**Aims and vision of St. Joseph’s College science department**

Science is a varied and rapidly changing subject. Science has been taught as simply a collection of facts and procedures for too long in schools. We recognize that science is as much a way of thinking as simply a knowledge base. Science as a subject is challenging but also relevant to our pupils’ futures, whether or not they choose to follow science courses beyond the age of 16.

In the teaching of science at St Joseph’s College we strive to produce young citizens who are aware of the current developments in science and the potential implications of those developments. We also aim to provide them with opportunities to develop the key skills (e.g. thinking, practical, data handling, ICT, communication) that have a broader relevance to their lives.

We recognize that science is an exciting subject and the delivery of science lessons should reflect this. Science lessons at St. Joseph’s College;

* Allow pupils to develop their practical skills and use these skills to test their predictions experimentally.
* Allow pupils to think for themselves rather than simply being told ‘this is how it is’.
* Allow pupils to experience a wide range of learning styles to help them understand abstract scientific concepts e.g. role play, creative writing, model making, presentations and group work.
* Have assessment for learning (AfL) at their core.
* Equip our students with an understanding of how science works so that they will be better placed to make future decisions relating to the applications and implications of science for society.

**We aim to be a lead department in the school and within the LA in terms of teaching and learning!**

**Course structure**

## KS3

# Year 7 will be following a new 2 year course linked to the new National Curriculum. Evaluation and refinement will be a key focus in this academic year. One important focus of this new course is How Science Works i.e. scientific process rather than simply content. Investigation will be central to the scheme with content taught through investigative approaches.

It is important that the language used when discussing investigative work (e.g. variables, accuracy, precision, reliability) relates to the definitions used in new AQA GCSE scheme. These definitions are available from the AQA science lab website.

## YEAR 7/8 – Students

|  |
| --- |
| **YEAR 7** |
| **TERM 1** | **TERM 2** | **TERM 3** |
| **Introduction:** Lab safety**Topic 1:** Particles**Topic 2:** Cells**Topic 3:** Energy**Topic 4:** Atomic Structure | **Topic 5:** Waves**Topic 6:** Interdependence**Topic 7:** Acids and bases | **Topic 8:** Variation**Topic 9:** Fossil fuels**Topic 10:** Magnets and electromagnets |
| **YEAR 8** |
| **TERM 1** | **TERM 2** | **TERM 3** |
| **Topic 1:** Cells**Topic 2:** Fossil fuels**Topic 3:** Energy**Topic 4:** Microbes and drugs | **Topic 5:**  Acids**Topic 6:** Waves**Topic 7:** Variation**Topic 8:** Atomic number | **Topic 9:** Recycling**Topic 10:** Electricity**Topic 11:** Space |

Y8 will be following the 2 year KS3 curriculum outlined above.

**ASSESSMENT IN YEAR 7 AND YEAR 8**

Home learning tasks, common to all form groups, will be set within each topic.

Before each school assessment point (AP point) each student will sit a test on work covered to date.

**Taking it further**

Useful websites/articlesor books of interest/family visits:

1. Jodrell Bank Observatory (near Holmes Chapel)
2. Trentham Monkey Forest
3. Chester Zoo
4. Blue Planet Aquarium (Chester)
5. Leicester Space Museum
6. Manchester Science Museum
7. Natural History Museum (London)
8. Eureka (Halifax)
9. BBC KS3 Bitesize website
10. @Bristol Youtube Channel (<https://www.youtube.com/user/atbristol>)
11. CGP KS3 Revision guides

**KS4**

**Year 9**

Students begin their GCSE’s in this academic year. They have nine hours per fortnight and are taught in subject specialist areas. Three hours are given to each subject area (chemistry, physics and biology).

All students study the first 3-4 topics on the GCSE content across each area (see content lists below).

Approximately two weeks after the Easter holiday, all students sit three hour long exams (one for each subject area) and performance in these tests determine the GCSE route each students will follow in the later parts of year 9 and continuing through to year 11.

