

Greenfields Academy (Secondary) - Long Term Planning – SCIENCE

Academic Year Overview 2020/21 – YEAR 11 AQA GCSE Combined Science (Trilogy)

Remainder of Y10 and Y11 Combined due to Covid-19 Virus

Term	Autumn		Spring		Summer	
	1	2	3	4	5	6
TRANSITION FROM Year 9 and 10 GCSE	Physics: <ul style="list-style-type: none"> • 6.2 Electricity • 6.5 Forces 	Chemistry: <ul style="list-style-type: none"> • 5.3 Quantitative Chemistry • 5.5 Energy Changes • 5.6 The rate of chemical changes 	Chemistry: <ul style="list-style-type: none"> • 5.7 Organic Chemistry • 5.8 Chemical Analysis • 5.9 Chemistry of the atmosphere 	Biology: <ul style="list-style-type: none"> • 4.2 Organisation • 4.4 Bioenergetics • 4.5 Homeostasis and Response • 4.6 Inheritance, Variation and Evolution 	GCSE Revision and Examination Preparation	

Required Practical – These are the JCQ Compulsory Required Practical sessions for all KS4 courses. They are common to all examination boards and students MUST have participated / seen / discussed in detail the practical and the outcomes.

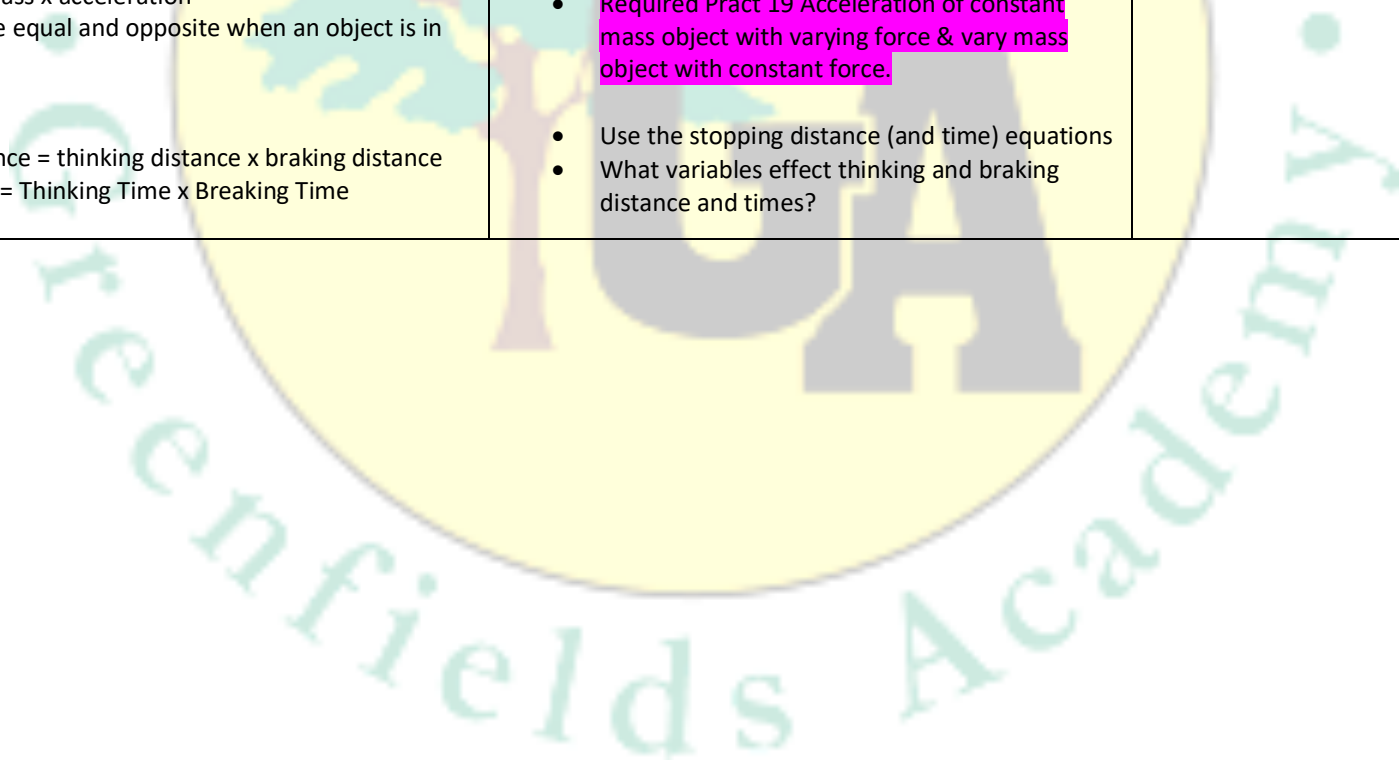
Suggested Practical – These are not JCQ compulsory required practicals but are strongly suggested as they demonstrate the key learning points for the topic.

