

KS4 Science

Head of Department: Ms Balogun



Curriculum Intent

We **serve** our students with an adaptive curriculum that meets the needs of all. Our different subjects have carefully identified plans outlining, what they teach and why. This is shared with all students, staff and parents to empower our community in their learning journey and includes careful consideration of sequencing of knowledge and skills. Cardinal Pole is committed to providing **opportunities** for staff and students to become life-long lovers of learning through personalised feedback, opportunities for reflection and progression. We are a community of **aspirant** learners where teachers are experts and students are critical scholars. This is achieved through absolute clarity of expectations and constant re-evaluation of needs through a shared language. We **reward** our community of learners by celebrating the successes, progress and achievements of all.

How do all KS4 Science lessons start? (Ready to Learn)

All lessons at Cardinal Pole start with a 'Ready to Learn' activity. The purpose of this is to support retrieval and prepare students for the lesson with recalling relevant knowledge. This activity is printed for students and handed out at the door. Students are expected to sit at their desk immediately and complete the task before sticking it in their books while the teacher welcomes the class and takes the register.

Ready to learn activities in **Science** look like this:

Y10 Science

Year 11

AP2
DIRT

AP2

C5 Energy changes, RQP 9
and topic test

C4b Electrolysis and
topic test

C4a Reactions of
acids and RQP 8

P2 Series, parallel
circuits, resistance and RQP 15

P2 Power, national grid
and topic test

C4a Redox and
metal
extraction

P4 Half-life and
topic test

C2 Giant covalent
structures,
molecules, metallic
bonding and topic
test

P2 IV
characteristics,
changing
resistance, RQP 16
and UK mains

C2 Types of bonds and their properties

P4 Radiation
and the effects

AP1 revision

P3 Particle model

B5 Contraception,
treating infertility,
negative feedback
and topic test

P1 Energy resources and
topic test

P1 Energy, power, specific
heat capacity and RQP 14

B5 The human
endocrine system –
blood glucose and
menstrual cycle

B5 Homeostasis, the nervous
system and RQP 6

B3 Communicable diseases and the
body defense mechanisms

B3 Humans battling
communicable diseases
and topic test

B2 Health – non-communicable
diseases and topic test

B2 Organisation in plants and
transport

B2 Organisation, human digestion
and enzymes

B2 The human circulatory system –
Heart, lungs and blood vessels

How is your attainment measured in Year 10 in Autumn term?

Autumn: HT1

Organisation (B2) Topic test	40 mark topic test covering current topic - assessed by teacher and DIRT
Plant tissue and infection and response (B2/3) Topic test	40 mark topic test covering current topic - assessed by teacher and DIRT

Autumn: HT2

Homeostasis and response (B5) Topic test	40 mark topic test covering current topic - assessed by teacher and DIRT
Nervous system (B5) quiz	15 mark quiz -assessed by teacher and DIRT

Assessment Point 1

What is assessed?	% of course	Why?
Biology paper 1	16.6	Covering key topics that come up in GCSE combined science biology paper 1 (actual paper) allowing students to practice what the real paper will be like – 70 marks
Chemistry paper covering C1 and C8	16.6	Covering key topics that come up in GCSE combined science chemistry paper 1 and KS3 chemistry content – 70 marks
Synoptic paper??	16.6	Covering key topics that come up in GCSE combined science allowing students to practice what the real paper will be like – 70 marks

How is your attainment measured in Year 10 in Autumn term?

Emerging	Achieving	Excelling
Digestion and Enzymes I can define cells, tissues and organs and organ systems I can define an enzyme and state three enzymes needed in the body I can recall the name of the 4 food tests: sugars, carbohydrates, proteins and fats I can carry out the steps and recall equipment needed for the effect of pH on the rate of reaction of amylase Heart I can name the three types of blood vessels in the body: arteries, veins and capillaries I can name the parts and state the composition of blood I can define coronary heart disease (CHD) Health I can define non-communicable disease and give examples e.g. cancer, diabetes, obesity	Digestion and Enzymes I can state the functions of different organs in the digestive system I can recall simple word equations for the breakdown of lipids, proteins and fats I can recall the positive test results for the 4 food tests: sugars, carbohydrates, proteins and fats I can describe how effect of pH and temperature affects the rate of reaction of amylase Heart I can describe the layers and structures in each of the three blood vessels: arteries, veins and capillaries I can describe the function of the different parts of blood I can describe the causes and treatments for CHD e.g. stents and statins Health I can describe what a causal mechanism vs. correlation is using graphical data	Digestion and Enzymes I can describe and the explain the journey of food in the digestive system into the bloodstream I can use the 'lock and key theory' to explain enzyme action I can write a scientific method using apparatus for food tests for sugars, carbohydrates, proteins and fats I can analyse the effect of pH and temperature on the rate of reaction of amylase Heart I can link structure to function of each of the three blood vessels: arteries, veins and capillaries I can explain how the parts are adapted to their functions I can explain the advantages and disadvantages of biological and mechanical valves, and artificial and transplant hearts Health I can explain how lifestyle factors like diet, alcohol and smoking affects the cases of non-communicable disease globally and nationally

How is your attainment measured in Year 10 in Autumn term?

Emerging	Achieving	Excelling
Plant I can state the different tissues in a leaf I can state the functions of xylem, phloem and root hair cells I can define transpiration and state the factors that affect the rate of transpiration Infection and response I can name diseases caused by pathogens: viruses, bacteria, fungi and protists I can define a vaccine I can recall the difference between antibiotics and painkillers and state examples I can recall that drugs can be discovered traditionally from natural sources e.g. foxgloves, willow and mould	Plant I can describe the functions of the different tissues in a leaf= I can describe adaptations of each xylem, phloem and root hair cells I can explain how the rate of transpiration changes with factors e.g. light, temperature, humidity, wind Infection and response I can describe how bacteria and viruses cause harm in different ways and give treatments for some diseases I can explain how spread of pathogens is reduced by immunising the population I can describe the risks of overusing antibiotics I can identify some key steps in drug development with the intention for testing for safety, efficacy and dosage	Plant I can explain how structures of plant tissues are related to their functions I can explain how the structure of root hair cells, xylem and phloem are adapted to their function I can explain how a potometer measures the rate of transpiration when changing conditions Infection and response I can identify symptoms of some diseases and give some treatments/ preventions of all diseases I can outline all the key steps involved in how a vaccine works to become effective in immunising I can explain why antibiotics can only be used to treat bacterial not viral disease I can explain the stages of drug development including pre-clinical and clinical trials and double-blind trials

How is your attainment measured in Year 10 in Autumn term?

Emerging	Achieving	Excelling
Homeostasis and response I can state the definition of homeostasis. I can identify the three conditions regulated in the human body. I can list the three mandatory components of an automatic control system. I can recall examples of coordination centres used by the body. I can define the endocrine system and identify hormones as chemical messengers. I can locate the six main endocrine glands on a body diagram. I can identify the pituitary gland as the body's master gland. I can state that insulin is released when blood sugar is high.	Homeostasis and response I can explain why homeostasis is needed for optimum enzyme action. I can trace a reflex arc from receptor, through neurones, to effector. I can identify the brain, spinal cord, and pancreas as coordination centres. I can explain why reflex actions are rapid and automatic I can compare the nervous and endocrine systems by speed and duration. I can explain how insulin causes glucose to move into liver and muscle cells. I can describe how FSH, LH, oestrogen, and progesterone interact during the menstrual cycle. I can evaluate the use of barrier, hormonal, and chemical methods of contraception	Homeostasis and response I can explain how negative feedback cycles restore conditions to optimum. I can describe how neurotransmitters diffuse across a synapse. I can extract and interpret data from reaction time graphs. I can deduce how a damaged pathway component stops a response. I can explain how glucagon interacts with insulin in a negative feedback cycle (Higher Tier). I can interpret glucose tolerance graphs to distinguish Type 1 from Type 2 diabetes. I can explain how hormones are used in modern fertility treatments and IVF (Higher Tier). I can explain the roles of adrenaline and thyroxine in feedback loops (Higher Tier)

Topic: B2 organisation

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Principles of organisation	Emerging - Cells are the building blocks of organisms Achieving - Organs are groups of tissues with specific functions Excelling - Multicellular organisms are organised as they are large and complex	1) Define cell 2) Define a tissue and give 2 examples 3) Define an organ and give 2 examples 4) Define an organ system and 3 examples 5) Explain the difference between unicellular and multicellular organisms
The Human Digestive system	Emerging - Digestive system digests and absorbs food Achieving - Describe the journey of food from the mouth to the rectum Excelling - Stomach digests food, small intestine digests and absorbs food into the blood, liver produces bile	1) Describe the role of the digestive system 2) Write a flowchart for the journey of food from the mouth to the rectum 3) State the function of the stomach and small intestine 4) Describe the function of the small intestine 5) Explain how the stomach, small intestine, large intestine and liver all work together to carry out absorption of food and water
Digestive enzymes and action	Emerging - An enzyme is a biological catalyst Achieving - The function and sites of production of amylase, protease and lipase in digestion Excelling - The lock and key theory shows that an enzyme's active site is specific to their substrate	1) Define an enzyme 2) Make a table to show what each enzyme breaks down and into what products 3) State where each enzyme is produced 4) Describe why enzyme action is called the lock and key theory 5) Explain how starch is digested by amylase

Topic: B2 organisation

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Required practical: Food tests	Emerging - The 4 reagents are iodine (starch), Benedicts (suagrs), Biuret (protein), ethanol (fats) Achieving - Carrying out the practical following a written method Excelling - Recalling the method for each with correct apparatus	1) State what each reagent tests for and the positive result 2) Name the correct equipment for combining small volumes of liquids 3) Name the correct equipment for adding drops of liquids 4) Write a scientific and logically sequence method to test for sugar, starch, protein and fats
Required practical: Food tests analysis	Emerging - The colours for positive result Achieving - Write a method for testing for carbohydrates, fats and protein Excelling - Recalling the method for each with correct apparatus considering safety precautions	1) State how to measure volumes of a liquid 2) Describe the safety precautions for carrying out food tests 3) Describe the test for sugars and how it is different to testing for proteins 4) Describe the different results for the tests for sugars 5) Explain why a water bath is used rather than a Bunsen burner
Factors affecting the rate of enzymes	Emerging - Rate of reaction is used to describe how quickly a reaction happens Achieving - Enzymes need optimum conditions to function properly Excelling - Enzymes active site will denature if the temperature is too high or the pH is too low or too high	1) Define rate of reaction 2) Define denature 3) Describe what happens if the temperature of the enzyme is too low 4) Describe what happens if the temperature is too high 5) Describe why if the pH is too low or too high it will no longer work
Required practical: Effect of pH on amylase theory	Emerging - Rate of reaction for starch being broken down can be measured by how quickly iodine turns black to orange in a spotting tile Achieving - A solution called a buffer can change the pH which alters the rate of amylase activity Excelling - Control variables are important in maintaining the validity of an experiment	1) State what is meant by independent, dependent and control variables 2) State the independent and dependent variables in this experiment 3) Explain why we use a spotting tile with drops of iodine in this experiment 4) Explain how we can use the colour change as an indication of rate of reaction 5) List three control variables and explain why they are needed in the experiment

Topic: B2 organisation

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Required practical: Effect of pH on amylase practical	Emerging - Carrying out the steps using a written method Achieving - Rate of reaction is measured using a timer and recording when iodine turns orange Excelling - Recalling the effect of pH on breakdown of starch using amylase and identifying the optimum pH for amylase	1) Draw a table and record your results 2) Describe the trend in your results, which pH was the optimum for enzyme activity? 3) Explain why for some pH's the iodine stayed black and did not change colour 4) Suggest why you think the optimum pH is this for amylase, using where it is produced / acts
Required practical: Effect of pH on amylase analysis	Emerging - The independent variable is pH, the dependent variable is rate of reaction Achieving - Write a method for effect of pH on amylase activity Excelling - Recalling the method for each with correct apparatus considering safety precautions	1) State which axis will have the independent and dependent variables 2) Use your data in your table to produce a line graph for pH against time to break down starch 3) Draw a line of best fit for your graph 4) Explain your graph in terms of enzyme activity where pH is too low or too high
The Heart	Emerging - The right side of the heart carries deoxygenated blood and left carries oxygenated Achieving - Label the parts of the heart Excelling - Describe the journey of blood from the body to heart, to the lungs and back to the heart and the rest of the body	1) State the names of the 4 chambers 2) State what is meant by double circulatory system 3) Define the word "pulmonary" 4) Define the words "artery" and "vein" 5) Write a flowchart showing the journey of blood from the vena cava to the aorta
Heart Dissection	Emerging - Dissect a heart safely using a scalpel, apron and gloves Achieving - Identify chambers of the heart and locate valves and coronary arteries Excelling - Locate main blood vessels	1) State the role of coronary arteries 2) Describe how to carry out a heart dissection safely using a scalpel 3) Complete a heart dissection with labelled parts on the heart where you have located different chambers and blood vessels 4) Locate the septum and explain the function

Topic: B2 Organisation

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Blood vessels	Emerging - Veins, arteries, capillaries all have different roles which link to their structure Achieving - Arteries carry blood away at high pressure, veins carry blood towards the heart at low pressure, capillaries is the site of exchange between the blood and cells Excelling - Compare the thickness and sizes of all three blood vessels	1) Name the three blood vessels 2) Give the role of each blood vessel 3) Explain why veins have valves but arteries do not 4) Order the blood vessels in size from smallest to largest 5) Arteries and veins have very different structures. Compare their lumens and the thickness of elastic and muscle layers
Blood	Emerging - Blood is a tissue consisting of plasma, red blood cells, white blood cells and platelets Achieving - Recognise different parts of the blood on a diagram Excelling - Describe the functions of each part of the blood in the body	1) Name the substances found in the plasma 2) Describe the structure and function of red blood cells 3) Label the parts of the diagram of the blood 4) Describe the function of white blood cells 5) Describe the function of platelets in protecting the body
Coronary Heart Disease	Emerging - Coronary heart disease is fatty material build up in the coronary arteries, narrowing them Achieving - Reduced blood flow in the coronary arteries, leads to lack of oxygen for the heart muscle and possible heart attacks/ angina Excelling - Stents are a metal mesh designed to open blocked arteries whereas statins are drugs that lower blood cholesterol	1) Define coronary heart disease 2) Explain how coronary heart disease can lead to a heart attack 3) Define stent and explain its use 4) Define statins and explain their use 5) Suggest why both stents and statins may be used together and where one may be more useful than another

Topic: B2 Organisation

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Faulty Hearts and Valves	Emerging - Faulty heart valves may become leaky, reducing blood flow in the heart Achieving - Leaky valves allow blood to flow backwards, reducing oxygen delivery to muscle cells Excelling - Faulty valves can be treated using biological valves (from animals) or mechanical valves; each has advantages and disadvantages such as durability, clotting risk, and need for lifelong medication	1) Define what is meant by a faulty heart valve 2) Describe how faulty valves affect blood flow and oxygen delivery 3) Evaluate the use of biological and mechanical replacement valves 4) Suggest why a young patient and an older patient might choose different types of replacement valves
Health and non-communicable diseases	Emerging - Health is defined as the state of physical and mental well-being, Achieving - Non-communicable diseases are not caused by pathogens and often develop due to lifestyle factors, genetics, or environmental exposure. Excelling - Risk factors: smoking, alcohol, poor diet, and stress can interact, increasing the likelihood of non-communicable diseases and placing a large financial burden on healthcare systems	1) Define health 2) Explain the difference between communicable and non-communicable disease 3) Describe how lifestyle factors can increase the risk of non-communicable diseases 4) Explain what is meant by a “risk factor” and give examples. 5) Discuss how non-communicable diseases can impact society and the NHS.
Diet, smoking, exercise and disease	Emerging - Diet, smoking, and no exercise increases risk of cardiovascular disease and obesity Achieving - Smoking affects heart and lung function, diet high in fat/sugar increases cholesterol/ blood pressure; exercise maintains a healthy BMI and strengthens heart Excelling - Smoking causes artery narrowing and lung tissue damage, high-fat diets increase atherosclerosis, and exercise improves cardiac output and insulin sensitivity	1. Describe how poor diet can increase the risk of cardiovascular disease 2. Explain how smoking affects the lungs and the heart 3. Describe how exercise maintains a healthy body mass 4. Explain how lifestyle choices interact to increase disease risk 5. Evaluate why public health campaigns target smoking, diet, and exercise.