**Year 10**

Students in year 10 are already following either *GCSE Separate Science* (one GCSE obtained in each subject area) or *GCSE Trilogy*(two GCSE’s with content from chemistry, physics and biology).

The head of science speaks to parents at Year 9 Options Evening to provide more information about the routes available and more information is shared at Year 10 Signposts to Success Evening.

**Whether a student is following GCSE Separate Science or GCSE Trilogy, the topics are the same. GCSE Separate Science students will cover some topics in greater depth.**

**Topics:**

|  |  |  |
| --- | --- | --- |
| **Chemistry** | **Physics** | **Biology** |
| * Atomic structure and the periodic table
* Bonding and structure
* Quantitative chemistry
* Chemical changes
* Energy changes
* The rate and extent of chemical change
* Organic chemistry
* Chemical analysis
* Chemistry and the atmosphere
* Using resources
 | * Energy
* Electricity
* Particle model of matter
* Atomic Structure
* Forces
* Waves
* Magnetism and electromagnetism
 | * Cell biology
* Organisation
* Infection and response
* Bioenergetics
* Homeostasis and response
* Inheritance, variation and evolution
* Ecology
 |

**Assessment for both GCSE options are at the end of year 11 (2018 for current year 10 and 2019 for current year 9)**

**Route 1: Separate Science**

The assessment of GCSE biology will involve 2 exams at the end of year 11 (1hr 45 mins each)

The assessment of GCSE chemistry will involve 2 exams at the end of year 11 (1hr 45 mins each)

The assessment of GCSE physics will involve 2 exams at the end of year 11 (1hr 45 mins each)

**Route 2: Trilogy**

This route allows students to gain two science GCSE’s with content from chemistry, physics and biology.

The assessment of GCSE Trilogy involves 6 x exams (1h 15 mins each) at the end of year 11. There are two exams from each subject area.

**Year 11 (2016-2017)**

Students in year 11 are the last cohort through the legacy GCSE. Students are following one of two routes detailed below. They will finish all taught modules approx. March 2017 allowing time for revision.

Listed below are the routes, content and assessment.

**Route 1:
GCSE Core Science/GCSE Additional Science**

The assessment of both of these GCSEs will take place at the end of year 11. Each GCSE comprises 25% controlled assessment and 75% exams.
GCSE Core Science: 3 exams, B1, C1 and P1 each worth 25%
GCSE Additional Science: 3 exams, B2, C2 and P2 worth 25%

**Route 2:
Triple Science (Separate GCSEs in biology, chemistry and physics)**

The assessment of GCSE biology will involve 3 exams at the end of year 11 (25% each) and 1 piece of controlled assessment.
The assessment of GCSE chemistry will involve 3 exams at the end of year 11 (25% each) and 1 piece of controlled assessment.
The assessment of GCSE physics will involve 3 exams at the end of year 11 (25% each) and 1 piece of controlled assessment.

**Content**

The content of the courses are shown below

|  |  |  |
| --- | --- | --- |
| **GCSE BIOLOGY** | **GCSE CHEMISTRY** | **GCSE PHYSICS** |
| **B1: Biology 1 (Core)*** Keeping healthy
* Nerves and hormones
* The use and abuse of drugs
* Interdependence and adaption
* Energy and biomass in food chains
* Waste material from plants and animals
* Genetic variation and its control
* Evolution

**B2: Biology 2 (Additional and Triple)*** Cells and simple cell transport
* Tissues, organs and organ systems
* Photosynthesis
* Organisms and their environment
* Proteins- their functions and uses
* Aerobic and anaerobic respiration
* Cell division and inheritance
* Speciation

