

Level IV - Physics

	Outcomes	Demonstrations
Unit 1	The student applies the concepts and principles of simple motion including vectors to the solution of everyday situations.	<ul style="list-style-type: none"> • distinguish between vector and scalar quantities • perform vector calculations both graphically and trigonometrically • resolve vectors into components • describe speed as a rate • perform calculations involving speed, time, and distance • interpret distance-time graphs • compare and contrast speed, velocity, and acceleration • calculate acceleration • solve projectile motion problems involving range, maximum height, and time of flight • Analyse motion with fixed and moving frames of reference
	The student applies the concepts and principles of force, work, and energy to the solution of everyday situations.	<ul style="list-style-type: none"> • define force and give its metric (SI) unit • list and recognise different types of forces • differentiate between weight and mass • define friction and list three methods of reducing it • define inertia, momentum, and action/reaction • define work and solve problems using the work formula (Work = Effort/Distance) • identify cause and effect relationships between force and changes in velocity • give examples of the effects of inertia • state Newton's first, second, and third laws of motion • analyse problems using Newton's laws • give examples of the effects of gravity • examine how gravitational force is related to mass and distance • distinguish between mass and weight • explain how force, mass, and acceleration are related

Level IV - Physics

	Outcomes	Demonstrations
		<ul style="list-style-type: none">• compare the rates at which different objects fall• observe the effects of air resistance• analyse action and reaction forces• calculate momentum• explain conservation and momentum• define energy and give the (SI) unit• state the law of conservation of energy• distinguish between kinetic and potential energy• recognise that energy can change from one form to other forms with no loss of total energy• compare the scientific meaning of work with its everyday meaning

Level IV - Physics

Level IV - Physics		
	Outcomes	Demonstrations
Unit 2 Waves	Apply the concepts and principles of mechanics to machines encountered in everyday life.	<ul style="list-style-type: none"> • explain how machines make work easier • describe the six types of simple machines • recognize examples of each of the three classes of levers • solve problems involving levers • calculate mechanical advantage • solve problems on the mechanical advantage for different types of simple machines • solve problems on the mechanical advantage of gears • describe and calculate the ideal mechanical advantage (IMA,) and the actual mechanical advantage (AMA) of a ramp • calculate the efficiency of a machine • calculate work done and efficiency of work done with a ramp • describe the relationship between work, power, and time
	Analyze energy transfer through mechanical wave motion.	<ul style="list-style-type: none"> • distinguish between the concept of wave medium vibration and energy transfer through waves. • identify and give examples of transverse and longitudinal waves. • analyze each wave form that results from a pulse and continuous vibration energy source. • define the wave properties of wavelength, amplitude, frequency, and velocity. • use the principles of superposition to solve wave propagation problems and be able to graphically illustrate the results. • use the laws of reflection and refraction and the concept of interference to analyze the boundary behavior of waves. • characterize simple harmonic motion and apply Newton's laws to such motion. • demonstrate knowledge of the properties unique to sound waves.

Level IV - Physics

	Outcomes	Demonstrations
		<ul style="list-style-type: none">• solve sound problems relating the wave properties of wavelength, amplitude, frequency, and velocity and the effect of the Doppler shift.• distinguish among forced vibration, natural frequency, standing wave, and resonance as they relate to the production of sound.• relate the physical properties of sound waves to the perceived notions of loudness and pitch.

