GCSE Combined Science (Trilogy) Course Information

Course Overview

- **Exam Board** – AQA
- **Usual Age Range** – 14 to 16
- **Qualification** – One GCSE
- **Curriculum Time** – Six 50-minute lessons per week in class plus work in Independent Learning Time
- **Assessment** – Six 1-hour-15-minute examinations taken at the end of the two-year course
- **Grading** – Reformed Liner GCSE Scale of 9, 8, 7, 6, 5, 4, 3, 2, 1. UTC students taking Foundation Tier examinations will be awarded within the range of 1 to 5. UTC students taking Higher Tier examinations will be awarded within the range of 4 to 9.
- **Full specification** - https://filestore.aqa.org.uk/resources/science/specifications/AQA-8464-SP-2016.PDF

Curriculum Intent

The **intent** of GCSE Combined Science is to give UTC students an opportunity to develop a broad understanding of the content within the following four fundamental areas that are further split into topics and to be able to apply this understanding to explain biological phenomena:

Biology

- Cell biology
- Organisation
- Infection and response
- Bioenergetics
- Homeostasis and response
- Inheritance, variation and evolution
- Ecology

Chemistry

- Atomic structure and the periodic table
- Bonding, structure, and the properties of matter
- Quantitative chemistry
- Chemical changes
- Energy changes
- The rate and extent of chemical change
- Organic chemistry
- Chemical analysis
- Chemistry of the atmosphere
- Using resources

Physics

- Energy
- Electricity
- Particle model of matter
- Atomic structure

- Forces
- Waves
- Magnetism and electromagnetism

At the UTC we specifically intend students to appreciate the relevance of science to the world of work, in particular healthcare science. Healthcare science **careers** are explicitly taught within relevant topics in the GCSE Combined Science sequence of learning. Students will also have direct first-hand experience of our healthcare science partners through project days and other aspects of UTC life such as our extensive UTC extra programme or via our assessed non-GCSE technical healthcare science curriculum. A variety of careers outside this specialism are also taught in appropriate topics in GCSE Combined Science so students have an appreciation of how science relates to the wider world of work so they can make an informed choice to the career they would like to pursue.

A further intent is to motivate all students to pursue further study in science beyond GCSE, irrespective of prior attainment.

Suggested **destinations** after completion of this course include progression onto a level 3 course at the UTC such as A-level Biology , A-level Chemistry and A-level Physics or Medical Science.

Throughout GCSE Biology students are encouraged to develop their **literacy skills**. Students are regularly exposed to reading material in class and extended writing activities such as experimental write ups. Extended response questions allow students to demonstrate their ability to construct and develop a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. Through the explicit teaching of specific science key words as each topic is taught students demonstrate their understanding of a growing scientific vocabulary as topics are taught through carefully designed written tasks, as well as verbally through questioning techniques used by their teacher. This **love of reading** is further developed by both non-fiction and fiction science related titles that have been carefully selected by their science teachers that are available to borrow in our Learning Resource Centre.

The following five fundamental **numeracy** threads running through GCSE science are taught via the context of each of the 3 science disciplines (Biology, Chemistry and Physics) in collaboration with our mathematics specialists:

- Arithmetic and numerical computation
- Handling data
- Algebra
- Graphs
- Geometry and trigonometry

For example, in Biology lessons UTC students may draw and analyse a straight-line graph of the change in mass against concentration of sugar solution in the osmosis practical. Whilst in Chemistry lessons, students may draw and analyse a straight-line graph of total volume of sodium hydroxide added against mean maximum temperature in the temperature changes practical. Students in Physics lessons may also draw and analyse a straight-line graph but of the temperature against work done in the specific heat capacity practical. Higher Tier students will also be taught how to complete multi-step calculations. Our students are well prepared in scientific numeracy as a significant proportion of the marks in GCSE Science examinations now requires such a skill.

