makes a universe for them to describe?
Stephen Hawking

Being an independent learner means having better chances for a successful career. It is all about one's ability to make the right decisions and have enough self-discipline to execute them.

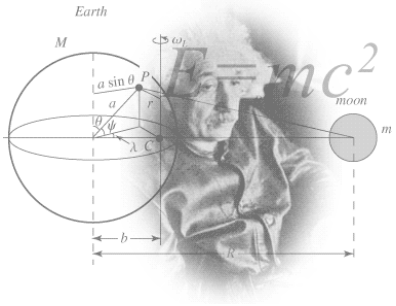
UTC Swindon Physics Department wants to help you become an independent learner and at the same time retain freedom of choice. To promote independent learning, we have put together some options:

We have put together the reading list and useful online resources. You can read a scientific journal article here https://www.scienceopen.com and explore it even further as more information and discoveries are made each week in space and particle physics. You can turn this article into your own PowerPoint presentation and have up to 5 minutes at the end of a lesson to present it to the class if you wish.

During Y12 and Y13 to help you with this aspect of independent learning you will be requested to read around the subject. You will be presented with a reading list and required to choose two books per year from it. You will then have sufficient time to read and then write a review of the book. Should you find a physics related book that is not on the list please consult with your teacher before submitting that. The deadline for each submission is the end of the first and second terms respectively.

Another aspect of Independent Learning is linked to the curriculum, and may I say that without this component it is going to be hard to achieve an 'A*' in physics. If you want to become a professional, you shouldn't restrict yourself to classwork and set tasks. You should find additional sources of information, plan more, do more and offer more in class. You shouldn't give up on a hard question or wait for the teacher to explain everything to you. It is hard work but success tastes sweeter in the end!

May we wish you every success in your studies of A' level physics.



10. Reading List for Sixth Form Physics

Universe in a Nutshell	Stephen Hawking
Black Holes and Baby Universe	Stephen Hawking
A Brief History of Time	Stephen Hawking
Surely you're joking Mr Feynman	Richard P. Feynman
Small World: Uncovering Nature's Hidden Networks	Mark Buchanan
The Theory of everything	Stephen Hawking
Physics for Game Developers	David M. Bourg
Super Symmetry	Gordon Kane & Edward Witten
The Future of Space Time	various
Quantum Theory: A Short Introduction	John Polkinghorne
The Character of Physical Law	Feynman & Davies
Elementary Particles & the Laws of Physics	Feynman & Weinburg
The Science of Cooking	P. Barham
QED: The strange theory of light & matter	Richard Feynman
The Physics of Star trek	L. Krauss
Schrodinger's Kittens	John Gribbin
How things work: the physics of everyday life	L. Bloomfield
The Emperor's new mind	R. Penrose
Bad Astronomy: Misconceptions & misuses revealed	Plait
In Search of the Edge of Time	J.Gribbon
Alice in Quantum Land	Robert Gilmore
The Wizards of Quarks	Robert Gilmore
Quantum: A Guide for the perplexed	Jim Al-Khalili
A Short History of nearly everything	Bill Bryson
The Man who changed everything	Basil Mahon

11. Action Verbs

These action verbs indicate the depth of treatment required for a given assessment statement. These verbs will be used in examination questions and so it is important that students are familiar with the following definitions.

Define	give the precise meaning of a word or phrase as concisely as possible.
Draw	represent by means of pencil lines (add labels unless told not to do so).
List	give a sequence of names or other brief answers with no elaboration, each one clearly separated from the others.
Measure	find a value for a quantity.
State	give a specific name, value or other brief answer (no supporting argument or calculation is necessary).
Annotate	add brief notes to a diagram, drawing or graph.
Apply	use an idea, equation, principle, theory or law in a new situation.
Calculate	find an answer using mathematical methods (show the working unless instructed not to do so).
Compare	give an account of similarities and differences between two (or more) items, referring to both (all) of them throughout (comparisons can be given using a table).
Describe	give a detailed account, including all the relevant information.
Distinguish	give the differences between two or more different items.
Estimate	find an approximate value for an unknown quantity, based on the information provided and scientific knowledge.
Identify	find an answer from a number of possibilities.
Outline	give a brief account or summary (include essential information only).
Analyse	interpret data to reach conclusions.
Construct	represent or develop in graphical form.
Deduce	reach a conclusion from the information given.
Derive	manipulate a mathematical equation to give a new equation or result.
Design	produce a plan, object, simulation or model.
Determine	find the only possible answer.
Discuss	give an account including, where possible, a range of arguments, assessments of the relative importance of various factors or comparisons of alternative hypotheses.
Evaluate	assess the implications and limitations.
Explain	give a clear account including causes, reasons or mechanisms.
Predict	give an expected result.
Solve	obtain an answer using algebraic and/or numerical methods.
Suggest	propose a hypothesis or other possible answer.
Hypothesise	write a testable statement

12. Physics learning & revision resources

- Revision Content: https://mmerevise.co.uk/a-level-physics-revision/
- Demos & Simulations: https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype
- Physics notes, topic questions & past papers: https://www.savemyexams.co.uk/a-level/physics/aqa/17/tqs/
- A-level Physics Online: https://www.alevelphysicsonline.com/aqa
- Earth orbit: https://www.earthspacelab.com/
- Solar System: https://solarsystem.nasa.gov/solar-system/our-solar-system/overview/
- Details of the history of the best scientific discoveries. https://www.nobelprize.org/educational/
- The site of the scientific journal. http://nature.com
- The Large Hadron Collider https://home.web.cern.ch/science/accelerators/large-hadron-collider