Summary

Topic 2 - Mechanics

Subject	Year	Start date	Duration
Physics	IB1, IB2	Week 3, September	6 weeks 22 hours

Course Part

Core

Curriculum

Aims

Appreciate scientific study and creativity within a global context through stimulating and challenging opportunities

Acquire a body of knowledge, methods and techniques that characterize science and technology

Apply and use a body of knowledge, methods and techniques that characterize science and technology

Develop an ability to analyse, evaluate and synthesize scientific information

Develop a critical awareness of the need for, and the value of, effective collaboration and communication during scientific activities

Develop experimental and investigative scientific skills including the use of current technologies

Develop and apply 21st century communication skills in the study of science

Become critically aware, as global citizens, of the ethical implications of using science and technology

Develop an appreciation of the possibilities and limitations of science and technology

Develop an understanding of the relationships between scientific disciplines and their influence on other areas of knowledge

Objectives

Demonstrate knowledge and understanding of

- facts, concepts and terminology
- methodologies and techniques
- communicating scientific information

Apply

- facts, concepts and terminology
- methodologies and techniques
- methods of communicating scientific information

Syllabus Content

Core

2. Mechanics

2.1 – Motion

Nature of science:

Observations: The ideas of motion are fundamental to many areas of physics, providing a link to the consideration of forces and their implication. The kinematic equations for uniform acceleration were developed through careful observations of the natural world.

Understandings:

Distance and displacement

Speed and velocity

Acceleration

Graphs describing motion

Equations of motion for uniform acceleration

Projectile motion

Fluid resistance and terminal speed

Applications and skills:

Determining instantaneous and average values for velocity, speed and acceleration

Solving problems using equations of motion for uniform acceleration

Sketching and interpreting motion graphs

Determining the acceleration of free-fall experimentally

Analysing projectile motion, including the resolution of vertical and horizontal components of acceleration, velocity and displacement

Qualitatively describing the effect of fluid resistance on falling objects or projectiles, including reaching terminal speed

2.2 – Forces

Nature of science:

Using mathematics: Isaac Newton provided the basis for much of our understanding of forces and motion by formalizing the previous work of scientists through the application of mathematics by inventing calculus to assist with this. Intuition: The tale of the falling apple describes simply one of the many flashes of intuition that went into the publication of Philosophiæ Naturalis Principia Mathematica in 1687.

Understandings:

Objects as point particles

Free-body diagrams

Translational equilibrium

Newton's laws of motion

Solid friction

Applications and skills:

Representing forces as vectors

Sketching and interpreting free-body diagrams

Describing the consequences of Newton's first law for translational equilibrium

Using Newton's second law quantitatively and qualitatively

Identifying force pairs in the context of Newton's third law

Solving problems involving forces and determining resultant force

Describing solid friction (static and dynamic) by coefficients of friction

2.3 – Work, energy and power

Nature of science:

Theories: Many phenomena can be fundamentally understood through application of the theory of conservation of energy. Over time, scientists have utilized this theory both to explain natural phenomena and, more importantly, to predict the outcome of previously unknown interactions. The concept of energy has evolved as a result of recognition of the relationship between mass and energy.

Understandings:

Kinetic energy

Gravitational potential energy

Elastic potential energy

Work done as energy transfer

Power as rate of energy transfer

Principle of conservation of energy

Efficiency

Applications and skills:

Discussing the conservation of total energy within energy transformations

Sketching and interpreting force–distance graphs

Determining work done including cases where a resistive force acts

Solving problems involving power

Quantitatively describing efficiency in energy transfers

2.4 – Momentum and impulse

Nature of science:

The concept of momentum and the principle of momentum conservation can be used to analyse and predict the outcome of a wide range of physical interactions, from macroscopic motion to microscopic collisions.

Understandings:

Newton's second law expressed in terms of rate of change of momentum

Impulse and force–time graphs

Conservation of linear momentum

Elastic collisions, inelastic collisions and explosions

Applications and skills:

Applying conservation of momentum in simple isolated systems including (but not limited to) collisions, explosions, or water jets

Using Newton's second law quantitatively and qualitatively in cases where mass is not constant

Sketching and interpreting force–time graphs

Determining impulse in various contexts including (but not limited to) car safety and sports

Qualitatively and quantitatively comparing situations involving elastic collisions, inelastic collisions and explosions

ATL Skills

Approaches to Learning

Thinking

- In this unit, we will
  - ask students to formulate a reasoned argument to support their opinion or conclusion
  - give students time to think through their answers before asking them for a response
  - reward a new personal understanding, solution or approach to an issue
  - ask open questions
  - set students a task which required higher-order thinking skills (such as analysis or evaluation)
  - build on a specific prior task
  - help students to make their thinking more visible (for example, by using a strategy such as a thinking routine)
  - require students to take an unfamiliar viewpoint into account when formulating arguments
  - ask questions that required the use of knowledge from a different subject from the one you are teaching
  - include a reflection activity
  - make a link to TOK

Social

- In this unit, we will
  - have students work in small groups
  - allocate, or ask students to allocate among themselves, different roles in a classroom discussion or activity
  - have students peer assess their group performance or process
  - support students in resolving a conflict in a team
  - give a group assessment task
  - give students feedback on how they worked as a group
  - have students discuss their understanding of a text or idea among themselves and come up with a shared understanding
  - provide an opportunity for students to analyse the impact of their behaviour on the class or on a group performance
  - encourage students to consider alternative points of view or to take the perspective of others
  - provide opportunities for students to make decisions

Developing IB Learners

Learner Profile

Inquirers

Knowledgeable

Thinkers

Balanced

Reflective