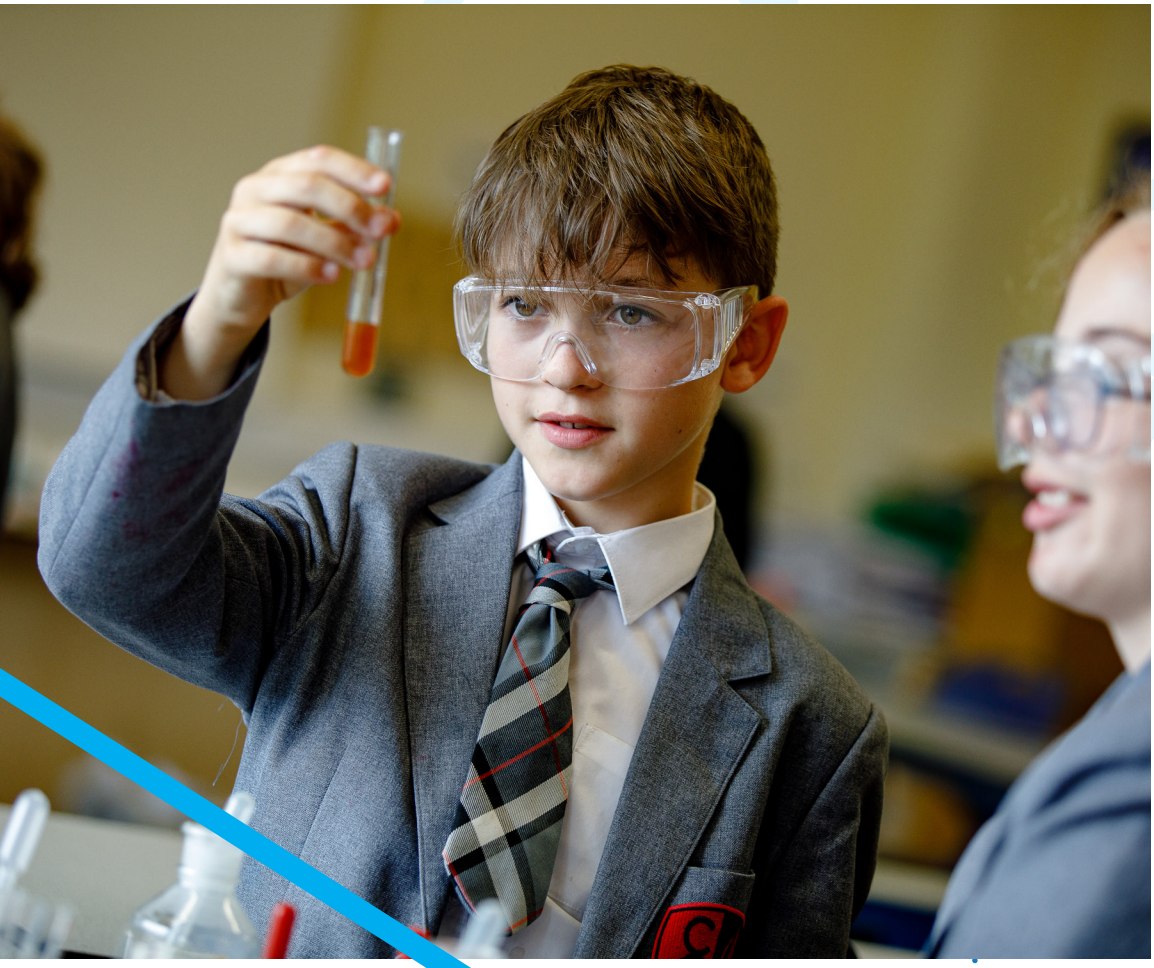
Maritime Futures

SCIENCE GUIDE KS3

3 YEAR JOURNEY | JUNE 2023



Maritime Futures

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Year 7 Science Curriculum Snake

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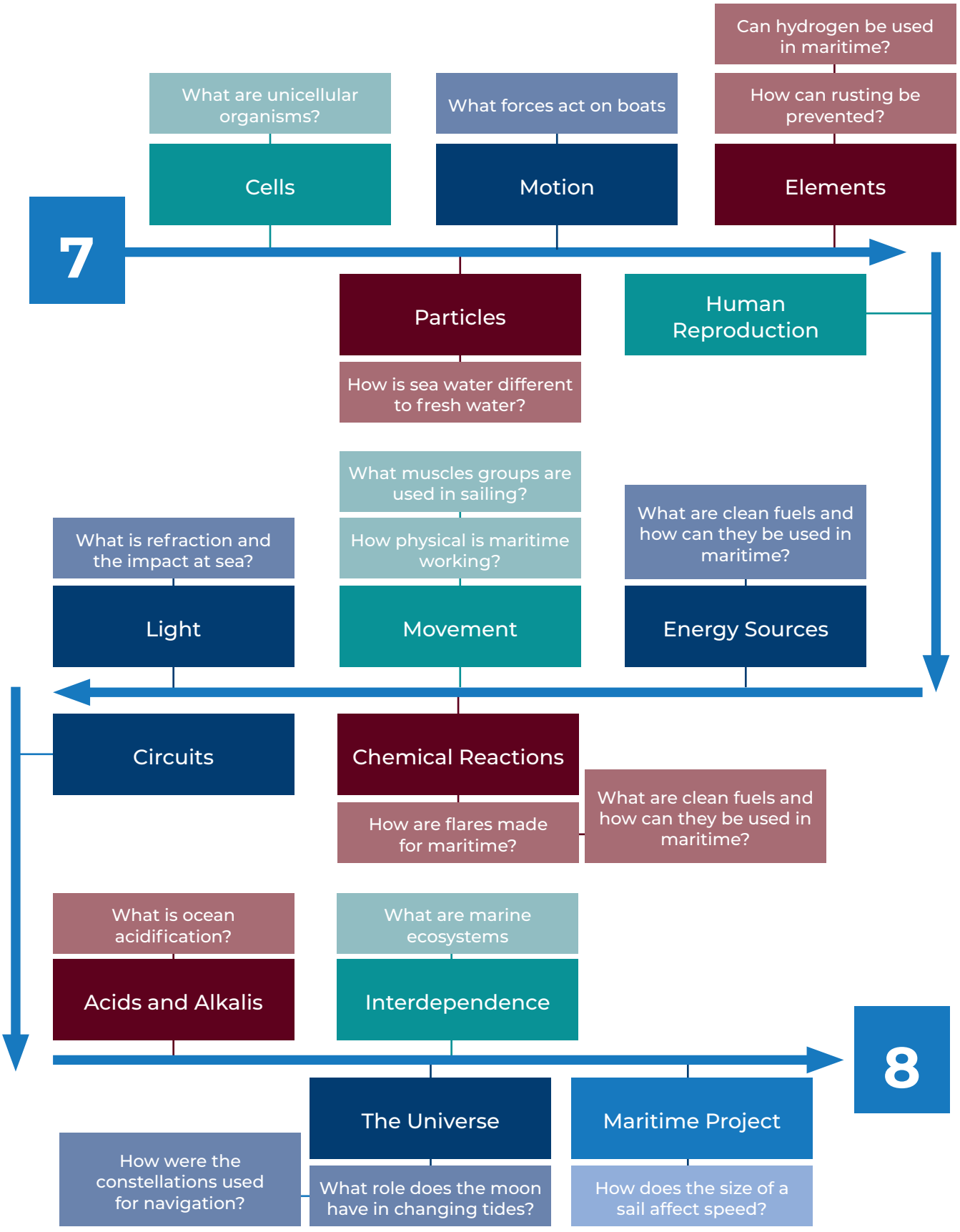

