

# Year 10 Biology Learning Outcomes

## Unit 4: Bioenergetics

### Unit 4.1: Photosynthesis

- Describe photosynthesis as an endothermic reaction in which energy is transferred from the environment to the chloroplasts by light.
- Explain the effects of temperature, light intensity, carbon dioxide concentration and the amount of chlorophyll on the rate of photosynthesis.
- Investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed.
- Describe all the ways plants use the glucose made in photosynthesis.
- Use data to relate limiting factors to the cost effectiveness of adding heat, light or carbon dioxide to greenhouses.

### Unit 4.2: Respiration

- Describe cellular respiration as an exothermic reaction which is continuously occurring in living cells.
- Investigate the effect of exercise on the body.
- Compare anaerobic respiration in humans with that in plants and yeast.
- Explain metabolism – the sum of all reactions in a cell or the body.

## Unit 5: Homeostasis & Response

### Unit 5.1: Nervous System

- Explain that homeostasis is the regulation of the internal conditions of a cell or organism.
- Plan and carry out an investigation into the effect of a factor on human reaction time.
- Explain how the structure of the nervous system is adapted to its functions.
- Explain how the various structures in a reflex arc relate to their function and understand why reflex actions are important.
- Identify cerebral cortex, cerebellum and medulla and describe their functions.
- Relate the structures of the eye to their functions.
- Explain focusing in the eye (accommodation) and common defects of the eye.

### Unit 5.2: Hormonal Control

- Describe the principles of hormonal coordination and control by the human endocrine system.
- Identify positions of 6 key organs and glands.
- Explain how insulin controls blood glucose (sugar) levels in the body.
- Explain what diabetes is and how diabetes can be treated.

- Explain the roles of thyroxine and adrenaline in the body.
- Describe the roles of hormones in human reproduction, including the menstrual cycle.
- Explain the interactions of FSH, oestrogen, LH and progesterone, in the control of the menstrual cycle, by extracting and interpreting data.
- Evaluate the different hormonal and non-hormonal methods of contraception.
- Explain the use of hormones in modern reproductive technologies to treat infertility.
- Describe the effects of some plant hormones and the different ways people use them to control plant growth.
- Investigate the effect of light or gravity on the growth of newly germinated seedlings.

### **Unit 5.3: Homeostasis**

- Explain how vasodilation and vasoconstriction lower or raise body temperature
- Explain the effect on cells of osmotic changes in body fluids.
- Describe the function of kidneys in maintaining the water balance of the body
- Describe the basic principles of dialysis.
- Use economic, social, and ethical arguments to evaluate treating kidney failure by dialysis or kidney transplant.

## **Unit 6: Reproduction, Variation & Evolution**

### **Unit 6.1: Reproduction**

- Describe the differences in asexual and sexual reproduction in terms of number of gametes involved, variation and chromosome number.
- Understand that meiosis leads to non-identical cells being formed while mitosis leads to identical cells being formed.
- Suggest and explain the advantages and disadvantages of organisms using both asexual and sexual reproduction.
- Discuss the benefits of studying the human genome and describe the structure of DNA.
- Relate the structure of DNA to its function.
- Explain how DNA controls protein synthesis.
- Evaluate the impact of mutations on gene expression.
- Complete a Punnett square diagram and extract and interpret information from genetic crosses and family trees.
- Evaluate how polydactyly and cystic fibrosis disorders are inherited.
- Evaluate embryo screening for genetic diseases.

### **Unit 6.2: Variation and Evolution**

- Describe simply how the genome and its interaction with the environment influence the development of the phenotype of an organism.
- Describe how the inherited characteristics of a population over time through a process of natural selection may result in the change of a species.
- Explain how selective breeding happens and the impact of selective breeding of food plants and domesticated animals.
- Describe the process of genetic engineering to give a desired characteristic.
- Explain the potential benefits and risks of genetic engineering in agriculture and in medicine and that some people have objections.

- Explain how animals and plants can be cloned.
- Describe the process involved in adult cell cloning and the benefits and risks associated with it.
- Explain the potential benefits and risks of cloning in agriculture and in medicine and why people have ethical objections to cloning.