The students at our UTC experience more that the ten required practical activities that the examination board requires. All students benefit from a combination of a hands-on approach and written work. Students are well prepared for further study and careers with a practical and procedural component. Students are engaged in science because they have this opportunity.

Remote Learning and Revision

Students will benefit from additional study on-site and at home using their personal copy of their Oxford University Press Revision Guide provided by the UTC.

Students can communicate with the teacher via the message function on Teams if absent from school and well enough to do some work.

Students should use the following websites:

- Free Science Lessons – https://www.freesciencelessons.co.uk
- AQA Practice Papers - https://www.aqa.org.uk/subjects/science/gcse/combined-science-trilogy-8464/assessment-resources?f.Resource+type%7C6=Question+papers

Students may choose to use the following additional websites:

- GCSE Pod – https://www.gcsepod.com
- Seneca – https://senecalearning.com/en-GB/

Curriculum Overview

The learning in GCSE Science is sequenced as follows.

Note: the full Curriculum Plans are available on request to info@nefuturesutc.co.uk

Revision Resources – Click on the following for links to videos

The following links are used for **independent learning** and **catch-up** tasks alongside the **revision guide** provided by us at the UTC.

Chemistry	**Biology**	**Physics**
Paper 1 - Year 10	**Paper 1 - Year 10**	**Paper 1 – Y10**
Term start -September	**Term start -September**	**Term start -September**
C1 Atomic structure 1. Elements, Compounds and Mixtures 2. Interpreting a Chemical Formula 3. Filtration and Crystallisation 4. Simple Distillation 5. Fractional Distillation 6. Paper Chromatography 7. Alpha-Scattering Experiment 8. The Nuclear Model 9. Atomic Number and Mass Number 10. Relative Atomic Mass 11. Electron Energy Levels	**B1 Cell structure and transport** 1. Eukaryotes vs Prokaryotes 2. Size of cells 3. Order of Magnitude 4. Animal cells 5. Plant cells 6. Animal cell specialisation 7. Plant cell specialisation 8. Microscopes (Required practical 1) 9. Microscopy 10. Diffusion 11. Surface area to volume ratio 12. Osmosis 13. Osmosis (required practical 3) 14. Active transport	**P1 Conservation and dissipation of energy** 1. Changes in energy stores 2. Conservation of energy 3. Energy and work 4. Gravitational potential energy 5. Kinetic energy 6. Elastic potential energy 7. Energy dissipation 8. Energy and efficiency 9. Electrical appliances 10. Energy and power **P2 Energy transfer by heating** 11. Energy transfer by conduction 12. Specific heat capacity

C2 The periodic table

12. Electron Energy Levels
13. Development of the Periodic Table
14. Group 0
15. Metals
16. Group 1 Part 1
17. Group 1 Part 2
18. Group 7 Part 1
19. Group 7 Part 2
20. Group 7 Part 3

Autumn Half Term

C3 Structure and bonding

21. The Three States of Matter
22. Ionic Bonding 1
23. Ionic Bonding 2
24. Properties of Ionic Compounds
25. Covalent Bonding 1
26. Covalent Bonding 2
27. Covalent Bonding 3
28. Properties of Small Covalent Molecules
29. Diamond and Silicon Dioxide
30. Graphite
31. Graphene and Fullerenes
32. Bonding in Polymers
33. Metals and Alloys
34. Limitations of Bonding Diagrams

Christmas Break

C4 Chemical calculations

35. Conservation of Mass
36. Charges on Ions
37. Formula of Ionic Compounds
38. Balancing Chemical Equations
39. Relative Formula Mass
40. Calculating Moles of an Element (HT only)

B2 Cell division

15. Bacterial division
16. Culturing microorganisms (Required practical 2)
17. Mitosis
18. Stem cells

B3 Organisation and the digestive system

19. Digestive system
20. Digestive enzymes
21. Effect of temperature on enzymes
22. Effect of pH on amylase (required practical 5)
23. Food tests (required practical 4)
24. Absorption in the small intestine