Year 8 Science Curriculum Snake

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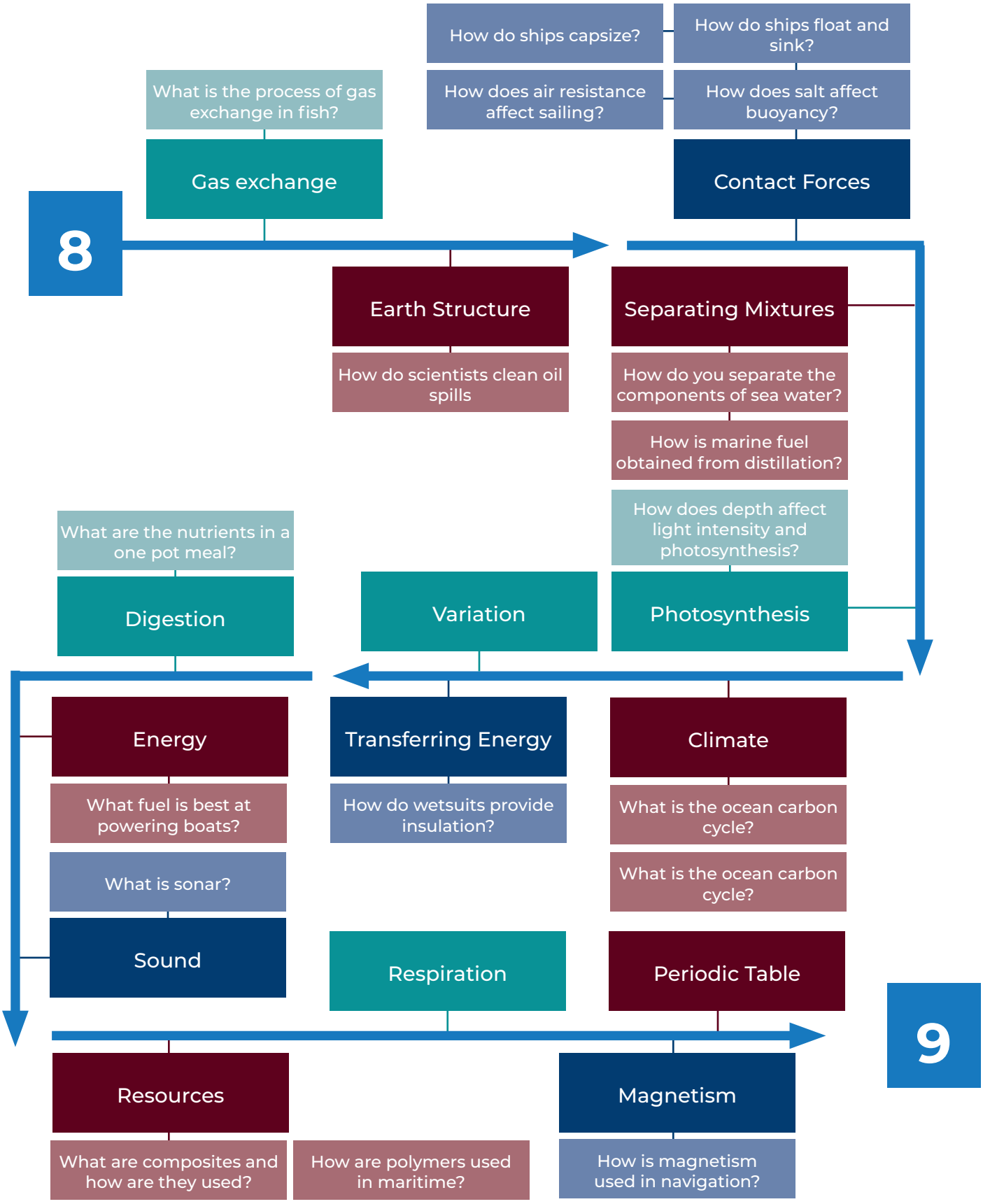

