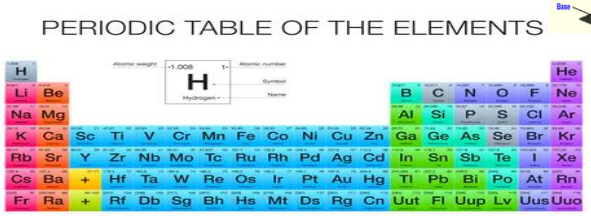
Topic: Introduction to Science

Duration: 6 lessons

Composite:

Key vocabulary:
Safety
Hazard
Laboratory
Bunsen
Beaker
Cylinder
Thermometer
Physical
Chemical
Property
Malleable
Sonorous
Lustrous
Ductile
Opaque

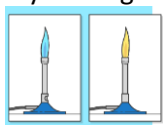
Core knowledge Components
Can outline and explain safety rules for working in a laboratory
Can label a Bunsen burner and light it safely.
Can select the correct equipment to measure volume and temperature
Use observations to decide what is a physical and chemical change.
What is the periodic table?



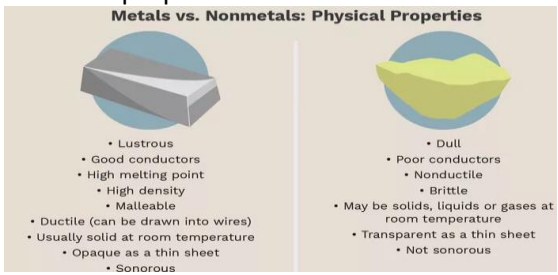
What are the key features of a periodic table and how was it developed?
What patterns are there in the periodic table?
Where are metals and non-metals on the periodic table?

Powerful knowledge components crucial to commit to long term memory

- Name at least 3 lab rules
- Explain what is meant by safety flame
- Explain what is meant by roaring flame



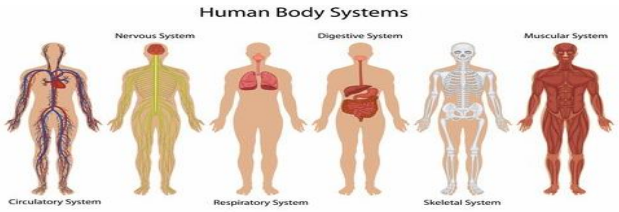
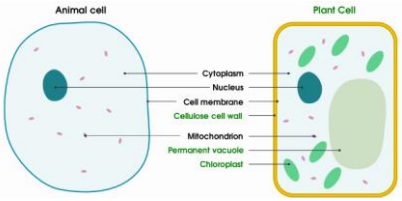
- Can state the difference between a chemical and physical property
- Explain what is shown on the periodic table
- Give an example of a metal and non-metal element
- List 3 properties of metal elements.



Links to previous and future topics
Links to previous KS2 science and extends practical skills and confidence around laboratory equipment.
Year 7 links to chemical reactions, elements and compounds.
Year 8 Metals
KS4 CC4 Periodic Table

Impressive reading	Impressive speaking	Impressive writing	Resilience	Employability and Careers via:
• Reading for learning from the biography of Mendeleev who developed the periodic table	• Articulate some reasons for lab rules and analyse and verbalise issues with unsafe situations.	• Use key words to accurately describe procedures and equipment used in practical.	Looking at patterns and problem solving.	**Employability**: Team working, working safely, following instructions. Analysing patterns **Careers**: lab assistant, research scientist, engineer, plumber, chemist. Need to understand properties and the periodic table.

SEND **Communication and Interaction** **Think, pair share, open class discussion. Groups in investigations. Dual coded presentations where possible. Targeted questioning. Cognition and Learning** **Key vocab explicit, lesson content chunked into a range of activities. Clear progression sequencing through a range of chunked activities. SEMH** **Clear routines, uniform lesson formats, practical where appropriate. Empathetic practical groupings. Physical/Sensory** **Demonstrations where appropriate. Modifications as required for written work and suitable seating plan.**		
Culture Capital: Mendeleev, Bunsen and risk management.		