Term 1

Weekly Sequence	New Learning & Knowledge	Key Question(s)	Whole School Focus (eg. Computing Week, Language Day)
1	<p>Electricity: Circuit symbol diagrams</p>		
2	<p>Charge flow = current x time Potential difference = current x voltage Current Vs p.d graphs Application of LDR and Thermistors</p> <p>Series and Parallel Circuits – arrangement, resistance and measuring I and V.</p> <p>Mains electricity, operating parameters and structure, including the National Grid</p> <p>Power = p.d x current Power = (current)² x resistance Energy transferred = power x time Energy transferred = charge x potential difference</p>	<ul style="list-style-type: none"> Identify the standard circuit symbol diagrams? Can you calculate a sum given an equation? Are you able to change the subject of an equation? Recall the units of I, V, Q, & R. Req Pract 15 – Resistance of wire practical Identify I Vs V graphs for fixed resistor, variable resistor and diode. Req Pract 16 – Resistance fixed resistor and diode Identify series and parallel circuits Recall and use $R_T = R_1 + R_2 + R_3 + \dots$ Recall I and V characteristics in series and parallel What frequency and p.d is mains electricity? What are the colours and functions of live, neutral and earth wires? What is the National Grid and the role of step-up and down transformers. Can you calculate a sum given an equation? Are you able to change the subject of an equation? 	
3	Forces:		

4	Know a range of scalar and vector quantities and the differences between them	<ul style="list-style-type: none"> • Describe what a scalar quantity is and give an example. 	
5		<ul style="list-style-type: none"> • Describe what a vector quantity is and give an example. 	
6	Give definitions and examples of contact and non-contact forces. Recall an interaction between two pairs of forces is required	<ul style="list-style-type: none"> • Define a contact force, with an example. • Define a non-contact force, with an example. 	
7	<p>Gravity = mass x gravitational field strength, $g=10\text{N/kg}$</p> <p>Work done = Force x Distance moved 1 J of work is done when a force of 1N displaces an object 1m. 1J = 1Nm</p> <p>Force = spring constant x extension Elastic PE = $0.5 \times \text{spring constant} \times (\text{extension})^2$ Remember that same equation for compression and stretch of spring. Extension is proportional to force until elastic limit is reached.</p> <p>Know how objects move in a straight line, using the term displacement (magnitude and direction) Speed = Distance / Time Velocity = Distance / Time Velocity is speed with a direction. Know the structure and representations of a distance time graph</p>	<ul style="list-style-type: none"> • Be able to identify and calculate resultant force for multiple force vectors. • Recall the units of gravity • Describe the difference between mass and weight • Use the gravity equation correctly • Is weight and mass directly proportional? • Recall and apply the work done equation • What is 1J the equivalent of? • Recall and apply the equations • How do you know when the limit of proportionality is reached / spring becomes plastic? • Required Practical 18 – Investigate relationship between force and extension of a spring • Recall, rearrange and apply the equations • Define speed and velocity • Identify an objects speed on a distance time graph. • Determine the speed of an object from a distance time graph. 	

	<p>Acceleration = change velocity / time taken Negative acceleration = deceleration Know the structure and representations of a velocity – time graph Use uniform acceleration equation: $v^2 - u^2 = 2as$ Earth acceleration due to gravity = 9.8N/kg (almost 10N/kg)</p> <p>N1 = Object with resultant force is: a) Stationary b) Keeps moving in same direction</p> <p>N2 = Force = mass x acceleration N3 = Forces are equal and opposite when an object is in equilibrium</p> <p>Stopping distance = thinking distance x braking distance Stopping Time = Thinking Time x Braking Time</p>	<ul style="list-style-type: none"> • Recall and apply the equations • Calculate acceleration from the gradient of a velocity time graph. <ul style="list-style-type: none"> • Recall Newtons 3 laws of motion • Use and rearrange N2 equation • Explain why a stationary object doesn't move (N1 and N3) • Required Pract 19 Acceleration of constant mass object with varying force & vary mass object with constant force. <ul style="list-style-type: none"> • Use the stopping distance (and time) equations • What variables effect thinking and braking distance and times? 	
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Term 2

Weekly Sequence	New Learning & Knowledge	Key Question(s)	Whole School Focus (eg. Computing Week, Language Day)
1 (8)	Quantitative Chemistry: Conservation of mass using the RAM of elements from the periodic table	<ul style="list-style-type: none"> Define conservation of mass Identify on the periodic table where the mass can be found 	
2 (9)			
3 (10)	Using RAM to find RFM (Relative Formula Mass) for balanced equations. How to calculate percentage by mass using RAM and RFM Know why mass changes during chemical reactions (in non-enclosed vessels) and where this mass goes. Be able to explain this in terms of particle models Be able to discuss uncertainties in terms of equipment and results. Be able to use estimations correctly. Calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution (g/dm ³).	<ul style="list-style-type: none"> Use RAM to calculate the RFM of compounds How can you calculate percentage mass of an element, eg amount of Cu in CuO₃ Explain why a conical flask appears to get lighter during a chemical reaction. Explain what happens in terms of the equation. How do you identify the uncertainty in equipment? Use the concentration of a solution to calculate how much solute would have been used. 	
4 (11)	Energy Changes: Know that energy is conserved during reactions.	<ul style="list-style-type: none"> Define exothermic and endothermic in terms of temperature and environment. Required Pract 10 – Variables that affect temperature change What do the reaction profiles look like for exothermic, endothermic and catalytic controlled reactions? Using bond energies calculate the amount of energy given out / taken in during the reaction. 	
5 (12)	Exothermic and endothermic reactions, everyday uses and what is happening at an atomic level in terms of bonding. Be able to draw reaction profiles for endothermic and exothermic reactions. Draw the reaction profile for a catalytic assisted reaction. Calculate the energy transferred using supplied bond energies.		

