

KIST DP Course Descriptions 2011-2012

Group: Group 4

Level: HL/SL

Subject: Physics

Grade: 12

Unit Number: 4

Unit Title: Sight and wave phenomena (SL option 1)

Approximate Duration: 2 weeks

Key Concepts:

The eye and sight

Diffraction

Standing waves

Resolution

Doppler effect

Polarization

LP Link: Open Minded

TOK Link(s):

How does light and color affect our perception of objects?

Description of the Unit:

In this chapter, we will look at the waves properties of light. The difference between light waves and sound waves will also be discussed. We will discuss the different experiments done to prove that light exhibits wave properties. We will also look into the technology and applications of light in telecommunication.

Computer simulations will be utilized in this unit to illustrate the different ideas in this chapter.

Key Knowledge/Skills Addressed:

1. Describe the function of the rods and of the cones in photopic and scotopic vision.
2. Compare standing and travelling waves and discuss the modes of vibration of strings and air in open and in closed pipes.
3. Explain Doppler effect by reference to wavefront diagrams for moving-detector and moving-source situations.
4. Describe the significance of resolution in the development of devices such as CDs and DVDs, the electron microscope and radio telescopes.
5. Describe the use of polarization in the determination of the concentration of certain solutions.
6. Solve problems involving standing waves, Doppler effect, polarization and resolution.

Main Summative Assessment of the Unit: DP Past Paper Exam

KIST DP Course Descriptions 2011-2012

Group: Group 4

Level: HL/SL

Subject: Physics

Grade: 12

Unit Number: 5

Unit Title: Quantum Physics and Nuclear Physics (SL Option 2)

Approximate Duration: 2 weeks

Key Concepts:

Quantum Physics

Nuclear Physics

LP Link: Thinker

TOK Link(s):

This topic raises fundamental philosophical problems related to the nature of observation and measurement.

Description of the Unit:

The students will study radical ideas of Einstein, Millikan, Schrodinger, de Broglie and Heisenberg about the existence of sub-atomic particles. This topic is a combination of physics and chemistry concepts. This topic raises fundamental philosophical problems related to the nature of observation and measurement. The concept of paradigm shift will also be developed here. The students will conduct researches using different databases. The students will be guided on how to present the result of their research logically and accurately.

Key Knowledge/Skills Addressed:

1. Describe the concept of the photon and use it to explain the photoelectric effect.
2. Describe and explain an experiment to test the Einstein model.
3. Describe de Broglie hypothesis and the concept of matter waves.
4. Explain how atomic spectra provide evidence for the quantization of energy in atoms and calculate wavelengths of spectral lines from energy level differences and vice versa.
5. Outline the Schrodinger model of the hydrogen atom.
6. Outline the Heisenberg uncertainty principle with regard to position-momentum and time-energy.
7. Describe how the masses of nuclei may be determined using a Bainbridge mass spectrometer.
8. State the radioactive decay law as an exponential function and define the decay constant.
9. Outline methods for measuring the half-life of an isotope.
10. Solve problems involving radioactive half-life.

Main Summative Assessment of the Unit: DP Past Paper Exam

KIST DP Course Descriptions 2011-2012

Group: Group 4

Level: HL/SL

Subject: Physics

Grade: 12

Unit Number: 1

Unit Title: Electrical Currents

Approximate Duration: 2 weeks

Key Concepts:

Electric potential differences, current and resistance
Electric currents

LP Link: Risk Taker

TOK Link(s):

We consider currents to flow in the opposite direction to the way that electrons actually flow. Does it matter that our model is completely backwards?

Description of the Unit:

In this chapter, we will look at how the different ideas and theories behind electric circuits have evolved. We will discuss the individual components of an electrical circuit and its functions. Students will be expected to build their own circuits and test the theories that govern electric circuits.

We will start the chapter by focusing on difference between the various quantities that are involved, and then introducing the techniques and approaches used when analyzing a circuit.

Although there is an expectation that the students already know how to analyze and interpret data gathered, data collection and processing will be emphasized in this unit.

Key Knowledge/Skills Addressed:

1. Define electric potential difference, electronvolt, electric current and resistance.
2. Determine the change in potential energy when a charge moves between two points at different potentials.
3. Derive and apply expressions for electrical power dissipation in resistors and solve problems involving potential difference, current and resistance.
4. Define electromotive force.
5. Draw circuit diagrams.
6. Describe a potential divider and the use of ideal ammeters and ideal voltmeters.
7. Solve problems involving electrical circuits.