Topic: KS3 – Yr 7 Cells		Duration: 6 lessons		Composite: Unit test
Key vocabulary:	Core knowledge Components	**Powerful knowledge components crucial to commit to long term memory**		**Links to previous and future topics**
Movement, respiration, sensitivity, growth, reproduction, excretion, nutrition, microscope, specimen, magnification, eyepiece, stage, organelles, nucleus, mitochondria, chloroplast, cytoplasm, membrane, cell wall hierarchy, organisation, tissue, organ system, organism, specialised, stem cell, adaptation,	1. Identify living and non living entities. 2. label the main parts of a microscope. 3. Explain the steps to set up a microscope. 4. Calculate overall magnification. **Total magnification:** Magnification = Objective lens X Eyepiece lens e.g. What is the total magnification if the objective lens is twenty times (X20) and the eyepiece lens five times (X5)? Magnification = 20 X 5 = X100  5. Describe a specialised cell. 6. Describe organs and tissues and systems in an animal 7. Describe organs and tissues and systems in a plant. 8. Give an example of tissue, organ and organ system in an animal. 9. Give an example of tissue, organ and organ system in a plant. 10. Identify organ systems in an animals and plants 	**11. Name the seven life processes described by MRS GREN.**  **12. Label an animal cell and label cell membrane, cytoplasm, nucleus and mitochondria** **13. Label a plant cell and correctly identify, cell wall, cell membrane, chloroplasts, mitochondria and the vacuole.** **14. Identify the main differences between plant and animal cells.** **Plant Cell**: •Plant cells contain chloroplasts to make food from solar energy during photosynthesis. •Underground parts of plants usually do not contain chloroplasts. •Plant cells contain cell wall. **Animal Cell**: •Animal cells do not contain chloroplasts. Animal cells do not have cell wall.  **15 Identify specialised cells like root hairs, red blood cells, nerves and sperm.**  **root hair cell** **16 Write down the hierarchy of the order of complexity.**	KS3 This topic should be the first Biology topic taught. Ecology, Reproduction, KS4 Cell biology, Transport systems, Photosynthesis, Ecosystems, Evolution KS5 Biodiversity, cells, ecosystems, control systems, genetics and evolution, energy for biological processes

Impressive reading	Impressive speaking	Impressive writing	Resilience	Employability via:
Use the information sheet provided for culture capital about stem cells	Is a zombie living or non living? explain your answer linking this to MRS GREN How can we see the organelles within a cell? Why do plant and animal cells have some of the same cell organelles? Should stem cells be collected at birth and stored for later use? Is this ethical? What should happen to the cells if they are not used? Donated or destroyed? Give reasons for your opinion. Do plants have organs and organ systems?	Answer the questions on the culture capital by extracting information from the text and using impressive language to explain your answers, ideas and opinions. Compare the similarities and differences in the structure and function of plant and animal cells	Setting up microscopes correctly and drawing accurate cells from observations. Describe a detailed method to set up and view onion cells using a light microscope Calculating overall magnification. Making models cells.	<u>Employability:</u> Using equipment Following instructions. Making accurate observations. <u>Careers:</u> Microbiologist Oncologist Doctor, Pathologist, Nurse All need to know about cells and body tissues and organs/

SEND Communication and Interaction Think, pair share, open class discussion. Groups in investigations. Dual coded presentations where possible. Targeted questioning. Cognition and Learning Key vocab explicit, lesson content chunked into a range of activities. Clear progression sequencing through a range of chunked activities. SEMH Clear routines, uniform lesson formats, practical where appropriate. Empathetic practical groupings. Physical/Sensory Demonstrations where appropriate. Modifications as required for written work and suitable seating plan.				
Culture Capital Stem cell technology and the future of medical treatments.				

