

Unit 3: Gravity and Electromagnetism T

Value 1.0

Specific Unit Goals

By the end of this unit, students:

- understand that motion in gravitational, electric and magnetic fields can be explained using Newton's Laws of Motion
- understand how the electromagnetic wave model explains the production and propagation of electromagnetic waves across the electromagnetic spectrum
- understand transformations and transfer of energy in electromagnetic devices, as well as transformations and transfer of energy associated with motion in electric, magnetic and gravitational fields
- understand how models and theories have developed over time, and the ways in which physical science knowledge and associated technologies interact with social, economic, cultural and ethical considerations
- use science inquiry skills to design, conduct, analyse and evaluate investigations into uniform circular motion, projectile motion, satellite motion and gravitational and electromagnetic phenomena, and to communicate methods and findings
- use algebraic and graphical representations to calculate, analyse and predict measurable quantities related to motion, gravitational effects and electromagnetic phenomena
- evaluate, with reference to evidence, claims about motion, gravity and electromagnetic phenomena and associated technologies, and justify evaluations
- communicate physics understanding using qualitative and quantitative representations in appropriate modes and genres.

Content

Science Inquiry Skills

- identify, research and construct questions for investigation; propose hypotheses; and predict possible outcomes
- design investigations, including the procedure to be followed, the materials required, and the type and amount of primary and/or secondary data to be collected; conduct risk assessments; and consider research ethics
- conduct investigations, including the manipulation of force measurers and electromagnetic devices, safely, competently and methodically for the collection of valid and reliable data
- represent data in meaningful and useful ways, including using appropriate si units, symbols and significant figures; organise and analyse data to identify trends, patterns and relationships; identify sources of uncertainty and techniques to minimise these uncertainties; utilise uncertainty and percentage uncertainty to determine the uncertainty in the result of calculations, and evaluate the impact of measurement uncertainty on experimental results; and select, synthesise and use evidence to make and justify conclusions
- interpret a range of scientific and media texts, and evaluate processes, claims and conclusions by considering the accuracy and precision of available evidence; and use reasoning to construct scientific arguments
- select, construct and use appropriate representations, including text and graphic representations of empirical and theoretical relationships, vector diagrams, free body/force diagrams, field diagrams and circuit diagrams, to communicate conceptual understanding, solve problems and make predictions

- select, use and interpret appropriate mathematical representations, including linear and non-linear graphs and algebraic relationships representing physical systems, to solve problems and make predictions
- communicate to specific audiences and for specific purposes using appropriate language, nomenclature, genres and modes, including scientific reports

Science as a Human Endeavour

- ICT and other technologies have dramatically increased the size, accuracy and geographic and temporal scope of datasets with which scientists work
- models and theories are contested and refined or replaced when new evidence challenges them, or when a new model or theory has greater explanatory power
- the acceptance of science understanding can be influenced by the social, economic and cultural context in which it is considered
- people can use scientific knowledge to inform the monitoring, assessment and evaluation of risk
- science can be limited in its ability to provide definitive answers to public debate; there may be insufficient reliable data available, or interpretation of the data may be open to question
- international collaboration is often required when investing in large-scale science projects or addressing issues for the asia-pacific region
- scientific knowledge can be used to develop and evaluate projected economic, social and environmental impacts and to design action for sustainability

Science Understanding

Gravity and motion

- the movement of free-falling bodies in earth's gravitational field is predictable
- all objects with mass attract one another with a gravitational force; the magnitude of this force can be calculated using newton's law of universal gravitation
- objects with mass produce a gravitational field in the space that surrounds them; field theory attributes the gravitational force on an object to the presence of a gravitational field
- when a mass moves or is moved from one point to another in a gravitational field and its potential energy changes, work is done on or by the field
- gravitational field strength is defined as the net force per unit mass at a particular point in the field
- the vector nature of the gravitational force can be used to analyse motion on inclined planes by considering the components of the gravitational force (that is, weight) parallel and perpendicular to the plane
- projectile motion can be analysed quantitatively by treating the horizontal and vertical components of the motion independently
- when an object experiences a net force of constant magnitude perpendicular to its velocity, it will undergo uniform circular motion, including circular motion on a horizontal plane and around a banked track
- Newton's Law of Universal Gravitation is used to explain Kepler's laws of planetary motion and to describe the motion of planets and other satellites, modelled as uniform circular motion