Topic: B2 Organisation

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Cancer	Emerging - Cancer is caused by uncontrolled cell division, forming tumours Achieving - Benign tumours stay in one place, whereas malignant tumours invade neighbouring tissues and spread to other parts of the body Excelling - Risk factors such as smoking, UV, viral disease, genetics can trigger mutations that lead to cancer; malignant tumours spread	1) Define cancer and explain how tumours form 2) Describe the difference between benign and malignant tumours 3) Explain how malignant tumours spread through the body 4) Identify lifestyle and genetic risk factors for cancer 5) Suggest why early detection greatly improves cancer survival rates
Plant tissues, organs and leaf structure	Emerging - Leaves, stems and roots are all organs, root hair cells and palisade cells are cells Achieving - Palisade and spongy mesophyll are tissues that work together to carry out photosynthesis Excelling - Explain the adaptations of each section of the leaf	1) State the function of palisade cells 2) State two tissues found in the leaf 3) Describe the adaptations of the palisade mesophyll layer 4) Describe the adaptations of the spongy mesophyll layer 5) Explain how leaves are adapted for their function include stomata in your answer.
Transport in plants: Xylem and phloem	Emerging - Xylem and phloem are tissues found in the stem that transport water and sugar Achieving - Xylem made up of dead cells, water travels up only, phloem live cells transports in both directions Excelling - Xylem has lignin for strength, phloem has companion cells with many mitochondria	1) Describe the role of the xylem 2) Describe the role of the phloem 3) Define transpiration and translocation 4) Explain how the xylem is adapted for its function 5) Explain how the phloem is adapted for its function

Topic: B2 Organisation

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Transpiration and factors affecting the rate	Emerging - Transpiration is the movement of water up the xylem, water evaporates from the surface of the leaf Achieving - The role of the stomata in opening and closing affects the transpiration stream Excelling - The rate of transpiration increases or decreases depending on light, temperature, humidity, air movement	1) Define transpiration 2) Define stomata and describe how they open and close 3) Describe the relationship between evaporation and transpiration in a plant 4) Explain how increased humidity affects the rate of transpiration 5) Explain how increased temperature affects the rate of transpiration
Factors affecting the rate and potometer	Emerging - The rate of transpiration can be measured using a potometer Achieving - A potometer measures the rate of transpiration by using a scale/ ruler for the movement of the air bubble in a given time using a stop clock Excelling - Predict and suggest when conditions are changed, how this will affect the rate of transpiration using experimental data	1) Describe the three main parts of a potometer 2) Describe how potometers measure the rate of transpiration 3) Predict what data you would have if you measured the rate of transpiration for a plant with no fan or fan. Explain your answer 4) Predict what data you would have if you measured the rate of transpiration for a plant with a bag around it compared to no bag. Explain your answer 5) Design an experiment to measure the rate of transpiration of a plant with different light availability.

Topic: B3 Infection & Response

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Pathogens and communicable diseases	Emerging (catching up): - Communicable diseases are infectious diseases caused by micro-organisms called pathogens Achieving (keeping up): - Pathogens can infect plants or animals and include bacteria, viruses, protists, and fungi Excelling (going beyond): - Pathogens spread through water, air, or direct contact	1) What name is given to any type of disease that can be passed from one person to another? 2) What are the four main types of pathogens? 3) Can pathogens infect only humans, or can they also cause diseases in plants and other animals? 4) State three major ways or routes by which pathogens are physically transmitted between individuals
Bacterial and fungal diseases	Emerging (catching up): - Salmonella and gonorrhoea are bacterial diseases, while rose black spot is a fungal disease. Achieving (keeping up): - Salmonella causes fever and cramps from food toxins, gonorrhoea causes yellow discharge, and rose black spot causes leaves to turn yellow and drop Excelling (going beyond): - Bacterial spread is controlled by poultry vaccination and antibiotics, while fungal spread is controlled by chemical fungicides and removing infected leaves.	1) Name two distinct infectious diseases in humans caused by a bacterial pathogen. 2) What specific physical symptom is seen on the leaves of a rose plant infected by rose black spot fungus? 3) Why does a plant grow much slower if rose black spot causes its leaves to turn yellow and drop off early? 4) Explain why the UK poultry industry vaccinates chickens against Salmonella if the disease affects humans who eat the food.
Viral and protist diseases	Emerging (catching up): - Measles, HIV, and tobacco mosaic virus (TMV) are viral diseases, whereas malaria is caused by a protist parasite Achieving (keeping up): - Measles causes fever and a red rash, HIV damages immune cells to cause AIDS, TMV discolours plant leaves, and malaria causes recurrent fevers Excelling (going beyond): - Viruses spread via droplets or bodily fluids and reproduce inside cells, malaria is spread by mosquito vector and controlled by preventing bites	1) What type of pathogen is responsible for causing malaria in humans? 2) Why does a plant infected with tobacco mosaic virus (TMV) suffer from stunted or reduced growth? 3) How does the HIV pathogen eventually cause a person to develop late-stage HIV, also known as AIDS? 4) Explain how a community can reduce the transmission of malaria by targeting its vector rather than using a vaccine

Topic: B2/B3 Plant tissue and infection/response

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Human non-specific defences	Emerging (catching up): - Non-specific defences act as a general physical and chemical barrier to trap or kill all pathogens before they can enter the body Achieving (keeping up) - The skin forms a physical barrier, while the nose, trachea, and bronchi use mucus and tiny hairs to trap airborne pathogens. Excelling (going beyond): - Glands in the stomach produce hydrochloric acid to kill swallowed pathogens, while ciliated cells in the airway move mucus up to the throat to be swallowed.	1) What does the term "non-specific" mean when describing these primary human defence systems? 2) How does your nose physically protect your respiratory system from airborne bacteria or viruses? 3) Why are ciliated cells in the trachea and bronchi vitally important after a pathogen has been trapped by mucus? 4) Explain how the chemical environment of the human stomach functions to destroy pathogens that enter via food or drink.
The immune system	Emerging (catching up): - If pathogens enter the body, the immune system destroys them using specialized white blood cells. Achieving (keeping up): - White blood cells protect the body by engulfing pathogens (phagocytosis), producing antibodies, and producing antitoxins. Excelling (going beyond): - Antibodies bind to unique antigens on a specific pathogen to destroy it, while antitoxins neutralise harmful toxins produced by bacteria	1) Which specific type of blood cell is responsible for defending the human body against invading pathogens? 2) State the three distinct methods used by white blood cells to destroy pathogens or counteract their effects. 3) What name is given to the process where a white blood cell surrounds, ingests, and digests a bacterial cell? 4) Explain why a specific antibody produced against the measles virus will not offer any protection against the influenza virus.
Vaccination	Emerging (catching up): - A vaccine contains a dead or inactive form of a pathogen to safely protect you from future infection Achieving (keeping up): - Vaccines stimulate white blood cells to produce specific antibodies, which can be quickly remade if the live pathogen attacks later. Excelling (going beyond): - If a large proportion of a population is vaccinated, it reduces the spread of the pathogen, protecting unvaccinated individuals via herd immunity.	1) What is inside a vaccine that makes it safe to inject without causing the full illness? 2) Which component of the blood produces antibodies in response to a vaccination? 3) Why does a person who has been vaccinated against a disease react much faster if they catch the real pathogen months later? 4) Explain how vaccinating a large majority of children

Topic: B2/B3 Plant tissue and infection/response

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Drugs - antibiotics and painkillers	Emerging (catching up): - Antibiotics kill infectious bacteria inside the body, while painkillers only treat the symptoms of a disease Achieving (keeping up): - Specific bacteria require specific antibiotics, but antibiotics are completely ineffective against viral diseases. Excelling (going beyond): - Overusing antibiotics allows mutated, resistant strains of bacteria to survive and multiply, creating dangerous infections that antibiotics cannot cure.	1) What is the main functional difference between taking a painkiller and taking an antibiotic? 2) Why will a doctor refuse to prescribe an antibiotic to a patient suffering from a severe viral infection like influenza? 3) What must a patient do when prescribed antibiotics to ensure all the pathogenic bacteria are completely destroyed? 4) Explain how natural selection leads to a population of bacteria becoming resistant to an antibiotic if the drug is overused
Drugs - discovery and development	Emerging (catching up): - Traditionally, drugs were extracted from plants and microorganisms, but today most new drugs are synthesized by chemists in labs. Achieving (keeping up): - New drugs must be rigorously tested for toxicity (safety), efficacy (if it works), and dosage (the right amount) before use. Excelling (going beyond): - Preclinical testing occurs on cells, tissues, and live animals; clinical trials use healthy volunteers and patients in blind or double-blind designs with placebos.	1) Name the heart drug that was originally extracted from foxglove plants, and the antibiotic discovered from mould. 2) What three main factors are scientists checking for when they test a completely new medicine? 3) Why must preclinical testing on cells and animals always happen before a new drug is ever given to a human volunteer? 4) Explain the difference between a blind and a double-blind trial, and describe why a placebo is used during these clinical stages.

Topic: B5 Homeostasis and response

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Introduction to homeostasis	Emerging: - Homeostasis is the regulation of a constant internal environment despite internal and external changes. Achieving (keeping up): - Homeostasis maintains stable conditions to prevent enzymes from denaturing due to temperature or pH changes Excelling (going beyond) - Negative feedback reverses a bodily change to return internal conditions back to normal	1. What does the term "homeostasis" mean in simple terms? 2. What happens to the shape of an enzyme if the temperature gets too high? 3. What is meant by the "optimum" temperature of an enzyme? 4. If a body factor rises too high, what does a negative feedback cycle do to it?
Structure and function of the nervous system	Emerging (catching up): - Every automatic control system relies on receptors to detect change, coordination centres to process information, and effectors to bring about a response. Achieving (keeping up): - The nervous pathway of a reflex arc always follows the strict sequence: Stimulus - Receptor - Sensory Neuron - Relay Neuron - Effector - Response. Excelling (going beyond): - Chemicals called neurotransmitters diffuse across the gap between two nerve cells.	1. Name the three mandatory components found in every automatic control system. 2. A person accidentally touches a hot pan. Trace the exact pathway the electrical impulse takes through the nervous system from the stimulus to the effector. 3. Identify two different types of effectors in the human body and state how each responds when stimulated. 4. Explain how an electrical impulse is able to travel from the sensory neurone to the relay neurone when they are not physically touch.
Structure of a reflex arc and synapses	Emerging (catching up): - A reflex arc is the quick pathway an impulse takes from a sensor to a muscle. Achieving (keeping up): - Reflexes are automatic and fast because they bypass the conscious brain to protect you from danger. Excelling (going beyond): - Reflex actions are rapid and automatic because they bypass the conscious, thinking parts of the brain to protect the body from immediate harm.	1. What is the name of the quick pathway that an electrical impulse travels along from a sensor to a muscle? 2. Why do reflex actions happen much faster than everyday actions like picking up a pen? 3. What is the main survival purpose of a reflex action being completely automatic? 4. Explain why a person only feels the pain of a hazard <i>after</i> their reflex arc has already moved their body away from danger.
Planned practical:	Emerging (catching up):	1. What happens to the distance measurement on

How is your attainment measured in Year 10 in Spring term?

Spring: HT1	
Energy (P1) Topic test	• 40 mark topic test covering current topic - assessed by teacher and DIRT
Particle model of matter (P3 and P4) Topic test	• 40 mark topic test covering current topic - assessed by teacher and DIRT

Spring: HT12	
Electricity (P2) Topic test	• 40 mark topic test covering current topic - assessed by teacher and DIRT
Magnetism and electromagnets (P7) Topic test	• 40 mark topic test covering current topic - assessed by teacher and DIRT

How is your attainment measured in Year 10 in Spring term?

Emerging	Achieving	Excelling
P1 Energy - I can identify different energy stores and describe how the energy stored changes when a system change. - I can calculate the amount of energy associated with a moving object, a stretched spring and an object raised above ground level. - I can state what is meant by specific heat capacity - I can carry out an investigation to determine the specific heat capacity of materials. - I can identify how to reduce unwanted energy transfers and make efficiency calculations. - I can describe the environmental impact arising from the use of different energy resources	P1 Energy - I can calculate the changes in energy involved when a system is changed. - I can rearrange the kinetic energy equation, the elastic energy equation and the gravitational potential energy along with converting between units. - I can calculate the amount of energy stored in or released from a system as its temperature changes. - I can carry out an investigation to determine the specific heat capacity of materials. - I can calculate the efficiency using power input values - I can explain patterns and trends in the use of energy resources.	P1 Energy - I can use calculations to analyse how energy is redistributed when a system change. - I can analyse the transfer of energy from a gravitational potential energy store to a kinetic energy store and make calculations - I can compare and evaluate different materials using their specific heat capacity values - I can analyse and make calculations using data collected from carrying out an investigation to determine the specific heat capacity of materials. - I can describe ways to increase the efficiency of an intended energy transfer. - I can evaluate environmental issues that may arise from the use of different energy resources

How is your attainment measured in Year 10 in Spring term?

Emerging	Achieving	Excelling
P2 Electricity - I can identify that for electrical charge to flow through a closed circuit the circuit must include a source of potential difference. - I can use the equation potential difference = current x resistance - I can identify I-V graphs associated with resistors at constant temperature, diode and filament lamp. - I can identify series and parallel circuits and build circuits using circuit diagrams - I can calculate total resistance in a series circuit. - I can state the difference between direct and alternating potential difference. I can recall the frequency and potential difference of domestic electricity supply in the UK - I can recall and apply power = potential difference and power = current² x resistance - I can state what the National Grid is.	P2 Electricity - I can use the equation charge = current x time - I can use circuit diagrams to set up investigate factors affecting resistance - I can describe how the resistance of a thermistor and LDR changes - I can describe how the current and potential difference change in a series and parallel circuit - I can solve problems for circuits which include resistors in series using the concept of equivalent resistance. - I can describe the function of the three wires in a 3-pin plug. - I can describe how different domestic appliances transfer energy - I can describe how the power of the circuit device is related to the potential difference and energy transferred. - I can explain why the National Grid system is an efficient way to transfer energy	P2 Electricity - I can convert between units and rearrange the equation charge = current x time - I can investigate the resistance of different fixed resistors in series and parallel circuits - I can explain the applications of thermistors and LDRs in sensing circuits. - I can analyse series and parallel circuits and calculate potential difference and current. - I can explain qualitatively why adding resistors in series increases the total resistance whilst adding resistors in parallel decreases the total resistance. - I can explain the dangers associated with the live wire - I can explain with examples, the relationship between the power ratings for domestic electrical appliances and the changes in stored energy when they are in use. - I can select and use the equation potential difference across primary coil x current in primary coil = potential difference across secondary coil x current in secondary coil

How is your attainment measured in Year 10 in Spring term?

