CHAPTER	LESSON	DESCRIPTION
I. Statics	**Forces**	At the end of this activity, students should be able to: recognise forces as a measurement of the interaction between bodies, describe the basic characteristics of a force vector, specify different types of forces, differentiate between the effects of the action of forces.
	Addition of Forces	At the end of this activity, students should be able to: add and resolve forces, determine graphically the resultant force and the component forces, calculate the magnitudes of the resultant forces and the component forces in right-angled triangles.
	Torque	At the end of this activity, students should be able to: know that the moment of a force indicates the ability of a force to rotate a body, be able to calculate the moment of a force, be able to add moments of forces, know how levers operate.
	Equilibrium	At the end of this activity, students should be able to: understand the concept of a rigid solid, determine the centre of gravity of a solid, explain the different types of equilibrium.
	Forces and Moments of Forces in Constructions	At the end of this activity, students should be able to: explain the difference between elements of a construction which are extended and those which are compressed, use ropes to substitute some of the elements in constructions, give examples of solutions that are applied in constructions.
II. Kinematics	**Uniform Motion**	At the end of this activity, students should be able to: understand that motion is relative, understand the concept of position, speed and average speed, read and construct graphs of position, calculate speed, given change in position and time, convert speed units.
	Accelerating Motion	At the end of this activity, students should be able to: understand the concept of uniform accelerating motion and non-uniformly accelerating motion, read and construct graphs of speed, calculate acceleration from a graph of speed in uniformly accelerating motion, understand the concept of free fall.
	Distance in Accelerating Motion	At the end of this activity, students should be able to: calculate any quantity in accelerating motion, interpret graphs of position in uniformly varying motion, calculate the distance covered by a body moving with uniformly varying motion, explain the equation of motion for uniformly accelerating motion.
	Description of Motion in Terms of Vectors	At the end of this activity, students should be able to: describe velocity and acceleration as vector quantities, describe the concept of position vector increment and velocity vector increment, understand the relationship between the direction of the acceleration vector and the shape of the path of motion.
	Circular Motion	At the end of this activity, students should be able to: describe circular motion at constant speed, understand the concepts: period, frequency, angular speed, and centripetal acceleration, calculate centripetal acceleration, calculate angular speed when you are given the period, frequency, or speed and radius.
	Projectile Motions	At the end of this activity, students should be able to: describe horizontal projectile motion and projectile motion at an angle, calculate basic parameters of projectile motion.
III. Dynamics	**The First and the Third Law of Motion**	At the end of this activity, students should be able to understand that forces always occur in pairs, understand and apply the First and the Third Laws of Motion, understand the concept of inertial and non-inertial systems and understand the concept of inertia.

CHAPTER	LESSON	DESCRIPTION
	Momentum	At the end of this activity, students should be able to apply the principle of conservation of momentum, use the principle of conservation of momentum to explain how a reaction engine works and explain the relationship between force impulse and change in momentum.
	Newton's Second Law of Motion	At the end of this activity, students should be able to understand Newton's Second Law of Motion and describe the relationship between the principle of conservation of momentum and Newton's Second Law of Motion.
	Forces in Curvilinear Motions	At the end of this activity, students should be able to understand the relationship between the behaviour of a body and the direction of the force exerted on it, understand the concepts of centripetal force and centrifugal force and describe the relationship between the curvature of a path and the magnitude of centripetal force.
	Friction	At the end of this activity, students should be able to describe when friction occurs, explain the concepts of static friction, kinetic friction ad rolling friction, explain on what the force of friction depends, calculate the coefficient of friction from the relationship between friction and the normal contact force and calculate the coefficient of friction by measuring the angle of inclination.
	Air Drag	At the end of this activity, students should be able to understand drag, explain how drag is affected by the velocity of a moving body, its cross-sectional area and the density of the medium and explain the concept of terminal velocity.
IV. Energy	**Work and Energy**	At the end of this activity, students should be able to: calculate the work done, and the change in potential and kinetic energy, give examples of situations when work is not performed.
	Potential Energy and Kinetic Energy	At the end of this activity, students should be able to: explain what mechanical energy is, apply the principle of conservation of mechanical energy in practice.
	Internal Energy	At the end of this activity, students should be able to: define internal energy, explain that temperature is a measure of changes in the internal energy, calculate the efficiency of an appliance.