**B3: Biology 3 (Triple)*** Movement of molecules in and out of cells
* Transport systems in plants and animals
* Homeostasis
* Humans and their environment
 | **C1: Chemistry 1 (Core)*** Fundamental ideas in chemistry
* Limestone and building materials
* Metals and their uses
* Alloys
* Crude oil and fuels
* Other substances from crude oil
* Plant oils and their uses
* Changes in the Earth and atmosphere

**C2: Chemistry 2 (Additional and Triple)*** Structure and bonding
* How structures influence the properties and use of substances
* Atomic structure, analysis and quantitative chemistry
* Rates of reaction
* Exothermic and endothermic reactions
* Acids, bases and salts
* Electrolysis

**C3: Chemistry 3 (Triple)*** The periodic table
* Water
* Calculating and explaining energy change
* Further analysis and quantitative chemistry
* The production of ammonia
* Alcohols, carboxylic acids and esters
 | **P1: Physics 1 (Core)*** Energy transfers
* Energy and efficiency
* The usefulness of electrical appliances
* Methods used to generate electricity
* Using waves

**P2: Physics 2 (Additional and Triple)*** Forces and their effects
* Kinetic energy
* Current and electrical circuits
* Using mains electricity safely
* Radioactive decay
* Nuclear fission and fusion

**P3: Physics 3 (Triple)*** Medical applications of physics
* Using physics to make things work
* Keeping things moving
 |

**KS5 Chemistry**

The new AQA Chemistry specification allows students to access the upper echelons of the subject of Chemistry. The specification is linear and reformed – this means there are no examinations at the end of Year 12 and all examinations occur at the end of Year 13. Moreover, there is no coursework element much alike the GCSE, but there is a requirement to complete certain ‘required practicals’ throughout the year that are assessed in the final exams.

The subject is co-taught meaning students will have access to two teachers throughout the year, with an allocation of 18 hours per fortnight provided for the students. This allows for dramatic and outstanding progress with our students as well as additional support for the students who need it the most. As a ‘facilitating subject,’ Chemistry is renowned for it’s academic vigour and requires the utmost concentration and a brilliant work ethic to succeed. All notes that are available in class will be uploaded to the Virtual Learning Environment in order for students who have missed work to catch up with what they have missed.

The specification allows students to:

* Gain hands-on practical and data analysis skills
* Appreciate *How Science Works* and its relevance beyond the laboratory
* Develop an enthusiasm for chemistry
* Demonstrate a synoptic understanding

Whilst studying this course, each student will come to understand how scientists investigate scientific phenomena in order to explain the world around us. Students will improve their scientific problem-solving skills by developing an understanding of the procedures associated with the testing of ideas and the interpretation and validation of evidence. Students will ultimately have an understanding of science’s place in the wider world.

**Subject content**

**3.1 Physical chemistry**

3.1.1 Atomic structure

3.1.2 Amount of substance

3.1.3 Bonding

3.1.4 Energetics

3.1.5 Kinetics

3.1.6 Chemical equilibria, Le Chatelier’s principle and Kc

3.1.7 Oxidation, reduction and redox equations

3.1.8 Thermodynamics (A-level only)

3.1.9 Rate equations (A-level only)

3.1.10 Equilibrium constant Kp for homogeneous systems (A-level only)

3.1.11 Electrode potentials and electrochemical cells (A-level only)

3.1.12 Acids and bases (A-level only)

**3.2 Inorganic chemistry**

3.2.1 Periodicity

3.2.2 Group 2, the alkaline earth metals

3.2.3 Group 7(17), the halogens

3.2.4 Properties of Period 3 elements and their oxides (A-level only)

3.2.5 Transition metals (A-level only)

3.2.6 Reactions of ions in aqueous solution (A-level only)

**3.3 Organic chemistry**

3.3.1 Introduction to organic chemistry

3.3.2 Alkanes

3.3.3 Halogenoalkanes

3.3.4 Alkenes

3.3.5 Alcohols

3.3.6 Organic analysis

3.3.7 Optical isomerism (A-level only)

3.3.8 Aldehydes and ketones (A-level only)

3.3.9 Carboxylic acids and derivatives (A-level only)

3.3.10 Aromatic chemistry (A-level only)

3.3.11 Amines (A-level only)

3.3.12 Polymers (A-level only)

3.3.13 Amino acids, proteins and DNA (A-level only)

3.3.14 Organic synthesis (A-level only)

3.3.15 Nuclear magnetic resonance spectroscopy (A-level only)

3.3.16 Chromatography (A-level only)

**Assessment**

There are three examinations at the end of Year 13:

Paper 1: (2 hours – 35% of the A-level)
Relevant physical chemistry topics (sections 3.1.1 to 3.1.4, 3.1.6 to 3.1.8 and 3.1.10 to 3.1.12)

Inorganic chemistry (section 3.2)

Relevant practical skills

Paper 2: (2 hours – 35% of the A-level)

Relevant physical chemistry topics (sections 3.1.2 to 3.1.6 and 3.1.9)

Organic chemistry (section 3.3)

Relevant practical skills

Paper 3: (2 hours – 30% of the A-level)
Any content

Any practical skills

The papers will also have a mathematical element to them by testing to at least a standard of a high-level GCSE Mathematics examination. 20% of the marks available will test the students in this way.

**Practical Skills**

Students are expected to complete 12 practicals by the end of the Year 13 course. These include:

|  |
| --- |
| 1  Make up a volumetric solution and carry out a simple acid–base titration |
| 2 Measurement of an enthalpy change |
| 3 Investigation of how the rate of a reaction changes with temperature |
| 4 Carry out simple test-tube reactions to identify:* cations – Group 2, NH4+
* anions – Group 7 (halide ions), OH–, CO32–, SO42–
 |
| 5 Distillation of a product from a reaction |
| 6 Tests for alcohol, aldehyde, alkene and carboxylic acid |
| 7 Measuring the rate of reaction:* by an initial rate method
* by a continuous monitoring method
 |
| 8 Measuring the EMF of an electrochemical cell |
| 9 Investigate how pH changes when a weak acid reacts with a strong base and when a strong acid reacts with a weak base |
| 10 Preparation of:* a pure organic solid and test of its purity
* a pure organic liquid
 |
| 11 Carry out simple test-tube reactions to identify transition metal ions in aqueous solution |
| 12 Separation of species by thin-layer chromatography |

Students will also receive a CPAC qualification at the end of year 13 that is ungraded (e.g pass/fail.) This shows universities that students have had sufficient training in working in a practical environment and allows our students to have a more suitable understanding of how the laboratories work.

**KS5 Biology**

**Year 12 A level Biology**

Students will follow the AQA course for their A- Level in biology.

Unit 1 (Cells)

Cells and cell structure

Transport across membranes

Cell division

Unit 2 Exchange and transport

Lungs and lung function

Structure of heart and blood vessels

Plant transport

Unit 3 Biological molecules

Biological molecules (proteins, carbohydrates, fats and water

Structure of DNA and protein synthesis

Enzyme structure and function

Unit 4 Food and health

Diet and food production

Infectious diseases

Smoking and heart disease

Unit 5 Biodiversity

Variation and classification

Evolution

Environmental issues

**Additional information**

* Further information on the course can be found at [www.aqa.org.uk](http://www.aqa.org.uk)
* Support from teachers is available on request
* Students will be given a target grade and then assessed at regular intervals (usually every half term) on a formal basis to determine progress in relation to their target grade. Students will be given ample warning to prepare for these tests.

**Year 13 A level Biology**

Students will follow the OCR course for their A2 in biology.

