KESTEVEN AND SLEAFORD HIGH SCHOOL

Science Scheme of Learning

Year 8 – Term 3/Units 9

Intent – Rationale

This unit allows students to develop key skills in a range of different disciplines within Biology, Chemistry and Physics. In Biology students learn about the skeletal system and how the system is connected together with a range of different types of joints. Muscle action is crucial to allow movement for the skeleton – antagonistic muscle action being an important part of this. This topic provides great curriculum links with physical education.
In Chemistry, the role acids and alkalis play in a range of chemical reactions is important, and this topic allows students to gain an in depth understanding of key concepts. Learning how neutralisation occurs will help students gain a deeper understanding of this topic.
In Physics, the role light plays in our day to day life cannot be underestimated – students will gain an understanding of key concepts; such as lenses, reflection, refraction and colour.

Sequencing – what prior learning does this topic build upon?	Sequencing – what subsequent learning does this topic feed into?
Builds upon prior learning from Ks1 and Ks2 National curriculum **Topic 6 Chem Compounds** **Topic 5 Chem Simple Chemical Reactions** **Topic 3 Chem Acids and Alkalis**	Biology – Leads to GCSE Chemistry – Leads to GCSE Topic 4 Chemical Changes Physics – Leads to GCSE topic P11 Light and P12 Waves
What are the links with other subjects in the curriculum?	**What are the links to SMSC, British Values and Careers?**
• **PE links with learning about the skeleton and joints.**	B8.9 L4 Practical Assessment GB4a GB4d GB4e C8.9 L4 Neutralisation SP2 GB4c
What are the opportunities for developing literacy skills and developing learner confidence and enjoyment in reading?	**What are the opportunities for developing mathematical skills?**
FROM THE LIBRARY *Atlas of the Human Skeleton*; M Hutchinson-405 *Horrible Science-Blood Bones and Body Bits*; Nick Arnold-612 *Skeleton:* S Parker,DK eye witness-612 *Chemicals in Action*; Chris Oxlade-546.24- *Horrible Science, Frightening light*; Nick Arnold 535 *Light*; David Burnie-535 *Sight, light and Colour* D Jollands-535	• Mathematical skills are developed through practical skills, such as the use of a protractor and measuring angles in the light practical's.

KESTEVEN AND SLEAFORD HIGH SCHOOL

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Intent – Concepts

What knowledge will students gain and what skills will they develop as a consequence of this topic?

Know

Recognise hazard warning symbols and know how to take precautions
State the formulae of some common acids and the names of the salts they make.
State that metal oxides are bases and non-metal oxides are acidic
State that all acids contain hydrogen ions and all alkalis contain hydroxide ions

Apply

Describe the structure of our skeleton
Describe the functions of the skeleton
Describe the different types of joint
Describe the three types of muscle
Describe what prosthetic limbs are
Describe how to make a salt from an acid and an insoluble base.
Describe how to separate the solid salt crystals from a salt solution.
Write word equations for the reactions of acids with metals, alkalis and carbonates.
Test for Carbon dioxide and Hydrogen
Write word and symbol equations for the reaction of elements with oxygen.
Write word equations for the reactions of metal oxides with acids.
Write an ionic equation for any acid–alkali neutralisation reaction.
Describe how objects are seen
Describe reflection using ray diagrams
Draw ray diagrams to represent refraction
Describe and label the structures of the eye
Draw a ray diagram to explain how a convex lens focuses light
Draw a ray diagram to show the focal point of a concave lens

Extend

Explain how and why muscles often work in antagonistic pairs
Carry out a dissection safely
Plan an investigation
Explain what light is
Explain how a prism disperses white light and produces a spectrum
Explain why coloured objects appear certain colours under different coloured lights
Explain how pinhole and lensed cameras work

KESTEVEN AND SLEAFORD HIGH SCHOOL

Explain the difference between specular and diffuse reflection
Explain how refraction occurs when light changes speed as it enters different media
Explain how light slows down when it enters a denser medium