	Power	At the end of this activity, students should be able to: understand the concept of power, calculate it and name its units.
	Collisions	At the end of this activity, students should be able to: distinguish between elastic and inelastic collisions, give examples demonstrating the conservation of momentum during collisions and showing that during elastic collisions the total kinetic energy of the bodies does not change, differentiate between head-on and oblique collisions.
	Simple machines	At the end of this activity, students should be able to: describe the operation of simple machines such as levers, pulleys, and inclined planes, and state the benefits of their application, explain why the application of simple machines does not decrease the amount of work that needs to be done.
V. Rotational Motion	**Angular Velocity and Angular Acceleration**	At the end of this activity, students should be able to give the definition of a radian, convert radians into degrees and vice versa, describe how to calculate angular velocity, explain the relationship between angular velocity and linear velocity, describe how to represent an angular velocity vector, explain how to calculate angular acceleration and state the relationship between angular acceleration and linear acceleration.

CHAPTER	LESSON	DESCRIPTION
	Newton's Second Law for Rotational Motion	At the end of this activity, students should be able to describe a force arm, calculate the moment of a force, and give a specific example, explain the concept of the moment of inertia and describe Newton's First and Second Law for rotational motion.
	Angular Momentum	At the end of this activity, students should be able to describe the concept of angular momentum, explain the relationship between angular momentum and change in angular momentum and provide examples to explain the principle of conservation of angular momentum.
	Energy of Rotational Motion	At the end of this activity, students should be able to explain the concepts of kinetic energy of rotational motion, describe how to calculate the total kinetic energy of a body moving simultaneously in rotational and translational motion and apply the principle of conservation of energy using the concept of kinetic energy of rotational motion.
VI. Gravitational Field	**Gravitational Force**	At the end of this activity, students should be able to: understand that any two bodies attract one another due to gravitation, calculate the magnitude of the gravitational force in a specific case, understand how the gravitational field is represented, distinguish between a central field and a uniform field.
	Gravitational Acceleration	At the end of this activity, students should be able to: understand that the gravitational acceleration on the surface of the Earth is not constant, explain the relationship between gravitational acceleration and distance from the surface of the Earth, state the difference between the mass and the weight of a body, determine the gravitational acceleration for a system of a few celestial bodies.
	Potential Energy	At the end of this activity, students should be able to: explain the relationship between the potential energy of the gravitational field and the distance from the Earth, state how to calculate changes in potential energy both close to and far from the surface of the Earth, describe the relationship between the changes in potential energy in a gravitational field, determine the potential energy of a system composed of several bodies.
	Potential	At the end of this activity, students should be able to: explain the concept of potential, describe how potential depends on the distance from Earth, calculate the potential of a system of bodies, explain the concept of equipotential surfaces.
	Satellites	At the end of this activity, students should be able to: understand how a satellite revolves around the Earth without propulsion, calculate the radius of the orbit of a satellite, given its period of revolution around the Earth, and calculate its period from the radius of its orbit, calculate speed of a satellite in an orbit, give a few examples of the application of satellites.
VII. Matter	**Density**	At the end of this activity, students should be able to explain the concept of density, describe how to determine the density of solids and liquids and explain the relationship between density and the molecular structure of matter.
	Stresses	At the end of this activity, students should be able to get to know the concept of stress, the concept of compression, tension and torsion and the relationship between the properties of materials and their microscopic structure.
	Hooke's Law	At the end of this activity, students should be able to explain the calculation for strain and stress, describe a strain-stress graph, formulate Hooke's Law, give an explanation of Young's modulus, define ultimate strength and calculate elastic potential energy.

CHAPTER	LESSON	DESCRIPTION
	Temperature	At the end of this activity, students should be able to describe the Celsius, Fahrenheit and Kelvin scales of temperature, explain how to measure temperature, describe the relationship between the temperature and the velocity of molecules and explain the thermal expansion of various substances.
	Heat Transfer	At the end of this activity, students should be able to explain heat transfer by conduction, convection, and radiation, explain thermal conductivity and calculate the heat flux in heat transfer by conduction between layers of different thicknesses and different thermal conductivities.