### **Unit 6.3: Genetics and Variation**

- Describe the development of our understanding of genetics including the work of Mendel and understand why the importance of Mendel's discovery was not recognised until after his death.
- Appreciate that the theory of evolution by natural selection developed over time and from information gathered by many scientists.
- Explain Darwin's theory of evolution and explain why it was not accepted straight away.
- Describe the steps which give rise to new species, linking this to Darwin and Wallace's theories.
- Explain how fossils are formed and what we can learn from them.
- Describe factors which may contribute to the extinction of a species.
- Explain how bacteria become antibiotic resistant and what we can do to reduce the spread of antibiotic resistant bacteria.
- Describe the Linnaean system of classification and describe the impact of developments in biology on classification systems.

# Year 10 Chemistry Learning Outcomes

## Unit 5: Energy Changes

- Define exothermic and endothermic reactions.
- Evaluate the applications of exothermic and endothermic reactions.
- Explain how energy changes when bonds are broken and made.
- Calculate the overall energy change of a reaction using bond energies, including the correct units.
- Explain why non-rechargeable batteries stop working.
- Evaluate the use of hydrogen fuel cells.

## Unit 6: Rates of Reaction

- Plot and use a graph to calculate the gradient to measure the initial rate of reaction.
- Explain how to use collision theory to explain the effect of surface area on reaction rate.
- Explain how altering the temperature affects the rate of reaction using collision theory.
- Explain, using collision theory, how changing concentration or pressure alters the rate of reaction.
- Explain, using collision theory, how adding a catalyst alters the rate of reaction.
- Predict the observations of a familiar reversible reaction when the conditions are changed.
- Predict the effect on the rate of forward and reverse reactions by applying the Le Chatelier's Principle when the conditions of a dynamic equilibrium are changed.
- Predict the effect on yield of changing temperature, concentration, or pressure in a given equilibrium system.

## Unit 7: Organic Chemistry

### Unit 7.1: Crude Oil and Fuels

- Describe the composition of crude oil.
- Explain how fractional distillation is used to separate fractions in crude oil.
- Link the size of the molecule to the boiling point, viscosity and flammability.
- Describe how cracking takes place and compare the products obtained.

### Unit 7.2: Organic Reactions

- Predict the word and balanced symbol equations to describe reactions between alkenes and hydrogen, water (steam), or a halogen.
- Predict the structure for primary alcohols and carboxylic acids when the number of carbon atoms is given.
- Explain why solutions of ethanol have a pH of 7 using word and balanced symbol equations for the reactions of alcohols.

- To describe how carboxylic acids react with carbonates and alcohols.

### Unit 7.3: Polymers

- Explain why monomers for addition polymers must be unsaturated and explain the process of addition polymerisation in detail, including using balanced symbol equations and the concept of atom economy.
- Compare and contrast in detail, giving appropriate examples, the two methods of polymerisation.
- Explain in detail the process of condensation polymerisation with natural monomers, including using equations.
- Demonstrate and apply knowledge and understanding to explain how nucleotide form DNA.

## Unit 8: Chemical Analysis

- Distinguish a pure substance from an impure substance using melting point data
- To describe how chromatography works to separates mixtures
- To identify gases chlorine, oxygen, carbon dioxide and hydrogen from their chemical tests.
- To identify the positive ions in a compound using flame tests and other chemical tests
- Describe the chemical tests for some negative ions and their results.
- Describe how instruments can be used to identify elements and compounds.

## Unit 9: Earth's Atmosphere

- Describe how oxygen was formed in the development of the atmosphere.
- Explain, using word equations, how gases were formed in the atmosphere and how oceans were formed.
- Explain why the composition of the Earth's atmosphere has not changed much for 200 million years.
- Explain how greenhouse gases increase the temperature of the atmosphere.
- Explain the possible effects of global climate change and why they are difficult to predict.
- Describe how carbon monoxide and soot (carbon) can be made from the incomplete combustion of fossil fuels.

## Unit 10: The Earth's Resources

### Unit 10.1: The Earth's Resources

- Explain the use of natural, sustainable, and finite resources.
- List the key processes to make drinking water.
- Explain reasons for filtration and sterilisation in water treatment.
- Describe the main processes in sewage treatment.
- Describe the processes of phytomining and bioleaching.
- Carry out Life Cycle Assessments for different products when data is supplied.
- Evaluate the environmental, economic, and social impacts of reusing and recycling products.