Main Summative Assessment of the Unit: DP Past Paper Exam

KIST DP Course Descriptions 2011-2012

Group: Group 4

Level: HL Only

Subject: Physics

Grade: 12

Unit Number: 2

Unit Title: Fields and Forces

Approximate Duration: 1 week

Key Concepts:

Gravitational Potential Orbital Motion
Escape Speed
Electrical Potential

LP Link: Thinker

TOK Link(s):

We can't really take a mass from infinity and bring it to the point in question, but we can calculate how much work would be required if we did. Is it OK to calculate something we can never do?

Description of the Unit:

This is an AHL topic in physics. The students will look further into the forces and factors that affect both macroscopic and microscopic objects in the universe. We will only extrapolate ideas about forces that we can not physically conduct experiments on, but are proven mathematically. This chapter requires the students to visualize the idea, so the students are encouraged to use what they have learned in TOK classes, particularly in the Ways of Knowing. Although this chapter is very conceptual, mathematical calculations still play a vital role. The students need to be comfortable in solving questions requiring very large numbers. The students are expected to have a firm grasp on the different measurement prefixes.

Key Knowledge/Skills Addressed:

1. Define gravitational potential and gravitational potential energy.
 2. State and apply the formula relating gravitational field strengths and gravitational potential gradients.
 3. Describe and sketch the pattern of equipotential surfaces due to one and two point masses.
 4. State the relation between equipotential surfaces and gravitational field lines.
 5. Explain the concept of escape speed from a planet.
- Solve problems involving gravitational potential energy and gravitational potential.
6. Derive Kepler's third Law.
 7. Discuss the concept of weightlessness in orbital motion, in free fall and in deep space.
 8. Solve problems involving orbital motion.
 9. State and apply the formula relating electric field strength to electric potential gradient.
 10. Solve problems involving electric potential energy and electric potential.

Main Summative Assessment of the Unit: DP Past Paper Exam

KIST DP Course Descriptions 2011-2012

Group: Group 4

Level: HL/SL

Subject: Physics

Grade: 12

Unit Number: 2

Unit Title: Fields and Forces

Approximate Duration: 2 weeks

Key Concepts:

Gravitational Force and Field

Electric Force and Field

Magnetic Force and Field

LP Link: Open Minded

TOK Link(s):

Was it reasonable for Newton to think that his law applied to the whole universe?

Description of the Unit:

This chapter how different forces are connected - from the force that pulls the apple to the ground to the force that holds the Earth in its orbit. The students will discover how Newton formulated this universal law of gravitation and how his law applies to both macroscopic and microscopic object. The students will also identify similarities and differences between magnetic, gravitational and electric fields.

Practical labs will be conducted focusing more on the design aspect of the experiment. The students will be guided on how to design practical experiments focusing on how to make sure that all controlled variables remain constant.

Key Knowledge/Skills Addressed:

1. State Newton's universal law of gravitation.
2. Define gravitational field strength.
3. Determine the gravitational field due to one or more point masses.
4. Solve problems involving gravitational forces and fields.
5. Describe and explain the difference in the electrical properties of conductors and insulators.
6. State Coulomb's law.
7. Solve problems involving gravitational forces and fields.
8. Determine the direction of the force on a current-carrying conductor in a magnetic field.
9. Solve problems involving magnetic forces, fields and currents.

Main Summative Assessment of the Unit: DP Past Paper Exam

KIST DP Course Descriptions 2011-2012

Group: Group 4

Level: HL Only

Subject: Physics

Grade: 12

Unit Number: 2

Unit Title: Electromagnetic Induction

Approximate Duration: 1 week

Key Concepts:

Induced Electromotive Force (emf)

Alternating Current (AC)

Transmission of Electrical Power

LP Link: Thinker

TOK Link(s):

Eventhough there is no scientific evidence that power lines adversely affect one's health, people still believe what they heard on TV 30 years ago.

Description of the Unit:

This is a continuation of the electric current unit. The students will study emf and current in greater detail. Students will be expected to compare the outputs from generators operating at different frequencies by sketching appropriate graphs. They would also understand why there is no ideal voltage for electrical transmission.