B4 Organising animals and plants

25. The heart and circulation
26. Arteries veins and capillaries
27. The blood
28. Cardiovascular disease
29. Gas exchange and the lungs
30. Plant tissues
31. Transpiration

B5 Communicable diseases

32. Pathogens
33. Measles and HIV
34. Salmonella and gonorrhoea
35. Malaria
36. Infectious disease in plants

B6 Preventing and treating disease

37. Vaccination
38. Antibiotics
39. Testing medicines

B7 Non-communicable diseases

40. Cancer

13. Specific heat capacity (Required practical 1)
14. Heating and insulating buildings

P3 Energy resources

15. Energy demands
16. Renewable energy
17. Nuclear energy
18. Big energy issues

P4 Electric circuits

19. Electrical charge
20. Current and charge
21. Potential difference
22. Component characteristics
23. Series and parallel circuits
24. Resistance (Required practical 3)
25. I-V characteristics (Required practical 4)

P5 Electricity in the home

26. AC and DC supply
27. Mains electricity
28. Electrical power
29. Energy transferred by appliances
30. Appliances and efficiency

P6 Molecules and matter

31. Density
32. Density (Required practical 5)
33. Internal energy
34. Specific Latent heat
35. Pressure in gases

P7 Radioactivity

36. Atomic structure
37. Changes in the nucleus
38. Properties of alpha, beta, and gamma radiation
39. Half life
40. Nuclear issues

41. Calculating Moles of a Compound (HT only) 42. Calculating Mass of a Number of Moles (HT only) 43. Using Moles to Balance Equations (HT only) 44. Avogadro's Constant 1 (HT only) 45. Avogadro's Constant 2 (HT only) 46. Reacting Masses 1 (HT only) 47. Reacting Masses 2 (HT only) 48. Limiting Reactant (HT only) 49. Calculating Percentage Yield 1 (Triple) (HT only) 50. Calculating Percentage Yield 2 (Triple) (HT only) 51. Atom Economy 52. Concentration of Solutions 53. Using Concentration of Solutions 1 54. Using Concentration of Solutions 2 **C5 Chemical changes** 55. Reaction of Metals with Oxygen 56. The Reactivity Series 57. Extraction of Metals 58. Oxidation and Reduction in terms of Electrons (HT only) 59. Acids and Alkalis 60. Acids Reacting with Metals 1 61. Acids Reacting with Metals 2 62. Three Reactions of Acids 63. Required Practical 1: Making Soluble Salts 64. Strong and Weak Acids (HT only) **Spring half Term** **C6 Electrolysis** 65. Introducing Electrolysis 66. Electrolysis of Aluminium Oxide	41. Communicable vs non-communicable 42. Risk factors 43. Lifestyle diseases **B8 Photosynthesis** 44. Photosynthesis 45. Uses of glucose from photosynthesis 46. Photosynthesis (required practical 6) 47. Factors affecting photosynthesis **B9 Respiration** 48. Respiration 49. Exercise and respiration 50. Metabolism	