Year 9 Science Curriculum Snake

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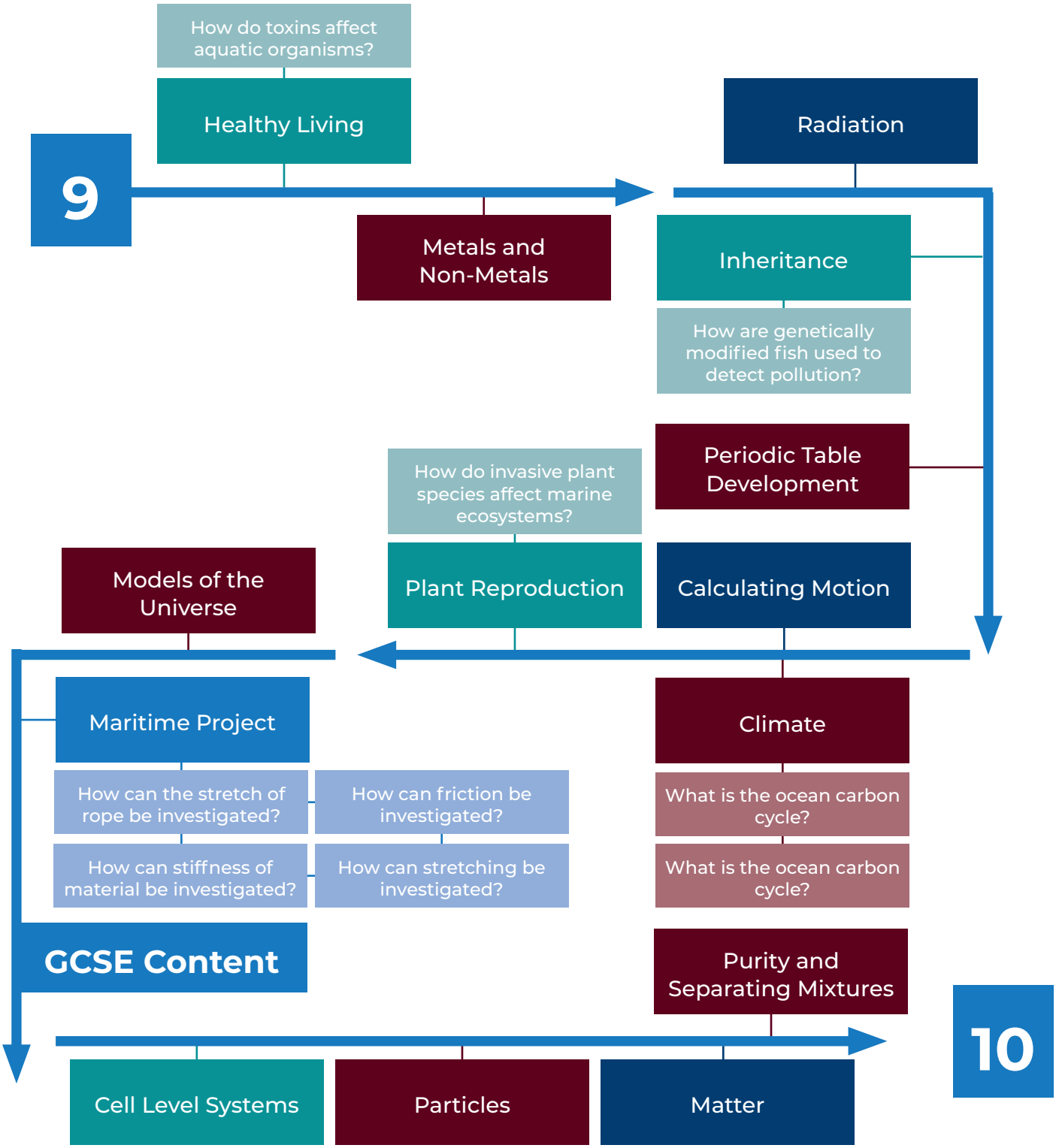


YEAR 7

SCIENCE

Year 7 Biology curriculum

Cells	How do you use a microscope?
	What are animal cells?
	What are plant cells?
	How are cells specialized?
	What are unicellular organisms?
Movement	What are the levels of organization?
	What is the skeleton?
	How do joints function?
	How do muscles function?
	What major muscle groups are used in sailing?
	What are reflexes?
	How does your brain control movement?
	How physical is maritime working?
Human Reproduction	What is adolescence?
	What are reproductive systems?
	What is fertilization and implantation?
	How does a foetus develop?
	What is the menstrual cycle?
	How can reproduction be controlled?

Maritime Futures Project

Size of Sails	Forces acting on a boat and planning an investigation.
	Control variables and boat making.
	Practical investigation and data collection.
	Practical write up and scientific communication.

Year 7 Chemistry curriculum

Particles	What are particles and atoms?
	What are the states of matter?
	What happens during heating?
	What happens during cooling?
	What happens to energy during physical changes?
	How is sea water different to fresh water?
Elements	What are elements and compounds?
	What are chemical formulae?
	How does rusting affect boats?
	How can the effects of rusting be reduced?
	How was the periodic table developed?
	Can hydrogen be used in maritime?
Chemical Reactions	What are chemical reactions?
	What are word equations?
	What is combustion?
	What is meant by clean fuels and can they be used in maritime?
	What is thermal decomposition?
	What does conservation of mass mean?
	How are flares used in the maritime industry?
Acids and Alkalis	What is an acid?
	How strong are acids?
	What is acid rain?
	How do acids react with alkalis?
	Which antacid is best at neutralizing stomach acid?
	What is ocean acidification?

Year 7 Physics curriculum

Space	What is in the night sky?
	What can be found in our Solar System?
	How does gravity change?
	What causes night and day?
	How does the moon change appearance?
	What role does the moon play in changing tides?
	How were constellation used for navigation?
Motion	What are forces, how are they measured and what forces act on a boat?
	How do unbalanced forces move objects?
	How do we measure speed?
	How can we calculate speed?
	What are distance-time graphs?
	How do speed cameras work?
Energy Sources	How is food a fuel?
	What energy sources exist?
	How is renewable energy used in maritime?
	How are energy and power related?
	How does energy transfer?
	How does energy dissipate?
	What food is the best fuel at sea?
Circuits	What is potential difference?
	What is current?
	What are series circuits?
	What are parallel circuits?
	What is resistance?
	What is static electricity?
Light	What is light and how does it travel?
	What is reflection and how can you measure it?
	What is refraction and what impact does it have at sea?
	How does your eye work?
	How does a camera work?
	How do coloured filters affect white light?