6 (13)	Rate of Chemical Changes: mean rate of reaction = quantity of reactant used/ time taken	<ul style="list-style-type: none"> • Use the equations to calculate mean rates of reactions • Recall the units that may be used 	
7 (14)	<p>mean rate of reaction = quantity of product formed/ time taken</p> <p>The quantity of reactant or product can be measured by the mass in grams or by a volume in cm³. The units of rate of reaction may be given as g/s or cm³/s.</p> <p>Factors which affect the rates of chemical reactions include: the concentrations of reactants in solution, the pressure of reacting gases, the surface area of solid reactants, the temperature and the presence of catalysts.</p> <p>Recall how changing these factors affects the rate of chemical reactions</p> <p>Be able to explain reactions in terms of collision theory and activation energy</p> <p>Recall reversible reactions and the appropriate symbol. Equilibrium occurs when rate forwards is same as rate backwards, and both occur simultaneously</p>	<ul style="list-style-type: none"> • Identify the factors which affect the rates of chemical reactions. • Explain how, in terms of particles and activation energy • Required practical 11 – Investigation into the effects of reaction rate. • What is collision theory? • What is activation energy? • Describe what a reversible reaction is. • Identify the symbol represented 	

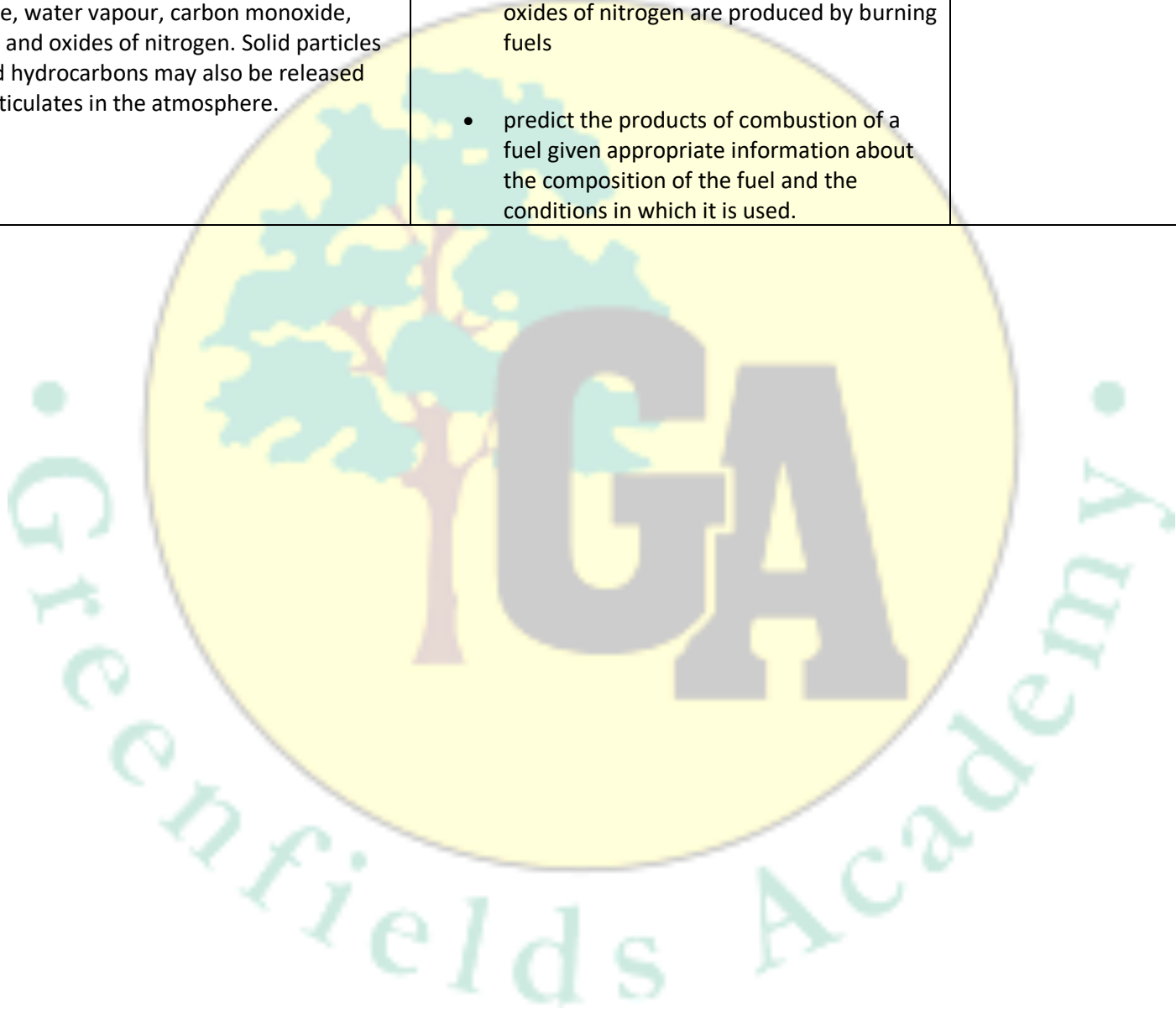
Term 3

Weekly Sequence	New Learning & Knowledge	Key Question(s)	Whole School Focus (eg. Computing Week, Language Day)
1 (15)	Organic Chemistry: Crude oil is a finite resource and is made up of many different compounds.	<ul style="list-style-type: none"> • What is a hydrocarbon? 	
2 (16)	<p>Hydrocarbons are made of hydrogen and carbon only. These make the majority of crude oil up. Alkanes (single bonds) and Alkenes (double bonds) are the suffix to many of the chains. They have prefixes depending upon the number of carbons present in the chain.</p> <p>Chain length gives hydrocarbons different properties including boiling points, viscosity and flammability.</p> <p>Hydrocarbons are separated through a process of fractional distillation using evaporation and condensation. Long carbon chains are made shorter through cracking. They are identified through the use of bromine water.</p>	<ul style="list-style-type: none"> • How does chain length change the hydrocarbon property? • Explain how fractional distillation works, using the terms evaporation, condensation and fractions. • Describe how carbons are named based upon chain length and type of bond • Explain what cracking is. • How do you identify if a carbon chain has double or single bonds? 	
