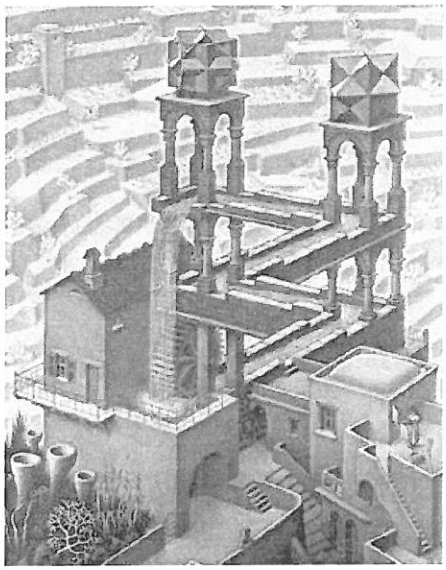
Physics 11



Waterfall (M. C. Escher, 1961)

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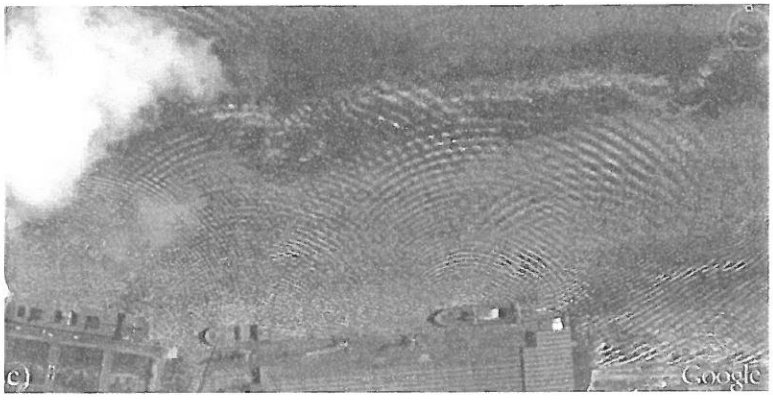
What are the **Big Ideas** in Physics 11?

- An object's **motion** can be predicted, analyzed, and described.
- **Forces** influence the motion of an object.
- **Energy** is found in different forms, is conserved, and has the ability to do work.
- Mechanical **waves** transfer energy but not matter.

Hello, and welcome to Physics 11. In the coming semester, we will be exploring these Big Ideas together, learning the habits of mind with "doing" science, and gaining the **Core Competencies** of:

- Have a curiosity to continually learn more about something of interest.
- Communicate scientific ideas and information, and a suggested course of action.
- Make an argument based on evidence.
- Contribute to care for self, others, community, and the world.



Interference on the Chao Phraya River, Bangkok, Thailand (Google Earth image)

Classroom Expectation

- Regular attendance is mandatory. Please come to the class on time.
- If you are going to miss class, please talk to me ahead of time.
  For sudden illness or emergency, please email me at your earlier convenience.
- Assignments are due at the beginning of the class on the due date.
  Late assignments may result in penalties.
- You will be working with other students in different experiments and projects. You might start with the same data or observation, but you will still have to do individual work in your own words.
  Copying will result in no mark on the assignment.
- Respect your teacher and classmates by not using your cellphone in class.

Assessment

The process of your learning will be evaluated in various ways.

10% Classroom Participation

- Self-assessment and reflections
- Providing and receiving peer feedbacks
- Homework checks

25% Experiments and Constructions

- 2 Constructions: Candy wave machine and straw recorder

45% Tests and Final Exam

20% Inquiry Project

- Construction Projects: Mouse Trap Car
- Design and construct your own device in an inquiry project.
- Present your finding to your classmates.

Week	Unit	Big Ideas
1 – 3	1. Kinematics	An object's **motion** can be predicted, analyzed, and described.
4 – 6	2. Dynamics	**Forces** influence the motion of an object.
7 – 8	3. Energy	**Energy** is found in different forms, is conserved, and has the ability to do work.
9 – 10	4. Electric Circuits	**Energy** is found in different forms, is conserved, and has the ability to do work.
12 – 14	5. Waves and Sound	Mechanical **waves** transfer energy but not matter.

Big Ideas:

- An object's motion can be predicted, analyzed, and described.

Question to Support Inquiry:

What effect does launch angle has on the path of a projectile?

How to experimentally determine acceleration due to gravity?

How to prove that an object has uniform or accelerated motion?

Core Competencies:

Communication
- I can communicate clearly about topics I know and understand well, using forms and strategies I have practiced. I gather the basic information I need and present it.

Creative Thinking
- I can use my imagination to get new ideas of my own, or build on other's ideas, or combine other people's ideas in new ways.

Critical Thinking
- I can assess my own efforts and experiences and identify new goals. I give, receive, and act on constructive feedback.