Emerging	Achieving	Excelling
P3 Particle model of matter - I can recall and apply density = mass / volume where mass is conserved. - I can use appropriate apparatus to determine the density of regular shaped objects. - I can define internal energy. - I can use the equations; Energy = mass x specific heat capacity x change in temperature and energy = mass x specific latent heat - I can state what gas pressure is.	P3 Particle model of matter - I can use the particle model to explain the differences in density. - I can use appropriate apparatus to determine the density of irregular shaped solid objects. - I can describe how heating changes the temperature or produces a change of state. - I can distinguish between specific heat capacity and specific latent heat. - I can explain how the motion in a gas is related to both its temperature and pressure.	P3 Particle model of matter - I can explain how to calculate the density of an irregular shape. - I can use appropriate apparatus to determine the density of liquids - I can explain why heating results in a change of state - I can interpret heating and cooling graphs that include changes of state. - I can explain qualitatively the relation between the temperature of a gas and its pressure at constant volume

How is your attainment measured in Year 10 in Spring term?

Emerging	Achieving	Excelling
P4 Atomic structure • I can describe the basic structure of an atom and identify properties of electrons, neutrons, protons • I can describe how the atom has evolved over the years • I can describe the activity of a radioactive source is the rate at which its unstable nuclei decay. • I can identify the three types of radiation. • I can identify some uses of radiation.	P4 Atomic structure • I can define and identify isotopes and ions in terms of charges and masse. • I can compare the different models of the atom. • I can define and determine half life of radioisotope from a graph. • I can describe and analyse the ionising and penetrating properties of alpha, beta and gamma • I can describe the uses of radiation to evaluate the best sources of radiation to use in a given situation	P4 Atomic structure • I can describe how the distance of the charged particles vary with the absorption or emission of electromagnetic radiation • I can explain how experimental evidence led to the models of the atom changing over time. • I can determine the half-life of a radioactive isotope from given information and calculate the net decline, expressed as a ratio, in a radioactive emission after a given number of half-lives. • I can use the names and symbols of common nuclei and particles to complete balanced nuclear equations, by balancing the atomic numbers and mass numbers • I can compare the hazards associated with contamination and irradiation

How is your attainment measured in Year 10 in Spring term?

Emerging	Achieving	Excelling
P7 Magnetism and Electromagnetism - I can state that the poles of a magnet are the places where the magnetic forces are strongest, and when two magnets are brought close together they exert a force on each other. - I can state that the region around a magnet where a force acts on another magnet or on a magnetic material (iron, steel, cobalt and nickel) is called the magnetic field. - I can state that when a current flows through a conducting wire, a magnetic field is produced around the wire. - I can state that when a conductor carrying a current is placed in a magnetic field, the magnet producing the field and the conductor exert a force on each other. - I can state the basis of an electric motor.	P7 Magnetism and Electromagnetism - I can state that two like poles repel each other. Two unlike poles attract each other. Attraction and repulsion between two magnetic poles are examples of non-contact force. - I can state that the direction of the magnetic field at any point is given by the direction of the force that would act on another north pole placed at that point. - I can state that the strength of the magnetic field depends on the current through the wire and the distance from the wire. - I can state that Fleming's left-hand rule represents the relative orientation of the force, the current in the conductor and the magnetic field. - I can state that a coil of wire carrying a current in a magnetic field tends to rotate. This is the basis of an electric motor.	P7 Magnetism and Electromagnetism - I can state that permanent magnet produces its own magnetic field. An induced magnet is a material that becomes a magnet when it is placed in a magnetic field. Induced magnetism always causes a force of attraction. - I can state that a magnetic compass contains a small bar magnet. The Earth has a magnetic field. The compass needle points in the direction of the Earth's magnetic field. - I can state that shaping a wire to form a solenoid increases the strength of the magnetic field created by a current through the wire. The magnetic field inside a solenoid is strong and uniform. - I can state that for a conductor at right angles to a magnetic field and carrying a current: $\text{force} = \text{magnetic-flux density} \times \text{current} \times \text{length}$ ($F = B \times I \times L$). - I can explain how the force on a conductor in a magnetic field causes the rotation of the coil in an electric motor.

Topic:

Spring Term 1 P1 Energy

Lesson Title	Golden Nugget	Work Hard
Energy stores and systems	Emerging (catching up): A system is a group of energy or objects. Energy cannot be created or destroyed, only transferred between different stores (law of conservation of energy).	- State the definition of a system in terms of energy. - State the law of conservation of energy. - Describe energy transfers in simple systems. - Use numerical values to illustrate energy transfers in systems.
	Achieving (keeping up): Energy can be transferred in a system between stores. Examples include an object projected upwards • a moving object hitting an obstacle • an object accelerated by a constant force • a vehicle slowing down • bringing water to a boil in an electric kettle.	
	Excelling (going beyond): Energy is measured in joules or kilojoules and we can use this to illustrate transfers between stores.	
Kinetic energy and calculations	Emerging (catching up): Kinetic energy is stored in moving objects	- State the definition of kinetic energy. - Describe a simple energy transfer involving kinetic energy. - Calculate the kinetic energy of a moving object. - Calculate the mass and speed of a moving object.
	Achieving (keeping up): Calculate the kinetic energy of moving objects using the kinetic energy equation	
	Excelling (going beyond): Rearrange the kinetic energy equation to calculate speed and mass of a moving object	
Elastic potential energy and calculations	Emerging (catching up): - Elastic potential energy is stored in an object that is stretched. - When a spring is stretched elastic potential energy store increases.	- State the definition of elastic potential energy. - Describe the energy transfers that take place when a spring is stretched. - Calculate the elastic potential energy stored in a stretched spring. - Calculate the extension and spring constant of a stretched spring.
	Achieving (keeping up): Calculate the elastic potential energy stored in a stretched spring.	
	Excelling (going beyond): - Rearrange the equation to: - Calculate the extension of a stretched spring. - Calculate the spring constant of a spring.	
GPE and calculations	Emerging (catching up): - Gravitational potential energy is stored in any object due to its position within gravitational field. - Mass is measured in Kg and weight is measured in Newtons. Your mass is the same on any planet, your weight changes due to the different gravitational field strengths of planets.	- State the definition of gravitational potential energy - Describe the difference between weight and mass. - Calculate gravitational potential energy of a raised object. - Calculate the mass and height of a raised object.
	Achieving (keeping up): Calculate the gravitational potential energy stored in a raised object.	
	Excelling (going beyond): - Rearrange the equation to: - Calculate the mass of a raised object. - Calculate the height of a raised object.	

Topic:

Spring Term 1 P1 Energy

Lesson Title	Golden Nugget	Work Hard
Specific heat capacity and calculations	Emerging (catching up): The specific heat capacity of a substance is the amount of energy required to raise the temperature of one kilogram of the substance by one degree Celsius.	1) State the definition of specific heat capacity. 2) Calculate the change in thermal energy of a substance 3) Calculate the mass, specific heat capacity and temperature change of different substances
	Achieving (keeping up): Calculate the change in thermal energy of different substances	
	Excelling (going beyond): - Rearrange the change in thermal energy equation to - Calculate specific heat capacity - Calculate mass of a substance - Calculate the temperature change of an substance	
Required practical: Specific heat capacity	Emerging (catching up): Describe and recall a 6 mark method for the specific heat capacity required practical.	1) Describe a 6 mark method to calculate the specific heat capacity of iron. 2) Calculate the specific heat capacity or iron from your results. 3) Describe how to improve the accuracy of your results from experimental technique 4) Explain if 1Kg of water or iron will reach 50degrees celcius quicker.
	Achieving (keeping up): - Calculate the specific heat capacity of substances from your data. - To improve the results of the practical you could insulate the material	
	Excelling (going beyond): Objects that have a low specific heat capacity will heat up quickly but also cool down quickly. Substances with a high specific heat capacity will heat up slowly but also cool down slowly	
Power calculations and descriptions	Emerging (catching up): - Power is defined as the rate at which energy is transferred or the rate at which work is done. - An energy transfer of 1 joule per second is equal to a power of 1 watt.	1) State the definition of power. 2) Calculate the power of an electrical device 3) Calculate the energy transferred and time of an electrical device that is switched on. 4) Explain which fridge will consume more energy when switched on for one hour. Fridge 1 – 600W OR Fridge 2 - 1000W
	Achieving (keeping up): Calculate the power of different electrical devices.	
	Excelling (going beyond): - Rearrange the power equation to calculate - Work done - Time - illustrate the definition of power eg comparing two electric motors that both lift the same weight through the same height but one does it faster than the other	
Conservation of energy and energy transfers	Emerging (catching up): - Energy cannot be created or destroyed, only transferred between different stores (law of conservation of energy). - Dissipated is when energy is not transferred usefully.	1) Describe the term dissipated in terms of energy transfers 2) Describe the energy transfers that take place when a pendulum swings. 3) Describe the energy transfers that take place when a bungee jumper jumps and how they eventually become stationary.
	Achieving (keeping up): When pendulum swings energy is transferred from kinetic to gravitational potential energy store.. Gravitational potential energy has the largest store when the pendulum is highest, the kinetic energy store is highest when the pendulum is lowest. Energy is dissipated as thermal	
	Excelling (going beyond): When a bungee jump person jumps there is an increases in kinetic energy and decrease in gravitational potential energy. When rope starts to stretch increase in elastic potential energy and decrease in kinetic energy. When rope rebounds the gravitational potential energy increases and elastic potential energy decreases. Kinetic decreasing.	

Topic:

Spring Term 1 P1 Energy

Lesson Title	Golden Nugget	Work Hard
Energy dissipation and reducing unwanted energy transfer	Emerging (catching up): Lubrication and insulation can reduce unwanted energy transfers.	- Describe how lubrication of bike brakes can increase the braking efficiency. - Describe how insulating a cup of hot liquid can keep it hot for longer - Explain what has a higher thermal conductivity, polystyrene or copper metal. - Explain how you could reduce heat loss through the walls of a house.
	Achieving (keeping up): The higher the thermal conductivity of a material the higher the rate of energy transfer by conduction across the material.	
	Excelling (going beyond): the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls.	
Efficiency calculations and descriptions of changing efficiency	Emerging (catching up): - The higher the efficiency of an energy transfer the more energy that is transferred usefully. - Calculate the efficiency based on energy and power.	- Describe the term efficiency in terms of energy transfers. - Calculate the efficiency of energy transfers. - Calculate the output and input energy from efficiency. - Describe how to increase the efficiency of energy transfers.
	Achieving (keeping up): - Rearrange the efficiency equation to calculate - Useful output energy - Total input energy	
	Excelling (going beyond): The efficiency of an energy transfer can be increased by insulation and lubrication.	
Non-renewable energy resources and advantages/disadvantages of non-renewables	Emerging (catching up): - Non-renewable energy resources are finite and being used up quicker than they can be replenished. - These include fossil fuels (Coal, oil, natural gas) and nuclear	- State the definition of a non-renewable energy resource. - State the four non-renewable energy resources. - State advantages and disadvantages of non-renewable energy resources. - Compare nuclear with fossil fuels.
	Achieving (keeping up): - Advantages of non-renewable energy resources are that they are reliable and produce a large amount of energy. - Disadvantages of non-renewable energy resources are that they will eventually run out, fossil fuels produce carbon dioxide that is a greenhouse gas adding to global warming.	
	Excelling (going beyond): Compare nuclear with fossil fuels.	
Advantages and disadvantages of renewable energy resources 1 - solar and wind	Emerging (catching up): - A renewable energy resource is one that can be replenished as it is used up. - Examples of renewable energy resources include solar and wind.	- State the definition of a renewable energy resource. - Give two examples of renewable energy resources. - State two advantages of Solar and wind - State one disadvantage of solar. - State two disadvantages of wind.
	Achieving (keeping up): Advantages of solar and wind are that they are renewable, they do not release carbon dioxide.	
	Excelling (going beyond): - Disadvantages of solar and wind are they are unreliable. - Disadvantages of wind is noise pollution, visually unappealing and harm to birds	

Topic:

Spring Term 1 P1 Energy

Lesson Title	Golden Nugget	Work Hard
Advantages and disadvantages of renewable energy resources 2	Emerging (catching up): Geothermal, hydroelectric, wave, tidal and biomass are examples of renewable energy resources.	1) State examples of renewable energy resources. 2) State advantages and disadvantages of tidal/wave. 3) State advantages and disadvantages of geothermal. 4) State advantages and disadvantages of hydroelectric. 5) State advantages and disadvantages of biomass.
	Achieving (keeping up): - Tidal and wave are ideal for islands and have the potential to generate a lot of electricity. - Geothermal has the potential for infinite energy supply. - Hydroelectric can supply energy at peak times and then return water to storage when demand is low. - Biomass is cheap, readily available and can provide a constant, reliable supply of energy.	
	Excelling (going beyond): - Tidal and wave can be costly and damage habitats. - Geothermal can be expensive to set up and can only be used in place of geothermal activity. - Hydroelectric is very costly, can damage habitats, can flood local communities. - Biomass can release greenhouse gases, adding to global warming. If not planet again it is non-renewable.	
Energy resources and the effect on the environment	Emerging (catching up): - Fossil fuels release carbon dioxide when they are burned – this is a greenhouse gas that adds to global warming. - Tidal, wave, geothermal, hydroelectric, solar and wind do not release greenhouse gases.	1) Describe why fossils are bad for the environment
	Achieving (keeping up): - Nuclear does not release greenhouse gases. - Biomass and wood do release greenhouse gases, but if they are replanted can be carbon neutral as they take in the carbon dioxide through photosynthesis.	
	Excelling (going beyond): There are numerous advantages/disadvantages to all energy resources. The UK needs to have a mix where it can have a reliable source of energy without causing environmental damage.	