	The States of Matter	At the end of this activity, students should be able to describe the states of matter of a substance, name the phase transitions between the states of matter, understand the concept of latent heat of vaporization and latent heat of fusion and explain how temperature is related to pressure.
VIII. Mechanics of Fluids	**Hydrostatic Pressure**	At the end of this activity, students should be able to: calculate the pressure exerted by solid bodies and by liquids, give examples to explain how a liquid exerts pressure in all directions, give examples to explain the hydrostatic paradox, give examples of the application of combined vessels.
	Atmospheric Pressure	At the end of this activity, students should be able to: state the definition of pressure, understand the concepts of high pressure, low pressure, vacuum, describe the devices that are used for measuring pressure, explain how atmospheric pressure changes with altitude.
	Pascal's Law	At the end of this activity, students should be able to: state Pascal's law, explain the operation of a hydraulic press and other devices that apply Pascal's law, describe the phenomenon of water hammer.
	Archimedes' Principle	At the end of this activity, students should be able to: measure upthrust, calculate upthrust, state Archimedes' Principle, name the conditions that need to be met for a body to float, explain what the depth of immersion of a floating body depends on.
	Bernoulli's Principle	At the end of this activity, students should be able to: how the principle of continuity and Bernoulli's Principle are applied in the mechanics of fluids, how to calculate the magnitudes of pressure/velocity for selected simple cases of flow, how a lift is generated on the wing of a plane or a bird.
	Movement of Bodies in Liquids	At the end of this activity, students should be able to: explain the difference between laminar flow and turbulent flow, explain the concept of kinematic viscosity and dynamic viscosity of a fluid, explain the concept of Reynolds number, explain Stokes' Law, explain how the type of flow affects the drag of a body.
IX. Gas Laws	**Gas Transformations**	At the end of this activity, students should be able to: define and use the gas equation of state, prove that the gas laws which refer to isoprocesses constitute specific cases of the gas equation of state, describe how an ideal gas differs from a real one.
	The Ideal Gas Equation	At the end of this activity, students should be able to: define and use the gas equation of state, prove that the gas laws which refer to isoprocesses constitute specific cases of the gas equation of state, describe how an ideal gas differs from a real one.

CHAPTER	LESSON	DESCRIPTION
	Kinetic Theory of Gases	At the end of this activity, students should be able to: explain the Maxwell velocity distribution of gas molecules, describe the concept of mean velocity, root-mean-square velocity and probability, state the relationship between the mean kinetic energy of gas molecules and the temperature, state the relationship between gas pressure and pressure and root-mean-square velocity, explain the basics of the kinetic theory of gases.
	Molar Specific Heat of a Gas	At the end of this activity, students should be able to: explain the concept of molar specific heat at constant volume, explain the concept of molar specific heat at constant pressure, state the theoretical assumptions for calculating the molar specific heat of gases from the kinetic theory of gases, explain the discrepancy between the values of the specific molar heat obtained in an experiment and those obtained from theoretical calculations, explain the principle of equipartition of energy.
	Adiabatic Transition	At the end of this activity, students should be able to: explain the significance of thermal insulation, describe an adiabatic transition, state the adiabatic equation, describe the difference between an adiabatic transition and an isothermal transition, name some examples of natural phenomena and technical processes in which we encounter an adiabatic transition.
X. Thermodynamics	**The First Law of Thermodynamics**	At the end of this activity, students should be able to: state The First Law of Thermodynamics, calculate the work done in the gas transitions mentioned above, explain the significance of The First Law of Thermodynamics, describe the consequences of The First Law of Thermodynamics.
	Heat Engine	At the end of this activity, students should be able to: explain how a heat engine operates, describe the operation of an internal-combustion engine, know the difference between reversible and irreversible processes, calculate the efficiency of an ideal heat engine, state some practical applications of heat engines.
	Specific Heat	At the end of this activity, students should be able to: explain the principle of heat balance, explain the zeroth law of thermodynamics, calculate the heat needed to heat up or cool down a given mass of a substance to a given temperature, explain the concept of specific heat capacity, describe the methods of the measurement of the specific heat capacity of liquids and solids.
	Sources of Heat	At the end of this activity, students should be able to: explain the reaction of combustion, name the alternative sources of energy and the methods of their application.