3 (17)	Chemical Analysis: A pure substance is an element or compound not mixed with any other substance.	<ul style="list-style-type: none"> • Describe what a pure substance is. • How can you identify unknown pure substances? 	
4 (18)	<p>Pure elements melt and boil at specific temperatures and these are recorded; and can be used to distinguish pure substances.</p> <p>A formulation is a mixture that has been designed as a useful product. They are carefully measured.</p> <p>Chromatography separates solids from solutions through stationary and mobile phases. Separation depends upon the distribution of substances between the phases.</p>	<ul style="list-style-type: none"> • Identify what a formulation is. • Give some examples • Identify formulations given appropriate information. 	

	<p>Rf = distance moved by substance/distance moved by solvent Different compounds have different Rf values.</p> <p>Identification of common gases, including hydrogen, oxygen, carbon dioxide and chlorine.</p>	<ul style="list-style-type: none"> • explain how paper chromatography separates mixtures • suggest how chromatographic methods can be used for distinguishing pure substances from impure substances • interpret chromatograms and determine Rf values from chromatograms • provide answers to an appropriate number of significant figures. • Required Practical 12 – Investigate chromatography • Explain the different gas tests and the positive results for each. 	
<p>5 (19)</p>	<p>Chemistry of the Atmosphere: For 200 million years, the proportions of different gases in the atmosphere have been much the same as they are today:</p>	<ul style="list-style-type: none"> • Given appropriate information, interpret evidence and evaluate different theories about the Earth's early atmosphere and its development to the atmosphere of today. 	
<p>6 (20)</p>	<ul style="list-style-type: none"> • about four-fifths (approximately 80%) nitrogen • about one-fifth (approximately 20%) oxygen • small proportions of various other gases, including carbon dioxide, water vapour and noble gases. <p>Evidence for the early atmosphere is limited because of the time scale of 4.6 billion years. During the first billion years of the Earth's existence there was intense volcanic activity that released gases that formed the early atmosphere and water vapour that condensed to form the oceans. At the start of this period the Earth's atmosphere may have been like the atmospheres of Mars and Venus today,</p>	<ul style="list-style-type: none"> • Describe the main changes in the atmosphere over time and some of the likely causes of these changes • Describe and explain the formation of deposits of limestone, coal, crude oil and natural gas. • Describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter. 	