What subject specific language will be used and developed in this topic?		What opportunities are available for assessing the progress of students?
Antagonistic muscle action	Muscles work against each other in pairs. When one muscle contracts, the other remains relaxed and stretches as a joint moves in a given direction. Contraction of the other muscle in the antagonistic pair moves the limb in the other direction, stretching the first muscle as it does so.	
Ball and socket joint	A type of joint in vertebrates where the ball-shaped end of one bone fits into cup-shaped socket in another bone (or bones). Synovial fluid lubricates the movement of the bones. Allows movement in all directions. Examples of ball and socket joints in the human body are the shoulder and the hip.	
Biceps	A muscle on the front of the upper arm that has the effect of raising the lower arm when it contracts.	
Cartilage	A special type of connective tissue that is found on the ends of bone and between the vertebrae to reduce friction and to act as a shock absorber. Cartilage is also found in the nose, ears, trachea and ribcage, because it is strong and slightly flexible.	
Fixed joint	A joint in the skeleton where the bones are fused together. For example, when a baby is born the skull is made of separate plates of bone that can move over each other to allow the head to be slightly squashed as it passes through the cervix and vagina. Within the first 2 years of a baby's life, the bones will fuse together to form fixed joints.	
Hinge joint	A joint in the skeleton that allows movement in one direction. The ends of the bones are lubricated by cartilage and synovial fluid. Examples of hinge joints are the knee, elbow and finger joints.	
Joint	Where two bones meet and usually move separately to allow movement of body parts. Examples of joints include the shoulder, ankle and wrist.	
Ligament	Strong connective tissue that is slightly elastic and found in joints to hold bones together and prevent dislocation injuries. If a joint is sprained, this involves damage to the ligaments.	
Skeletal system	The organ system that is made up of the bones and muscles. Its functions include supporting the body, movement, protection of body organs and production of blood cells.	
Synovial fluid	The fluid that is found trapped inside movable joints in the skeleton. It lubricates the ends of the bone and helps to reduce wear and tear.	
Tendon	A tough, strong and inelastic connective tissue that connects the end of a muscle to a bone so that the muscle can pull on the bone. For example, the Achilles tendon connects the calf muscle to the heel bone, so that you can straighten your foot.	
Triceps	A muscle on the back of the upper arm that is part of an antagonistic pair with the biceps muscle. When the triceps contracts, it pulls the arm straight, lowering the lower arm against a resistance.	