	The Second Law of Thermodynamics	At the end of this activity, students should be able to: state the reasons for entropy increase in an isolated system, explain the physical interpretation of entropy, state the significance of the Second Law of Thermodynamics, explain the consequences of the Second Law of Thermodynamics.
XI. Electrostatics	**Coulomb's Law**	At the end of this activity, students should be able to: name the ways of charging bodies and explain what they involve, give an example to explain the law of conservation of charge, give the unit of electric charge, explain what an elementary charge is, state Coulomb's Law.
	Electric field	At the end of this activity, students should be able to: explain the concept of electric field strength, explain what the electric field lines represent, describe the movement of an electric charge in a homogeneous electric field.

CHAPTER	LESSON	DESCRIPTION
	Potential	At the end of this activity, students should be able to: explain the concepts of electric field potential and equipotential surfaces, explain why the potential of a homogeneous field changes linearly with distance.– state the formula for the potential in a field due to a point charge, describe the relationship between potential and electric field strength in the form of a gradient, explain the concept of potential energy of a charge in an electric field.
	Capacitance	At the end of this activity, students should be able to: define capacitance, explain how a capacitor works, explain the meaning of dielectric, describe the changes in the electric field inside a capacitor and the capacitance of the capacitor when a dielectric is placed in between the plates.
	Capacitors	At the end of this activity, students should be able to: explain why the capacitance of a capacitor depends on its dimensions and the distance between its plates – describe the phenomenon of capacitor leakage, state the formula for the energy of a capacitor, state the formula for the capacitance of capacitors connected in series, state the formula for the capacitance of capacitors connected in parallel.
XII. Direct Current	**Electric Current**	At the end of this activity, students should be able to: draw a scheme for an electric circuit containing the basic elements, explain the concept of the flow of electrons, calculate current, explain the flow of current through a conductor from a microscopic point of view, explain what an ammeter is, what it is used for and how it is operated, give examples demonstrating Kirchhoff's First Law, define direct current.
	Electrical Resistance	At the end of this activity, students should be able to: state Ohm's Law, explain what the resistance of a conductor depends on, calculate the resistance of a conductor of specified dimensions and resistivity, describe the relationship between the resistance of metals and their temperature, explain the phenomenon of superconductivity.
	Resistors	At the end of this activity, students should be able to: recognise connection in series and connection in parallel, calculate the combined resistance of a system of resistors, name the characteristic features of connection in series and connection in parallel.
	Electromotive Force	At the end of this activity, students should be able to: explain the structure of a cell and name its elements, describe the EMF and the internal resistance of a cell and state the formulae for calculating the magnitudes of the two quantities, state Ohm's Law for a whole circuit, explain the concept of fault current, describe the method of connecting cells.
	Work and Power of Electric Current	At the end of this activity, students should be able to: calculate the work done by a current, estimate the cost of work of a device of a given power, determine the power of a given electrical device using an electric energy meter, explain when overloading occurs and how we can protect household electrical wiring against its effects.
XIII. Magnetism	**Magnetic Field**	At the end of this activity, students should be able to: explain the concepts of: magnetic field, flux density and uniform field, understand the difference in behaviour of various materials placed in a magnetic field, give a graphical representation of the magnetic field of the Earth and describe it.
	The Magnetic Field Around Current-Carrying Wires	At the end of this activity, students should be able to: describe magnetic field around current-carrying wires, calculate the magnitude of magnetic flux density in simple cases, describe how an electromagnet operates.
	Electromagnetic Force	At the end of this activity, students should be able to: give the definition of electromagnetic force, state Fleming's left-hand rule, explain on what and in what way the magnitude of the electromagnetic force depends, calculate the magnitude of the electromagnetic force.

CHAPTER	LESSON	DESCRIPTION
	Application of Electromagnetic Forces	At the end of this activity, students should be able to: describe a commutator, a rotor, and brushes, explain the operation of an electric engine, calculate the moment of a couple of electromagnetic forces exerted on a frame.
	The Movement of a Charge in a Magnetic Field	At the end of this activity, students should be able to: describe the movement of a charge in a magnetic field, calculate the magnitude of Lorentz force, give and describe examples of the application of Lorentz force.