Unit 1 (Communication and homeostasis)

Temperature regulation)

The Nervous system

Unit 2 Excretion

Liver and Kidney structure and function

Unit 3 Photosynthesis and respiration

Photosynthesis

Respiration

Unit 4 Cellular control

DNA, protein synthesis and cell division

Control of gene expression

Population genetics

Unit 5 Biotechnology

Biotechnology and cloning

Gene technologies)

Unit 6 Ecosystems and sustainability

Ecosystems and population studies

Sustainability and biotourism

Unit 7 Responding to the environment

Plant hormones

Brain and nervous system

Muscle structure and function

**Additional information**

* Support from teachers is available on request
* Students will be given a target grade and then assessed at regular intervals (usually every half term) on a formal basis to determine progress in relation to their target grade. Students will be given ample warning to prepare for these tests.
* There are three papers at the end of year 13 on which students are assessed (further information can be gained from the student’s teacher if required)

**KS5 Physics**

We follow the AQA specification for A-level physics. The AQA course is a linear 2-year course based with 100% exam based assessment. There are multiple required practicals throughout the course, and the practical skills gained during these are assessed during the final exams. All the exams are sat at the end of the 2-years.

**Year 12 Physics**

**Unit 1 – Measurement and their errors**

Use of SI units and their prefixes

Limitation of physics measurements

Estimation of physical quantities

**Unit 2 – Particles and radiation**

Particles

Electromagnetic radiation

Quantum phenomena

**Unit 3 – Waves**

Progressive and stationary waves

Refraction, diffraction and interference

**Unit 4 – Mechanics and Materials**

Forces

Energy and momentum

Materials

**Unit 5 – Electricity**

Current

Resistivity

Circuits

**Year 13 Physics**

**Unit 6.1 – Further mechanics**

Circular motion

Simple harmonic motion

Forced vibrations and resonance

**Unit 6.2 – Thermal physics**

Energy transfer

Ideal gases

Molecular kinetic theory

**Unit 7 – Fields and their consequences**

Gravitational fields

Electric fields

Capacitance

Magnetic fields

**Unit 8 – Nuclear physics**

Radioactive decay

Nuclear radius

Mass and energy

**Unit 9 – Optional topic:**

Astrophysics

Medical physics

Engineering physics

Turning points in physics

Electronics

**Assessment**

**Paper 1 – 2hrs**

All of the year 1 material plus periodic motion from year 2.

85 marks: 60 short and long questions, 25 multiple choice.

**Paper 2 – 2hrs**

The remaining content from year 2, with assumed knowledge from year 1.

85 marks: 60 short and long questions, 25 multiple choice.

**Paper 3 – 2hrs**

Practical skills, data analysis, and optional topic from year 2.

80 marks: 45 short and long questions on practical skills and data analysis, 35 short and long questions on optional topic

**Additional Information**

Regular formal assessment will be given to students in order to ascertain progress and gauge development

Students will be set a targeted skills improvement task to work on during half-termly breaks, this will be followed by an assessment on their particular topic when they return.

Powerpoints, resources and homeworks will be uploaded to VLE so that students have access to these and can catch up on any work missed.

Students are expected and required to ask for help when attempting to solve physics problems or complete homework.

Physics requires a solid understanding of mathematical algebra. Across the two year course multiple mathematical skills will be required in order to solve problems. These include:

* High competency at re-arranging, and manipulating algebra.
* Trigonometry.
* Linear and quadratic equation solving.
* Base 10 and log rules.
* Differentiation and integration.
* Natural logs and exponents.
* Dimensional analysis.

**KS5 Applied Science**

This course is a broad-based qualification in Science which may be used to give an understanding of how science is applied in a variety of contexts.

**AS Applied Science**

At AS students study **Science at Work**, **Chemical and Physical Analysis at Work** as portfolio units and **Monitoring the Activity of the Human Body** which is assessed in a module exam and is largely a biology-based examination.

**Science at Work**

The intention is that this unit will provide students with an introduction to the importance of how science impacts on the society in which they live. It has been designed to focus on important aspects of science used in the work place and the involvement of science in organisations, to enable students to understand the significance of the work they are studying.

This unit should also help candidates see the relationship between what they learn, and what they may experience in a working environment.