Topic:

Spring Term 1 P3 Particle model of matter

Lesson Title	Golden Nugget	Work Hard
Density	Emerging (catching up): Define density	- Define density - Use the equation density = mass / volume - Identify the correct units for density mass and volume - Rearrange the equation to calculate mass and volume - Convert grams into kilograms and centimetres cubed into metres cubed
	Achieving (keeping up): Use density = mass / volume to calculate density with correct units	
	Excelling (going beyond): - Rearrange density = mass/ volume to calculate mass and volume - Convert between units of mass and volume	
Investigating and calculating densities of regular objects	Emerging (catching up): Select and use appropriate apparatus to measure volume and mass of regular shaped objects	- Use appropriate apparatus to make and record measurements of length, area, mass and volume accurately. - Use recorded measurements to determine the density of regular shaped objects - Calculate the density in kilogram per metre cubed.
	Achieving (keeping up): Use appropriate apparatus to make and record measurements needed to determine the density of regular objects	
	Excelling (going beyond): Use measurements recorded to calculate density in kilogram per metre cubed.	
Investigating and calculating densities of irregular objects	Emerging (catching up): Select and use appropriate apparatus to measure volume and mass of irregular shaped objects	- Use appropriate apparatus to make and record measurements mass and volume of irregular shaped objects accurately. - Use recorded measurements to determine the density of irregular shaped objects - Calculate the density in kilogram per metre cubed.
	Achieving (keeping up): Use appropriate apparatus to make and record measurements needed to determine the density of irregular objects	
	Excelling (going beyond): Use measurements recorded to calculate density in kilogram per metre cubed for irregular shaped objects	
States of matter and changes of state	Emerging (catching up): Recognise/draw simple diagrams to model the difference between solids, liquids and gases	- Identify and draw simple particles showing the differences between solid, liquids and gasses. - Describe the motion and arrangement of particles in solids, liquids and gases. - Describe why the mass is conserved when there is a change in state - Explain using the particle model why changes of state are reversible - Use the particle model to explain differences in density.
	Achieving (keeping up): Use the particle model to explain why a change of state is reversible and affects the properties of a substance, but not its mass	
	Excelling (going beyond): Use the particle model to explain the properties of different states of matter and differences in the density of materials	

Topic:

Spring Term 1 P3 Particle model of matter

Lesson Title	Golden Nugget	Work Hard
Internal energy and temperature	Emerging (catching up): State that the internal energy of a system is stored in the atoms and molecules	- State what internal energy is - Describe how heating a substance changes the kinetic energy. - Describe how potential energy changes when a substance changes state - Compare solids, liquids and gases in terms of forces of attraction. - Describe gas pressure
	Achieving (keeping up): Describe how heating changes the internal energy	
	Excelling (going beyond): Explain that internal energy is the total kinetic energy and potential energy of all the particles in a system	
Specific heat capacity recap	Emerging (catching up): State what specific heat capacity is	- Calculate the change in thermal energy of a substance - Calculate the mass, specific heat capacity and temperature change of different substances - Use the specific heat capacity of materials to evaluate their suitability
	Achieving (keeping up): Calculate the change in thermal energy by applying but not recalling the equation [$\Delta E = m c \Delta \theta$]	
	Excelling (going beyond): Select materials by evaluating their specific heat capacity.	
Specific latent heat and calculations	Emerging (catching up): State what is meant by specific latent heat	- Define specific latent heat - Define specific latent heat of fusion and vaporisation. - Use the equation Energy = mass x specific latent heat - Rearrange the equation to calculate the mass or specific latent heat. - Describe how to measure specific latent heat
	Achieving (keeping up): - Calculate the specific latent heat of fusion/vaporisation by applying, but not recalling, the equation: [$E = mL$] - Describe how to measure specific latent heat	
	Excelling (going beyond): Interpret and draw heating and cooling graphs that include changes of state	
Gas pressures and factors affecting gas pressure	Emerging (catching up): Recall how the molecules of a gas are in constant random motion and that the higher the temperature of a gas, the greater the particles' average kinetic energy	- State what gas pressure is - Describe how temperature affects gas pressure at constant volume. - Describe how changing the temperature of a gas, held at constant volume, changes the pressure exerted by the gas. - Explain how the motion of the molecules in a gas is related to both its temperature and its pressure - explain qualitatively the relation between the temperature of a gas and its pressure at constant volume - Describe Brownian motion
	Achieving (keeping up): Explain, with reference to the particle model, the effect of changing the temperature of a gas held at constant volume on its pressure	
	Excelling (going beyond): Calculate the change in the pressure of a gas or the volume of a gas (a fixed mass held at constant temperature) when either the pressure or volume is increased or decreased	

Topic:

Spring Term 1 P4 Atomic structure

Lesson Title	Golden Nugget	Work Hard
Atoms and isotopes	Emerging (catching up): Describe the basic structure of an atom	- Describe the basic structure of an atom including the size of the radius . - Recall the relative mass and charge of subatomic particles - State why atoms are neutral - Describe what an isotope is - State what an ion is and how it is formed - Compare isotopes
	Achieving (keeping up): - Recall the mass and charge of electrons, neutrons, protons, isotopes and ions - Describe how the distance of the charged particles vary with the absorption or emission of electromagnetic radiation	
	Excelling (going beyond): Relate differences between isotopes to differences in conventional representations of their identities, charges and masses	
Development of the atomic model	Emerging (catching up): Identify the scientist involved in the development of the atom	- Identify the key scientist involved in the development of the atom. - Describe how experimental evidence led to the plum pudding model of the atom - Explain why the plum pudding model was rejected, and the nuclear model was established - Describe how Bohr adapted the nuclear model. - State who discovered the neutron
	Achieving (keeping up): Describe how the atomic model has changed over time due to new experimental evidence, inc discovery of the atom and scattering experiments (inc the work of James Chadwick)	
	Excelling (going beyond): Explain why the atomic models changed using experimental data.	
Properties of nuclear radiation	Emerging (catching up): State what a radioactive substance is	- State what a radioactive substance is - State how a radioactive substance becomes stable - Describe the structure of an alpha and beta particle. - Compare gamma radiation with alpha and beta particles. - Evaluate the best sources of radiation to use in each situation.
	Achieving (keeping up): - Describe the properties of alpha, beta and gamma radiation. - Describe the penetration through materials, the range in air and the ionising power for alpha particles, beta particles and gamma rays	
	Excelling (going beyond): Explain the dangers associated with alpha, beta and gamma radiation.	
Radioactive decay	Emerging (catching up): Describe and apply the idea that the activity of a radioactive source is the rate at which its unstable nuclei decay, measured in Becquerel (Bq) by a Geiger-Muller tube	- State what activity of a radioactive source is - Identify the three main types of radiation - Describe how emission of alpha, beta change the mass and/or the charge of a nucleus. - What are the symbols used for alpha, beta and gamma. - Use names and symbols to complete balanced nuclear equations
	Achieving (keeping up): Describe how the emission of the different types of nuclear radiation may cause a change in the mass and /or the charge of the nucleus	
	Excelling (going beyond): Use the names and symbols of common nuclei and particles to complete balanced nuclear equations, by balancing the atomic numbers and mass numbers	

Topic:

Spring Term 1 P4 Atomic structure

Lesson Title	Golden Nugget	Work Hard
Half-life and activity	Emerging (catching up): Define half-life of a radioactive isotope	- Define activity - Define half life - Determine the half-life of a radioactive isotope from a graph - Determine the half-life of a radioactive isotope given information and calculate the net decline, expressed as a ratio,
	Achieving (keeping up): - Determine the half-life of a radioactive isotope from given information. - Explain the concept of half-life and how it is related to the random nature of radioactive decay	
	Excelling (going beyond): Determine the half-life of a radioactive isotope from given information and calculate the net decline, expressed as a ratio, in a radioactive emission after a given number of half-lives	
Irradiation and contamination	Emerging (catching up): - State what contamination is - State what irradiation is	- State what contamination is - State what irradiation is - compare the hazards associated with contamination and irradiation - Identify suitable precautions must be taken to protect against any hazard that the radioactive source used in the process of irradiation may present.
	Achieving (keeping up): Compare the hazards associated with contamination and irradiation and outline suitable precautions taken to protect against any hazard the radioactive sources may present	
	Excelling (going beyond): Discuss the importance of publishing the findings of studies into the effects of radiation on humans and sharing findings with other scientists so that they can be checked by peer review	

Topic:

Spring Term 2 P2 Electricity

Lesson Title	Golden Nugget	Work Hard
Circuit symbols and the flow of charge		
Series and parallel circuits		
Constructing series and parallel circuits		
Current, resistance and potential difference		
Required practical: Resistance of wire		
Required practical: Resistance of wire		
Resistance of circuit components		
Required practical: IV characteristics		
Required practical: IV characteristics		
Thermistors and light dependent resistors		
Direct and alternating potential difference		
Mains electricity and the three core cable		
Electricity and power		
Energy transfers and power		
The National Grid		

Topic: P7 Magnetism

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How is your attainment measured in Year 10 in Summer term?

Summer: HT1

Structure and bonding (C2) Topic test	40 mark topic test covering current topic - assessed by teacher and DIRT
Chemical changes and energy changes (C4a and C5) Topic test	40 mark topic test covering current topic - assessed by teacher and DIRT

Summer: HT2

Chemical changes (C4b) Topic test	40 mark topic test covering current topic - assessed by teacher and DIRT
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Assessment Point 2

What is assessed?	% of course	Why?
Biology paper 1	16.6	Covering key topics that come up in GCSE combined science biology paper 1 (actual paper) allowing students to practice what the real paper will be like – 70 marks
Chemistry paper covering C1, C2, C4 and C5	16.6	Covering key topics that come up in GCSE combined science chemistry paper 1 (actual paper) allowing students to practice what the real paper will be like – 70 marks
Physics paper 1	16.6	Covering key topics that come up in GCSE combined science physics paper 1 (actual paper) allowing students to practice what the real paper will be like – 70 marks

How is your attainment measured in Year 10 in Summer term?

Emerging	Achieving	Excelling
• Structure and bonding • I can name the three types of bonding (ionic, covalent and metallic) • I can identify whether a substance is ionic, covalent or metallic • I can describe ionic bonding as the transfer of electrons • I can describe covalent bonding as the sharing of electrons • I can describe metallic bonding as positive ions surrounded by delocalised electrons • I can name the three states of matter (solid, liquid and gas) • I can describe the basic properties of ionic, covalent and metallic substances • I can identify simple molecular and giant structure • I can name forms of carbon such as diamond and graphite • I can identify that carbon forms covalent bonds	• Structure and bonding • I can explain bonding in terms of electrostatic forces between particles • I can describe how ions are formed by gaining or losing electrons • I can draw dot and cross diagrams for ionic and covalent bonding • I can predict the charge on ions based on group number (Groups 1, 2, 6, 7) • I can explain the properties of ionic compounds (high melting point, conduct when molten or in solution) • I can explain why simple molecules have low melting and boiling points • I can describe the properties of giant covalent structures such as diamond and graphite • I can describe why metals conduct electricity and heat • I can describe the structure of diamond and graphite • I can explain why diamond is hard and graphite is soft • I can describe graphene and fullerenes as forms of carbon	• Structure and bonding • I can explain the formation of ionic compounds as giant lattices of oppositely charged ions • I can compare ionic, covalent and metallic bonding in terms of structure and electron behaviour • I can use diagrams and models to explain bonding in unfamiliar substances • I can explain how bonding and structure determine physical properties of substances • I can compare properties of ionic, metallic, simple molecular and giant covalent structures • I can explain trends in properties using particle models and bonding theory • I can explain how the structure of carbon allotropes gives them different properties and uses • I can compare diamond, graphite, graphene and fullerenes in terms of structure and bonding • I can evaluate why different carbon structures are useful in specific applications

How is your attainment measured in Year 10 in Summer term?

• Emerging	Achieving	Excelling
C4a Chemical changes • I can understand how metals reactivity depends on their tendency to form metal ions • I can describe and explain the 3 ways in which metals are extracted from the earth • I can recall all general equations for reactions of acids, alkalis, metals and carbonates and apply this to predict products from reactants • I can describe the procedure of how to a pure dry sample of a soluble salt from an insoluble oxide or carbonate C4b Electrolysis • I can draw a labelled diagram of an ionic compound being electrolysis and describe the method for this in the lab • I can explain which metals need to be extracted using electrolysis using the reactivity series	C4a Chemical changes • I can explain why different metals react to form compounds with varying reactivity • I can describe oxidation and reduction in terms of both oxygen and electrons • I can write balanced symbol equations for all general equations of acids, alkalis, metals and carbonates • I can explain improvements in the process of producing dry soluble salts when giving a method C4b Electrolysis • I can predict products of electrolysis for molten solutions at each electrode • I can explain why aluminium oxide is a mixture when electrolysed and why the electrode needs to be continually replaced	C4a Chemical changes I can plan and deduce order of reactivity of metals from a practical • I can write ionic equations for displacement reactions and half equations for redox reactions • I can explain these reactions in terms of electron loss and gain, identify reduction and oxidation • I can describe and explain the differences between strong and weak acids, and dilute and concentrated acids C4b Electrolysis • I can predict products of electrolysis for aqueous solutions at each electrode • I can write half equations for reactions at electrodes given the electrolyte used

How is your attainment measured in Year 10 in Summer term?

Emerging	Achieving	Excelling
Energy changes • I can state that energy is conserved in chemical reactions • I can define exothermic reactions as transferring energy to the surroundings • I can define endothermic reactions as taking in energy from the surroundings • I can identify temperature increases and decreases during reactions	Energy changes • I can describe energy transfer in terms of products having more or less energy than reactants • I can give examples of exothermic (e.g. combustion, neutralisation) and endothermic reactions • I can interpret temperature changes to identify reaction type • I can describe everyday uses of exothermic and endothermic reactions	Energy changes • I can explain energy changes using bond breaking and bond making • I can compare exothermic and endothermic reactions in terms of energy flow • I can predict whether a reaction is exothermic or endothermic from given data • I can evaluate applications of energy changes in real-world contexts

How is your attainment measured in Year 10 in Summer term?

Emerging	Achieving	Excelling
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Topic: C2 Structure and bonding

Summer Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Types of chemical bonds	Emerging: • State the three types of bonding and that they involve transfer or sharing of electrons	1) Define each bond type 2) Identify bonding types 3) Explain electron movement 4) Compare bonding types
	Achieving: • Describe ionic, covalent and metallic bonding in terms of electron transfer, sharing and delocalisation	
	Excelling: • Explain how electrostatic attraction in different bond types determines structure and properties	
Ionic bonding	Emerging: • State that ionic bonding involves electron transfer between metals and non-metals	1) Describe ionic bonding 2) Explain ion formation 3) Determine ion charges
	Achieving: • Describe how positive and negative ions form and attract to achieve full outer shells	
	Excelling: • Explain how charge and ionic size affect the strength of ionic bonding	
Ionic bonding 2	Emerging: • State that ionic compounds form a giant lattice structure	1) Draw diagrams 2) Describe lattice 3) Explain bond strength
	Achieving: • Describe the arrangement of ions in a repeating 3D lattice	
	Excelling: • Explain why strong electrostatic forces act in all directions in the lattice	

Topic: C2 Structure and bonding

Summer Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Ionic Bonding 2	Emerging: • High melting/boiling points	1. State what a lattice is 2. Describe the structure of an ionic lattice 3. Explain why ionic compounds are strong 4. Draw and interpret dot-and-cross diagrams
	Achieving: • Conduct when molten or dissolved	
	Excelling: • Explained by strong electrostatic forces	
Properties of ionic compounds	Emerging: • State that ionic compounds have high melting points and can conduct electricity	1. State key properties of ionic compounds 2. Describe when ionic compounds conduct electricity 3. Explain why they have high melting points 4. Explain why they do not conduct when solid
	Achieving: • Describe how ionic structure leads to high melting points and conductivity when molten or dissolved	
	Excelling: • Explain properties in terms of ion movement and strong electrostatic attraction	
Covalent bonding	Emerging: • State that covalent bonding involves sharing pairs of electrons between non-metals	1. State what covalent bonding is 2. Describe how atoms share electrons 3. Explain why covalent bonds are strong 4. Draw dot-and-cross diagrams
	Achieving: • Describe how shared electrons form strong bonds between atoms	
	Excelling: • Explain covalent bonding as electrostatic attraction between nuclei and shared electrons	
Covalent bonding 2	Emerging: • State that covalent substances can form simple molecules	1. State what a simple molecule is 2. Describe how to represent molecules 3. Explain limitations of models 4. Deduce molecular formulas from diagrams
	Achieving: • Describe how covalent bonds can be represented using diagrams and models	
	Excelling: • Explain the limitations of covalent models compared to real 3D structures	

