FRAMEWORK FOR LEARNING

CHS South

CREATIVE	An education where imagination, curiosity and resilience enable us to ignite our learning.
HAPPY	A shared belief that optimism, empathy and responsibility are the foundations for a respectful, safe and inclusive community.
SUCCESSFUL	Individuals who are ready to learn, practise being reflective, and are motivated to become champions.

SUBJECT SCIENCE

INTENT

"Every brilliant experiment, like every great work of art, starts with an act of imagination." - **Jonah Lehrer**

The Scientific area of learning is concerned with increasing pupils' knowledge and understanding of our world, and with developing skills associated with Science as a process of enquiry. It will develop the natural curiosity of the child, encourage respect for living organisms and the physical environment and provide opportunities for critical evaluation of evidence.

At CHS south we aim to create Scientists that are curious about the natural world and understand the importance of scientific process. We are passionate about developing a curriculum that is accessible to all and one that enriches through cultural capital and extra-curricular opportunities which are provided throughout the 5-year course.

We encourage students to be inquisitive throughout their time at the school and beyond. The curriculum is designed to ensure that students can acquire key scientific knowledge through practical experiences, using equipment, conducting experiments, building arguments and explaining concepts confidently. The school's approach to science takes account of the school's own context, ensuring access to people with specialist expertise and places of scientific interest as part of the school's commitment to learning outside the classroom.

CHS SOUTH - CURRICULUM - FRAMEWORK FOR LEARNING

YEAR GROUP	YEAR 10

RATIONAL / NARRATIVE

In year 10, pupils will continue to develop the skills and key ideas they have already learnt in biology, chemistry and physics.
The complex and diverse phenomena of the natural world can be described in terms of a small number of key ideas in biology, chemistry and physics:
Key ideas in biology:

- life processes depend on molecules whose structure is related to their function
- the fundamental units of living organisms are cells, which may be part of highly adapted structures including tissues, organs and organ systems, enabling living processes to be performed effectively
- organic compounds are used as fuels in cellular respiration to allow the other chemical reactions necessary for life
- the characteristics of a living organism are influenced by its genome and its interaction with the environment

Key ideas in chemistry:

- matter is composed of tiny particles called atoms and there are about 100 different naturally occurring types of atoms called elements
- elements show periodic relationships in their chemical and physical properties
- these periodic properties can be explained in terms of the atomic structure of the elements
- energy is conserved in chemical reactions so can therefore be neither created or destroyed.

Key ideas in physics:

- the use of models, as in the particle model of matter or the wave models of light and of sound
- the concept of cause and effect in explaining such links as those between force and acceleration, or between changes in atomic nuclei and radioactive emissions
- the phenomena of 'action at a distance' and the related concept of the field as the key to analysing electrical, magnetic and gravitational effects

Students will cover a wide range of topics described below (which can be found in the unit 1 AQA trilogy specification). This will help to equip the students with the knowledge base and skills to pursue further education in science and hopefully a future career in STEM.
The material underlined in italics is the separate science material that will be taught to the top set, with the premise that they will study separate sciences with specialist teachers in year 11.
The numbers below reference the AQA specification which can be accessed via this link (this is the programme of study followed in years 10 and 11):
https://filestore.aqa.org.uk/resources/science/specifications/AQA-8464-SP-2016.PDf

TERM KNOWLEDGE

AUTUMN 1	AUTUMN 2	SPRING 1	SPRING 2	SUMMER 1	SUMMER 2
Chem 5.1 Atomic structure and the periodic table 5.1.2.2 Development of the periodic table 5.1.2.3 Metals and non-metals 5.1.2.4 Group 0 5.1.2.5 Group 1 5.1.2.6 Group 7 *Chemistry*	Phys 6.2 Electricity 6.2.1.1 Circuit diagrams 6.2.1.2 Electrical charge and current 6.2.1.3 Current, resistance and potential difference 6.2.1.4 Resistors 6.2.2 Series and parallel circuits 6.2.3.1 AC and DC 6.2.3.2 Mains Electricity	Biology 4.4 Unit 1 Biology. Bio 4.1 Cell Biology 4.1.3.1 Eukaryotes and prokaryotes 4.1.2.1 Chromosomes and mitosis 4.1.3.3 active transport *Biology* *4.1.1.6 culturing microorganisms* Bio 4.2 Organisation	Chem 5.4 Chemical changes 5.4.1.1 Metal oxides 5.4.1.2 The reactivity series 5.4.1.3 Extraction of metals 5.4.1.4 Oxidation and reduction 5.4.2.1 Reaction of acids with metals	Chemistry 5.5 5.5.1.1 Exo and Endothermic reactions 5.5.1.2 Reaction profiles 5.5.1.3 Energy change of reactions *Chemistry* *4.5.2.1 Cells and batteries* *4.5.2.2 Fuel cells* Phys 6.3 Particle model of matter 6.3.1.1 of materials	Revision for unit 1 exam. Chemistry. Phys 6.4 Atomic structure and radiation 6.4.1.1 The structure of an atom 6.4.2.1 Mass number, atomic number and isotopes 6.4.1.3 The development of the model of the atom