### Unit 10.2: Using Materials

- Compare how different conditions affect rusting.
- Evaluate the composition and uses of alloys.
- Link the structure of the polymers to their uses.

- Compare the properties of ceramics, polymers, composites and metals.
- Explain how the Haber process works.
- Explain the trade-off between the rate of production and the position of equilibrium in the Haber process.
- Compare the industrial and laboratory production of fertilisers.

# Year 10 Physics Learning Outcomes

## Unit 4: Radioactivity

- Explain what causes radiation and what risks there could be.
- Explain the observations that led to the current structure of the atom.
- Describe the different ways radiation can be emitted.
- Explain the properties of the different types of radiation.
- Interpret graphs about half life.
- Explain the features of radiation that makes them usable for medicine.
- Explain how we can get electricity from nuclear radiation.
- Describe the differences between Nuclear fission and fusion.
- Explain why we should still use nuclear power.

## Unit 5: Forces

### Unit 5.1: Forces in Balance

- Explain the difference between scalars and vectors.
- Classify forces into contact and non-contact.
- Draw and calculate resultant force.
- Calculate and explain moments.
- Explain how levers and gears work and why we use them.
- Identify the centre of mass for a variety of objects.
- Explain why things balance in terms of forces.
- Calculate clockwise and anti-clockwise moments.
- Use the parallelogram of forces to solve various real life situations.
- Calculate the resultant force using the resolution of forces idea.

### Unit 5.2: Motion

- Draw a distance-time graph and explain all of the sections.
- Explain the difference between distance-time graphs and velocity-time graphs.
- Calculate acceleration.
- Calculate the gradient and area under a velocity-time graph.
- Explain and calculate constant acceleration using an equation.

### Unit 5.3: Force and Motion

- Explain Newton's second law and use the equation for a variety of real life situations.
- Describe fully the motion of a falling object.
- Explain how forces affect braking on objects and vehicles.
- Calculate and explain the effects of momentum.

- Explain the principle of conservation of momentum and apply it to various situations.
- Explain the effect of impulse.
- Explain how the safety features in a car help to keep us safe.
- Explain Hooke's law and apply it to various materials.

#### **Unit 5.4: Force and Pressure**

- Decide which types of objects will cause the most pressure, based on mass and surface area.
- Calculate pressure.
- Explain what affects pressure in a liquid.
- Explain what causes atmospheric pressure and how it changes with altitude.
- Decide what causes things to float or sink by discussing pressure, density and upthrust.

## Unit 6: Waves

### **Unit 6.1: Waves**

- Compare transverse and longitudinal waves in terms of direction of vibration and propagation.
- Perform calculations involving rearrangements of the period equation and the wave speed equation.
- Describe a method to measure the frequency of a wave in a liquid.
- Describe the relationship between the angle of incidence and angle of reflection.
- Explain refraction in terms of changes in the speed of waves when they move between one medium and another.
- Explain real world uses of ultrasound.
- Explain how the detection of seismic waves can be used to investigate the structure of planet Earth.

### **Unit 6.2: Electromagnetic Waves**

- Draw and label EM spectrum.
- Justify the use of a particular part of the EM spectrum for a particular job.
- Explain how radio waves are used to send information across long distances.
- Evaluate uses of a particular part of the EM spectrum by consideration of dangers.
- Evaluate the use of x-rays.

### **Unit 6.3: Light**

- Explain how the law of reflection works so that we can see ourselves in mirrors.
- Explain how refraction works.
- Suggest the apparent colours of objects based on the light they are in.
- Explain using ray diagrams how lenses work.



# Year 11 Biology Learning Outcomes

## Unit 7: Ecology

### Unit 7.1: Adaptations Interdependence and Competition

- Describe different levels of organisation in an ecosystem from individual organisms to the whole ecosystem and describe the importance of interdependence and competition in a community.
- Explain how abiotic and biotic factors affect the location and abundance of species in a habitat.
- Measure the population size of a common species in a habitat. Use sampling techniques to investigate the effect of a factor on the distribution of this species.
- Suggest when given appropriate information, which factors organisms are competing for in a habitat.
- Explain how organisms are adapted to live in their natural environment (given appropriate information).