Topic: C2 Structure and bonding

Summer Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Properties of simple covalent molecules	Emerging: • State that simple covalent substances have low melting and boiling points	1. State properties of simple molecules 2. Describe intermolecular forces 3. Explain low boiling points 4. Compare with ionic compounds
	Achieving: • Describe how weak intermolecular forces explain these properties	
	Excelling: • Explain why simple molecules do not conduct electricity	
Properties of giant covalent molecules	Emerging: • State that giant covalent structures contain many atoms bonded together	1. State what giant covalent means 2. Describe structure 3. Explain high melting points 4. Compare with simple covalent molecules
	Achieving: • Describe how strong covalent bonds extend throughout the structure	
	Excelling: • Explain why these substances have very high melting points and hardness	
Diamond and graphite	Emerging: • State that diamond and graphite are forms of carbon	1. State similarities between diamond and graphite 2. Describe their structures 3. Explain why graphite conducts electricity 4. Explain why diamond is hard
	Achieving: • Describe the different bonding and structure in diamond and graphite	
	Excelling: • Explain differences in properties, including conductivity and hardness	
Graphene and fullerenes	Emerging: • State that graphene and fullerenes are forms of carbon	1. State what graphene is 2. Describe its structure 3. Explain its strength and conductivity 4. Evaluate its uses
	Achieving: • Describe their structures and key properties	
	Excelling: • Explain why their properties make them useful in modern applications	

Topic: C2 Structure and bonding

Summer Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Polymers	Emerging: • State that polymers are large molecules made from repeating units	1. State what a polymer is 2. Describe structure 3. Explain bonding 4. Link structure to properties
	Achieving: • Describe how covalent bonds form long chains	
	Excelling: • Explain how intermolecular forces influence properties of polymers	
Metallic bonding	Emerging: • State that metals contain positive ions and delocalised electrons	1. State what metallic bonding is 2. Describe delocalised electrons 3. Explain how bonding occurs 4. Link bonding to properties
	Achieving: • Describe how electrons move freely through the structure	
	Excelling: • Explain metallic bonding as electrostatic attraction between ions and delocalised electrons	
Metals and conductors	Emerging: • State that metals conduct electricity and heat	1. State properties of metals 2. Describe how they conduct electricity 3. Explain conduction using electrons 4. Compare with ionic substances
	Achieving: • Describe how free electrons allow conduction	
	Excelling: • Explain conductivity and malleability using the metallic bonding model	
Alloys	Emerging: • State that alloys are mixtures of metals	1. State what an alloy is 2. Describe structure 3. Explain increased strength 4. Give examples and uses
	Achieving: • Describe how different sized atoms disrupt layers	
	Excelling: • Explain why alloys are harder than pure metals	

Topic: C2 Structure and bonding

Summer Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
States of matter & limitations of the particle model	Emerging: • State the three states of matter	1. State the three states of matter 2. Describe particle arrangement 3. Explain changes of state 4. Evaluate limitations of the model
	Achieving: • Describe particle arrangement and movement in each state	
	Excelling: • Explain the limitations of the particle model	

Topic: C4a Chemical changes

Summer Term 2 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Metal oxides	Emerging (catching up): Describe how metals react with oxygen to form metal oxides	- What is formed when a metal reacts with oxygen? - What is the definition of oxidation in terms of oxygen transfer? - What is the definition of reduction in terms of oxygen transfer? - In the equation $2\text{Cu} + \text{O}_2 \rightarrow 2\text{CuO}$, which substance has been oxidised and how do you know? - Why are reactions involving oxidation and reduction known as redox reactions? - In the reaction $\text{ZnO} + \text{C} \rightarrow \text{Zn} + \text{CO}$, identify which substance has been reduced and explain your answer
	Achieving (keeping up): Explain oxidation and reduction in terms of loss or gain of oxygen	
	Excelling (going beyond): Analyse redox reactions and justify which substance has been oxidised or reduced	
Reactivity series of metals	Emerging (catching up): Describe how different metals react with water, dilute acids and place them in order of reactivity.	- What is the reactivity series? - Which metal is more reactive: magnesium or copper? How do you know? - Write a word equation for the general reaction of a metal with acid. - How does the reactivity of a metal affect its reaction with water or dilute acids? - Why are some metals more reactive than others?
	Achieving (keeping up): Explain why more reactive metals react vigorously in terms of ability to form positive ions.	
	Excelling (going beyond): Analyse experimental results to deduce and justify the order of metal reactivity	
Displacement reactions	Emerging (catching up): Identify when a displacement reaction has taken place.	- What is a displacement reaction? - Which metal would displace copper from copper sulfate solution: magnesium or silver? - Complete the word equation: Magnesium + Copper Sulfate $\rightarrow$? - Why does zinc displace iron from iron sulfate solution? - Predict the products of the reaction: Iron + Copper Sulfate $\rightarrow$?
	Achieving (keeping up): Construct word equations for displacement reactions.	
	Excelling (going beyond): Predict and explain displacement reactions using the reactivity series.	

Topic: C4a Chemical changes

Summer Term 2 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Extraction of metals	Emerging (catching up): Some metals are found as ores and, reduction is the removal of oxygen from a metal oxide	- Why are metals such as gold found in the Earth as the metal itself, while many other metals are found as compounds? - Define oxidation in terms of the loss or gain of oxygen - What is formed when a metal reacts with oxygen? - Define reduction in terms of the loss or gain of oxygen - Why can carbon be used to extract some metals from their oxides? - Name a process that can be used to extract each of these metals from their metal oxides, a)Iron, b)calcium, c) zinc, d) potassium
	Achieving (keeping up): Metals less reactive than carbon can be extracted from their oxides using carbon.	
	Excelling (going beyond): Analyse extraction reactions to identify which substances are oxidised and reduced and evaluate the extraction method used	
Redox reactions	Emerging (catching up): Oxidation is the loss of electrons.	- What happens to electrons during oxidation? - What happens to electrons during reduction? - Is the loss of electrons oxidation or reduction? - In a reaction, one substance loses electrons and another gains them. What type of reaction is this? - Why must oxidation and reduction always occur together?
	Achieving (keeping up): Reduction is the gain of electrons	
	Excelling (going beyond): Redox reactions involve oxidation and reduction happening at the same time through electron transfer.	
Reactions of acids with metals	Emerging (catching up): Acids react with metals to produce a salt and hydrogen gas	- What are the products when an acid reacts with a metal? - Which gas is produced when magnesium reacts with hydrochloric acid? - What salt is produced when sulfuric acid reacts with zinc? - Which metal would react more vigorously with acid: magnesium or copper? - How can the reactivity series help predict reactions with acids?
	Achieving (keeping up): The name of the salt depends on the acid used in the reaction.	
	Excelling (going beyond): The reactivity series can be used to predict how vigorously a metal will react with an acid	

Topic: C4a Chemical changes

Summer Term 2 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Neutralisation reactions	Emerging (catching up): Neutralisation happens when an acid reacts with a base or alkali	1. What is a neutralisation reaction? 2. What types of substances react during neutralisation? 3. What are the products of a neutralisation reaction? 4. Complete the word equation: Hydrochloric acid + sodium hydroxide → ? 5. Write a word equation for sulfuric acid reacting with magnesium oxide.
	Achieving (keeping up): Neutralisation reactions produce a salt and water	
	Excelling (going beyond): Neutralisation can be represented using word equations and balanced symbol equations.	
Naming and forming salts	Emerging (catching up): The name of a salt is linked to the acid used to make it	
	Achieving (keeping up):	
	Excelling (going beyond):	
Forming soluble salts	Emerging (catching up):	
	Achieving (keeping up):	
	Excelling (going beyond):	

Topic: C4a Chemical changes

Summer Term 2 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
RQP		
PH scale and neutralisation	Emerging (catching up):	
	Achieving (keeping up):	
	Excelling (going beyond):	
Strong and weak acids	Emerging (catching up):	
	Achieving (keeping up):	
	Excelling (going beyond):	

Topic: C5 Energy changes

Summer Term 2 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Endothermic and exothermic reactions		
RQP		
Reaction profiles and activation energy		
RQP		
Bond energy calculations		
Strong and weak acids		
Endothermic and exothermic reactions		

Topic: C4b Electrolysis

Summer Term 2 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Electrolysis procedure and apparatus	Emerging (catching up): •Evolution is the change in	
	Achieving (keeping up): •Evolution is the change in	
	Excelling (going beyond): •Evolution is the change in	
Electrolysis of molten ionic compounds		
Electrolysis of aluminium oxide and metal ores		
Electrolysis of aqueous ionic solutions		
Required practical: Electrolysis		

How do all KS4 Science lessons start? (Ready to Learn)

All lessons at Cardinal Pole start with a 'Ready to Learn' activity. The purpose of this is to support retrieval and prepare students for the lesson with recalling relevant knowledge. This activity is printed for students and handed out at the door. Students are expected to sit at their desk immediately and complete the task before sticking it in their books while the teacher welcomes the class and takes the register.

Ready to learn activities in **Science** look like this:

Velocity-time graphs 2



Describe what a horizontal line at 4m/s tells us on a velocity-time graph.

Constant velocity

Last Lesson

Describe what a straight line with a negative gradient tells us on a velocity-time graph

Deceleration

Last lesson 2

Describe the movement and arrangement of particles in a solid.

Movement – Vibrate on the spot
Arrangement - Regular

Last Term / Last Year

Suggest how to calculate displacement from a velocity-time graph

Area underneath the line

Stretch & Challenge

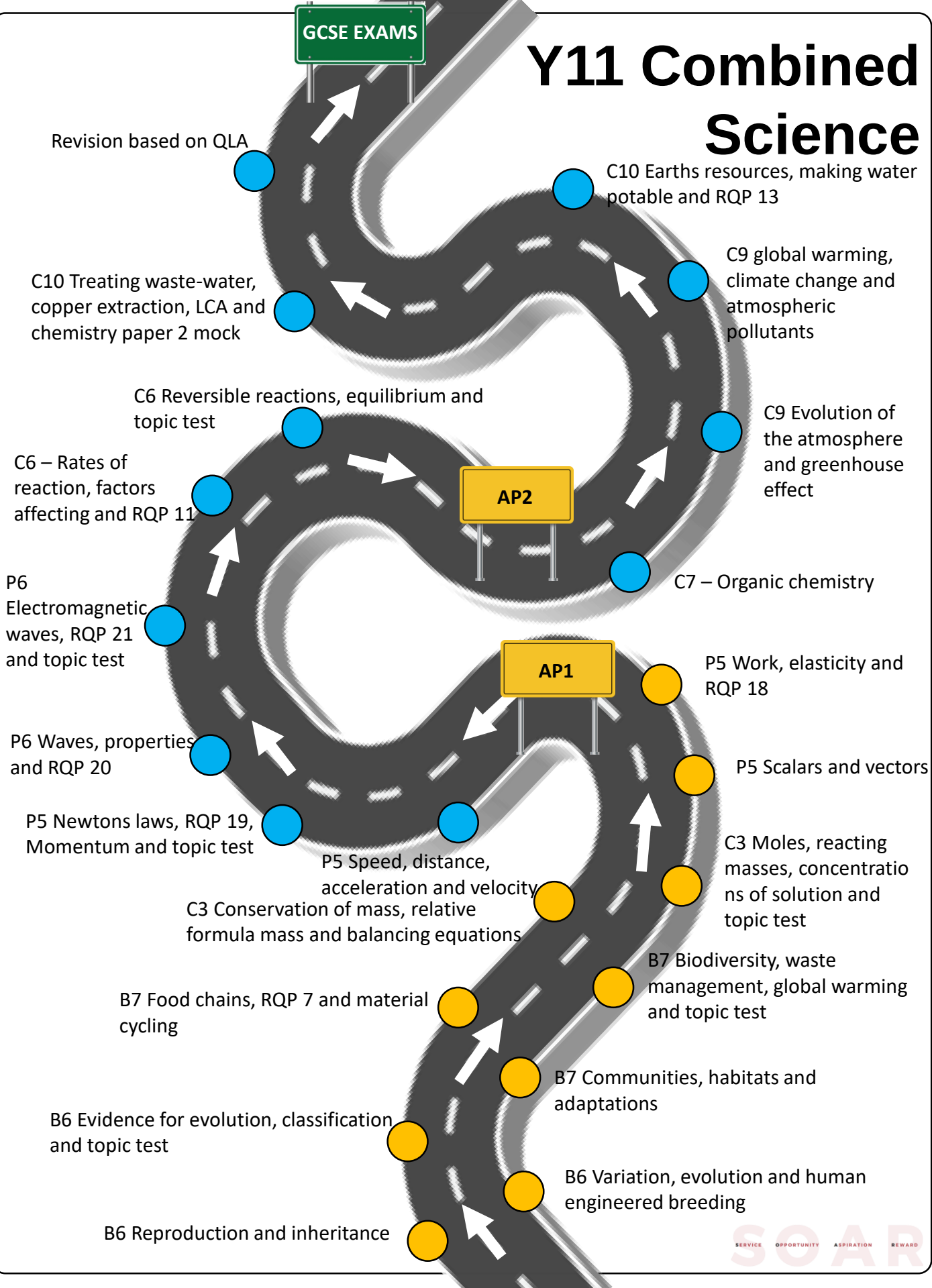
Ready to learn

One Voice

Work hard

GCSE EXAMS

Y11 Combined Science



How is your attainment measured at GCSE in Autumn term?

Autumn: HT1

B6 Inheritance variation and evolution topic test	40 mark topic test covering current topic - assessed by teacher and DIRT
B7 Ecology topic test	40 mark topic test covering current topic - assessed by teacher and DIRT

Assessment Point 1

What is assessed?	% of course	Why?
Biology paper 2	16.6	Covering key topics that come up in GCSE combined science biology paper 2 (actual paper) allowing students to practice what the real paper will be like.
Chemistry paper 1	16.6	Covering key topics that come up in GCSE combined science chemistry paper 1 (actual paper) allowing students to practice what the real paper will be like.
Physics paper 1	16.6	Covering key topics that come up in GCSE combined science physics paper 1 (actual paper) allowing students to practice what the real paper will be like.

Autumn: HT2

C3 Quantitative chemistry topic test	40 mark topic test covering current topic - assessed by teacher and DIRT
Consolidation test	40 mark topic test covering key areas from QLA of last years papers - assessed by teacher and DIRT

How is your attainment measured at GCSE in Autumn term?

Emerging	Achieving	Excelling
Inheritance, variation and evolution • I can define sexual and asexual reproduction and name their gametes. • I can state that meiosis creates four genetically different cells. • I can define the human genome and what a gene codes for. • I can identify key genetic terms like allele, dominant, and recessive. • I can state that variation can be caused by genes, the environment, or both. • I can define evolution as a gradual change in inherited characteristics over time. • I can define selective breeding as crossing organisms for specific desirable traits. • I can recall that fossils are the remains of organisms from millions of years ago.	Inheritance, variation and evolution • I can explain how fertilisation restores the full number of chromosomes. • I can describe the repeating nucleotide structure that makes up DNA. • I can outline the medical importance of mapping the human genome. • I can use a Punnett square to predict sex determination • I can explain how natural selection allows the survival of the fittest organisms. • I can describe the main steps used to genetically engineer a new organism. • I can outline the evidence for evolution using fossils and antibiotic-resistant bacteria. • I can describe the Linnaean system of classification from kingdom down to species	Inheritance, variation and evolution • I can compare the full cellular stages of mitosis and meiosis. • I can explain how a mutation alters a protein's shape. • I can explain how non-coding DNA switches specific genes on or off. • I can interpret a family pedigree tree to determine genotypes, phenotypes, and probabilities of inheriting a disorder . • I can explain how mutations can create new phenotypes that lead to speciation. • I can evaluate the benefits and risks of GM crops and medical genetic engineering. • I can explain how extinction occurs when a species cannot adapt to rapid environmental changes. • I can compare the Linnaean system with Carl Woese's three-domain classification system.

How is your attainment measured at GCSE in Autumn term?