	<p>consisting of mainly carbon dioxide with little or no oxygen gas. Volcanoes also produced nitrogen which gradually built up in the atmosphere and there may have been small proportions of methane and ammonia. When the oceans formed carbon dioxide dissolved in the water and carbonates were precipitated producing sediments, reducing the amount of carbon dioxide in the atmosphere. No knowledge of other theories is required.</p> <p>Algae and plants produced the oxygen that is now in the atmosphere by photosynthesis, which can be represented by the photosynthesis equation. Carbon dioxide was also decreased by the formation of sedimentary rocks and fossil fuels that contain carbon.</p> <p>Greenhouse gases in the atmosphere maintain temperatures on Earth high enough to support life. Water vapour, carbon dioxide and methane are greenhouse gases.</p> <p>The carbon footprint is the total amount of carbon dioxide and other greenhouse gases emitted over the full life cycle of a product, service or event. The carbon footprint can be reduced by reducing emissions of carbon dioxide and methane.</p> <p>The combustion of fuels is a major source of atmospheric pollutants. Most fuels, including coal, contain carbon and/or hydrogen and may also contain some sulfur. The gases released into the atmosphere when a fuel is burned may include</p>	<ul style="list-style-type: none"> • Recall two human activities that increase the amounts of each of the greenhouse gases carbon dioxide and methane • evaluate the quality of evidence in a report about global climate change given appropriate information • describe uncertainties in the evidence base • recognise the importance of peer review of results and of communicating results to a wide range of audiences. • describe briefly four potential effects of global climate change • discuss the scale, risk and environmental implications of global climate change. • describe actions to reduce emissions of carbon dioxide and methane • give reasons why actions may be limited. • describe how carbon monoxide, soot (carbon particles), sulfur dioxide and 	
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	<p>carbon dioxide, water vapour, carbon monoxide, sulfur dioxide and oxides of nitrogen. Solid particles and unburned hydrocarbons may also be released that form particulates in the atmosphere.</p>	<p>oxides of nitrogen are produced by burning fuels</p> <ul style="list-style-type: none">• predict the products of combustion of a fuel given appropriate information about the composition of the fuel and the conditions in which it is used.	
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Weekly Sequence	New Learning & Knowledge	Key Question(s)	Whole School Focus (eg. Computing Week, Language Day)
<p>1 (21)</p>	<p>Bioenergetics: Recall and use the photosynthesis equation in word and symbol format. Know that the effects of temperature, light intensity, carbon dioxide concentration, and the amount of chlorophyll on the rate of photosynthesis</p> <p>Know that glucose from plants is:</p> <ul style="list-style-type: none"> ○ used for respiration ○ converted into insoluble starch for storage ○ used to produce fat or oil for storage ○ used to produce cellulose, which strengthens the cell wall ○ used to produce amino acids for protein synthesis. <p>Recall aerobic and anaerobic respiration equations and the differences</p> <p>Know that heart rate and breathing rate increase during exercise and why. Define metabolism as the sum of all the reactions in a cell or the body.</p>	<ul style="list-style-type: none"> • Recall and use the photosynthesis equation • measure and calculate rates of photosynthesis • extract and interpret graphs of photosynthesis rate involving one limiting factor • plot and draw appropriate graphs selecting appropriate scale for axes • translate information between graphical and numeric form. • Required practical 5 – Photosynthesis factors <ul style="list-style-type: none"> • What is aerobic respiration? • What is anaerobic respiration? • Recall the word and symbol equations for both. <ul style="list-style-type: none"> • Explain why heart rate and breathing rate increase with exercise. • Define metabolism and state what it is. Why is this confused with exercise? 	
<p>2 (22)</p>	<p>Homeostasis and Response: Homeostasis is the regulation of the internal conditions of a cell or organism to maintain optimum</p>	<ul style="list-style-type: none"> • Explain what homeostasis is. 	
<p>3 (23)</p>	<p>conditions for function in response to internal and external changes. Homeostasis maintains optimal</p>	<ul style="list-style-type: none"> • Give examples of homeostasis in the human body. • How does the body control these examples? 	

conditions for enzyme action and all cell functions. In the human body, these include control of:

- blood glucose concentration
- body temperature
- water levels

Information from receptors passes along cells (neurones) as electrical impulses to the central nervous system (CNS). The CNS is the brain and spinal cord. The CNS coordinates the response of effectors which may be muscles contracting or glands secreting hormones.

Stimulus → receptor → coordinator → effector → response

The endocrine system is composed of glands which secrete chemicals called hormones directly into the bloodstream. The blood carries the hormone to a target organ where it produces an effect. Compared to the nervous system the effects are slower but act for longer. The pituitary gland in the brain is a 'master gland' which secretes several hormones into the blood in response to body conditions. These hormones in turn act on other glands to stimulate other hormones to be released to bring about effects.

Blood glucose concentration is monitored and controlled by the pancreas. If the blood glucose concentration is too high, the pancreas produces the hormone insulin that causes glucose to move from the blood into the cells. In liver and muscle cells excess glucose is converted to glycogen for storage.