Acid	A substance that has a pH of less than 7 and is capable of giving away hydrogen ions (H^+) in a chemical reaction. Acids make salts when they react.
Acid rain	Rain that is acidic, as a result of either naturally occurring or human-made chemicals that have dissolved in rain water.
Alkali	A solution that has a pH of more than 7. All alkalis contain hydroxide ions (OH^-) and this is usually because the chemical that has dissolved in the water is a metal hydroxide. Sometimes, however, the hydroxide ions come from water molecules because the substance dissolved in the water has been able to split up the water molecules. Alkalis are bases that have dissolved in water.
Base	A substance that is capable of neutralising an acid. Some bases are soluble in water, and this means that they can also be called alkalis. All alkalis are bases, but not all bases are alkalis.
Concentrated	A solution is concentrated when it has a large amount of solute dissolved into a given volume of solvent. We could also say that the solution has a high concentration. This will mean that within the solution, the solute particles are closer together than in a dilute solution, where there are many more solvent molecules and fewer solute molecules. Concentration is measured in mol/dm^3, so a bottle of hydrochloric acid that is 5 mol/dm^3 is more concentrated than a solution of 1 mol/dm^3.
Dilute	A solution that contains a lot of solvent (usually water) and not very much of the solute. Dilute is the opposite of concentrated. Since concentration is measured in mol/dm^3, a dilute solution would have a low value. For example, 0.1 mol/dm^3 is very dilute compared with 5 mol/dm^3.
Dissociation	To separate. In chemistry, when the ions in a compound split apart when it is dissolved in water.
Effervescence	Bubbles coming out of a solution, as can be seen when the lid is undone on a bottle of fizzy drink.
Neutralisation	A type of chemical reaction in which an acid is reacted with a base in such a way that there is no acid left. A salt is produced in neutralisation reactions.
Proton acceptor	Another name for a base. A proton acceptor is a chemical that is able to bond with a hydrogen ion (H^+) in an acid–base reaction.
Proton donor	Another name for an acid. All acids are able to provide hydrogen ions (H^+) in chemical reactions.
Pure	A substance made from only one compound or element. For example, pure water contains only water molecules, no dissolved solids or gases.
Salt	There are many salts, but 'common salt' is sodium chloride, which can be formed when hydrochloric acid is neutralised by a base containing sodium, such as the alkali sodium hydroxide. Another salt is copper sulfate, which can be made when sulfuric acid is neutralised by copper oxide, copper hydroxide or copper carbonate.
Angle of incidence	The angle between the incident ray (incoming ray) and the normal line. The normal line is drawn at right angles to the mirror (in reflection) or the second substance (in refraction) – for example, at right angles to the edge of a glass block.
Angle of reflection	The angle between the reflected ray and the normal line. It will always be the same as the angle of incidence.
Camera obscura	A portable box or darkened room with a hole or lens in one side that allows an image of the objects in front of the hole or lens to be projected on the back wall of the box or room. For a portable camera obscura (often called a pinhole camera), the back wall is often a screen of tracing paper (or similar material) so that the image can be viewed from outside the box.
Cones	Specialised cells in the retina of the eye that are sensitive to coloured light. In humans, there are three types of cone cell, each adapted to absorb (and thus detect) light of a particular frequency: red, green and blue. The cones are less sensitive, however, than the rods, which are the other type of photoreceptive cell in the retina. Rods are not able to detect colour, which is why we cannot see in colour when it is fairly dark.
Convex lens	A lens that is thicker in the middle than at the edges. A convex lens will converge (bring together) rays of light that enter the lens parallel to each other. The point at which light rays converge from a convex lens is called the focal point.
Cornea	A transparent surface at the front of the eye.
Diffuse reflection	How light reflects from a dull surface, so that a reflected image cannot be seen. This is because the surface is rough on a microscopic scale, so individual light rays hit many different surfaces, which are at different angles, and this scatters the light rays in different directions.
Dispersion	Splitting white light into the colours of the spectrum, typically using a prism in the laboratory. Dispersion of sunlight by water droplets in the air is what creates a rainbow. It is somewhat arbitrary that we think of seven colours in the visible spectrum because the spectrum is a continuously changing pattern of colours.
Focal point	The point at which light rays that were originally parallel converge, having passed through a convex lens. The distance of the focal point from the midline of the lens is called the focal length.
Iris	The coloured part of the eye, a ring of muscle that changes size to control the amount of light entering through the pupil.

KESTEVEN AND SLEAFORD HIGH SCHOOL

Lens	A shaped piece of glass (or other suitable material) that has a shape that can be used to bring light rays to a focus (a converging lens) or to spread them out (a diverging lens). Converging lenses have a convex shape; diverging lenses have a concave shape. *An example of a lens is the one in your eye. This lens is made from transparent cells and is a convex lens that provides about one-third of the focusing power of the eye (two-thirds of the focusing power of the eye comes from the cornea). The shape of the lens can be changed by the ciliary muscles, which allows us to focus rays from near and distant objects onto the retina.*
Normal (normal line)	An imaginary line drawn at right angles to a mirror or the edge of a glass block (or similar boundary between two substances) at the point where a light ray touches, in order to investigate the angle of reflection or refraction.
Opaque	A substance that prevents any light from passing through it. Opaque surfaces may reflect light of a particular colour (or all colours or no colours) but they do not work as windows!
Optic nerve	The bundle of nerve fibres that leaves the back of the eye and carries signals from the retina to the brain. Where the nerve cells pass from the inside of the eye to the outside of the eye, there is a spot with no photoreceptive cells. This is called the blind spot.
Pinhole camera	A type of camera obscura that uses a very small hole to focus an image of an object outside the box onto a screen at the back of the box. *See also* 'camera obscura'.
Plane	A flat surface. *For example, a plane mirror is a flat mirror.*
Primary colours (of light)	The three colours of light (red, green, blue) that can be mixed together in equal proportions to give white light. These primary colours can also be mixed in different ratios to give any colour that we can see. Mixing two primary colours in equal proportions produces a secondary colour (yellow, cyan, magenta).
Prism	Any transparent three-dimensional shape that has flat polished surfaces and refracts light. Shining white light through a prism can result in dispersion to form a spectrum.
Pupil	A hole of varying size (controlled by the iris) which allows light to enter the eye.
Real image	An image that light reaches or passes through, which is formed by light rays coming together after being refracted by a convex lens or reflected by a concave mirror. If a screen is placed at this focal point, an image will usually be projected onto the screen. *Examples of real images include the image projected onto the board at school and the image on the retina of your eye. If you look through a concave lens the image you see is not a real image – it is a virtual image.*
Refraction	When a wave changes direction as it passes from one medium to another as a result of it changing speed. Refraction does not occur when a wave hits another object at 90° (along the normal line). *An example of refraction is when you look at someone standing waist deep in a swimming pool. Their legs look very short.*
Retina	A light-sensitive layer of cells at the back of the eye.
Secondary colours (of light)	Colours made by mixing two primary colours in equal proportions. *Yellow is made from red and green. Cyan is made from green and blue. Magenta is made from red and blue.*
Source (of light)	An object that gives off its own light, rather than simply reflecting light from somewhere else. *Examples of light sources include the Sun, a candle, a lamp and a glowstick. Note that the Moon is not a source of light, but only reflects light from the Sun.*
Spectrum	A continuously variable range of values. It is commonly used to describe the colours that white light can be split into using a prism (also seen in a rainbow), because even though we have learnt to distinguish seven colours in the spectrum, in fact there are an infinite number of colours. *Another example of a spectrum is the electromagnetic spectrum, of which the colours of visible light are a small part.*
Specular reflection	The reflection (bouncing back) of light from very smooth surfaces such that an image can be seen in the reflecting surface. *Examples of materials that are more likely to cause specular reflection are flat and smooth metals, and very still lakes.*
Translucent	Something that allows light to pass through it, but does not allow a clear image to pass through. This means that the light rays are not able to pass straight through; many are scattered. *Tracing paper is an example of a translucent material.*
Transparent	Something that allows light to pass through it in such a way that a clear image can be seen through it. *Water and glass are transparent.*
Virtual image	An image that light rays do not pass through. *The image in a mirror and the image that you see when looking through a concave lens are both examples of virtual images.*