	4.1.3.1 Properties of transition metals Chem 5.2 Bonding, structure, and the properties of matter 5.2.1.1 Chemical bonds 5.2.1.2 Ionic bonding 5.2.1.3 Ionic compounds 5.2.1.4 Covalent bonding 5.2.1.5 Metallic bonding 5.2.2.1 The three states of matter 5.2.2.2 State symbols 5.2.2.3 Properties of ionic compounds 5.2.2.4 Properties of small molecules 5.2.2.5 Polymers 5.2.2.6 Giant covalent structures 5.2.2.7 Properties of metals and alloys 5.2.2.8 Metals as conductors 5.2.3.1 Diamond 5.2.3.2 Graphite 5.2.3.3 Graphene and fullerenes *Chemistry* *4.2.4.1 Sizes of particles and their properties* *4.2.4.2 Uses of nano particles* Biology – 4.3 Infection and response 4.3.1.1 communicable diseases 4.3.2.1. viral diseases 4.3.1.3 Bacterial diseases 4.3.1.4 Fungal diseases 4.3.1.5 Protist diseases 4.3.1.6 Human defence systems 4.3.1.7 Vaccination	6.2.4.1 Power 6.2.4.2 Energy transfers in everyday appliances 6.2.4.3 The national grid *Physics* *4.2.5.1 Static charge* *4.2.5.2 Electric fields* Bioenergetics 4.4.1.1 Photosynthetic reaction 4.4.1.2 Rate of photosynthesis 4.4.1.3 Use of glucose 4.4.2.1 Aerobic and Anaerobic 4.4.2.2 Response to exercise 4.4.2.3 Metabolism Revision for unit 1 exam.	4.2.3.1 Plant tissues 4.2.3.2 Plant organ systems Biology revision – Progress test (unit 1 Biology).	5.4.2.2 Neutralisation of acids and salts 5.4.2.3 Soluble salts 5.4.2.4 The pH scale 5.4.2.5 Strong and weak acids 5.4.3.1 The process of electrolysis 5.4.3.2 Electrolysis of ionic compounds 5.4.3.3 extraction using electrolysis *Chemistry* *4.4.2.5 titrations* Chem 5.3 quantitative chemistry 5.3.1.1 Conservation of mass and balanced chemical equations 5.3.1.2 Relative formula mass 5.3.1.3 Mass changes 5.3.1.4 Chemical measurements 5.3.2.1 Moles 5.3.2.2 Amount of substances in equations 5.3.2.3 Using Moles to balance equations 5.3.2.4 Limiting reactions 5.3.2.5 Concentration of solutions *Chemistry* *4.3.3. Yield and atom economy* *4.3.4 Using concentrations* *4.3.5 Use of amount of substance in relation to volume of gas*	6.3.1.2 Changes of state 6.3.2.1 Internal energy 6.3.2.2 Temperature changes and specific heat capacity 6.3.2.3 Changes of state and latent heat 6.3.3.1 Particle motion of gases *Physics* *4.3.3.2 Pressure in gases* *4.3.3.3 Increasing the pressure of a gas*	6.4.2.1 Radioactive decay and nuclear radiation 6.4.2.2 Nuclear equations 6.4.2.3 Half life 6.4.2.4 Radioactive contamination *Physics* *4.4.3.1 Background radiation* *4.4.3.2 Different half lives* *4.4.3.3 Uses of nuclear radiation* *4.4.4.1 Nuclear fission* *4.4.4.2 Nuclear fusion* **Phys 6.5 Forces** 6.5.1.1 Scalar and vector quantities 6.5.1.2 Contact and noncontact forces 6.5.1.3 Gravity 6.5.1.4 Resultant forces 6.5.2 Work done and energy transfer 6.5.3 Forces and elasticity Required practical activity 18: force and extension of a spring 6.5.4.1.1 Distance and displacement 6.5.4.1.2 Speed 6.5.4.1.3 Velocity 6.5.4.1.4 The distance–time relationship 6.5.4.1.5 Acceleration 6.5.4.2.1 Newton's First Law 6.5.4.2.2 Newton's Second Law Required practical activity 19: force and acceleration 6.5.4.2.3 Newton's Third Law 6.5.4.3.1 Stopping distance