Topic: Energy Resources

KS3 National Curriculum sub-topics:-

- **Energy – Changes in Systems**

Duration: 8 lessons

Composite: Unit test

Key vocabulary:	Core knowledge Components	Powerful knowledge components crucial to commit to long term memory	Links to previous and future topics

Joule
Kilojoule
Renewable
Non-renewable
Stored
Transferred
Fuel
Thermal
Generating
Solar
	Fuels
	• Common examples = coal, oil, hydrogen, gas, wood, petrol, diesel.
	• A fossil fuel is a group of fuels (coal, oil, and gas) that have been formed over millions of years by the crushed remains of dead plants and animals.
	Stores and Transfers
	• Energy can be transferred between and held in different energy stores.
	• There are 4 main ways to transfer energy between stores
	Units of Energy
	• Measured in Joules (J).
	• Energy can also be measured in Kilojoules. There are 1000 Joules in a Kilojoule.
	• We can convert from Joules into Kilojoules by dividing by 1000.
	• We can convert from Kilojoules into Joules by multiplying by 1000.
	Energy in the Body
	• We get all our energy from the food that we eat.
	• All energy on Earth has come from the sun.
	• Our body needs energy to move and go about our daily lives.
	Renewable and non-renewable energy resources
	• Examples of renewable energy resources are solar, wind, tidal, hydroelectric, wave, geothermal and biomass.
	• Examples of non-renewable energy resources are fossil fuels (Crude oil, coal, natural gas) and nuclear fuels (e.g. uranium).
	• Thermal Power Stations
	  ○ Electricity is generated in a thermal power station in the following three steps.
	  ▪ Chemical energy in fuel is transferred into thermal energy when it burns. This heat is used to change water into steam.
	  ▪ The kinetic energy in the steam is used to turn turbine blades.
	  ▪ A generator that transfers the kinetic energy in the turbine to the national grid as an electrical current.
		• State the law of conservation of energy.
		• State 3 common examples of fuels
		• Define renewable and non-renewable with examples of each type of fuel.
		• State the unit of energy.
		• State where the body gets in energy.
		• Name the main types of energy stores (8)
		• Name the four ways in which energy can be transferred.
			• KS2 Generating Electricity
			• Yr 8 Heating and Cooling
			• Yr 8 Light and Sound
			• Yr 9 Energy
			• KS4: Conservation of Energy

Sankey Diagrams

- Sankey diagrams show the energy transfers within a system. They show the useful energy in a system and the wasted energy.

Advantages and disadvantages of different energy resources.

Energy Resource	Advantage	Disadvantage
Fossil fuels	A concentrated energy source. There are still many years of this resource left.	Non-renewable. They produce polluting gases (carbon dioxide or sulphur dioxide) when they burn. Mining and transport can have a bad impact on the environment (e.g. oil spills).
Nuclear	A very concentrated energy source. Does not produce carbon dioxide or sulphur dioxide.	Non-renewable. They produce radioactive waste that is unsafe for a long time. Risk of catastrophic nuclear accidents (e.g. Chernobyl).
Hydroelectric	Renewable, no fuel costs. Produces no polluting gases when in use.	Building dams is expensive. Land must be flooded to create the reservoirs, affecting farmland and settlements.
Wind	Renewable, no fuel costs. Produces no polluting gases when in use.	Unreliable. Power output will vary depending on how windy it is Unsightly and noisy.
Solar	Renewable, no fuel costs. Produces no polluting gases when in use.	Solar cells are expensive to produce Output will vary depending on how sunny it is. They will not work at night.
Tidal	Renewable, no fuel costs. A reliable source of energy. Produces no polluting gases when in use.	Building a tidal barrage affects animal and plants living in estuaries. Tidal barrages are expensive to build.
Biomass	Renewable. Carbon neutral.	Growing crops for biofuel can lead to deforestation. Growing crops for biofuel can lead to food shortages and food prices rise.
Geothermal	Renewable. No fuel costs.	Most parts of the world do not have the conditions (hot rocks close to the surface) to use this source.