The importance of health and safety, both in a working and educational environment is introduced to support both the practical work and the way in which organisations may impact upon society and the environment

Practical techniques and procedures give candidates the opportunity to carry out experimental work within a vocational context. This practical work also gives an opportunity to put into practice risk assessment and some of the health and safety laws and regulations they have researched.

Examples of some experimental work might be:

 titrations for acid/base calculations;

 testing quality of products (quality assurance);

 biological action of enzymes;

 food testing procedures

**Analysis at Work**

The intention is that this unit will provide students with an introduction to the importance of testing and analysis within many industries and work places. It begins by focusing on the more obvious methods of testing, and then considers the importance of analysing procedures for quality control and improving efficiency.

This unit should also help candidates learn how to do simple tests in the laboratory and to be able to link them to realistic testing methods within one of the industries they have been researching.

Qualitative analysis is carried out which allows candidates to build on their skills, knowledge and understanding from GCSE Science or Applied Science with specific regard to simple test-tube reactions for the anions and cations.

Students have experience of simple titrations that involve making and using standard

solutions. They carry out straightforward acid-base, redox titrations.

The titrations performed have a vocational slant. Suggested exercises include finding the:

 concentration of commercial vinegars;

 % of iron in ‘iron tablets’;

 % of copper in brass samples;

 hardness of water using a solution of EDTA.

Candidates need to be aware of the principles behind colorimetry and to have tried a colorimetric procedure. This might be to find the percentage of copper in a sample of brass, or to determine the percentage of iron in samples of iron filings.

They need to be aware of the great importance of colorimetric techniques in industry and in hospital laboratories.

**Monitoring the activity of the human body**

Within this examined unit, students study topics on:

1. Respiration
2. Structure and function of the circulatory and respiratory system
3. Use of physiological measurements
4. Methods of taking physiological measurements
5. Imaging method
6. Regulations and ethics related to diagnosis, monitoring and treatment

**A2 Applied Science**

At A2 students study **Investigating the Scientists’ Work**, **Synthesising Organic Compounds** as portfolio units and **Working Waves** which is assessed in a module exam and is largely a physics-based examination.

**Synthesising Organic Compounds**

This unit draws on the scientific knowledge, skills and understanding provided by the study of G620: Science at work, G621: Analysis at work and G622: Monitoring the activity of the human body.

It is important that students become familiar with and confident in using standard chemical substances and laboratory equipment. Correct nomenclature and terminology need to be embodied within the delivery, whilst the underpinning chemical principles need to be introduced gradually as the unit progresses, using practical sessions to support the theory wherever possible.

Practical work is an integral part of the unit and the skills required for the preparation and analysis of the organic compounds can be developed through a practical based approach to the underpinning theory. This allows candidates with all learning styles the opportunity to understand the basic chemistry requirements for the unit.

The principal aim of the unit is to give candidates a sufficient grounding in theoretical and practical organic chemistry to allow them to appreciate the work and contribution made by the organic chemist to modern day living and realise the diversity of their work.

**Investigating the Scientists’ Work**

The intention is that this unit will provide students with time to work on projects that reflect the activities of scientists in the workplace. It has been designed to allow candidates scope to draw on knowledge, understanding and skills gained from other units, as well as knowledge which will be gained specifically for this investigation. The investigation needs to, as far as possible, replicate a real working situation and be subject to constraints of deadlines, support and resources. The topic chosen needs to have some vocational/real life context.

**Working Waves**

Within this examined unit, students study topics on:

1. Waves
2. Thermal imaging and other applications of Infrared
3. How optical fibres carry data
4. Communication systems – mobiles and broadband
5. X-ray and gamma ray imaging and therapy

A large amount of past paper material is available to support in the preparation for the examinations.

All coursework units and internally moderated and then a sample is submitted to OCR for final moderation. Class teachers work hard to guide the students in the completion of their coursework and guidance is given along the way.