- How does information pass along cells to and from the CNS?
- What is a reflex arc and why is it important in automatic responses?
- Required practical 6 – investigation into human reaction time
- Identify the position of the following on a diagram of the human body:
 - pituitary gland
 - pancreas
 - thyroid
 - adrenal gland
 - ovary
 - testes.
- Explain how insulin controls blood glucose (sugar) levels in the body.
- Describe Type 1 and Type 2 diabetes and how it is treated.
- Extract information and interpret data from graphs that show the effect of insulin

During puberty reproductive hormones cause secondary sex characteristics to develop. Oestrogen is the main female reproductive hormone produced in the ovary. At puberty eggs begin to mature and one is released approximately every 28 days. This is called ovulation. Testosterone is the main male reproductive hormone produced by the testes and it stimulates sperm production. Several hormones are involved in the menstrual cycle of a woman.

- Follicle stimulating hormone (FSH) causes maturation of an egg in the ovary.
- Luteinising hormone (LH) stimulates the release of the egg.
- Oestrogen and progesterone are involved in maintaining the uterus lining.

Fertility can be controlled by a variety of hormonal and nonhormonal methods of contraception. These include:

- oral contraceptives that contain hormones to inhibit FSH production so that no eggs mature
- injection, implant or skin patch of slow release progesterone to inhibit the maturation and release of eggs for a number of months or years
- barrier methods such as condoms and diaphragms which prevent the sperm reaching an egg
- intrauterine devices which prevent the implantation of an embryo or release a hormone
- spermicidal agents which kill or disable sperm

in blood glucose levels in both people with diabetes and people without diabetes.

- Describe the roles of hormones in human reproduction, including the menstrual cycle.
- evaluate the different hormonal and non-hormonal methods of contraception.
- Explain everyday and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments

	<ul style="list-style-type: none"> • abstaining from intercourse when an egg may be in the oviduct • surgical methods of male and female sterilisation. 		
4 (24)	<p>Inheritance, Evolution and Response: Meiosis leads to non-identical cells being formed while mitosis leads to identical cells being formed. Sexual reproduction involves the joining (fusion) of male and female gametes:</p> <ul style="list-style-type: none"> • sperm and egg cells in animals • pollen and egg cells in flowering plants. <p>In sexual reproduction there is mixing of genetic information which leads to variety in the offspring. The formation of gametes involves meiosis. Asexual reproduction involves only one parent and no fusion of gametes. There is no mixing of genetic information. This leads to genetically identical offspring (clones). Only mitosis is involved.</p>	<ul style="list-style-type: none"> • Define mitosis and describe how cells divide. • Define meiosis and describe how cells divide. • State the differences • Evaluate the benefits and drawbacks of mitosis and meiosis in terms of reproduction 	
5 (25)	<p>The genetic material in the nucleus of a cell is composed of a chemical called DNA. DNA is a polymer made up of two strands forming a double helix. The DNA is contained in structures called chromosomes. A gene is a small section of DNA on a chromosome. Each gene codes for a particular sequence of amino acids, to make a specific protein. The genome of an organism is the entire genetic material of that organism. The whole human genome has now been studied and this will have great importance for medicine in the future.</p> <p>Some characteristics are controlled by a single gene, such as: fur colour in mice; and red-green colour blindness in humans. Each gene may have different</p>	<ul style="list-style-type: none"> • Discuss the importance of understanding the human genome. This is limited to the: <ul style="list-style-type: none"> • search for genes linked to different types of disease • understanding and treatment of inherited disorders • use in tracing human migration patterns from the past. • Explain the terms: <ul style="list-style-type: none"> • gamete • chromosome • gene • allele • dominant 	

forms called alleles. The alleles present, or genotype, operate at a molecular level to develop characteristics that can be expressed as a phenotype. A dominant allele is always expressed, even if only one copy is present. A recessive allele is only expressed if two copies are present (therefore no dominant allele present). If the two alleles present are the same the organism is homozygous for that trait, but if the alleles are different they are heterozygous. Most characteristics are a result of multiple genes interacting, rather than a single gene.

Some disorders are inherited. These disorders are caused by the inheritance of certain alleles.

- Polydactyly (having extra fingers or toes) is caused by a dominant allele.
- Cystic fibrosis (a disorder of cell membranes) is caused by a recessive allele.

Ordinary human body cells contain 23 pairs of chromosomes. 22 pairs control characteristics only, but one of the pairs carries the genes that determine sex.

- In females the sex chromosomes are the same (XX).
- In males the chromosomes are different (XY).

Differences in the characteristics of individuals in a population is called variation and may be due to differences in:

- the genes they have inherited (genetic causes)
- the conditions in which they have developed (environmental causes)
- a combination of genes and the environment.

- recessive
- homozygous
- heterozygous
- genotype
- phenotype.

- Complete a Punnett square diagram and extract and interpret information from genetic crosses and family trees.

- Make informed judgements about the economic, social and ethical issues concerning embryo screening, given appropriate information.

- How many chromosomes in a normal adult?
- Why are chromosomes in pairs?