Emerging	Achieving	Excelling
Ecology - I can describe the way in which ecosystems are organised - I can state living and non-living factors that will affect an ecosystem - I can demonstrate how to use a quadrat and transect to estimate the population of a species in an ecosystem - I can identify the adaptations shown by animals and plants for their survival - I can describe the relationship between predators and prey and construct food chains - I can name the processes involved in the water cycle and the carbon cycle - I can define biodiversity and state examples of ways that humans decrease biodiversity - I can state the greenhouse gases and describe how increasing greenhouse gases in the atmosphere can lead to global warming - I can state measures taken to limit the decrease in biodiversity	Ecology - I can describe the difference between communities and populations within an ecosystem - I can describe how abiotic and biotic factors affect the populations within an ecosystem - I can describe how to use a quadrat randomly to calculate the approximate population of a species - I can describe how the adaptations shown by animals and plants aids in their survival - I can analyse and construct food chains and food webs for a given ecosystem - I can describe how materials, such as carbon and water, are cycled through ecosystems - I can describe how human actions affect the biodiversity in a variety of ecosystems - I can describe the greenhouse effect and state the possible impact of global warming on ecosystems - I can state and explain the impact of measures to maintain biodiversity	Ecology - I can compare the organisation of ecosystems across Earth and suggest explanations for their differences - I can measure and evaluate the impact of biotic and abiotic factors on an ecosystem - I can evaluate a student's method of calculating the population and distribution of organisms - I can categorize adaptations into behavioural, structural and functional, and explain in detail how an organism's adaptations aid in their survival - I can analyse food chains and food webs and discuss how stability of food webs is maintained in stable ecosystems - I can explain in detail how all organisms aid in the cycling of carbon, and how human impact upsets the balance - I can explain how humans have impacted biodiversity on both a local and global scale - I can explicitly link human action to global warming and the impact it has on global ecosystems - I can evaluate proposed measures for maintaining biodiversity and make suggestions to increase impact

How is your attainment measured at GCSE in Autumn term?

Emerging	Achieving	Excelling
Quantitative chemistry - I can state that mass is conserved in chemical reactions - I can recognise that atoms are not created or destroyed in a reaction - I can identify reactants and products in a word equation - I can copy/write simple word equations - I can recall that substances are measured in moles - I can define relative atomic mass (Ar) - I can define relative formula mass (Mr) - I can calculate Mr from a chemical formula	Quantitative chemistry - I can write balanced symbol equations from word equations - I can explain conservation of mass in terms of atoms being rearranged - I can calculate relative formula mass (Mr) from a given formula - I can explain why equations must be balanced - I can use balanced equations to describe reactions - I can use the equation: moles = mass $\div$ Mr - I can calculate the number of moles in a substance - I can calculate mass from moles and Mr - I can use moles in simple calculations with balanced equations - I can recognise that coefficients in equations show mole ratios	Quantitative chemistry - I can justify conservation of mass using particle theory - I can balance more complex chemical equations accurately - I can use balanced equations to predict amounts of substances - I can explain why mass may appear not to be conserved in open systems (e.g. gases escaping) - I can evaluate experimental evidence for conservation of mass - I can use mole ratios from balanced equations to calculate reacting quantities - I can calculate masses of products and reactants in reactions - I can solve multi-step quantitative chemistry problems - I can rearrange and apply the mole equation confidently - I can evaluate the accuracy of calculations and identify errors

Topic: B6 – Inheritance, variation and evolution

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Types of reproduction	Emerging (catching up): Sexual reproduction involves gametes and meiosis	1) Describe sexual reproduction 2) Explain one advantage of sexual reproduction 3) Explain one disadvantage of asexual reproduction 4) Compare sexual and asexual reproduction
	Achieving (keeping up): Asexual reproduction involves mitosis	
	Excelling (going beyond): Compare sexual and asexual reproduction	
Cell division in sexual reproduction	Emerging (catching up): Meiosis involves the production of 4 gametes that are all genetically different	1) Describe how meiosis produces 4 daughter cells. 2) Explain why halving chromosome number important? 3) Explain the importance of restoring the chromosome number
	Achieving (keeping up): Chromosome number is halved	
	Excelling (going beyond): Fertilisation restores full chromosome number	
DNA and the genome	Emerging (catching up): DNA is a double helix polymer carrying genetic information	1) Describe the structure of DNA 2) Define gene and genome 3) State one use of genome research
	Achieving (keeping up): Genes code for proteins (via amino acids)	
	Excelling (going beyond): Genome = all genetic material in an organism	
Genetic inheritance 1 – key terms and punnet square introduction	Emerging (catching up): Alleles can be dominant or recessive	1) Define allele, genotype, phenotype, dominant and recessive 2) Describe the difference between genotype and phenotype 3) Complete a punnet square
	Emerging (catching up): Genotype vs phenotype distinction	
	Excelling (going beyond): Punnett squares predict probability	

Topic: B6 – Inheritance, variation and evolution

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Genetic inheritance 2 – Cystic fibrosis	Emerging (catching up): Cystic fibrosis is caused by a recessive allele	1) Explain why CF is recessive 2) Complete two punnet squares based on different parents genotypes and predict probability of offspring suffering phenotype 3) Explain how genetic disorders affect the phenotype
	Achieving (keeping up): Both parents must carry allele for the offspring to have the expressed phenotype	
	Excelling (going beyond): Genetic disorders affect phenotype	
Genetic inheritance 3 – polydactyly and embryo screening	Emerging (catching up): Polydactyly = dominant allele	1) Explain why polydactyly is dominant 2) Complete two punnet squares based on different parents genotypes and predict probability of offspring suffering phenotype 3) Evaluate embryo screening in terms of ethical considerations
	Achieving (keeping up): Embryo screening identifies genetic disorders	
	Excelling (going beyond): Ethical considerations are important in embryo screening	
Sex determination	Emerging (catching up): Females chromosomes = XX, males chromosomes = XY	1) Complete a punnet square showing the probability of offspring being male or female 2) Explain which gamete determines sex 3) Explain the probability of offspring being male or female
	Achieving (keeping up): Sperm determines sex	
	Excelling (going beyond): 50/50 probability of biological male or female offspring	
Mutations leading to variation	Emerging (catching up): Mutations are random DNA changes	1) Define mutation 2) Describe effects of mutations 3) Explain differences in variation
	Achieving (keeping up): Most mutations have no effect; few beneficial: some give an advantage	
	Excelling (going beyond): Variation caused by genes + environment	

Topic: B6 – Inheritance, variation and evolution

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Theory of evolution	Emerging (catching up): Evolution is the change in inherited characteristics over time	- Describe evolution by natural selection - Use the example of a peppered moth to describe evolution by natural selection - Use the example of a finch to describe evolution by natural selection
	Achieving (keeping up): Natural selection drives evolution and Charles Darwin is the theorist behind evolution by natural selection	
	Excelling (going beyond): Best-adapted species survive and reproduce	
Selective breeding	Emerging (catching up): Humans select desired traits of a species	- Describe the process of selective breeding using an animal. - Describe the process of selective breeding using a plant - Describe an issue with selective breeding
	Achieving (keeping up): These species are bred over many generations until desired trait becomes dominant trait	
	Excelling (going beyond): Selective breeding can cause inbreeding issues	
Genetic engineering	Emerging (catching up): genetic engineering as a process which involves modifying the genome of an organism by introducing a gene from another organism to give a desired characteristic.	- Define genetic engineering - State advantages and disadvantages of genetic engineering - Describe the process of genetic engineering
	Emerging (catching up): Plant cells are genetically modified to product bigger fruit or be resistant to disease, bacteria are modified to produce human insulin	
	Excelling (going beyond): Genetic engineering process involves vectors and enzymes.	

Topic: B6 – Inheritance, variation and evolution

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Ethics of selective breeding and genetic engineering	Emerging (catching up): Selective breeding can lead to bigger fruit and disease resistant crops but cause inbreeding	1) Explain benefits and risks of selective breeding 2) Explain the potential benefits and risk of genetic engineering in agriculture and in medicine 3) Evaluate the ethics of genetic engineering
	Achieving (keeping up): Genetic engineering could cure inherited disease but also we do not know the long-term health effects	
	Excelling (going beyond):	
Evidence for evolution – fossils and extinction	Emerging (catching up): Fossils are the ‘remains’ of organisms from millions of years ago – they are formed from	1) Describe the term fossils and state the ways they are formed. 2) Explain why we are unsure of early forms of life. 3) Explain extinction. 4) Explain different ways species can become extinct.
	Achieving (keeping up): Many early forms of life were soft-bodied, which means that they have left few traces behind. What traces there were have been mainly destroyed by geological activity.	
	Excelling (going beyond): Extinctions occur when there are no remaining individuals of a species still alive. Students should be able to describe factors which may contribute to the extinction of a species.	

Topic: B6 – Inheritance, variation and evolution

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Evidence for evolution – resistant bacteria and evolutionary trees	Emerging (catching up): - Bacteria can evolve at a fast rate due to them reproducing rapidly - All organisms have evolved from a common ancestor.	1) Explain why bacteria can evolve at a fast rate. 2) Explain how bacteria can become resistant to antibiotics. 3) State three factors that can increase the chance of bacteria developing antibiotic resistance. 4) I analyse evolutionary trees and identify common ancestors.
	Achieving (keeping up): - Mutations can lead to resistance that is passed on. - Organisms that are closer together on an evolutionary tree are more closely related.	
	Excelling (going beyond): - Incorrectly prescribing antibiotics, completing full course and agricultural use lead to rise of antibiotic-resistant bacteria - Evolutionary trees provide timelines of evolution and illustrate when species evolved from their last common ancestor	
Classification of living organisms - Carl Linnaeus and binomial name	Emerging (catching up): Linnaeus classified living organisms by characteristics - kingdom, phylum, class, order, family, genus and species	1) State the name of the scientist who classified by structure and characteristics.. 2) State the order of this classification system. 3) State the binomial name of an organism. 4) Use the classification system to state different parts of the classification.
	Achieving (keeping up): The binomial system is used to name living organisms (genus and species)	
	Excelling (going beyond): Organisms can be classified further by characteristics in groups	

Topic: B6 – Inheritance, variation and evolution

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Classification of living organisms – Carl Woese and the three-domain system	Emerging (catching up): Carl Woese classified the three-domain system that classified organisms based on the understanding of biochemical processes and internal structures due to the microscope improvements	1) State the name of the system devised by Carl Woese 2) Classify different organisms in the three-domain system 3) Use an evolutionary tree to find a common ancestor and extinct organism
	Achieving (keeping up): Carl Woese devised the three-domain system and classified organisms into archaea, bacteria and eukaryota	
	Excelling (going beyond): Evolutionary trees show how closely related organisms are – fossil data is used for extinct organisms	

Topic: B7 – Ecology

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Communities, ecosystem, interdependence and competition	Emerging (catching up): Ecosystems are organised into populations and communities that live in different habitats and compete	1) Define population 2) Define community 3) State 3 things that animals compete for in an ecosystem 4) Two trees growing in a forest are different heights. Suggest why this could be. 5) Describe 2 examples of interdependence. Give examples of particular organisms
	Achieving (keeping up): - Communities are made from all the populations of organisms living in an ecosystem - Animals compete for food, territory and mating partners, whilst plants compete for sunlight, water, space and minerals	
	Excelling (going beyond): Different organisms occupy a niche where they rely on other organisms for survival. This is called interdependence.	
Biotic and Abiotic factors affecting habitats	Emerging (catching up): Biotic factors are living parts of an ecosystem and abiotic factors are non-living parts of an ecosystem	1) Describe the difference between biotic and abiotic factors 2) Give 3 examples of biotic and abiotic factors 3) Suggest the abiotic factors that have the most impact on plant growth in a rainforest 4) Suggest the biotic factor that stops flowers growing in a school field 5) Explain how light intensity can impact plant growth
	Achieving (keeping up): - Abiotic factors include light intensity and temperature. - Biotic factors include food, predators and new pathogens	
	Excelling (going beyond): Abiotic factors that be measured in order to assess their impact on populations	
Adaptations 1 – Animals	Emerging (catching up): - Predators have sharp claws and teeth to catch and kill prey - Animals that live in cold places have thick fur to keep heat energy in	1) State 3 structural adaptations that most predators have 2) State 3 structural adaptations that most prey have 3) Define behavioural adaptation 4) State 2 behavioural adaptations 5) Describe a functional adaptation shown by camels to conserve water
	Achieving (keeping up): Adaptations can be structural, behavioural and functional	
	Excelling (going beyond): Structural and behavioural adaptations are easier to see than functional ones, a functional adaptations involve internal body function	

Topic: B7 – Ecology

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Adaptations 2 – Plants and Extremophiles	Emerging (catching up): - The adaptations of cacti help them to conserve water - Extremophiles live in areas of extreme temperature and pH	1) State 2 structural adaptations shown by cacti 2) Describe why cacti have small leaves 3) Explain the structure of a cactus stem 4) Explain why extremophiles can survive at very high temperatures, but other animals cannot 5) State 2 other conditions that extremophiles can survive in
	Achieving (keeping up): - Cacti have small leaves to minimise water loss by transpiration - Extremophiles are normally bacteria that live in extreme conditions	
	Excelling (going beyond): - Plants with large leaves maximise photosynthesis and have adaptations to help reduce water loss - Extremophiles are highly adapted and specialised, and their enzymes can withstand extreme temperature and pH	
Food chains and food webs	Emerging (catching up): - Producers are green plants and algae that carry out photosynthesis - Producers are eaten by consumers	1) Define producer 2) Draw a food chain to show a rabbit that eats grass. The rabbit is eaten by a fox. On your food chain label the producer and consumers 3) Draw a food web to represent the information displayed 4) Suggest the impact on the shown ecosystem if a pathogen killed all of the mice
	Achieving (keeping up): - The arrow in food chains and food webs represent the transfer of energy and biomass - Primary consumers are herbivores whilst secondary consumers are carnivores	
	Excelling (going beyond): - Food webs are better at representing ecosystems than food chains as organisms often have multiple food sources - The amount of biomass transferred between levels of a food chain decreases each time	

Topic: B7 – Ecology

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Required practical 7 – Estimating population size	Emerging (catching up): Population size is calculated using a quadrat that is placed randomly	1) State a piece of apparatus used in sampling 2) Describe how to carry out a random sample 3) A quadrat has sides of 50cm. Calculate the area of the quadrat 4) Calculate the population of daisies in the sample area using the displayed information
	Achieving (keeping up): A random sample is made by splitting an area into equal squares and assigning each a grid reference	
	Excelling (going beyond): The accuracy of a population calculation is increased by taking more samples and calculating a mean	
Required practical 7 – Distribution of organisms	Emerging (catching up): Distribution of organisms is investigated using a transect	1) State two pieces of apparatus used to measure distribution of organisms 2) Explain how distance from a tree effects the number of flowers in a field 3) Suggest how a scientist could increase the accuracy of their results in sampling 4) Compare the sampling methods to measure abundance and distribution of organisms
	Achieving (keeping up): A transect can be used to show that the number of daisies decreases as you get closer to a tree because of changing light intensity	
	Excelling (going beyond): Quadrats are placed at specific intervals along a transect to compare the distribution of organisms in an ecosystem	
The water cycle	Emerging (catching up): Water is cycled by evaporation, condensation and precipitation	1) State the 3 forms of precipitation 2) State the key processes involved in the water cycle 3) Describe how clouds form 4) Describe the role of plants in the water cycle 5) Describe, in detail, the events of the water cycle
	Achieving (keeping up): Water returns to the atmosphere through evaporation and transpiration and cools down so that it condenses	
	Excelling (going beyond): The water cycle provides fresh water for plants and animals on land before draining into the seas and oceans	