YEAR 8
SCIENCE

Year 8 Biology curriculum

Gas Exchange	What is diffusion?
	What factors affect diffusion?
	What is gas exchange?
	How do humans breathe?
	What is the process of gas exchange in fish?
Digestion	What are nutrients in food?
	How do scientists test nutrients in food?
	What nutrients are in a one pot meal?
	How is food digested?
	How do enzymes aid in digestion?
	What factors affect enzyme activity?
Photosynthesis	What is photosynthesis?
	How does light intensity affect photosynthesis?
	What is the structure of a leaf?
	Why do plants require minerals?
	How do plants transport water?
Respiration	What is aerobic respiration?
	What is anaerobic respiration?
	How can anaerobic respiration be used in food production?
	How are substances transported around the body?

Year 8 Chemistry curriculum

Separating Mixtures	How do pure substances and mixtures differ?
	What are solutions?
	What factors affect solubility?
	How do you carry out filtration?
	How do you separate sea water?
	What is evaporation and distillation?
	How do you obtain marine fuel via distillation?
	How does chromatography work?
Periodic Table	What is the Periodic Table?
	What is the structure of the atom?
	What are the properties of group 1?
	What are the properties of group 7?
	What are the properties of group 0?
Energy	What are exothermic and endothermic reactions?
	What do energy level diagrams show?
	What are catalysts?
	How can bond energy be found?
	What fuel is best at powering a boat?
Earth Structure	What is the structure of the Earth?
	How do sedimentary rocks form?
	How do igneous and metamorphic rocks differ?
	What is the rock cycle?
	How do scientists clean oil spills?
Climate	What is global warming?
	What is the carbon cycle?
	What is the ocean carbon cycle?
	What is climate change?
	How does melting polar ice caps affect shipping?
	What gases are in the atmosphere?
Resources	Where do metals come from?
	What can we recycle?
	How are composites used in maritime?
	How are polymers used in maritime?

Year 8 Physics curriculum

Space	What is friction?
	How does air resistance affect sailing?
	What are squashing and stretching forces?
	What is a turning force?
	How do boats capsize?
	What happens to gases under pressure?
	What happens to liquids under pressure?
	Why do ships float?
	How does salt affect buoyancy?
	Can you put solids under pressure?
Magnetism	What are magnets?
	What are electromagnets?
	How can electromagnets be used?
	How do motors work?
	How can magnetism be used in navigation?
Transferring Energy	How do motors work?
	How can magnetism be used in navigation?
	How do machines work?
	How are energy and temperature related?
	How do particles transfer energy?
	How does radiation transfer energy?
	How does insulation work?
	How do wetsuits provide insulation?
Sound	What are the types of wave?
	What is sound and how does it travel?
	What is the difference between loudness and pitch?
	How do we detect sound?
	How can we use sound waves?
	How does sonar work?

YEAR 9
SCIENCE

Year 9 Biology curriculum

Healthy Living	Why are drugs harmful to the body?
	Why is alcohol harmful to the body?
	Why is smoking harmful to the body?
	What is a poor diet?
	How do toxins released into the sea affect marine life?
Plant Reproduction	What is the structure of a flower?
	What is pollination?
	What is fertilization?
	What factors affect germination?
	How are seeds dispersed?
	How are plant clones produced?
	How do invasive plant species affect marine life?
Inheritance	What is DNA?
	What is inheritance?
	What is a genetic cross?
	What is an inherited disease?
	What is gene modification?
	How are genetically engineered fish used to detect pollution?
GCSE – B1 **Cell Level Systems**	Plant and animal cells
	Bacterial cells
	Light microscopy
	Electron microscopy
	DNA
	Enzymes
	Enzyme reactions
	Carbohydrates, proteins, and lipids
	Aerobic respiration
	Anaerobic respiration
	Photosynthesis
	Photosynthesis experiments
	Factors affecting photosynthesis
	Interaction of limiting factors

Year 9 Chemistry curriculum

Metals and Non-Metals	What are the properties of metals?
	What reactions happen with metals and non-metals?
	How do metals react with acid?
	How do metals react with oxygen?
	How do metals react with water?
	How do you create a reactivity series?
	How are metals extracted for use in maritime?
The Periodic Table Development	What is the Dalton model of the atom?
	What did Mendeleev's table look like?
	How is the Periodic Table arranged?
	How does the Bohr model of the atom relate to group number?
Models of the Universe	How was the universe discovered?
	How have we detected planets?
	What is the Big Bang theory?
	How do conditions on plants differ?
GCSE – C1 **Particles**	Introducing particles
	Chemical and physical changes
	Limitations of the particle model
	Atomic structure
	Isotopes
	Developing the atomic model
GCSE C2.1 **Purity and Separating Mixtures**	Relative formula mass
	Empirical formula
	Pure and impure substances
	Filtration and crystallization
	Distillation
	Chromatography
	Purification and checking purity

Year 9 Physics curriculum

Uses of Radiation and Electromagnetism	What is radiation used for?
	What are the dangers of radiation?
	What is alternating current?
	How are different waves used?
Calculating Motion	How can speed be calculated?
	What are vectors and scalers?
	How can you measure acceleration?
	How can speed be calculated from distance-time graphs?
	What are velocity-time graphs?
	What are the equations for motion and kinetic energy?
GCSE – P1 **Matter**	The model of the atom
	Density
	Energy and temperature
	Specific heat capacity
	Specific latent heat
	Gas pressure and temperature
	How does insulation work?

Maritime Futures Project

Properties of Materials	How can the strength of rope be investigated?
	How can the stiffness of materials be investigated?
	How can friction be investigated?
	How can stretching be investigated?

Maritime Futures Lessons Statistics

Year 7 Science – 3 lessons per week over 39 weeks, a total of 117 science lessons.
Year 8 Science – 3 lessons per week over 39 weeks, a total of 117 science lessons.
Year 9 Science – 4 lessons per week over 39 weeks, a total of 156 science lessons.

The total number of lessons shown does not include bank holidays, development/inset days or times when students are not in lesson because of assessments or other school activities (trips, sports day).

Year Group	Number of Lessons	Number of Maritime Futures Lessons	Percentage of Maritime Futures Lessons
Year 7	117	20	17%
Year 8	117	19	16%
Year 9	156	8	5%

Students at CEC receive a total of 390 science lesson in KS3 over three years. Students have access to 47 dedicated Maritime Futures lessons which equates to 12% of KS3 science lessons at CEC.