XIV. Alternating Current	**Phenomenon of Electromagnetic Induction**	At the end of this activity, students should be able to: describe the phenomenon of induction, calculate the induced EMF, calculate the magnitude of flux, describe the origin of eddy currents.
	Generator and Alternating Current	At the end of this activity, students should be able to: understand the concept of flux density, calculate the EMF value of a rotating frame, calculate the work and power of an alternating current, understand how a generator operates, describe an alternating current, give the definition of r.m.s. voltage and r.m.s. current, give the definition of inductance, ohmic resistance and reactance.
	Transformer	At the end of this activity, students should be able to: describe how a transformer operates, explain the concepts of primary coil and secondary coil, calculate the voltage across a transformer when the number of coil turns and the input voltage is given, explain how an induction coil operates, calculate the efficiency of a transformer, explain the concept of eddy currents.
	Transmission of Electrical Energy	At the end of this activity, students should be able to: explain why high-voltage overhead lines are constructed, describe the way in which a transformer transfers energy, calculate power losses in a transmission line.
	Current in a Household	At the end of this activity, students should be able to: state the advantages and disadvantages of batteries and mains as power supplies, describe the structure of a household electric mains, explain why circuit breakers are used, state the purpose of the third wire in a cable of certain devices, describe how a residual current circuit breaker is used, explain how three-phase current is separated for use in different apartments.
XV. Electronics	**Electronics**	At the end of this activity, students should be able to explain the concepts of semiconductor, doped conductor, p–n junction, diode, explain how a diode operates and explain how to use diodes to convert alternating current into direct current.
	Light and Current	At the end of this activity, students should be able to explain the concepts of a light-dependent resistor, photocell, light-emitting diode, semiconductor laser, describe an internal photoelectric effect, explain the abbreviations LDR, LED and give examples of the application of light emission and absorption by a p-n junction.
	Transistors and Gates	At the end of this activity, students should be able to explain the concept of a transistor, describe the operation of a bipolar junction transistor and a field-effect transistor, explain how to amplify an electric signal using a transistor and construct logic gates using transistors.
	Digital Systems	At the end of this activity, students should be able to explain the concepts of both an analogue and a digital signal, describe the digital storage of sound and state the advantages of digital signals over analogue ones.
XVI. Harmonic Motion	**Oscillations**	At the end of this activity, students should be able to describe harmonic oscillations and state the equation for displacement, velocity and acceleration in simple harmonic motion.

CHAPTER	LESSON	DESCRIPTION
	Pendulum	At the end of this activity, students should be able to explain the theory of the simple gravity pendulum and the physical pendulum, describe the movement of a simple pendulum, state the changes in the force which cause a pendulum to oscillate, explain on what quantities the period of a simple and a physical pendulum depend, determine the gravitational acceleration given the T(L) measurement for a ball pendulum and describe the concept of a Foucault pendulum.
	Energy of Oscillations	At the end of this activity, students should be able to plot a graph of energy as a function of time and position and plot a graph representing the changes in amplitude and the displacement of damped oscillations.
	Resonance	At the end of this activity, students should be able to describe free, damped and forced oscillations and explain the phenomenon of resonance and also give examples.
XVII. Mechanical Waves	**Mechanical Waves**	At the end of this activity, students should be able to: to characterise electromagnetic waves by comparing their properties with those of mechanical waves, to name the particular ranges of electromagnetic waves, to provide a short description of the ranges of electromagnetic waves by discussing various examples of their applications.
	Reflection and Refraction of Waves	At the end of this activity, students should be able to: explain the movement of a wave reflected at a fixed and at a free end of a string, describe the movement of a wave along a string made of segments of different density, state Huygens' principle, describe the reflection and the refraction of waves in two-dimensional areas, explain the concepts of echo and reverberation.
	Diffraction and Interference of Mechanical Waves	At the end of this activity, students should be able to: the concept of diffraction, the concept of interference, the concept of stationary waves, where stationary waves occur in musical instruments, the concept of beats.
	Oscillations of a String	At the end of this activity, students should be able to: state the formula for the velocity of a wave in a string, state the formula for harmonic frequencies, explain the concept of resonance.
	The Intensity of a Wave	At the end of this activity, students should be able to: the shape of spherical, circular and plane waves, the meaning of the intensity of a wave, how intensity and amplitude of a circular wave and a spherical wave change with the distance from the source, what change in sound intensity is described by 1 bel = 10 dB.