Topic: B7 – Ecology

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
The Carbon Cycle	Emerging (catching up): Carbon dioxide is released by respiration and absorbed by photosynthesis	1) Describe the role of plants in the carbon cycle 2) Describe the role of animals in the carbon cycle 3) Describe the role of decomposers in the carbon cycle 4) Explain the role of humans in upsetting the balance of carbon dioxide
	Achieving (keeping up): Animals, plants and decomposers carry out respiration. Carbon dioxide is also released by burning fossil fuels	
	Excelling (going beyond): Carbon moves through the carbon cycle as carbon dioxide gas and organic carbon through a food chain	
Biodiversity 1 – Impact of a changing human population and land pollution	Emerging (catching up): - The human population is increasing which is producing more waste on the land - Biodiversity is the variety of all organisms living on Earth	1) Define biodiversity 2) State 2 habitats with high biodiversity and 1 habitat with low biodiversity 3) State two effects of the increasing human population 4) State 2 examples of land pollution 5) Explain how increasing the quality of living is affecting waste production
	Achieving (keeping up): - Land pollution includes landfill sites - The quality of living is increasing which is producing more waste	
	Excelling (going beyond): Although there is a negative correlation between waste production and biodiversity, it is hard to prove	
Biodiversity 2 – Waste management and air and water pollution	Emerging (catching up): Air and water pollution are decreasing biodiversity	1) Describe the effect of air and water pollution on biodiversity 2) Describe 2 examples of air pollution 3) Describe 2 examples of water pollution 4) Explain how high levels of fertiliser leads to a decreased biodiversity
	Achieving (keeping up): - Air pollution includes acidic gases and pollutants such as carbon monoxide - Water pollution occurs from fertilisers running into water ways	
	Excelling (going beyond): Fertilisers building up in water can lead to an algal bloom that leads to the death of aquatic plants and aquatic animals	

Topic: B7 – Ecology

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Land Use and Deforestation	Emerging (catching up): - Deforestation is the cutting down of trees. This decreases biodiversity - Land is used for farming, building and quarrying. These all decrease biodiversity	1) Describe deforestation 2) State the impact of deforestation on biodiversity 3) State 3 other human interactions that decrease biodiversity 4) Explain how deforestation contributes to global warming
	Achieving (keeping up): - Land use destroys animal habitats and kills plants which decrease biodiversity - Deforestation also increases the carbon dioxide concentration of the atmosphere which contributes to global warming	
	Excelling (going beyond): Deforestation takes place to make space for additional farming and building, which release greenhouse gases and decrease biodiversity	
Global Warming	Emerging (catching up): Global warming caused by an increase in greenhouse gases in the atmosphere	1) State the three greenhouse gases 2) State 3 biological impacts of global warming 3) Explain how melting sea caps effects biodiversity 4) Describe the importance of peer review
	Achieving (keeping up): The consequences of global warming include ice caps melting, sea levels rising, extreme weather and droughts	
	Excelling (going beyond): Global warming is difficult to measure, and scientists carry out peer review to understand the impact of global warming	
Maintaining Biodiversity	Emerging (catching up): Humans have put programmes into place to stop biodiversity from decreasing	1) State 3 ways that humans are reducing negative effects of biodiversity 2) Explain how recycling stops biodiversity from being reduced 3) Explain the importance of reintroducing hedgerows
	Achieving (keeping up): Biodiversity is maintained by breeding programmes, reintroducing hedgerows and recycling resources	
	Excelling (going beyond): Maintaining biodiversity is challenging because governments across the world are not in agreement about reducing carbio dioxide emissions	

Topic: C3 Quantitative chemistry

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Conservation of mass & gases	Emerging: • State that mass is conserved in chemical reactions	1. State the law of conservation of mass 2. Describe what happens to mass when a gas escapes 3. Explain why mass is conserved in a closed system 4. Evaluate experimental evidence for conservation of mass
	Achieving: • Describe how mass appears to change when gases are gained or lost in reactions	
	Excelling: • Explain conservation of mass in terms of atoms being rearranged in a closed system	
Balancing equations	Emerging: • State that equations must be balanced	1. State what a balanced equation is 2. Describe how to balance simple equations 3. Explain why equations must be balanced 4. Balance increasingly complex equations
	Achieving: • Describe how to balance equations by adjusting coefficients	
	Excelling: • Explain balancing in terms of conservation of atoms and mass	
Relative formula mass	Emerging: • State that relative formula mass (Mr) is the sum of atomic masses	1. State what Mr means 2. Describe how to calculate Mr 3. Calculate Mr for compounds 4. Explain why Mr is important in chemistry
	Achieving: • Describe how to calculate Mr from a formula	
	Excelling: • Explain how Mr relates to quantities of substances in reactions	

Topic: C3 Quantitative chemistry

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Chemical measurements	Emerging: • State that chemists measure amounts using mass and volume	1. State common measurements in chemistry 2. Describe how they are used in calculations 3. Explain the importance of accuracy 4. Evaluate sources of error
	Achieving: • Describe how measurements are used to calculate reacting quantities	
	Excelling: • Explain why accurate measurements are important in chemical reactions	
Moles	Emerging: • State that 1 mole of a substance contains a fixed number of particles	1. State what a mole is 2. Describe how to calculate moles 3. Calculate moles from mass 4. Explain why the mole is useful
	Achieving: • Describe how to calculate moles using mass and Mr (moles = mass/Mr)	
	Excelling: • Explain the mole as a link between mass and number of particles	
Amount of substance 1	Emerging: • State that moles can be used to calculate quantities of reactants	1. State what mole ratio means 2. Describe how to find ratios from equations 3. Calculate reacting masses 4. Explain how ratios link to equations
	Achieving: • Describe how to use ratios from balanced equations	
	Excelling: • Explain how mole ratios determine amounts of substances reacting	

Topic: C3 Quantitative chemistry

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Amount of substance 2	Emerging: • State that reacting masses can be calculated using moles	1. State steps in mole calculations 2. Describe how to calculate reacting masses 3. Complete multi-step calculations 4. Explain each stage of the method
	Achieving: • Describe the steps to calculate masses from equations	
	Excelling: • Explain multi-step calculations using mole relationships	
Limiting reactants	Emerging: • State that one reactant can limit a reaction	1. State what a limiting reactant is 2. Describe how to identify it 3. Calculate limiting reactants 4. Explain impact on yield
	Achieving: • Describe how to identify the limiting reactant	
	Excelling: • Explain how limiting reactants affect product yield	
Using moles to balance equations	Emerging: • State that mole ratios can balance equations	1. State what coefficients represent 2. Describe mole ratios in equations 3. Use moles to balance equations 4. Explain the link between moles and equations
	Achieving: • Describe how mole ratios relate to coefficients	
	Excelling: • Explain balancing equations using quantitative relationships	

Topic: C3 Quantitative chemistry

Autumn Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Concentration of solutions	Emerging: • State that concentration is the amount of solute in a volume	1. State what concentration means 2. Describe how to calculate it 3. Calculate concentration from data 4. Explain the effect of concentration changes
	Achieving: • Describe how to calculate concentration (g/dm^3)	
	Excelling: • Explain how changing concentration affects reactions	
Concentration of solutions 2	Emerging: • State that concentration can be expressed in mol/dm^3	1. State units for concentration 2. Describe how to calculate mol/dm^3 3. Convert between units 4. Explain the relationship between moles and volume
	Achieving: • Describe how to calculate concentration using moles	
	Excelling: • Explain how concentration links to moles in solution chemistry	

How is your attainment measured at GCSE in Spring term?

Spring: HT1

P5 Forces topic test	40 mark topic test covering key content – assessed by teacher and DIRT
P6 Waves topic test	40 mark topic test covering key content – assessed by teacher and DIRT

Assessment Point 2

What is assessed?	% of course	Why?
Biology paper 2 Physics paper 2 Chemistry (Chemistry paper 2 will be undertaken in class under exam conditions)	16.6 each	Covering key topics that come up in GCSE combined science papers (actual paper) allowing students to practice what the real paper will be like.

Spring: HT2

C6 Rates of reaction topic test	40 mark topic test covering key content – assessed by teacher and DIRT
Consolidation test	40 mark topic test covering key content – assessed by teacher and DIRT

How is your attainment measured at GCSE in Spring term?

Emerging	Achieving	Excelling
Forces - I can define forces as vectors, scalars, contact and non-contact. Calculate weight and use resultant forces. - I can describe work done in terms of forces and elasticity relating to a spring. I can describe spring constant and carry out the spring extension required practical. - I can calculate speed and recall speed of different moving objects. I can describe speed using a distance-time graph. - I can describe the different parts of a velocity-time graph. - I can calculate acceleration using change in velocity and time. This can be used to describe basic terminal velocity 1 in terms of acceleration. - I can carry out the acceleration required practical and use it to describe the relationship between force and constant mass.	Forces - I can state units of scalars, vectors and draw diagrams showing contact and non-contact forces. Calculate mass and draw resultant force diagram. - I can Use graphs to determine the limit of proportionality and describes Hooke's law in terms of directly proportional. I can Calculate spring constant. - I can calculate speed with unit conversions and rearrange the equation. I can calculate speed from a distance-time graph. - I can calculate acceleration from a velocity-time graph. - I can calculate final and initial velocity from uniform acceleration equation. This can be used to further describe terminal velocity 1. - I can describe a method for the acceleration required practical and use it to describe the relationship between constant force and mass.	Forces - I can calculate resultant force and use these on free body diagrams. Draw resolving forces diagrams. - I can use spring constant to describe the stiffness of springs. Use the spring constant and energy to calculate extension in terms of dual equations. - I can calculate acceleration from distance-time graph using a tangent. - I can calculate the distance travelled using the area of a velocity-time graph. - I can calculate acceleration and distance from uniform acceleration equation. This can be used to explain terminal velocity 1 and 2. - I can explain acceleration required practical and use

How is your attainment measured at GCSE in Spring term?

Emerging	Achieving	Excelling
Forces • I can recall Newtons first, second and third law • I can calculate overall stopping distance and recall factors that affect it in terms of reaction time. • I can describe the term momentum and calculate momentum	Forces • I can describe Newtons first, second and third law • I can describe factors that affect braking distance and thinking distance and analyse these on a graph. • I can describe conservation of momentum.	Forces • I can apply Newtons first, second and third law • I can estimate forces involved in deceleration and describe how large decelerations can cause loss of control. • I can use the momentum equation and conservation of momentum to calculate factors involved in objects touching.

How is your attainment measured at GCSE in Spring term?

Emerging	Achieving	Excelling
Rates of Reactions, reversible reactions and dynamic equilibrium - I can describe a method of how to investigate how SA:Vol ratio and concentration effect the rate of a reaction - I can recall which factors effect rate of reaction - I can recall what reversible reactions are and what the symbol for one is - I can recall the difference between a closed and open system Organic chemistry - I can recall what crude oil is and how it is formed - I can recall what fractional distillation is and explain how it separates crude oil	Rates of Reactions, reversible reactions and dynamic equilibrium - I can calculate rates of reaction from data given and from a graph - I can explain using collision theory how factors will effect the rate of a reaction - I can explain how if a reversible reaction is exothermic in one direction then it must be endothermic in the other - I can explain how changing the conditions in a system at equilibrium will mean the system responds to counteract the change Organic chemistry - I can recall what alkanes are, name the first 4 and know the formula for all others - I can explain how hydrocarbons are broken down, why smaller ones are more useful and balance cracking equations	Rates of Reactions, reversible reactions and dynamic equilibrium - I can find rate of reaction at a point in time using a tangent from a graph - I can understand how catalyst alter rates of reactions, and be able to compare them to enzymes in biology - I can explain how yield of a reversible reaction is not effected by a catalyst - I can apply Le Chatelier's Principle of changing conditions to temperature, concentration and pressure in a reversible reaction Organic chemistry - I can explain the differences between alkanes and relate length of carbon chain to boiling point, viscosity and flammability - I can describe the test for alkenes

How is your attainment measured at GCSE in Spring term?

Emerging	Achieving	Excelling
Waves - I can state the definition n of transverse and longitudinal waves - I can calculate the speed of a wave - I can label parts of the EM spectrum and describe some properties of the different waves - I can carry out the infrared practical and recall a method	Waves - I can label key parts of a transverse and longitudinal wave and describe key properties - I can use a ripple tank to determine the speed of a wave - I can label all parts of the EM spectrum and explain some properties of different waves - I can analyse data form the infrared practical and explain improvements	Waves - I can label all parts of a transverse and longitudinal wave - I can rearrange the equation to calculate different functions and complete refraction diagrams - I can label all parts of the EM spectrum and explain properties of all waves, including radio wave s(HT) - I can use the infrared practical in different situations to explain properties of infrared waves

Topic: P5 Forces

Spring Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Types of Forces	Emerging: • State examples of scalar and vector quantities, and contact/non-contact forces	1. State an example of a contact and non-contact force 2. State an example of a contact and non-contact force 3. Describe the difference between contact and non-contact forces 4. Explain the difference between scalar and vector quantities
	Achieving: • Describe the difference between contact and non-contact forces	
	Excelling: • Explain the difference between scalar and vector quantities	
Gravitational and Resultant Forces	Emerging: • State the difference between weight and mass	1. State the difference between weight and mass 2. Write the equation which links mass and weight 3. Calculate weight of 75kg person on Earth 4. Calculate resultant forces from diagrams given
	Achieving: • Describe how to calculate a calculation between weight and mass	
	Excelling: • Explain how to calculate a resultant force given multiple forces on a diagram	
Drawing and Resolving Force Diagrams	Emerging: • To be able to draw and label free body diagrams	1. Label this free body diagram 2. Write the steps to resolve forces on 2 direction 3. Label this diagram given the data 4. Label and resolve this diagram given the data
	Achieving: • Describe how to resolve forces at right angles	
	Excelling: • Explain how to balance a free-body diagram in 2 directions	

Topic: P5 Forces

Spring Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Vector Diagram Scale Drawing	Emerging: To be able to draw a vector as a line on a scale drawing	1. Draw a scale drawing of these resultant force for these two forces combined 2. Calculate the value of this vector scale drawing in each direction 3. Draw and label this free body diagram, resolve, and draw this resolved force as a scale vector drawing
	Achieving: Describe how to calculate each component of a vector scale drawing	
	Excelling: Explain how to draw a resultant force from a free body diagram of multiple forces	
Work Done and Energy Transfer	Emerging: State the equation and units for Work Done	1. Write the equation for Work Done, including units for each part 2. Calculate Work Done given data 3. Describe energy transfer in a person pushing a box across the floor with high friction
	Emerging: Describe energy transfers involving work done	
	Excelling: Explain how friction increases work required	
Hooke's Law	Emerging: State Hooke's Law and give the equation	
	Achieving: Describe the factors which effect the extension of a spring	
	Excelling: Explain how work done can be calculated in stretching a spring	

Topic: P5 Forces

Spring Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Hooke's Law Required Practical	Emerging: • Recall how to carry out practical to investigate Hooke's Law	Analysis of results 1. Calculation of spring constant 2. Graph drawing
	Achieving: • Describe how to improve Hooke's Law Practical	
	Excelling: • Explain the difference between linear and non-linear relationship of force and extension	
Distance, Displacement & Speed	Emerging: • State the difference between displacement and distance	1. What is the difference between distance and displacement 2. What is the equation which links speed, distance and time 3. Calculate speed given data 4. Convert these speeds from m/s to km/hr 5. Which speed is faster 10m/s or 35km/hr
	Achieving: • To be able to calculate speed	
	Excelling: • To be able to convert between units to compare speeds	
Velocity & Distance-Time Graphs	Emerging: • State how velocity is different to speed	1. What is difference between speed and velocity 2. Label this D-T graph with part each section show 3. Calculate speed in each section of D-T graph
	Achieving: • Describe what a distance time graph shows	
	Excelling: • To be able to calculate speed from a D-T graph	