- Describe simply how the genome and its interaction with the environment influence the development of the phenotype of an organism.
- state that there is usually extensive genetic variation within a population of a species

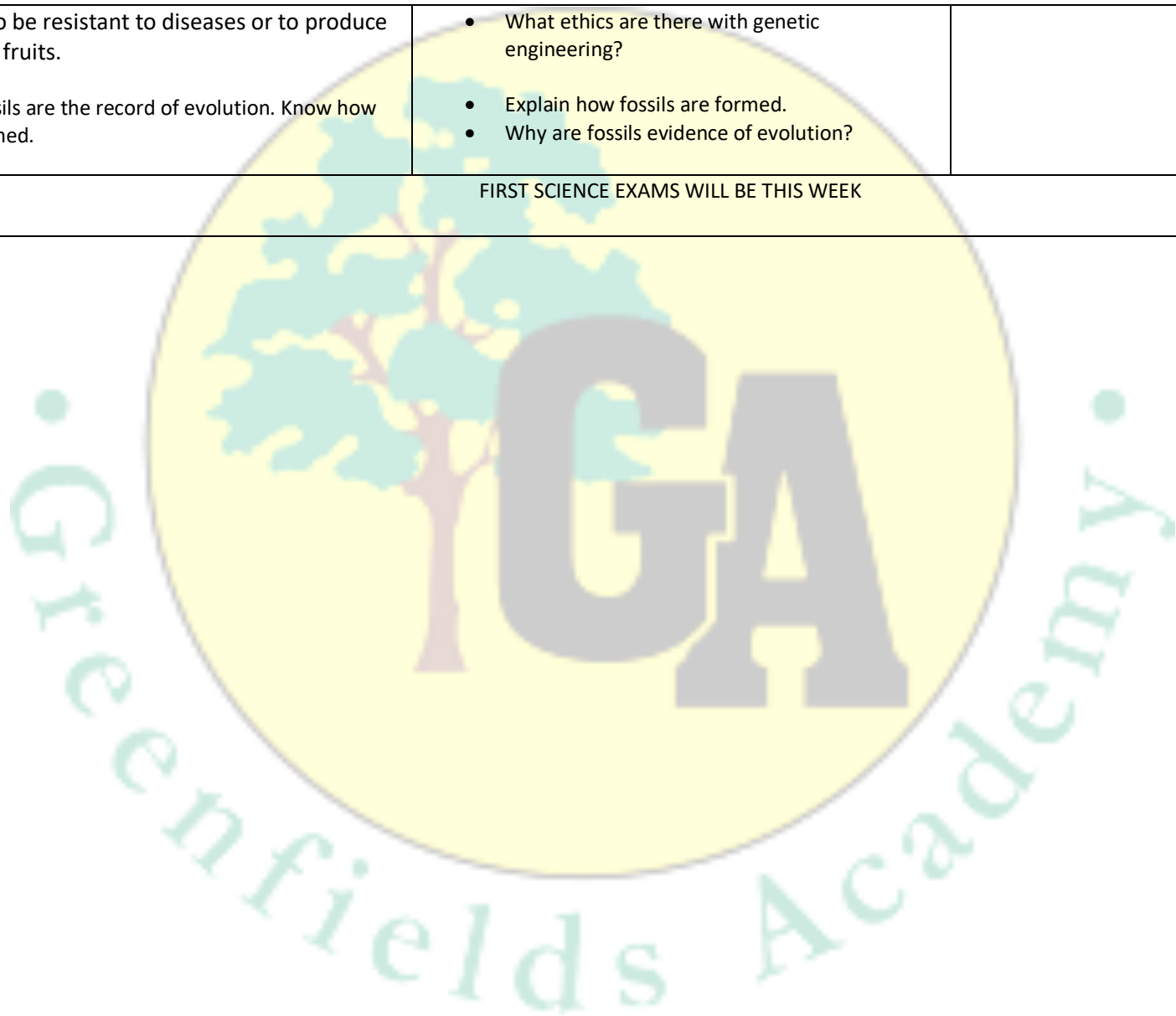
The theory of evolution by natural selection states that all species of living things have evolved from simple life forms that first developed more than three billion years ago. Evolution occurs through natural selection of variants that give rise to phenotypes best suited to their environment. If two populations of one species become so different in phenotype that they can no longer interbreed to produce fertile offspring they have formed two new species.

Selective breeding (artificial selection) is the process by which humans breed plants and animals for particular genetic characteristics. Humans have been doing this for thousands of years since they first bred food crops from wild plants and domesticated animals. Selective breeding involves choosing parents with the desired characteristic from a mixed population. They are bred together. From the offspring those with the desired characteristic are bred together. This continues over many generations until all the offspring show the desired characteristic.