Principles of Planning

The science curriculum at Cowes Enterprise College has been designed to fulfil the ambitions of the school and the Science Department.

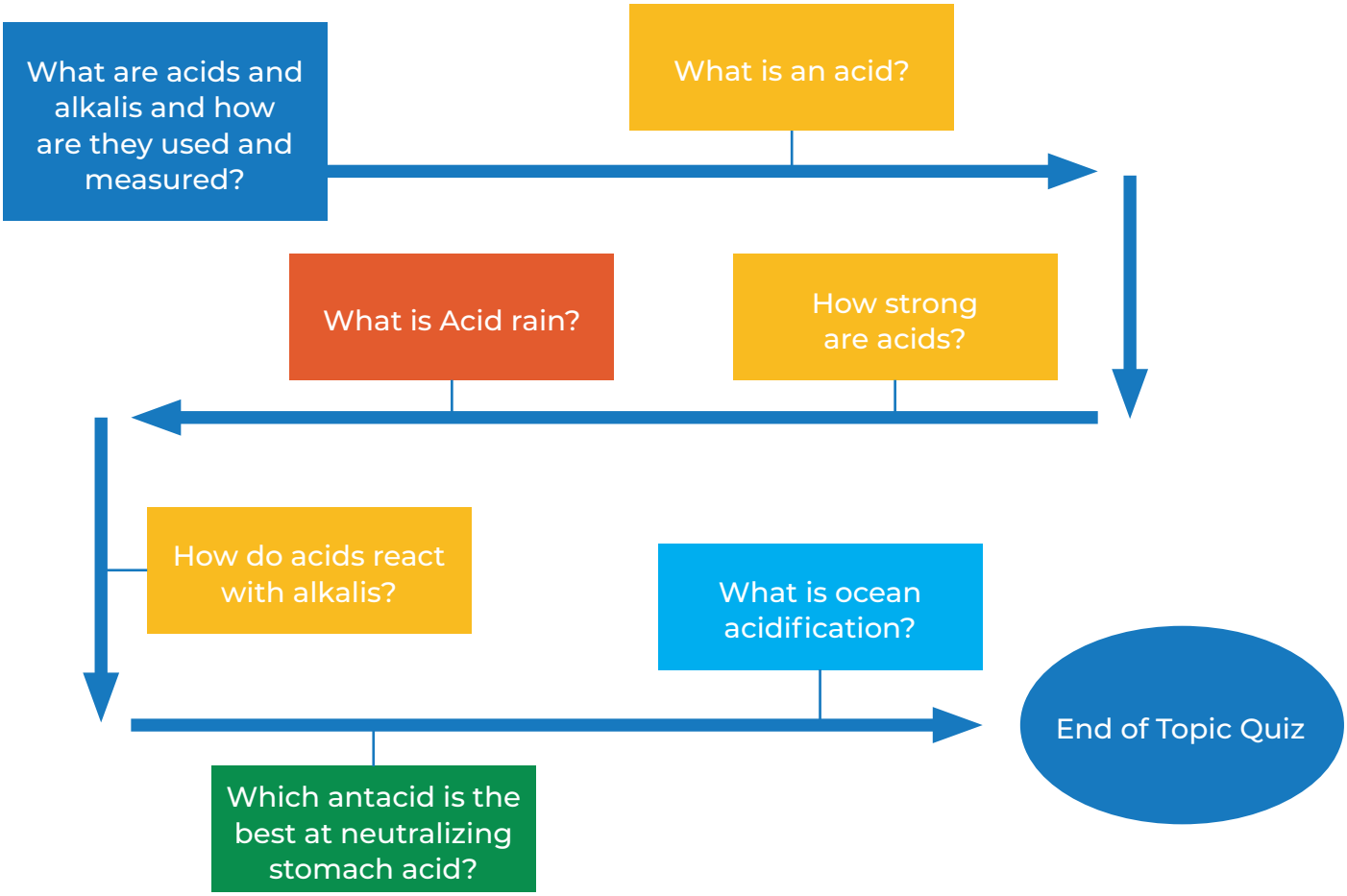
Each topic has been planned to integrate the 'four pillars of science'. These departmentally agreed principles include; Knowledge in Science, Practical Skills in Science, Literacy in Science, and Maritime in Science.

Knowledge in Science	Practical Skills in Science	Literacy in Science	Maritime in Science
Fundamental principles are taught extensively and are frequently revisited.	Practical work is embedded throughout the curriculum with dedicated lessons to allow students to 'do science'.	Key terms are taught along with dedicated lessons embedded throughout the curriculum based on comprehension tasks.	Maritime is embedded throughout the curriculum to extend and engage students in science around them.

Example Topics

Example Topic – Topic Overview

The topic 'snake' below illustrates how each of the 'four pillars' of science have been incorporated into the scheme of work for the topic.



Knowledge in Science | Practical Skills in Science | Literacy in Science | Maritime in Science

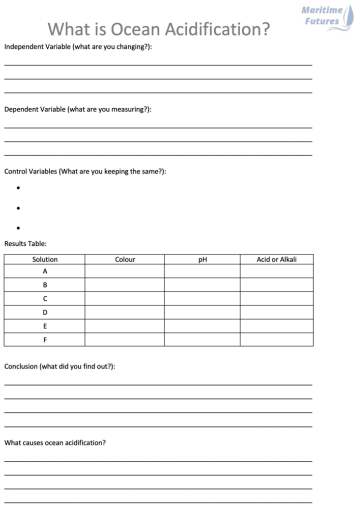
Example Topic - Lesson Resources

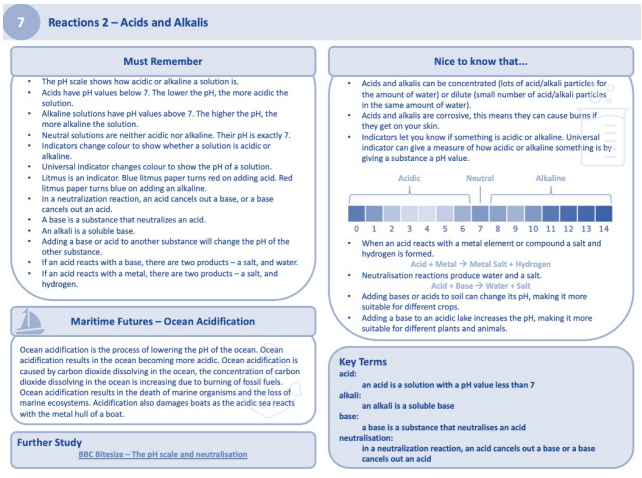
All science topics taught at CEC have a bank of resources attached to the topic. All lesson resources required for the delivery of Maritime Futures have been produced for staff to use. This is to ensure all students have access to the Maritime Futures curriculum, reduces planning time for staff, and provides a level of consistency in the delivery of the Maritime Futures curriculum.