Curricular Competencies:

Questioning and Predicting
- Make observations aimed at identifying their own questions, including increasingly abstract ones, about the natural world

Processing and Analyzing Data and Information
- Analyze cause-and-effect relationships

Evaluating
- Exercise a healthy, informed skepticism and use scientific knowledge and findings to form their own investigations to evaluate claims in primary and secondary sources

Content:

Vector and scalar quantities:
- addition and subtraction
- right-angle triangle trigonometry

Uniform and accelerated motion:
- graphical and quantitative analysis

Projectile motion:
- 1D and 2D, including:
- vertical launch
- horizontal launch
- angled launch

First Peoples Principles of Learning:

- Learning involves patience and time.

Learning Targets:

1. Differentiate between scalar and vector quantities.
2. Construct displacement-versus-time graphs.
3. Construct velocity-versus-time graphs and it to determine acceleration.
4. Solve a range of problems for objects with constant acceleration.
5. Recognize that a projectile experiences a constant downward acceleration due to gravity if friction is ignored.
6. Describe the shape of the path taken by a projectile fired at some angle above the horizon if friction is negligible.
7. Draw conclusions about a projectile's horizontal velocity and downward acceleration due to gravity if friction is discounted.
8. Resolve a projectile's velocity into horizontal and vertical components and solve projectile motion problems.

Assessments:

Formative:

- Homework checks and review
- Teacher signature to provide oral feedback during data measurement for both experiments
- Determination of the launch velocity of crossbow project using projectile motion.

Summative:

- Acceleration due to gravity lab report
  - data, graphing, uncertainties and analysis
- Unit test
- Projectile motion lab report
  - data, calculation and analysis

Big Ideas:

- Forces influence the motion of an object.

Question to Support Inquiry:

How can forces change the motion of an object?

How can Newton's laws be used to explain changes in motion?

Why is the weight measured from a stationary and accelerating elevator different?

Core Competencies:

Communication
- I contribute during group activities, cooperate with others, and listen respectfully to their ideas. I can work with others for a specific purpose.

Critical Thinking
- I use observation and data to draw conclusions, make judgments, and ask new questions.

Personal Awareness and Responsibilities
- I can take action toward meeting my own wants and needs and finding joy and satisfaction, and work toward a goal or solving a problem.

Curricular Competencies:

Planning and Conducting
- Use appropriate SI units and appropriate equipment, including digital technologies, to systematically and accurately collect and record data

Processing and Analyzing Data and Information
- Seek and analyze patterns, trends, and connections in data, including describing relationships between variables, performing calculations, and identifying inconsistencies

Evaluating
- Evaluate their methods and experimental conditions, including identifying sources of error or uncertainty, confounding variables, and possible alternative explanations and conclusions

Content:

Contact forces:
- for example, normal force, spring force, tension force, frictional force

- Newton's laws of motion:
- First: the concept of mass as a measure of inertia
- Second: net force from one or more forces
- Third: actions/reactions happen at the same time in pairs

Forces in systems:
- one-body and multi-body systems
- inclined planes
- angled forces
- elevators

First Peoples Principles of Learning:

- Learning is holistic, reflexive, reflective, experimental, and relational (focused on connectedness, on reciprocal relationships, and a sense of place)
- Learning involves patience and time.

Learning Targets:

1. Describe force as a vector quantity and resolve a force into orthogonal components
2. Convert among the numbers of particles, moles, and mass.
3. State Hooke's law.
4. Illustrate Newton's first and third laws with examples.
5. Create free-body diagrams for use in solving problems.
6. Apply Newton's laws and the concepts of kinematics to solve problems.
7. Determine the net force from two or more forces
8. Solve a variety of problems related to unbalanced forces (e.g., sliding objects, Atwood's machine, inclined planes).

Assessments:

Formative:

- Homework checks and review
- Teacher signature to provide oral feedback during data measurement for the experiment
- Determination of the launch velocity of crossbow project using projectile motion.

Summative:

- Unit Test
- System of mass lab report
  - full lab write-up

Big Ideas:

- Energy is found in different forms, is conserved, and has the ability to do work.

Question to Support Inquiry:

Is an electric motor always more efficient than a combustion engine?

What explanations can you offer when your experimental data show that energy is not conserved?

What are some heat-efficient structures around our homes?

Core Competencies:

Communication
- I listen and respond to others. I can consider my purpose when I am choosing a form and content. I can communicate clearly about topics I know and understand well.

Critical Thinking
- I can use what I know and observe to identify problems and ask questions.

Social Awareness and Responsibilities
- I can interact with others and my surroundings respectfully.