Genetic engineering is a process which involves modifying the genome of an organism by introducing a gene from another organism to give a desired characteristic. Plant crops have been genetically

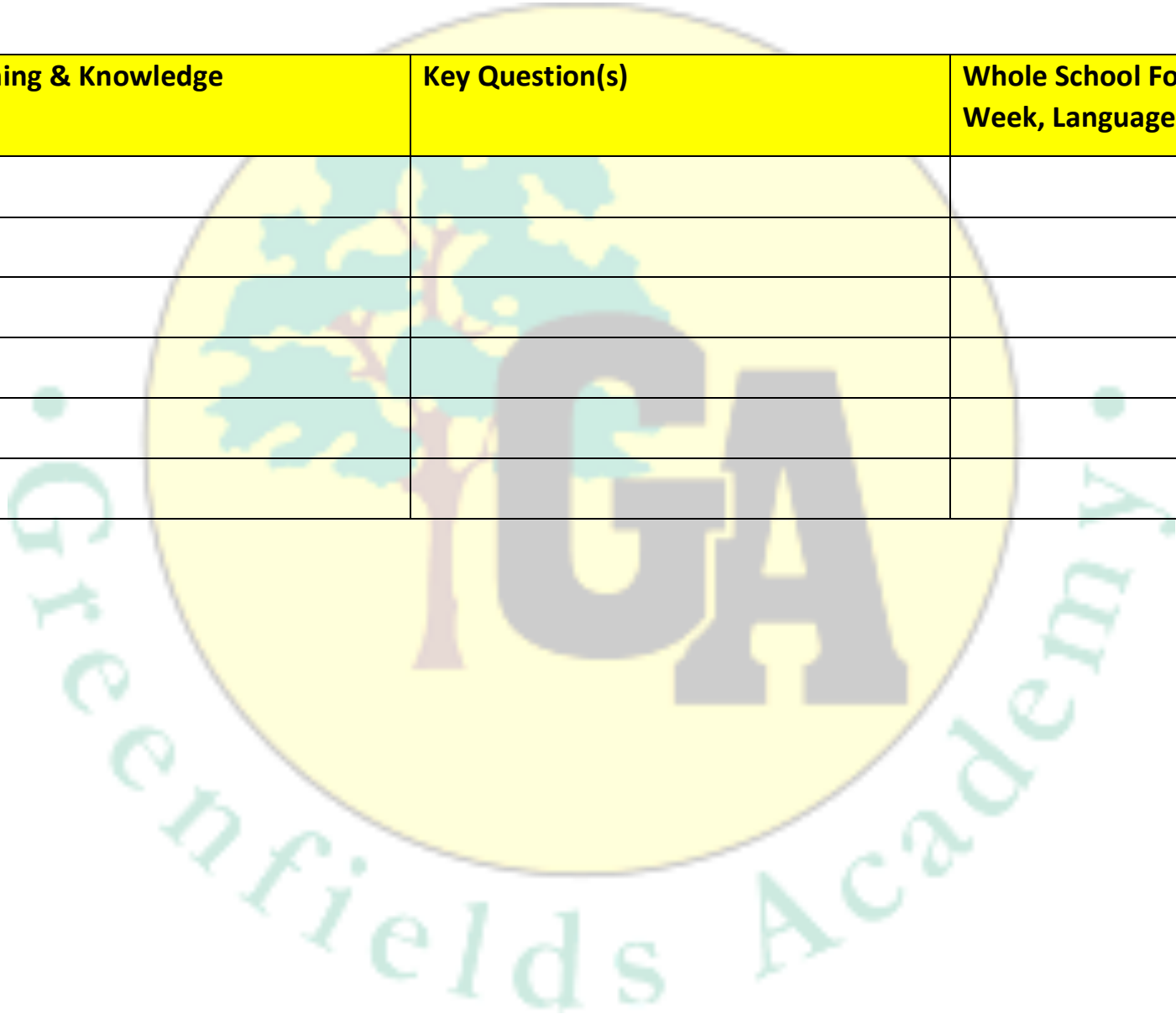
- recall that all variants arise from mutations and that: most have no effect on the phenotype; some influence phenotype; very few determine phenotype.
- Describe evolution as a change in the inherited characteristics of a population over time through a process of natural selection which may result in the formation of a new species.
- Explain the term survival of the fittest
- Explain the term natural selection
- Explain the term selective breeding.
- Why do we selective breed?
- Give examples.
- Give drawbacks of selective breeding.
- Define genetic engineering.
- Give examples of why we would want to genetically engineer an organism?

	<p>engineered to be resistant to diseases or to produce bigger better fruits.</p> <p>Know that fossils are the record of evolution. Know how fossils are formed.</p>	<ul style="list-style-type: none"> • What ethics are there with genetic engineering? • Explain how fossils are formed. • Why are fossils evidence of evolution? 	
<p>6 (26)</p>	<p>FIRST SCIENCE EXAMS WILL BE THIS WEEK</p>		



Term 5

Weekly Sequence	New Learning & Knowledge	Key Question(s)	Whole School Focus (eg. Computing Week, Language Day)
1 (27)			
2 (28)			
3 (29)			
4 (30)			
5 (31)			
6 (32)			



Term 6

Weekly Sequence	New Learning & Knowledge	Key Question(s)	Whole School Focus (eg. Computing Week, Language Day)
1 (33)			
2 (34)			
3 (35)			
4 (36)			
5 (37)			
6 (38)			
7 (39)			