	The Doppler Effect	At the end of this activity, students should be able to: explain the Doppler effect, decide whether in a given situation the frequency of the perceived wave is higher or lower than the frequency of the emitted wave, give examples of the practical application of the Doppler effect, state the definition of a shock wave.
XVIII. Electromagnetic Waves	**Electromagnetic Waves**	At the end of this activity, students should be able to characterise electromagnetic waves by comparing their properties with those of mechanical waves, name the particular ranges of electromagnetic waves and provide a short description of the ranges of electromagnetic waves by discussing various examples of their applications.
	Diffraction and Interference	At the end of this activity, students should be able to state Huygens' Principle, describe the phenomena of wave interference and wave diffraction, describe Young's experiment, explain the type of image that can be obtained when monochromatic light passes through a diffraction grating and also the type obtained when white light is used and explain the idea of light wavelength measurement with a diffraction grating.

CHAPTER	LESSON	DESCRIPTION
	Polarization	At the end of this activity, students should be able to describe a polarised wave and explain the difference between complete and partial polarisation, describe polarisation by reflection and by refraction and give examples of the application of the polarisation of light.
	Application of Waves for Communication	At the end of this activity, students should be able to describe the Hertz's experiment, state the range of radio waves and describe their propagation in the atmosphere of the Earth and provide the basic information on the operation of mobile telephony, television broadcasting, satellite television, and satellite telephony.
	Signal Encoding	At the end of this activity, students should be able to describe amplitude modulation and frequency modulation as well as explain the idea of digital encoding and give examples of digital encoding of both sound and images.
XIX. Optics	**Reflection and Refraction of Light**	At the end of this activity, students should be able to: describe the phenomenon of total internal reflection, state Huygens' Principle, calculate the refractive index, explain how an image is produced in a mirror, state Snell's Law.
	Spherical Mirrors	At the end of this activity, students should be able to: explain the principles of image formation in spherical mirrors, define focal point and focal length, calculate the distance and the size of an image when the size and location of the object and the parameters of the mirror are given, describe how an image is formed by a mirror, explain how to calculate the magnification of an image, use the mirror equation.
	Lenses	At the end of this activity, students should be able to: explain the principle of the formation of images by lenses, define focal point and focal length, calculate the image distance and the size of an image when the size of the object and its distance are given, define the power of a lens, determine the focal point given the shape of a lens and its refractive index, calculate the magnification, use the lens formula.
	Optical Instruments	At the end of this activity, students should be able to: state the principle of operation of a magnifying glass, a refracting telescope, and a microscope, calculate the magnification of a refracting telescope, a microscope and a magnifying glass, explain the concept of a prism and its applications, explain how light diffraction limits the resolving power of some optical devices.
	An Eye	At the end of this activity, students should be able to: explain how images are formed in the eye, explain the concept of accommodation, long-sightedness and short-sightedness, explain how the sight defects of long-sighted and short-sighted people can be corrected, state the definition of colour blindness, explain how a moving picture is formed.
XX. Atomic Physics	**Radiation of Objects**	At the end of this activity, students should be able to define a black body, state the Stefan-Boltzmann Law and state Wien's Law.
	External Photoelectric Effect	At the end of this activity, students should be able to describe the photoelectric effect, calculate the threshold wavelength, determine the work function and apply experimental measurement to determine Planck's constant.
	Emission and Absorption Spectra	At the end of this activity, students should be able to: state Planck's postulates, understand the formation of emission and absorption spectra of gases, understand the difference between spontaneous and stimulated emission, explain the operation of a laser.
	Electron Energy Levels in an Atom	At the end of this activity, students should be able to describe the atomic models of Thomson, Rutherford and Bohr, explain how emission and absorption are related to changes in atomic energy levels and describe the band model of a solid body.

CHAPTER	LESSON	DESCRIPTION
	X-Rays	At the end of this activity, students should be able to define X-radiation, state the reasons for the occurrence of X-radiation, give examples of practical applications of X-radiation, explain the causes for the detrimental effect of X-radiation on live organisms and describe the application of X-rays in the analysis of crystal structure.