### Unit 7.2: Organising an Ecosystem

- Understand that photosynthetic organisms are the producers of biomass for life on Earth and that feeding relationships can be represented by food chains
- Explain the importance of decomposers in the ecosystem and the importance of the water cycle to living organisms.
- Explain the importance of the carbon cycle to living organisms
- Explain how temperature, water and availability of oxygen affect the rate of decay of biological material
- Investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change.

### Unit 7.3: Biodiversity and Ecosystems

- Explain the reasons for an increasing human population and what impact this has on the planet.
- Explain what causes pollution on land and in water and the effects of this on biodiversity.
- Explain the impact of acid rain, smoke and smog on the human population and the environment including methods to reduce the impact on human health and describe how acid rain forms.
- Explain the environmental impacts of deforestation on the biodiversity of life and describe the reasoning for deforestation and peat bog destruction.
- Explain the biological consequences of global warming and discuss the potential methods to prevent global warming from happening.

- Evaluate the impact of environmental changes on the distribution of species in an ecosystem given appropriate information.
- Suggest the most significant means to maintain biodiversity from a range of methods.
- Explain reasons why all potential chemical energy (biomass) is not transferred to each consumer levels and describe the issues of using biomass to record potential energy transfer through consumers.
- Explain the impact if people do not have food security and decide on methods to ensure food security.
- Evaluate the advantages and disadvantages to intensive modern farming techniques in order to make ethical considerations to its future.
- Consider the future of obtaining protein-based foods through using biotechnology and explain the issues of overfishing.

# Year 11 Chemistry Learning Outcomes

## Unit 3: Chemical Reactions

- Work out relative formula mass of a range of substances using the periodic table.
- Calculate the number of moles in a substance, when given the mass and chemical formula.
- Use Avogadro's number to calculate the number of particles in a given amount of a substance.
- Calculate the mass of a substance produced in a chemical reaction.
- Balance equations using moles.
- Identify limiting reactants in a chemical reaction.
- Calculate the concentration of a solution from moles and volume.
- Rearrange formula triangles to calculate moles, concentration and volume.

## Unit 4: Chemical Change

### Unit 4.1: Chemical Changes

- Explain how to deduce an order of reactivity of metals based on experimental results.
- Describe oxidation and reduction in terms of gain or loss of oxygen.
- Describe, using equations, how some common metals react with oxygen, water and dilute acid.
- Describe what displacement is.
- Use the reactivity series to determine whether a reaction between a metal and a different metal salt will occur.
- Construct word equations for displacement reactions.
- Describe how metals can be extracted from ores.
- Describe the reaction of a metal with an acid.
- Construct the names of salts, using common metals and acids.
- Explain the difference between an alkali and base.
- Describe how you would obtain a pure, dry sample of a soluble salt from an insoluble base and a dilute acid.
- Construct balanced symbol equations for the reactions of acids with alkalis.
- Evaluate how universal indicator or a data logger can be used to determine the approximate pH of a solution.
- Explain the terms dilute and concentrated, and weak and strong in relation to acids.
- Describe how the concentration of hydrogen ions in a solution affects the numerical value of pH.

### Unit 4.2: Electrolysis

- Describe what happens in electrolysis.

- Explain why ions are attracted to the electrodes.
- Predict the products of electrolysis.
- Describe electrolysis with half equations at the electrodes.
- Explain how water affects the products of electrolysis.
- Represent the reactions at each electrode using half equations .
- Explain the electrolysis of brine using half equations, classifying reactions at the electrode as oxidation or reduction.
- Describe the process of extracting aluminium from its ore.
- Construct the half equation at each electrode during the electrolysis of aluminium oxide.
- Explain why some metals are extracted by electrolysis and others with carbon.

# Year 11 Physics Learning Outcomes

## Unit 7: Electromagnetism

- Explain how magnets work.
- Explain how and why we use electromagnets.
- Evaluate various devices that use electromagnets.
- Describe magnetic flux and how this relates to a motor.
- Use Fleming's left hand rule.
- Explain the generator effect and ways to influence it.
- Explain how an AC generator produces an induced potential difference.
- Explain how a transformer works.

## Unit 8: Space

- Explain the formation of the solar system that led to us being here.
- Discuss the link between features of a star and the fate of the star.
- Explain how and why satellites orbit the Earth.
- Explain the evidence for an expanding Universe.
- Explain how the Universe began and evidence for the Big Bang Theory.