	4.3.1.8 Antibiotics and Pain killers 4.3.1.9 Discovery and development of drugs *Biology* *4.3.2.2 producing monoclonal antibodies* *4.3.2.2 using monoclonal antibodies* *4.3.3.1 Detection and identification of plant diseases* *4.3.3.2 Plant defence response*					6.5.4.3.2 Reaction time 6.5.4.3.3 Factors affecting braking distance 1 6.5.4.3.4 Factors affecting braking distance 2 6.5.5.1 Momentum is a property of moving objects (HT only) 6.5.5.2 Conservation of momentum (HT only)
SKILLS	**5.2 Bonding and 4.3 infection and response skills:** Visualise and represent 2D and 3D forms including two dimensional representations of 3D objects. WS 1.2, 1.4, 1.6 WS 1.2 MS 4a MS 1a, 1c Recognise substances as small molecules, polymers or giant structures from diagrams showing their bonding. Students will plan, prepare and deliver speeches on types of pathogen and evaluate each other's work.	**Phys 6.2 Electricity** Students should be able to recall and apply the following equations: Q=It V= IR P= VI P= I2R E= Pt E= QV Physics AT 1 – use appropriate apparatus to measure and record length accurately. Physics AT 6 – use appropriate apparatus to measure current, potential difference and resistance. Physics AT 7 – use circuit diagrams to construct and check series and parallel circuits. AT 6 Investigate the relationship between the resistance of a thermistor and temperature. Investigate the relationship between the resistance of an LDR and light intensity	**Biology** 4.4 Bioenergetics MS 3d Solve simple algebraic equations. MS 1a, 1c, 2c, 3d, 4a, 4c MS 3a, 3d (HT only) WS 1.4 Use data to relate limiting factors to the cost effectiveness of adding heat, light or carbon dioxide to greenhouses. AT skills covered by this practical activity: biology AT 1, 2, 3, 4 and 5. AT1 Use of appropriate apparatus to make and record a range of measurements accurately. AT 2 Safe use of appropriate heating devices and techniques including use of a Bunsen burner and a water bath or electric heater. AT 3 Use of appropriate apparatus and techniques for the observation and measurement of biological changes and/or processes.	**Chem 5.3 and 5.4 Chemical** changes and E**nergy Changes** AT 1, 2,6 Opportunities within investigation of mass changes using various apparatus. AT 3 This is an opportunity to investigate pH changes when a strong acid neutralises a strong alkali. AT 6 Mixing of reagents to explore chemical changes and/or products. MS 1a Recognise and use expressions in decimal form. MS 1b Recognise and use expressions in standard form. MS 1c Use ratios, fractions and percentages. MS 2a Use an appropriate number of significant figures. MS 2h Make order of magnitude calculations. MS 3a Understand and use the symbols: =, <>, >,	**Phys 6.3 Particle model of matter** A large part of the unit will focus on mathematical skills, students will be required to recall and use the following equations. ρ = m /V Δ E = m c Δ θ E = m Lv E = m Lf **Students will complete:** **Required Practical 17 – density** **Required Practical 13 – Specific Heat Capacity** MS 1a Recognise and use expressions in decimal form. MS 1b Recognise and use expressions in standard form. MS 1c Use ratios, fractions and percentages. MS 3b Change the subject of an equation. MS 3c Substitute numerical values into algebraic equations using	**Phys 6.4 Atomic structure and radiation** MS 1b WS 4.4 Students should be able to recognise expressions given in standard form WS 1.1, 1.6 This historical context provides an opportunity for students to show an understanding of why and describe how scientific methods and theories develop over time. WS 1.1 Why the new evidence from the scattering experiment led to a change in the atomic model WS 1.2 The difference between the plum pudding model of the atom and the nuclear model of the atom. WS 1.5 Students should be able to compare the hazards associated with contamination and irradiation