In addition to lesson PowerPoints, all work sheets, technician notes and CLEAPSS sheets are included, this makes delivering Maritime Futures as efficient as possible for teaching and technical staff.

The Maritime Futures science lessons have been designed to be as practical as possible. This ensures students develop their working scientifically skills.

The practical activities that are used for Maritime Futures are modifications of 'normal' science practical activities. This ensure equipment required is already within the department, therefore financing the curriculum is not an issue making it sustainable.





Example Topic - Knowledge Organizer

To incorporate Maritime Futures further and to emphasis its importance knowledge organisers for KS3 have a dedicated section on Maritime Futures.

The section of the knowledge organiser dedicated to Maritime Futures is clearly labelled with a title and symbol. The hope is that students can place the science that they have learnt into context and apply the science to an area of the maritime sector.

Transferable Skills and Industry Knowledge

Employability Skills

- Communication skills are embedded in all lessons as students are required to complete practical investigations are discuss their results both verbally and written.
- Problem solving skills are developed during Maritime Projects as students are tasked with designing their own investigations
- Working under pressure and within time limits is developed within all lessons as students are required to complete practical activities within given time limits.
- Organisational skills are developed in all lessons as students are required to work through a method methodically.
- Team working skills are developed in all lessons as students are required to work in groups during practical activities with some students developing leadership skills by leading their group practical.
- Numeracy is developed in all lessons as students are required to calculate averages, produce results tables, and draw graphs to present their findings.
- Diversity is promoted as students are required to work together in all lessons and to value options.
- Negotiation skills are developed during Maritime projects as students are required to work together to develop their own practical investigations.

Employability Knowledge

- Unicellular Organisms, Gas Exchange in Fish, Photosynthesis – **Marine Biologist, conservation scientist, microbiologist, zoologist**
- Muscles, Sailing Fitness, Energy in Food, Nutrients at Sea – **Physiotherapist, coaching, care professions, dietitian, food scientist**
- Sea Water and Emergency Flares – **Analytical chemist, chemical engineer**
- Rusting and Ocean Acidification – **Marine architects, engineering, and ecologists.**
- Loss of Marine Ecosystems, Polar Ice Caps, Invasive Species – **Conservation science, ecologists, chemists who monitor pollution levels, oceanographer**
- Hydrogen Fuel, Clean Fuels, Renewable Energy, Energy in Fuels – **Analytical chemist, chemical engineer, green chemistry, civil engineering, marine engineering**
- Navigation, Sonar – **Captain, sailors, communications, physicist**
- Forces, Sails, Composites, Polymers, Wetsuits, Buoyancy – **Maritime engineering, boat building, boat design, materials engineer, material Scientist, chemist**
- Oil Spills, Toxins in Sea – **Toxicologist, eco-toxicology, ecologist**
- Genetically Engineered Fish – **Biologist, geneticist, genomics, synthetic biology**
- Extracting Iron – **Boat manufacturing, geologist, metal industry**

YR7 Maritime Science – Lesson Overview

Lesson Title / Question	Aims and Objectives	Key Information
What are unicellular organisms?	Describe and explain what is meant by the term unicellular.	• Unicellular organisms are composed of one cell • Amoeba and euglena are examples of unicellular organisms
What major muscle groups are used in sailing?	Describe and explain how muscles work.	• Pulling rope or moving objects requires muscle contraction • Muscles are tissues • Tissues are a group of cells working together • Muscles work in pairs termed antagonistic pairs • When muscles contracts they get shorter • When muscles relax, they get longer • Muscles are connected to bone through tendons
How physical is maritime working?	Describe and explain how fitness can be measured.	• Sailing in a sport and which requires athletes to be physically fit • A measure of fitness is heart rate/pulse rate • Athletes have a lower resting heart rate • Physical training over a long period of time can reduce heart rate
How does the size of a sail affect speed?	Describe and explain sail design.	• Weight is the force exerted by gravity on an object • Upthrust is the force exerted by the water on a vessel • An independent variable is what you are changing or investigating • A dependent variable is what you are measuring or observing • Control variables are factors that must be kept the same to ensure an investigation is reliable • A table is used to record results, the independent variable always goes on the left and the dependent variable always goes on the right • Bar charts are used to present discontinuous data • A conclusion is a summary of findings • Scientists present findings using posters, presentations, and reports • All findings undergo peer review which means findings are check for reliability and accuracy
How is sea water different to fresh water?	Describe and explain how sea water is different to drinking water.	• Impure substances contain elements or compounds in itself • Salt changes the boiling point and freezing point of water • Ice floats of sea water • Salt increases the density of water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Year 7 Maritime Science - Lesson Overview