	Waves of Matter	At the end of this activity, students should be able to explain the de Broglie hypothesis, state the formula for wavelength related to a material particle and describe the operation of an electron microscope.
XXI. Nuclear Physics	**The structure of Atomic Nucleus**	At the end of this activity, students should be able to: define an atomic nucleus, a nucleon, a neutron, and an isotope.– explain the concepts of atomic mass and atomic mass unit.– explain the concepts of mass number and atomic number, describe the composition of a nucleus of any isotope.– state the forces which are present in a nucleus.
	Nuclear Radiation	At the end of this activity, students should be able to: describe the phenomenon of radiation, describe alpha and beta radiation, describe a radioactive series, specify the reasons why nuclear radiation is so harmful.
	Decay Law	At the end of this activity, students should be able to: describe the decay of radioactive elements, explain the concepts of: half-life, decay constant, mean lifetime; and describe the relationship between them, state the formula for exponential law of decay, explain the concept of the activity, name its units, and state on what its magnitude depends, understand the radiocarbon method and scintigraphic examination.
	Stability of the Nuclei	At the end of this activity, students should be able to: explain the concept of binding energy and mass defect, describe the table of isotopes, explain why certain nuclei are characterised by higher stability and others by lower stability, explain where unstable isotopes which are heavier than lead are found in nature.
	Nuclear Fusion	At the end of this activity, students should be able to: describe a particular reaction of nuclear fusion, calculate the energy released during a reaction, given the masses of the substrates and the products, explain the operation of the Sun as a thermonuclear reactor, describe the operation of a hydrogen bomb.
	Nuclear Fission	At the end of this activity, students should be able to: describe a nuclear fission reaction, calculate the energy released during a reaction given the mass of the substrates and the products, explain the meaning of critical mass, describe the operation of a nuclear reactor, explain the operation of an atomic bomb.
	Elementary Particles	At the end of this activity, students should be able to: describe a lepton, baryon, boson and a fermion, explain the concept of particle-antiparticle, state what is meant by antimatter, explain the concept of a quark, and the fact that nucleons are made of quarks.
XXII. Astrophysics	**The Solar System**	At the end of this activity, students should be able to: explain the concept of the astronomical unit, state the relationship between the size of the Sun and the planets and give the distances between them, name the elements of the Solar System and provide a short description of each of them.
	Classification of Stars	At the end of this activity, students should be able to: recognise a few of the best-known constellations, explain the concept of stellar parallax, define the parsec and the light year, explain the difference between apparent magnitude and absolute magnitude, describe the radiation emitted by stars and explain how it can be used to estimate the surface temperature of a star, name the spectral classes of stars, describe an H-R diagram.

CHAPTER	LESSON	DESCRIPTION
	Evolution of Stars	At the end of this activity, students should be able to: describe the basic stages in the evolution of stars in relation to their initial masses, given an H-R diagram, indicate the position of: the main sequence, white and red dwarves, red and blue giants, describe the fate of the Sun, explain the origin of heavy elements.
	Galaxies	At the end of this activity, students should be able to: explain what is the Milky Way, describe the structure of the Galaxy, name the different types of galaxies, describe the position of the Earth and the Sun in the Universe, state Hubble's Law, state the basic observations that indicate that the Universe is expanding, describe the different cosmological models: close, open and flat.
XXIII. Theory of Relativity	**The Speed of Light**	At the end of this activity, students should be able to: explain how Roemer proved that the speed of light was finite in value, describe the measurement of speed as conducted by Fizeau, explain the concept of relative motion, define inertial and non-inertial frames, state Einstein's postulates.
	Time and Distance	At the end of this activity, students should be able to: describe the relativity of simultaneity, time dilation and length contraction, calculate time dilation and length contraction, describe the twin paradox and the barn-pole paradox.
	Mass, Energy and Momentum	At the end of this activity, students should be able to: describe the changes in mass and momentum of an object with increasing velocity, calculate the rest energy of an object, calculate the total and the kinetic energy of an object, state the relativistic relationship between momentum and energy, calculate the mass defect and the related energy in nuclear reactions.
	General Theory of Relativity	At the end of this activity, students should be able to: explain the equivalence principle, describe the effects resulting from the general theory of relativity including the deflection of light, the precession of the orbits of planets, the slowing of time and the curvature of space.