Level IV - Physics

Level IV - Physics		
	Outcomes	Demonstrations
	Analyze energy transfer through electromagnetic wave motion.	<ul style="list-style-type: none"> • contrast between energy transfer by electromagnetic and mechanical waves. • describe evidence for the wave nature of light. • recognize the dual wave particle nature of light and its relationship to quantum mechanics. • describe the origin and production of electromagnetic radiation.
Unit 3 Electricity	Explain the theory of the atom and the behaviour of electrons.	<ul style="list-style-type: none"> • explain the structure of the atom • describe the electrical charges on the neutron, proton, and electron • describe the behaviour of the valence electrons • define conductors, non-conductors, and semi-conductors in terms of valence electrons
	Explain the behaviour of electricity in the static state.	<ul style="list-style-type: none"> • state the law of electrical charges • identify several applications of static electricity • describe the processes of charging by conduction and by induction • describe the distribution of charge on a conductor • use Coulomb's law to calculate electrical force • describe the properties of an electrical field • describe the concepts of electric field energy and electric potential difference
	Analyze and solve series parallel and combination circuits.	<ul style="list-style-type: none"> • state the units and symbols of current, voltage and resistance • perform calculations involving Ohm's law • compare characteristics of series, parallel and combination circuits • draw schematic diagrams of series, parallel and combination circuits

Level IV - Physics

Level IV - Physics		
	Outcomes	Demonstrations
		<ul style="list-style-type: none">• solve for unknown currents, voltages and resistances in different circuits• state Kirchoff's Current Law and Kirchoff's Voltage Law• describe the factors affecting resistance of a material• state the function and identify the circuit symbol of: batteries, resistors, fuses, circuit breakers, ground wires, and switches• distinguish between direct current and alternating current

Level IV - Physics

Level IV - Physics		
	Outcomes	Demonstrations
	Analyze electrical energy use and distribution.	<ul style="list-style-type: none"> ● define electrical energy ● describe six sources of electrical energy ● define power ● solve problems requiring the calculation of power. ● calculate electrical energy using $E=Pt$ and $E=Vit$ ● calculate electrical power costs ● describe a typical electrical energy distribution network ● describe the factors affecting power loss in the distribution of electricity ● state the function and identify the circuit symbol of: relays, transformers, rectifiers, and filter capacitors.
	Explain magnetism and electromagnetic devices.	<ul style="list-style-type: none"> ● describe magnetic fields and lines of force ● describe the magnetic effects of electricity, including the orientation of electric fields around current-carrying conductors and coils ● describe the factors that affect the strength of an electromagnet ● describe how magnetic forces, such as deflection coils, act on moving charges ● describe the operation of common D.C. electrical devices ● explain the principles of electromagnetic induction ● apply an understanding of magnetism to common experiences and practical applications ● solve problems relating electromagnetism to practical applications
Unit 4 Modern Physics	Describe and explain the current model of the atom through an analysis of the evolution of atomic theory beginning with Dalton's model.	<ul style="list-style-type: none"> ● Distinguish between the Dalton and Thomson model of the atom. ● Analyze and describe the relative charge, mass, and location of the 3 sub-atomic particles. ● Distinguish between the Rutherford and Bohr model of the atom.

Level IV - Physics

	Outcomes	Demonstrations
		<ul style="list-style-type: none">• Identify the relationship among atomic particles necessary to explain the existence of isotopes.• Identify the structure of the quantum mechanical model of the atom.• Explain the relationship between emission spectrum lines and atomic energy levels including the electron configuration of various elements.• Explain how quantum mechanics theory relates to both black body radiation and the photoelectric effect.• Describe the concepts and relationships among the various theories that lead to the modern view of the atom.

Level IV - Physics

	Outcomes	Demonstrations
Unit 6 Radioactivity	Describe and explain radioactivity and its role in the production of energy through both fission and fusion.	<ul style="list-style-type: none">• Distinguish among physical, chemical, and nuclear change.• Describe radioactive decay in terms of alpha, beta, and gamma emissions among natural and constructed environments.• Define the half-life concept; and calculate and explain decay.• Distinguish between fission and fusion reactions and their nuclear equations.• Compare the application of radioactivity through analyzing the benefits and related limitations.• Identify and explain the design factors that are critical to sustain a chain reaction.• Predict, through Einstein's mass energy equivalence, the mass energy conversion during a decay reaction.• Explain how atomic spectra relates to atomic structure.• Examine nuclear electrical power production and nuclear weapon production and explain the consequences that would flow from their use in the context of a long-term sustainable environment.• Discuss the use of nuclear energy in terms of the benefits and related limitations.