		MS 1c Use ratios, fractions and percentages. MS 3b Change the subject of an equation. MS 3c Substitute numerical values into algebraic equations using appropriate units for physical quantities. MS 3d Solve simple algebraic equations WS 1.2, 1.4: The application of LDRs in circuits e.g. switching lights on when it gets dark is required. WS 1.5: Most electrical appliances are connected to the mains using three core cable. The insulation covering each wire is colour coded for easy identification: **Students will complete:** **Required *Practical 2 – culturing microorganisms.*** **Required practical activity 15:** **Use circuit diagrams to set up and check appropriate circuits to investigate the factors affecting the resistance of electrical circuits. This should include:** **The length of a wire at constant temperature** **Combinations of resistors in series and parallel.**	**Students will complete:** **Required Practical 5: investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed.**	∝, ~ MS 3b Change the subject of an equation. MS 3c Substitute numerical values into algebraic equations using appropriate units for physical quantities. **Students will complete:** **Required Practical 8 – salt preparation** **Required practical 9 - electrolysis** **Required practical 10- temperature changes**	appropriate units for physical quantities. MS 4a Translate information between graphical and numeric form AT 5 Perform an experiment to measure the latent heat of fusion of water **Students will complete:** **Required practical 10- temperature changes**	
ASSESSMENT	Students will be assessed on:	Students will be assessed on: EOT with teacher assessment - **Describing**	Students will be assessed on: EOT with teacher assessment – **graph and**	Students will be assessed on: EOT with teacher assessment – **correcting a**	Students will be assessed on: EOT with teacher assessment – **explaining**	Students will be assessed on:

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	EOT with teacher assessment - **Comparing properties of metals** EOT with teacher assessment - **Writing a comparison for Bonding (ionic / covalent and metallic)** Group presentation – types of pathogen	**the primary and secondary defence systems.** EOT with teacher assessment – **writing a method for required prac (resistance in a wire).**	**conclusion for pond weed investigation.** **<u>Progress test – Unit 1 Biology</u>**	**method for the production of a soluble salt from an insoluble metal oxide or carbonate.** EOT with teacher assessment – **copper extraction and recycling.**	**the how to measure the specific heat capacity of a metal safely.** **EOT** with teacher assessment – **kinetic theory of solids, liquids and gases.**	EOT with teacher assessment – **explaining the plum pudding model** **<u>Progress test – Unit 1 (Physics and Chemistry)</u>**
HOME LEARNING	Weekly quizzes set on Educake covering the terms topics, 5.1, 5.2 and 4.3.	Weekly quizzes set on Educake covering the terms topics, 4.1, 4.2 and 6.2.	Weekly quizzes set on Educake covering the terms topics, 4.4 and 5.4. Revision booklet to support with revision for progress test. Unit 1 Biology.	Weekly quizzes set on Educake covering the terms topics, 5.5 and 5.3.	Weekly quizzes set on Educake covering the terms topics, 6.3 and 6.4.	Weekly quizzes set on Educake covering the terms topics, 6.4. Revision booklet to support with revision for progress test. Unit 1 Physics.
READING, WRITING, TALK, NUMERACY	**Reading:** Students will read information sheets on various types of bonding and answer comprehension questions. Students will read an article on polymers and answer comprehension questions. Students will read about the history of the atom. **Writing** Students will use CUSTARD to develop their writing skills specific to comparisons. **Talk** Students will present work on the types of pathogen and describe the symptoms, treatments for disease. **Think pair share:**	**Reading** Students will read and write a method for how changing the length of a wire affects its resistance. Students will read about the factors that affect resistance. **Writing and talk** Students will demonstrate familiarity with CUSTARD showing their development of how to write comparisons. Students will also develop their method writing skills from KS3. **Think pair share:** **Students will discuss the following key words and topics in class:** What is charge? What is voltage, current and resistance? What factors affect resistance and why?	**Reading:** Students will read about how to investigate the effects of light intensity on photosynthesis. Student's will also read about the limiting factors that affect the rate of photosynthesis. **Writing:** Students will write a method about how changing light intensity affects the rate of photosynthesis in pond weed. They will also conclude and evaluate the investigation. **Think pair share:** **Students will discuss the following key words and topics in class:** Why does temperature, chlorophyll and light intensity affect the rate of photosynthesis?	**Writing:** Students will write a method about how to produce a soluble salt. They will also conclude and evaluate the investigation. Students will write a method about how to carry out the electrolysis of brine. They will also conclude and evaluate the investigation. Students will write and form conclusions for the following investigations: metals + oxygen Soluble and insoluble salts Displacement Electrolysis Students may be asked to explain how atom economy and percentage yield helps scientists to	**Writing:** Students will write a method about how to carry out exothermic and endothermic investigations. They will also conclude the investigation. Students will write a method about how to calculate the density of regular and irregular objects Students will write a method about how to investigate the specific heat capacity of different metals **Think pair share:** **Students will discuss the following key words and topics in class:** Specific heat capacity Latent heat Exothermic Endothermic Pressure (in a gas)	**Talk** **Think pair share:** **Students will discuss the following key words and topics in class:** The history of the atom and the way models are used to describe atomic structure and electron movement in shells or energy levels. The uses and dangers associated with short term and long-term radioactive sources. Discussing power generation in Chernobyl and Fukushima and how nuclear may help support with lowering global emissions. Discuss fusion as a future model for power generation and the reason it is not currently used. **Think pair share:**