Lesson Title / Question	Aims and Objectives	Key Information
How does rusting affect boats?	Use the variables present to set up an investigation into factors that affect the rate of rusting.	• Rusting is the oxidation of iron, because the iron is reacting with oxygen. • Rusting can be slowed down or prevented by painting the surface, attaching a sacrificial metal or using oil/ grease. • A sacrificial metal must be more reactive than the metal it is designed to protect. • A chemical formula shows the relative number of each type of atom in a molecule.
Can hydrogen be used in maritime?	Describe and explain how hydrogen is produced.	• Elements are made of one kind of atom and cannot be broken down. • The atoms of one element are different to the atoms of all other elements. • There are 92 elements that exist naturally. • The periodic table lists all the elements. • Hydrogen is the smallest element and can be used as a fuel
How can clean fuels be used in maritime?	Describe what is meant by a clean fuel and explain the importance of clean energy.	• Fuels are substances that release energy that can be used. • Fossil fuels are non-renewable and release carbon dioxide and water. • Burning reactions are oxidation, because the fuel is reacting with oxygen. • Hydrogen is clean as a fuel as it only releases water vapour. • Hydrogen needs to be used safely, which is a concern with its use as a fuel.
How are flares used in maritime?	Describe explain why compounds emit different colours when exposed to a flame.	• When some metals are burnt, they release distinctive colours. This can be used in the maritime industry to produce coloured flares. • Most chemical reactions are not reversible. • Many chemical reactions are useful and make products used in daily life.
What role does the moon play in changing tides?	Describe how the tides are affected by the position of the Moon in the sky.	• The tides on Earth are largely caused by the gravitational pull of the Moon, but the Sun's gravitational pull also contributes. • The Earth spins on its axis once a day. This is why we have day and night, and why the Sun and stars appear to move across the sky.
How were constellations used for navigation?	Describe and explain how stars and constellations were used by sailors when navigating the seas.	• Celestial navigation relies heavily on the position and movement of the constellations. • Constellations are groupings of stars that create recognizable patterns in the sky. • As Earth orbits around the sun, these star patterns shift in the sky, making different constellations visible during different seasons. • Sailors measured the height of the stars in the sky to track their progress.

Year 7 Maritime Science - Lesson Overview

Lesson Title / Question	Aims and Objectives	Key Information
What forces act on a boat?	Describe what is meant by the term force and describe the forces acting on a boat.	• Forces are pushes or pulls, measured in newtons (N) using a newton meter. • Forces exist when objects interact – this produces an interaction pair. • Forces can be a push or a pull. • There are many different forces. • Some of these forces can be seen by using force arrows on a boat. • Forces acting on a boat include; weight, air resistance, friction, upthrust, thrust.
How is renewable energy used in maritime?	Describe how renewable and non-renewable sources are used to generate electricity and used in the maritime industry.	• Energy is measured in Joules (J). • Fossil fuels are non-renewable energy resources used for heating, transportation and generating electricity. • Renewable energy resources can be used to generate electricity. • The Mayflower Autonomous boat uses renewable energy including solar power.
What food is the best fuel at sea?	Describe how food can be tested to determine the energy content.	• There is energy associated with food and fuels. • Energy is measured in Joules (J). • Energy cannot be created or destroyed, it can only transfer between stores. This is the law of conservation of energy. • An energy store is a way of keeping track of energy.
What is refraction and the impact at sea?	Describe and explain what is meant by refraction.	• Light is emitted from luminous sources. It can be transmitted through, reflected, or absorbed by non-luminous objects. • Your brain uses the fact that light travels in straight lines and you see a virtual image when you look in the mirror. • When light slows down it is refracted from the normal.

YR8 Maritime Science – Lesson Overview

Lesson Title / Question	Aims and Objectives	Key Information
What is the process of gas exchange in fish?	Describe and explain how gills are adapted for their function.	• Fish have gills used for gas exchange • Gills are specialized gas exchange surfaces • Gills are adapted to maximise diffusion • Diffusion is the movement of particles from an area of high concentration to an area of low concentration • Water is much denser than air and contains a lower concentration of oxygen than air
What nutrients are in a one pot meal?	Describe and explain the importance of nutrients in food at sea.	• Carbohydrates –provide energy • Lipids –provide energy • Proteins –growth and repair • Vitamins –keep you healthy • Minerals –keep you healthy • Fibre –allows food to move through your gut. • One pot meals are easy to cook, nutritional meals that can be made by off-shore crews • Benedict's test is used to identify sugar, biuret test is used to identify protein, iodine is used to identify starch, and the emulsion test is used to identify fats
How does light intensity affect photosynthesis?	Describe and explain the process of photosynthesis.	• Plants require light energy for photosynthesis. • As light intensity increases so does the rate of photosynthesis. • Chloroplast are situated on the top surface of a leaf to absorb as much sunlight as possible.
How do you separate sea water?	Describe and explain techniques used to separate the components of sea water.	• Filtering allows you to separate a solid from a liquid. • Filter paper has tiny holes in it. • Water particles are very small and so pass through the filter paper. • Sand (or another solid) is made up from large particles, these cannot pass through the filter paper. • Evaporation can be used to separate a solid and a liquid, specifically it can be used soluble and insoluble solids. • If you apply heat to salty water, the water will evaporate and leave you with salt crystals.
How do you obtain fuel from distillation?	Describe and explain fractional distillation.	• Marine fuel is commonly used in the maritime sector. • Marine fuel can be obtained from petroleum industry. • Marine fuel is separated from oil by using fractional distillation.


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Year 8 Maritime Science - Lesson Overview