KESTEVEN AND SLEAFORD HIGH SCHOOL

Intent – Concepts

Lesson title	Learning challenge	Higher level challenge	Suggested activities and resources
B8.9 L1 Bones and joints	Can I describe the structure of our skeleton? Can I describe the functions of the skeleton? Can I describe the different types of joint?	Can I explain how joints are adapted for their function?	
B8.9 L2 Muscles	Can I describe the three types of muscle?	Can I explain how and why muscles often work in antagonistic pairs?	
B8.9 L3 Joints	Can I carry out a dissection safely?	Can I describe what prosthetic limbs are?	

KESTEVEN AND SLEAFORD HIGH SCHOOL

B8.9 L4 Practical Assessment	Can I plan an investigation?	Can I explain my choice of equipment when planning an investigation?	
C8.9 L1 Making salts	Recognise hazard warning symbols and know how to take precautions ?	Describe how to separate the solid salt crystals from a salt solution.?	
C8.9 L2 Acids and Alkalis	Can I state the formulae of some common acids and the names of the salts they make.? Can I write word equations for the reactions of acids with metals, alkalis and carbonates?	Can I test for Carbon dioxide and Hydrogen?	
C8.9 L3 Compounds and Acidity	Can I write word and symbol equations for the reaction of elements with oxygen? Can I state that metal oxides are bases and non-metal	Can I write word equations for the reactions of metal oxides with acids?	

	oxides are acidic?		
C8.9 L4 Neutralisation	Can I state that all acids contain hydrogen ions and all alkalis contain hydroxide ions?	Can I write an ionic equation for any acid–alkali neutralisation reaction?	
P8.9 L1 Light and reflection	Can I explain what light is? Can I describe how objects are seen? Can I describe reflection using ray diagrams?	Can I explain the difference between specular and diffuse reflection?	
P8.9 L2 Refraction	Can I explain how refraction occurs when light changes speed as it enters different media? Can I draw ray diagrams to represent refraction?	Can I explain how pinhole and lensed cameras work? Can I explain how light slows down when it enters a denser medium?	
P8.9 L3 Focussing light	Can I describe and label the structures of the eye? Can I draw a ray diagram	Can I draw a ray diagram to explain how a convex lens focuses light?	

	to show the focal point of a concave lens?		
P8.9 L4 Coloured light	Can I explain how a prism disperses white light and produces a spectrum?	Can I explain why coloured objects appear certain colours under different coloured lights?	