Impressive reading	Impressive speaking	Impressive writing	Resilience	Employability via:
Students will read a piece of text about renewable energy resources and the benefits they can bring. Students will be required to extract information from the text to answer a set of questions.	Students will state and describe the benefits of a specific energy resource to their peers in groups.	Students will be required to write a step by step method for an experimental procedure.	Completing two separate practical's in a pair, using only a set of instructions and their knowledge gained from the previous lesson.	There are a range of people that need to consider a person's energy requirements. Some people need more energy than others to do their job. Energy in food: Athletes, dieticians, doctors Energy in fuels: Engineers, Energy Managers, Energy advisor for energy delivery, Ecologist, Environmental Lawyer, Environmental Scientist.

CULTURE CAPITAL:

Students will discuss the importance of renewable energy resources, eventually producing a small report about the use of wind turbines and solar panels, and why they are required. Students will need to consider the following;

- What impact are non-renewable resources, specifically fossil fuels, having on the global environment?
- Why we cannot use non-renewables forever.
- What are the benefits to using renewable energy resources, specifically wind and solar?
- What are the challenges with switching to renewable energy resources?

SEND

- Opening activity/theme is opening slide to ensure learner buy in
- Opportunities for retrieval practice and building on prior knowledge: knowledge recall slide.
- Multi-sensory approach using reading, listening, watching, doing practicals, pair-work, participation via speaking
- Impact of non-renewable energy resources on the global environment case study chosen to support cultural capital
- Calories in food chosen as relatable for unit of energy
- Energy in food practicals to encourage group work and practice life skills or work-related to support the pathway into adulthood
- Benefits of renewable energy resources theme chosen to reflect learner aspirations
- Sankey diagram topic chosen due to cross curricular links with Heating and Cooling topic supporting non-verbal reasoning
- Repetition of key vocabulary in every lesson
- Curriculum time allocated for the explicit teaching of key vocabulary
- Skills ordered logically and sequenced with an increase in complexity
- Links to prior learning explicitly highlighted to support non-verbal reasoning
- Activities are scaffolded with over-learning of previous content to encourage independence

Yr7: Particles and Solutions

Duration: 9-lessons

Composite Unit Test

Keywords

Particles
Atoms
State
Phase
Solid
Liquid
Gas
Condensation
Evaporation
Boiling
Melting
Freezing
Sublimation
Solidify
Conservation
Mass
Diffusion
Concentration
Gradient
Equilibrium
Pressure
Motion
Collisions
Frequency
Vigorous
Solution
Solute
Solvent
Unsaturated
Saturated
Soluble
Insoluble
Dissolving
Crystallisation
Variable
Independent
Dependant

Any extra words?

Core Knowledge

Q. Explain what happens during freezing in terms of arrangement of, motion of, energy of and forces between particles:

Particles lose energy to the surroundings Particles move slower and eventually only vibrate. Forces between particles pull them together from their random positions into a fixed regular arrangement.

Q. Explain what happens during melting in terms of arrangement, motion, energy and forces between particles:

Particles gain energy from surroundings Particles vibrate faster as they gain energy. Particles gain enough energy to overcome forces holding them together in fixed position and can move around each other.

Q. **Why can diffusion only take place in liquids and gases?**

Particles can flow in liquids and gases.

Q. What factors affect diffusion?

Temperature and concentration gradient.

Q Explain what happens to particles when a solute dissolves:

The solvent particles push apart the solute particles from each other. The solute particles are moved into the spaces between the solvent particles.

Q. How does increasing temperature affect rate of dissolving?

Increasing the temperature increases the rate at which dissolving happens.

Q. How does increasing surface area affect rate of dissolving?

Increasing the surface area increases the rate at which dissolving occurs.

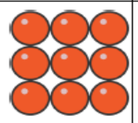
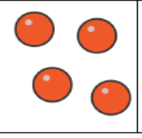
Q. Explain how gases cause pressure:

Gas particles move quickly in all directions and bump into each other or the walls of their container. When particles hit the walls they cause pressure. The more frequent the collisions the higher the pressure.