	Students will discuss the following key words and topics in class: What is a communicable / non communicable disease? The importance of vaccines and antibiotics How evidence led to the evolution of the atom and theories surrounding its evolution.	Why do metals conduct?	Why does your heartbeat faster when you exercise? Why do we need to breathe faster?	improve sustainability and lower industrial costs. **Think pair share:** **Students will discuss the following key words and topics in class:** mnemonics to remember the reactivity series and use models to discuss displacement. strong, weak, dilute and concentrated.		**Students will discuss the following key words and topics in class:** Half life Decay Fission fusion
TIER 2 VOCABULARY	Analyse Compare Describe Explain Formula, Suggest, Develop Outline Estimate Examine Respond Review	Analyse Data, Design Function Illustrate Support Contract Principle Relate Outline Respond Review	Research Determine Deduce Derive, Estimate Evident	Balance Benefit Calculate, Data, Find Formula Select Apply Deduce	Area Calculate Context Data Discuss Find Formula Occur State Consider Factor Develop Interpret Deduce	Annotate Comment Describe Develop Find Process Research Suggest Summarise Environment Source Deduce Derive
TIER 3 VOCABULARY	Metallic bonding Delocalised Ionic bonding Covalent bonding Properties Melting point Boiling point Conductivity Inter molecular forces Pathogen Microorganism Antiretroviral Phagocyte Vaccination	Alternating / Direct current Oscilloscope Frequency Conductor Insulator Characteristics Transformer Efficiency Voltage Current Resistance Charge	Respiration Anaerobic Aquatic Oxidation Oxygen debt Accumulated Metabolism	Activation Energy Reversible Dynamic Endothermic Exothermic Equilibrium Le Chatelier Mole Concentration Base Neutralisation Soluble Insoluble Salt Electrolysis Aqueous Anode Cathode	Endothermic Exothermic Latent heat of vaporization Latent heat of fusion Density Pressure Reduction Oxidation	Radioactive, Ionising Nuclear equation Contamination Irradiation Half-life Decay

PSPSMC, BRITISH VALUES AND DIVERSITY	**Social, Moral and Spiritual:** Students will learn about how electricity is generated from a variety of sources, both renewable and non-renewable and how demand is met to keep a stable supply for the country. **Cultural :** Students will learn how reactions can be modified by a set of conditions which will allow the maximum amount of money to be made by industrial chemical companies especially when producing ammonia and fertilisers. Students will have a variety of opportunities to work partake in group work with their peers: practical experiments; discussions; debates; sharing ideas and group presentations. Students will look at the pro's and cons of the extraction of metals and metal ores on the environment and the costs, not only financial of these processes. **Social:** Students will study the nuclear model of the atom and its development over time to the model we know and understand now, they will be taught that much of this development took place in Manchester at the turn of the last century. The processes of radioactive decay and the uses and dangers of these materials will be studied. Classes will reference nuclear disasters including Chernobyl.