Topic: P5 Forces

Spring Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Acceleration and Velocity-Time Graphs	Emerging: • State and apply equation for acceleration	- What is equation to calculate acceleration - Calculate acceleration given $\Delta v = 30$ and $t=4$ - Calculate initial velocity given $v=30\text{m/s}$; $a=5\text{m/s}$; $t = 5\text{s}$ - Using Velocity-Time graph calculate acceleration in each section - Using Velocity-Time graph find displacement over journey
	Achieving: • Be able to use velocity time graph to calculate acceleration	
	Excelling: • Be able to use velocity time graph to calculate displacement over a journey	
Circular Motion and Tangents	Emerging: • State that speed is constant for circular motion	- Explain how speed changes in circular motion - Explain how velocity changes in circular motion - Calculate velocity at point A in distance time graph using a tangent - Calculate acceleration at point B on velocity time graph using a tangent
	Achieving: • Describe with examples how velocity changes in circular motion	
	Excelling: • Calculate velocity and acceleration from tangents on distance/velocity - time graphs	
Uniform Acceleration Calculation	Emerging: • Define and calculate acceleration	- What is uniform acceleration equation - Calculate acceleration given data - Calculate distance given data - Calculate final/initial velocity given data
	Achieving: • Interpret motion graphs for uniform acceleration	
	Excelling: • Apply SUVAT-style equations to solve problems	

Topic: P5 Forces

Spring Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Acceleration and Velocity-Time Graphs	Emerging: • Describe how terminal velocity occurs	1. What is meant by terminal velocity? 2. A skydiver has just jumped from a plane. Which force is larger at the start of the fall: weight or air resistance? 3. What happens to air resistance as a falling object's speed increases? 4. At terminal velocity, what is the resultant force acting on the object? 5. Why does a parachutist slow down when they open their parachute?
	Achieving: • Explain changes in forces during free fall	
	Excelling: • Interpret and apply terminal velocity concepts	
Newton's First Law and Inertia	Emerging: • State Newton's First Law	1. What does Newton's First Law state? 2. What is inertia? 3. Which has more inertia: a football or a lorry? Why? 4. Why do passengers move forwards when a car brakes suddenly? 5. What is the resultant force on an object moving at constant velocity in a straight line?
	Achieving: • Describe and explain inertia	
	Excelling: • Apply Newton's First Law to real-life situations	
Newton's Second Law	Emerging: • State and use Newton's Second Law	1. What is the equation for Newton's Second Law? 2. What acceleration is produced when a 10 N force acts on a 2 kg object? 3. If the resultant force on an object doubles, what happens to the acceleration (assuming mass stays
	Achieving: • Predict how force and mass affect acceleration	
	Excelling: • Apply Newton's Second Law to solve problems	

Topic: P5 Forces

Spring Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Investigating Acceleration Required Practical	Emerging: • Investigate the relationship between force, mass and acceleration	- What happens to the acceleration of an object if the resultant force is increased but the mass stays the same? - What happens to the acceleration if the mass is increased but the force stays the same? - Which variable should be kept constant when investigating the effect of force on acceleration? - What equation links force, mass and acceleration? - A trolley of mass 2 kg accelerates at 3 m/s^2. What resultant force is acting on it?
	Achieving: • Measure and calculate acceleration accurately	
	Excelling: • Analyse results and evaluate the investigation	
Newton's Third Law	Emerging: • State and apply Newton's Third Law	- What does Newton's Third Law state? - When you push on a wall, what does the wall do? - Do action and reaction forces act on the same object? - Why can a rocket move forwards in space when there is no air to push against? - What is the reaction force to a swimmer pushing water backwards?
	Achieving: • Identify action–reaction force pairs	
	Excelling: • Apply Newton's Third Law to real-life situations	
	Emerging:	
	Achieving:	
	Excelling:	

Topic: P5 Forces

Spring Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Stopping Distances and Reaction Time	Emerging: Describe the components of stopping distance	- What two distances make up the total stopping distance? - What is meant by reaction time? - Name two factors that can increase reaction time. - How does increasing speed affect braking distance? - Why is braking distance greater on an icy road than on a dry road?
	Achieving: Explain factors affecting reaction time and thinking distance	
	Excelling: Explain factors affecting braking distance	
Momentum Calculations	Emerging: Define and calculate momentum	- What equation is used to calculate momentum? - What is the momentum of a 4 kg object moving at 3 m/s? - What happens to the total momentum in a closed system during a collision? - A 2 kg trolley moving at 5 m/s collides with a stationary trolley. What is the momentum of the moving trolley before the collision? - A 1000 kg car travels at 20 m/s. Calculate its momentum.
	Achieving: Apply the principle of conservation of momentum	
	Excelling: Solve momentum calculation problems	
Conservation of Momentum	Emerging: State and explain the principle of conservation of momentum	- What happens to the total momentum of a closed system during a collision? - A 2 kg trolley travelling at 4 m/s has what momentum? - A stationary object has what momentum? - In an explosion, why do the fragments move apart with
	Achieving: Apply conservation of momentum to calculations	
	Excelling: Analyse momentum	

Topic: P5 Forces

Spring Term 1 Golden Nuggets and Work Hard

[illegible]

Topic: P5 Forces

Spring Term 1 Golden Nuggets and Work Hard

[illegible]

Topic: P6 Waves

Spring Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Transverse and Longitudinal waves	Emerging (catching up): Waves may be either transverse or longitudinal. Achieving (keeping up): describe the difference between longitudinal and transverse waves. Excelling (going beyond): describe evidence that, for both ripples on a water surface and sound waves in air, it is the wave and not the water or air itself that travels	
Wave calculations	Emerging (catching up): All waves obey the wave equation: $\text{wave speed} = \text{frequency} \times \text{wavelength}$. Achieving (keeping up): identify amplitude and wavelength from given diagrams. Excelling (going beyond): describe a method to measure the speed of sound waves in air, and the speed of ripples on a water surface.	
Required practical 20 - measuring speed of waves through water (ripple tank)	Emerging (catching up): make observations to identify the frequency and wavelength of waves in a ripple tank. Achieving (keeping up): make observations to calculate the speed of ripples on a water surface	

Topic: P6 Waves

Spring Term 1 Golden Nuggets and Work Hard

[illegible]

Topic: C6 rates of reaction

Spring Term 1 Golden Nuggets and Work Hard

[illegible]

Topic: C7 Organic chemistry

Spring Term 1 Golden Nuggets and Work Hard

[illegible]

How is your attainment measured at GCSE in Summer term?

Spring: HT1

Chemistry paper 2

• 70 mark full paper – assessed by teacher and DIRT

Emerging	Achieving	Excelling
C9 – Chemistry of the atmosphere • I can state percentage of gases in the Earth's current atmosphere • I can describe how changes in the greenhouse gases are leading to climate change • I can state the atmospheric pollutants C10 – using resources • I can state how humans use the Earth's natural resources • I can describe the term potable water and explain the difference with pure water • I can state how to find the mass of dissolved solids in samples of water • I can describe why waste water needs treating • I can state why phytomining and bioleaching are needed • I can state the processes in a life cycle assessment	C9 – Chemistry of the atmosphere • I can describe how changes to the Earth's atmospheric gases took place over time • I can suggest potential consequences of climate change • I can describe the effects of atmospheric pollutants C10 – using resources • I can describe the difference between the Earth's finite and renewable natural resources and how synthetic can replace them • I can explain how to make water potable • I can describe how to distil water • I can describe how to aerobically and anaerobically treat waste water • I can describe the process of phytomining and bioleaching • I can use data and my own ideas in a life cycle assessment	C9 – Chemistry of the atmosphere • I can explain how changes to the Earth's atmospheric gases took place over time • I can explain the greenhouse effect in terms of radiation • I can explain the effects of atmospheric pollutants C10 – using resources • I can extract and interpret data from graphs in terms of how the Earth's natural resources are changing unsustainably • I can explain tests for potable and pure water • I can calculate the mass of dissolved solids in a sample of water • I can explain the uses of products from anaerobic respiration • I can explain how to extract the copper from the product of phytomining and bioleaching • I can evaluate and draw a conclusion from a life cycle assessment

Topic: C9 Chemistry of the atmosphere

Spring Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Properties of the gases in the atmosphere and evolution of the atmosphere – 5.9.1.1	Emerging (catching up): State that the atmosphere is 80% nitrogen and 20% oxygen .	1) State the two main gases and their percentages in the atmosphere. 2) Describe the other gases present in the atmosphere. 3) Calculate the fraction and ratio of nitrogen to oxygen in the atmosphere.
	Achieving (keeping up): Describe that there are small amounts of carbon dioxide, water vapour and noble gases.	
	Excelling (going beyond): Calculate gas proportions as fractions and percentages	
Evolution of the atmosphere 5.9.1.1/2/3	Emerging (catching up): State early air had little oxygen and carbon dioxide changed over time.	1) State two differences between the early atmosphere and the atmosphere today. 2) Describe how volcanoes and photosynthesis changed the gases in the atmosphere. 3) Explain how carbon dioxide levels decreased and oxygen levels increased over time.
	Achieving (keeping up): Describe volcanoes and photosynthesis changing gases in the atmosphere.	
	Excelling (going beyond): Explain and evaluate how gases changed over time using evidence and processes.	
Greenhouse gases and Greenhouse effect 5.9.2.1	Emerging (catching up): State greenhouse gases keep Earth warm.	1) State the role of greenhouse gases in maintaining Earth's temperature. 2) Describe how greenhouse gases affect heat energy in the atmosphere. 3) Explain how short and long wavelength radiation interact with greenhouse gases to produce the greenhouse effect.
	Achieving (keeping up): State greenhouse gases keep Earth warm.	
	Excelling (going beyond): Explain how radiation interacts with greenhouse gases to warm Earth.	
Human activities which contribute to an increase in greenhouse gases in the atmosphere 5.9.2.2	Emerging (catching up): State human activities increase carbon dioxide and methane.	1) State two human activities that increase carbon dioxide and methane in the atmosphere. 2) Describe how these human activities lead to an increase in greenhouse gases. 3) Evaluate the evidence that human activities cause climate change, including uncertainties and the role of peer review.
	Achieving (keeping up): Describe how activities release carbon dioxide and methane into the atmosphere	
	Excelling (going beyond): Explain and evaluate evidence for human impact and climate change uncertainty.	
Global climate change 5.9.2.3 and the carbon footprint/reduction 5.9.2.4	Emerging (catching up): State climate change is caused by temperature rise and carbon footprint is emissions.	1) State what causes global climate change and what a carbon footprint is. 2) Describe effects of climate change and ways to reduce carbon emissions. 3) Explain the impacts of climate change and why reducing carbon footprints can be difficult.
	Achieving (keeping up): Describe climate change effects and ways to reduce emissions.	
	Excelling (going beyond): Evaluate impacts, risks and limits of reducing emissions.	
Atmospheric pollutants and their effects 5.9.3.1/2	Emerging (catching up): State burning fuels releases pollutants.	1) State two pollutants released when fuels are burned. 2) Describe how burning fuels produces pollutants such as carbon monoxide, sulphur dioxide or particulates. 3) Explain the effects of these pollutants on human health and the environment.
	Achieving (keeping up): Describe how burning fuels produces pollutants and their effects.	
	Excelling (going beyond): Evaluate the impact of	

Topic: C10 Using resources

Spring Term 1 Golden Nuggets and Work Hard

Lesson Title	Golden Nugget	Work Hard
Using the Earth's resources and sustainable development 5.10.1.1	Emerging (catching up): State Earth's resources are used for food, materials and energy.	1) State what is meant by a finite resource and give one example. 2) Describe how natural resources can be supplemented or replaced by agricultural or synthetic products. 3) Explain why sustainable development is important for managing Earth's resources for future generations.
	Achieving (keeping up): Describe the use of finite and renewable resources.	
	Excelling (going beyond): Explain sustainable development and evaluate how resources are managed for future generations.	
Making water potable from freshwater and salt water 5.10.1.2	Emerging (catching up): State that potable water is safe to drink but not pure.	1) State what is meant by potable water. 2) Describe how water is treated to make it safe to drink in the UK. 3) Explain why different methods are needed to produce potable water from fresh and salty water. 4) Evaluate why desalination is not always widely used.
	Achieving (keeping up): Describe how fresh water is treated by filtering and sterilising.	
	Excelling (going beyond): Explain differences in water treatment and why methods like desalination are used.	
Required practical 13 - Analysis of water samples by pH, distillation and dissolved solids	Emerging (catching up): State that water can be tested and purified by distillation.	1) State one way to test water quality and one way to purify water. 2) Describe how distillation purifies water. 3) Explain what pH and dissolved solids results tell you about a water sample. 4) Evaluate the advantages and limitations of distillation compared to filtration.
	Achieving (keeping up): Describe how water is analysed (pH, solids) and purified by filtration and distillation.	
	Excelling (going beyond): Explain test results and evaluate purification methods including distillation.	
Waste water treatment 5.10.1.3	Emerging (catching up): State that waste water must be treated to remove harmful substances.	1) State why waste water needs to be treated before release. 2) Describe the main stages of sewage treatment. 3) Explain how biological treatment removes organic matter from wastewater. 4) Evaluate which is easier to make potable: wastewater, ground water or salt water.
	Achieving (keeping up): Describe the stages of sewage treatment (screening, sedimentation, digestion and aeration).	
	Excelling (going beyond): Explain how treatment processes remove waste and compare water sources for obtaining potable water.	
Alternative methods of extracting metals 5.10.1.4	Emerging (catching up): State that some metals are extracted using plants or bacteria.	1) State what is meant by phytomining or bioleaching. 2) Describe how plants or bacteria are used to extract metals from low-grade ores. 3) Explain how copper can be obtained from the solutions produced. 4) Evaluate the advantages and disadvantages of biological extraction compared to traditional mining.
	Achieving (keeping up): Describe how phytomining and bioleaching extract metals from low-grade ores.	
	Excelling (going beyond): Explain and evaluate biological extraction methods compared to traditional mining.	
Life cycle assessment 5.10.2.1	Emerging (catching up): State that LCA assesses environmental impact across a product's life.	1) State what a life cycle assessment (LCA) is used for. 2) Describe the main stages included in an LCA. 3) Explain why some parts of an LCA are difficult to measure accurately. 4) Evaluate how reliable LCAs are when comparing products (e.g. plastic vs paper bags).
	Achieving (keeping up): Describe the stages of an LCA from raw materials to disposal.	
	Excelling (going beyond): Explain and evaluate LCAs, including data limits and possible bias.	
Recycling 5.10.2.1	Emerging (catching up): State that reducing, reusing and recycling saves resources.	1) State two ways to reduce the use of natural resources. 2) Describe how recycling or reusing materials helps conserve resources. 3) Explain why recycling can reduce energy use and environmental damage. 4) Evaluate the advantages and disadvantages of recycling materials such as metals or plastics.
	Achieving (keeping up): Describe how materials can be reused or recycled to reduce waste and energy use.	
	Excelling (going beyond): Explain and evaluate methods of reducing resource use and their environmental impact.	