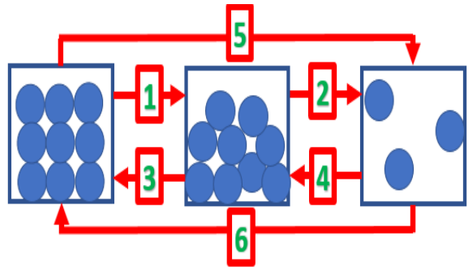
Powerful knowledge

Draw particles arrangements illustrating solids, liquids and gases.

Describe the properties, arrangement and forces between particles in solids, liquids and gases.

Q What are the three states of matter?	Q What are the properties of solids, liquids and gases	Q Describe the arrangement and motion of particles in solids, liquids and gases	Q Describe the forces between particles in solids, liquids and gases
Solid 	• They have a fixed shape and cannot flow • They cannot be compressed (squashed)	• Particles vibrate in a fixed position • Regular arrangement • Particles cannot move from place to place	Strong forces, called bonds, attract the particles towards each other.
Liquid 	• They flow and take the shape of the bottom of their container • They cannot be compressed	• Particles are close together • Particles are arranged in a random way • Particles move around each other	Forces between particles are strong enough to keep them close together, but weak enough to let them move around each other.
Gases 	• They flow and completely fill their container • They can be compressed (squashed)	• Particles are far apart • Particles are arranged randomly • Particles move quickly in all directions	There are very weak bonds between particles in a gas, so they are free to move in any direction.

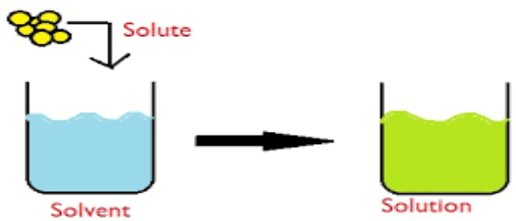
Recall the names for changes of state between solids, liquids and gases:



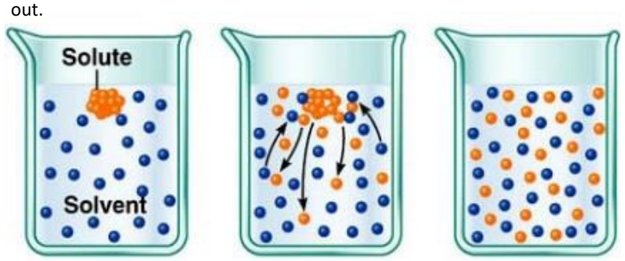
Number	Change of state when a...	Name of state change
1	...solid changes state to a liquid	Melting
2	...liquid changes state to a gas	Evaporating/boiling
3	...liquid changes state to a solid	Freezing
4	...gas changes state to a liquid	Condensing
5	...solid changes state straight to a gas	Sublimation
6	...gas changes state straight to a solid	Sublimation

Define the term solute, solvent, solution, soluble, insoluble and saturated:

Solute	This is the substance dissolved in a solvent
Solvent	This is the liquid that is dissolves a solute
Solution	This is a mixture of a solute dissolved in solution
Soluble	A substance that will dissolves in a solvent
Insoluble	A substance that does not dissolve
Saturated	When no more solute can be dissolved in a solvent



Diffusion is the net movement of particles from an area of high concentration to an area of low concentration. This occurs until particles are equally spread out.



Links to previous and future topics

Overview of typical starting points for learners:

As one of the very first topics of KS3, there may be a mixed level prior knowledge depending on experience at KS2:

Most pupils are likely to be able to state the three states of matter.

Some pupils may be able to draw particles in each state (though there is huge commonality of misconceptions when drawing liquids).

Some pupils may also be able to name changes of state, but the majority will be unfamiliar with arrangement, motion and properties.

Links to future topics:

The particles topic presents core knowledge and key principles that underpin many key aspects of Chemistry, Physics and Biology at all levels.

Topics linked at KS3:

Chemical reactions, elements and compounds.

Energy transfer, conduction and convection.

Motion and forces the Newtonian World.