Lesson Title / Question	Aims and Objectives	Key Information
What fuel is best at powering a boat?	Describe and explain what is meant by a green fuel.	• Marine fuel can be very polluting. • Some boats require vast amounts of fuel to travel long distances. • Green fuels such as ethanol could be used as a placement for fossil fuels, these green fuels maybe less polluting.
How do scientists clean oil spills?	Describe and explain how oil spills are cleaned.	• An oil platform, offshore platform, or offshore drilling rig is a large structure with facilities for well drilling to explore, extract, store, and process petroleum • Oil spills affect organisms as they can prevent sea plants from getting sunlight and so cannot photosynthesise • Oil can also be consumed by animals meaning the animals can die
What is the ocean carbon cycle?	Describe and explain the carbon cycle.	• The oceanic carbon cycle (or marine carbon cycle) is composed of processes that exchange carbon between various pools within the ocean as well as between the atmosphere, Earth interior, and the seafloor. • The carbon cycle is a result of many interacting forces across multiple time and space scales that circulates carbon around the planet, ensuring that carbon is available globally. • The Oceanic carbon cycle is a central process to the global carbon cycle.
How does melting polar ice caps affect shipping?	Describe the reasons for melting polar ice caps and explain the impact of this melting ice.	• With ice melting in the Arctic Archipelago, multi-year ice in the Arctic Ocean can flow into shipping lanes. • Old ice is thicker and stronger and may present serious navigational hazards that can cause greater damage to a ship's hull as compared to first-year ice. • This ice presents a hazard to most vessels.
How are composites used in maritime?	Describe and explain how composites are used in the maritime industry.	• Different materials will have different properties, materials are chosen because of their properties. • The hull, sail control rope, sails, and hydrofoils are all made from different materials as they all have different roles in a boat. • A composite material is a modern material, composites are made from two or more materials mixed together. • The constituents of a composite are combined but not chemically bonded. • Composites combine the properties of the different materials to create improved characteristics or properties.
How are polymers used in maritime?	Describe and explain polymerization and the uses of polymers.	• A polymer is a substance with very long molecules. A polymer molecule has identical groups of atoms, repeated many times. Polymers can be natural or synthetic. • Usage of polymer based, fiber reinforced composites (FRP) offers several advantages for naval architects and boat builders to achieve effective and reliable structures.

Year 8 Maritime Science - Lesson Overview

Lesson Title / Question	Aims and Objectives	Key Information
How does air resistance affect shipping?	Describe and explain how boats can be streamlined to reduce drag.	• Air resistance is a type of friction • Air resistance occurs between the air another object • Air resistance acts on an object and can move an object • Racing boats aim to reduce drag and resistive forces • Water resistance is high and can slow a boat • Racing boats can be lifted from the water to reduce drag and move by the forces exerted by the wind
How do boats capsize?	Describe and explain capsizing.	• A moment is a force or a system of forces which may cause an object to turn. Moments are forces applied to levers or pivots. • In the case of a ship, if a moment is applied beyond its pivot (centre of mass) the ship will capsize.
Why do ships float?	Describe and explain how and why things float.	• Principle of Archimedes states that the net upward force on an object immersed in water is equal to the weight of the water displaced by the object.
How does salt affect buoyancy?	Describe and explain the factors that affect buoyancy.	• Buoyancy: Buoyancy or upthrust, is an upward force exerted by a fluid that opposes the weight of a partially or fully immersed object. • Upthrust is a force which ensures a boat can float, however upthrust must be equal for a boat to float. • If weight is too high, then the boat will sink. • The salt concentration in the water will affect the density of the water and so will affect upthrust.
How can magnetism be used in navigation?	Describe and explain how a compass works.	• A magnetic compass and a bar magnet when suspended freely align themselves along the geographical north-south direction, i.e. they are useful in finding the directions. • Wood and plastic are non-magnetic materials. They do not align along any particular direction.
How do wetsuits provide insulation?	Describe and explain the materials used to make wetsuits.	• Neoprene is a synthetic rubber produced by polymerization of chloroprene. • Neoprene is used to make wetsuits as it exhibits good chemical stability and remains flexible over a wide range of temperatures.
How does sonar work?	Describe and explain how sonar can be used.	• Sonar is a technique used to navigate, communication and detect objects • Sonar uses sound waves • Transmitter sends sound waves • Transducer detects reflected sound waves • Echolocation uses reflected sound waves to identify the position of a vessel/object

Maritime Science – Lesson Overview

Lesson Title / Question	Aims and Objectives	Key Information
How do toxins released into the sea affect marine life?	Describe and explain the term bioaccumulation.	• Pollution and toxins in the sea disrupt ecosystems. Some organisms may consume these toxins and cause a bioaccumulation effect. • Some toxins can speed up heart rate and may cause a range of different physiological issues.
How do invasive plant species affect marine life?	Describe and explain what is meant by an invasive species.	• Invasive species are non-native species that have colonised a new area to the point of damaging the surrounding environment • They can be brought into a new environment from pathways such as ships, fishing equipment or accidental releases. • Invasive species can have impacts on our marine industries, such as growing on marine structures, killing or competing with marine aquaculture species and by spreading disease.
How are genetically engineered fish used to detect pollution?	Describe and explain how organisms can be genetically engineered.	• Scientist can now alter an organisms genes to get the desired characteristics. • This is called genetic engineering. • Scientists have altered the genes if one type of fish to make them fluoresce (glow). • The aim was to produce fish that glow in the presence of polluted water.
How are metals extracted for use in maritime?	Describe and explain displacement reactions.	• Metals are used extensively in the maritime industry. Metals can be extracted from ores by using displacement. • Carbon is used in displacement as it is more reactive than some metals but less expensive than reactive metals.
How can the strength of rope be investigated?	Describe and explain the materials used to make rope and the properties of fibers.	• Materials can be classed in many different groups based on their properties and their chemical composition including; metals, non-metals, synthetic polymers, natural polymers, ceramics • Polymers are long chains of repeating subunits • Polymers are made from monomers • Polymers are made from a process called polymerisation • Some materials are biodegradable, this means they break down by natural biological processes

Year 9 Maritime Science - Lesson Overview

Lesson Title / Question	Aims and Objectives	Key Information
How can the stiffness of materials be investigated?	Describe and explain stiffness and a property of a material.	• Stiffness is defined as the resistance to a force causing an object to bend. • Stiffness is an important property when considering boat design. • Materials used need to be lightweight, have high strength but can also be worked/moulded into the shape required. • Carbon-fiber-reinforced plastic is often used as it has a high strength-to-weight ratio and stiffness.
How can friction be investigated?	Describe and explain the role of friction in the maritime industry.	• Friction is the resistance to motion of one object moving relative to another. • Friction can be used by using lubricants. • Friction is very important when considering how we walk or move, without friction we would just slide. • Decks are very wet, for this reason it is important that footwear provides friction.
How can stretching be investigated?	Describe and explain the role of stretching of materials in the maritime industry.	• Every time you hoist a brand new woven sail, it will stretch. • The more load you carry, the more it will stretch. • The way to prevent your sails from becoming too stretched is to monitor their sail shape • Cruising sailcloth must be strong and low stretch. • When sails stretch a boat becomes more difficult to handle.

Maritime Futures