The students will also be made aware that current experimental evidence suggests that low-frequency fields do not harm genetic materials. The students will also be made aware of the fact that risks attached to the inducing current in the body are not yet fully understood.

Computer simulations of AC generator are going to be used to assess understanding of the concepts.

Key Knowledge/Skills Addressed:

1. Describe the inducing of an emf by relative motion between a conductor and a magnetic field.
2. Define the formula for the emf induced in a straight conductor moving in a magnetic field.
3. Define magnetic flux and magnetic flux linkage.
4. State Faraday's law and Lenz's law.
5. Solve electromagnetic induction problems.
6. Explain the operation of a basic alternating current (AC) generator.
7. Describe the operation of an ideal transformer and solve problems on the operation of an ideal transformer.
8. Outline the reasons for power losses in transmission lines and real transformers.
9. Explain the use of high-voltage step-up and step-down transformers in the transmission of electrical power.
10. Discuss some of the possible risks involved in living and working near high-voltage power lines.

Main Summative Assessment of the Unit: DP Past Paper Exam

KIST DP Course Descriptions 2011-2012

Group: Group 4

Level: HL/SL

Subject: Physics

Grade: 12

Unit Number: 3

Unit Title: Atomic and Nuclear Physics

Approximate Duration: 1 month

Key Concepts:

The atom

Radioactive decay

Nuclear reactions, fission and fusion

LP Link: Open Minded

TOK Link(s):

What does it mean when we say we know these things? Do we know that this is true or is it just the model that's true?

Description of the Unit:

In this chapter, we will be looking at the development of the atomic model from Thomson's model to the current atomic model. We will also be investigating the connection between atoms and the nature of matter. We will be looking further into the nuclear structure of matter and the energy that is generated in the nucleus of an atom.

Simulation experiments will be used to understand the nuclear reaction taking place inside an atom. There are opportunities throughout this topic to look at databases, use spreadsheets and perform data-logging experiments.

Key Knowledge/Skills Addressed:

1. Describe a model of the atom that features a small nucleus surrounded by electrons.
2. Outline the evidence that supports a nuclear model of the atom and limitations of the simple model of nuclear atom.
3. Explain how atomic spectra provide evidence for the quantization of energy in atoms.
4. Explain the terms nuclide, isotope and nucleons and describe the interactions in a nucleus.
5. Outline the biological effects of ionizing radiation.
6. Explain why some nuclei are stable while others are unstable.
7. Define the term radioactive half-life and determine the half-life of a nuclide from a decay curve.
8. Solve problems involving fission and fusion reactions.

Main Summative Assessment of the Unit: DP Past Paper Exam

KIST DP Course Descriptions 2011-2012

Group: Group 4

Level: HL/SL

Subject: Physics

Grade: 12

Unit Number: 4

Unit Title: Energy, power and climate change

Approximate Duration: 2 months

Key Concepts:

Energy degradation and power generation	Greenhouse effect
World energy sources	Global warming
Fossil and non-fossil fuel power production	

LP Link: Knowledgeable

TOK Link(s):

The use and importance of computer modelling can be explained as a powerful means by which knowledge may be gained.

Description of the Unit:

In this chapter, we will look at how we use energy. We will study the basic physical principles behind converting energy possessed by different sources into useful work. We will also tackle the different ways that we utilize sources of energy.

Databases of energy statistics on global and national scale will be analyzed. Moral, environmental and economic aspects are going to be considered when choosing the best energy source. The importance of the international dimensions in scientific research to solve global problems are going to be demonstrated.

Computer simulations, spreadsheets and databases will play a significant role in this chapter.

Key Knowledge/Skills Addressed:

1. Outline the principal mechanisms involved in the production of electrical power.
2. Outline and distinguish between renewable and non-renewable energy sources.
3. Discuss the relative advantages and disadvantages of various energy sources.
4. Describe the environmental problems associated with the recovery of fossil fuels and their use in power stations.
5. Outline the problems associated with producing nuclear power using nuclear fusion and solve problems on the production of nuclear power.
6. Discuss international efforts to reduce the enhanced greenhouse effect.

Main Summative Assessment of the Unit: DP Past Paper Exam