67. Electrolysis of Aqueous Solutions 1 68. Electrolysis of Aqueous Solutions 2 69. Required Practical 3: Electrolysis **Easter break** **C7 Energy changes** 70. Exothermic and Endothermic Reactions 71. Bond Energy Calculations 1 (HT only) 72. Bond Energy Calculations 2 (HT only) 73. Required Practical 4: Temperature Changes **Revision and mocks – end of year 10**		
Paper 2 - Year 11 **Term start -September** **C8 Rates and equilibrium** 1. Mean Rate of Reaction 2. Using Tangents to Determine Rate (HT only) 3. Effect of Concentration on Rate 4. Required Practical 5: Rates of Reaction 5. Effect of Surface Area on Rate 6. Effect of Temperature on Rate 7. Catalysts 8. Reversible Reactions 9. Concentration and Reversible Reactions (HT only) 10. Temperature and Reversible Reactions (HT only) 11. Pressure and Reversible Reactions (HT only)	**Paper 2 - Year 11** **B10 The human nervous system** 1. Homeostasis 2. The Nervous System 3. Reaction Time (required practical 7) **B11 Hormonal coordination** 4. The Endocrine System 5. Blood Glucose Regulation 6. Menstrual Cycle (Interaction of hormones HT only) 7. Contraception 8. Hormones to treat infertility 9. Negative Feedback **B12 Reproduction** 10. Sexual and Asexual reproduction 11. Meiosis 12. DNA and the genome 13. Alleles 14. Cystic Fibrosis 15. Polydactyly 16. Family trees	**Paper 2 – Y11** **P8 Forces in balance** 1. Vectors and scalars 2. Contact and non-contact forces 3. Resultant forces 4. Resolving forces HT **P9 Motion** 5. Distance-time graphs 6. Velocity-time graphs 7. Further acceleration calculations and terminal velocity 8. Velocity and acceleration **P10 Forces and motion** 9. Newton's first law 10. Newton's second law 11. Newton's third law 12. Acceleration (Required practical 7) 13. Vehicle stopping distance 14. Forces and braking 15. Momentum HT 16. Forces and elasticity

C9 Crude oil and fuels

12. Crude Oil and Hydrocarbons
13. Properties of Hydrocarbons
14. Combustion of Hydrocarbons
15. Fractional Distillation of Crude Oil
16. Cracking
17. Alkenes

Autumn Half Term

Christmas Break

C12 Chemical analysis

18. Purity and Formulations
19. Chromatography
20. Required Practical 6: Chromatography
21. Testing for Gases
22. Flame tests
23. Metal Hydroxide Precipitates
24. Identifying Non-Metal Ions
25. Required Practical 7: Identifying Ions

C13 The Earth's atmosphere

26. The Atmosphere
27. Fossil Fuels
28. The greenhouse effect
29. Climate change
30. Carbon footprint
31. Pollutants from fuels

Spring Half Term

C14 The Earth's resources

32. Using the Earth's Resources
33. Potable Water
34. Required Practical 8: Water
35. Waste Water Treatment
36. Alternative Methods of Extracting Metals (HT only)
37. Life-Cycle Assessment
38. Recycling

Easter Break

17. Inheritance of Sex

B13 Variation and evolution

18. Variation
19. Evolution by Natural Selection
20. Selective Breeding
21. Genetic Engineering

B14 Genetics and evolution

22. Fossils as evidence for evolution
23. Resistant Bacteria as evidence for evolution
24. Classification

B15 Adaptation and interdependence

25. Competition and Interdependence
26. Biotic and abiotic factors
27. Adaptations
28. Sampling Organisms
29. Required practical 9
30. Mean, median, mode

B16 Organisation of an ecosystem

31. Food chains and predator-prey relationships
32. Carbon cycle
33. Water cycle
34. Decomposition
35. Decay (required practical 10)

B17 The effect of human interactions on ecosystems and biodiversity

36. Biodiversity
37. Waste Management
38. Land Use
39. Climate Change
40. Maintaining Biodiversity

17. Stretching a spring (Required practical 6)

P11 Wave properties

18. Transverse and longitudinal waves
19. Properties of waves
20. The wave equation
21. Waves in a ripple tank (Required practical 8)
22. Waves in a solid (Required practical 8)
23. Refraction HT

P12 Electromagnetic waves

24. Electromagnetic waves
25. Uses of electromagnetic waves
26. Infrared (Required practical 10)

P13 Electromagnetism

27. Permanent and induced magnets
28. Magnetic fields
29. Electromagnets
30. The motor effect HT
31. The electric motor

C15 Using our resources 39. Corrosion **End of year 11 - Exams**		