Heating and Cooling.

Solutions and mixtures.

Light and Sound.

Pressure in gases, liquids and solids.

Topics linked at KS4:

Atomic structure.

Types of substance.

Forces and matter.

Radioactivity.

States of matter.

Separation techniques: filtration and distillation.

Water purification.

Calculations involving masses.

Rates of reactions.

Dynamic equilibria.

Particle model.

Impressive Reading:	Impressive Speaking:	Impressive Writing / Cultural Capital:	Resilience:	Employability:
Encouraging the use of impressive vocabulary each lesson. Identifying command words and key information from questions. Identifying and summarising key information from a body of text describing the science behind how a weather balloon took Dave the teddy bear on a voyage to the edges of upper atmosphere.	Narrating Scientific models to describe how particle arrangement, motion and closeness changes as a substance changes state. Use scientific words accurately to articulate ideas during think, pair and share tasks.	Explain, using diagrams, how the size of an inflated balloon changes when it is taken out of a fridge and placed into a warm room. This description should include the key words temperature, energy, particles, movement, random, collisions, pressure, gas, volume and speed. Introducing writing frames supporting scientific explanation. This approach emphasises that a statement must be followed by the word 'because' and be justified using core and/or powerful knowledge. Cultural Capital—The development of scientific ideas: How did Scientists theory and experiments develop the principles behind Brownian Motion.	Use a broad approach when presenting abstract ideas this should include models, clear visuals, concise descriptions and diagrams to help learners to engage. Learners should also be offered this range of options to help express their ideas and communicate their understanding. Articulate ideas with partners or in groups to build comprehensive responses when apply core and powerful knowledge to the bigger ideas of the topic.	Develop skills to work as part of a team and practice communicating, expressing and sharing ideas. Present occupations linked to this topic: Particle Physicists and Molecular Sciences – discuss Scientific research shared - the Hadron Collider.

Topic: REPRODUCTION
KS3 National Curriculum sub-topics:-

Duration: 10 lessons

Composite: Unit test

Key vocabulary:

Fertilisation
Gamete
Menstrual
Hormones
Puberty
Asexual
Sexual
Clones
Sperm
Testes
Scrotum
Semen
Sperm duct
Urethra
Penis
Sexual intercourse
Egg cell
Ovary
Oviduct
Uterus
Cervix
Vagina
Ovulation
Contraception
Condom
Contraceptive pill
Placenta
Umbilical cord
Fluid
Sac
Reproduction
Fertilisation
Ejaculation
Adolescence
Period
Gestation
Foetus

Core knowledge Components

Types of Reproduction:

1. Asexual reproduction produces clones.
2. Asexual reproduction

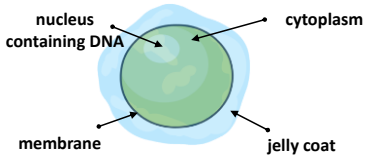
Advantages	Disadvantages
Only one parent needed.	Any faulty genetic material is passed on.
All offspring are clones.	No genetic variation.
Fast	More of population likely to be susceptible to same disease – greater chance of extinction.

3. Sexual reproduction

Advantages	Disadvantages
All offspring are genetically different.	Two parents are needed.
Allows adaptation and evolution.	Takes a lot of time.
There is variation in the offspring.	Not always successful.

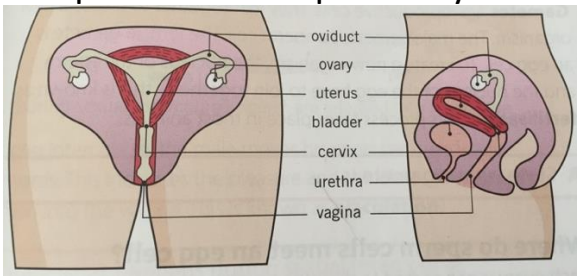
Human Reproduction:

4. The structure of an egg cell.

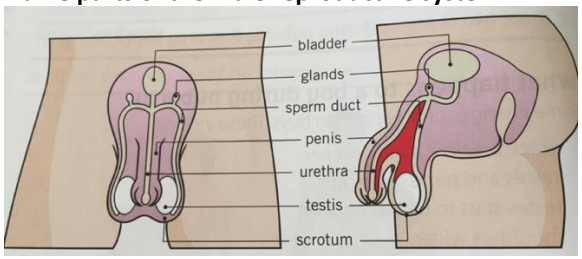


Powerful knowledge components crucial to commit to long term memory

- **Asexual reproduction is with a single parent (cloning) whereas sexual reproduction requires two parents and the mixing of genetic material.**
- **The male gamete is known as the sperm cell. The female gamete is known as the egg cell.**
- **Name parts of the female reproductive system**



- **Name parts of the male reproductive system**



- **Fertilisation takes place in the oviduct and occurs when the sperm and egg cell meet and their nucleus (genetic material) mixes.**
- **The human gestation period is 40 weeks. This is the time in uterus from fertilisation until birth.**

Puberty and the Menstrual Cycle.

- **During puberty a boy or a girl starts to change into an adult that can reproduce.**
- **During puberty a girl will start her periods. This happens every 28 days and is called the menstrual cycle.**

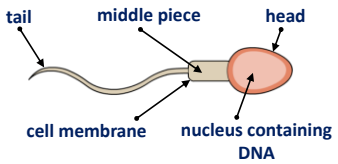
Links to previous and future topics

Y7: Cells topic

Y8: Health and Disease

This topic helps to develop knowledge specialised cells and organ systems visited in Cells.

5. The structure of the male sex cell (sperm).



Puberty & Menstrual Cycle:

6. During puberty many changes take place in both females and males including; growth spurt (getting taller), growth of pubic hair, reproductive organs develop and start working and start sweating.
7. The menstrual cycle lasts 28 days. Some of the main events includes;
   a) Day 1 – blood from uterus lining leaves the body through the vagina (period)
   b) Day 5 – bleeding stops. The lining of the uterus begins to regrow. The lining is spongy and filled with blood. This will provide a deep layer for implantation if egg cell is fertilised.
   c) Day 14 – an egg cell is released from one of the ovaries. This is called **ovulation**. The egg cell travels through the oviduct towards the uterus.

Pregnancy & Contraception:

8. Maternal habits that could harm an unborn child include; alcohol, drugs, smoking, poor diet.
9. Examples of contraception include condoms and contraceptive pill.

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Pregnancy and Contraception

- **Pregnancy is when a female has a baby developing inside her uterus.**
- **Contraception describes methods to prevent a pregnancy. These stop eggs being released or prevent sperm reaching the egg.**

Impressive reading	Impressive speaking	Impressive writing	Resilience	Employability via:
Read aloud recent news article. Sharks reproducing with no sperm https://qz.com/715428/theres-a-whole-group-of-animals-who-dont-need-males-to-reproduce/ • Read aloud in pairs – evaluate information in article by highlighting advantages for shark species for reproducing in this way. • Chose two words from the article that you have not come across before. • What is your opinion?	Group presentations on factors effecting foetal development during pregnancy	6 mark question on journey of a sperm cell from testes to ovary.	Show maturity in topic. Opinions around sensitive topics.	**Employability:** Collaboration, mature discussion. Analysing data. Careers**:** Midwife, health worker, nurse, doctor. All need to know how fertilisation, reproduction and development occurs and is controlled.

SEND

Communication and Interaction
Think, pair share, open class discussion. Groups in investigations. Dual coded presentations where possible. Targeted questioning.
Cognition and Learning
Key vocab explicit, lesson content chunked into a range of activities. Clear progression sequencing through a range of chunked activities.

SEMH Clear routines, uniform lesson formats, practical where appropriate. Empathetic practical groupings .Care when discussing or showing scientific diagrams due to sensitivity. Physical/Sensory Demonstrations where appropriate. Modifications as required for written work and suitable seating plan.
Culture Capital Granny mummies and reproductive technologies and ethics.