Curricular Competencies:

Planning and Conducting
- Use appropriate SI units and appropriate equipment, including digital technologies, to systematically and accurately collect and record data

Processing and Analyzing Data and Information
- Construct, analyze, and interpret graphs, models, and/or diagrams

Evaluating
- Evaluate the validity and limitations of a model or analogy in relation to the phenomenon modelled

Communicating
- Formulate physical or mental theoretical models to describe a phenomenon

Content:

Power and efficiency:
- mechanical and electrical
  (e.g., motors, simple machines, steam engines, kettles)
- numerical examples
  (e.g., friction and power)

Simple machines:
- lever, ramp, wedge, pulley, screw, wheel and axle

Thermal equilibrium:
- as an application of law of conservation of energy
  (e.g., calorimeter)

First Peoples Principles of Learning:

- Learning involves patience and time.

Learning Targets:

1. Define work in terms of force and displacement.
2. Define energy, potential energy and kinetic energy.
3. Relate energy change to work done.
4. State the law of conservation of energy.
5. Solve problems, using the law of conservation of energy.
6. Determine the mechanical advantage of a machine.
7. Perform calculations involving relationships among power, work, time and efficiency.
8. Define temperature, thermal energy, and specific heat capacity.

Assessments:

Formative:

- Homework checks and review
- Analyze whether energy is conserved in a sloped track.
- Self-reflection and peer evaluation on the crossbow project

Summative:

- Crossbow construction
  - launch velocity
  - draw weight and Hooke law
  - energy stored in the crossbow and conservation of energy
- Unit test

Big Ideas:

- Energy is found in different forms, is conserved, and has the ability to do work.

Question to Support Inquiry:

How does the quantum mechanical model extend our understanding of the atom?

Why is fluorine the most electronegative element?

How do spectral lines relate to the quantum mechanical model?

Core Competencies:

Communication
- I can identify and apply roles and strategies to facilitate groupwork. I am an active listener and speaker

Critical Thinking
- I consider more than one way to proceed and make choices based on my reasoning and what I am trying to do.

Positive Personal & Cultural Identity
- I can identify my individual characteristics and explain what interests me.

Curricular Competencies:

Questioning and Predicting
- Make observations aimed at identifying their own questions, including increasingly abstract ones, about the natural world

Planning and conducting
- Assess risks and address ethical, cultural, and/or environmental issues associated with their proposed methods

Processing and Analyzing Data and Information
- Experience and interpret the local environment

Evaluating
- Evaluate the validity and limitations of a model or analogy in relation to the phenomenon modelled

Content:

Power and efficiency:
- mechanical and electrical
  (e.g., light bulbs and motors)
- numerical examples
  (e.g., resistance, power, and efficiency in circuits)

Electric circuits (DC)
- Ohm's law
- Kirchhoff's laws:
- including terminal voltage versus electromotive force (EMF)
  (e.g., safety, power distribution, fuses/breakers, switches, overload, short circuits, alternators)

First Peoples Principles of Learning:

- Learning involves patience and time.

Learning Targets:

1. Define resistance in terms of Ohm's law.
2. Calculate the total (equivalent) resistance for resistors connected in parallel, series, or a combination of both.
3. State Kirchhoff's laws, and apply them to circuits containing one source of electric potential difference.
4. Draw and interpret circuit diagrams.
5. Demonstrate the correct placement and use of an ammeter and voltmeter.
6. Define electromotive force (emf), terminal voltage, and internal resistance.
7. Solve a range of problems involving the efficiency of electrical devices.
8. Explain why electric energy is transmitted through transmission lines at high voltage and low current.

Assessments:

Formative:

- Homework checks and review
- Inquiry simulation of circuit building
- Mystery circuit investigation

Summative:

- Mystery circuit investigation #2

Big Ideas:

- Mechanical waves transfer energy but not matter.

Question to Support Inquiry:

What are the factors that affect wave behaviours of sound in a concert or sporting events?

How would you investigate the relationships between the properties of a wave and properties of the medium?

How can you determine which harmonics are audible in different musical instruments?

Core Competencies:

Communication
- I recognize how my contributions and those of others complement each other. I can plan with others and adjust our plan according to the group's purpose.

Critical Thinking
- I consider alternative approaches and make strategic choices. I take risks and recognize that I may not be immediately successful.

Creative Thinking
- I generate new ideas as I pursue my interests. I deliberately learn a lot about something by doing research, talking to others, or practicing, so that I can generate new ideas.

Curricular Competencies:

Questioning and Predicting
- Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal, local, or global interest

Evaluating
- Connect scientific explorations to careers in science

Applying and innovating
- Co-operatively design projects with local and/or global connections and applications
- Implement multiple strategies to solve problems in real-life, applied, and conceptual situations

Content:

Propagation of waves:
- transverse versus longitudinal
- linear versus circular

Properties and behaviours:
- properties: differences between the properties of a wave and the properties of the medium, periodic versus pulse
- behaviours: reflection (open and fixed end), refraction, transmission, diffraction, interference, Doppler shift, standing waves, interference patterns, law of superposition
- characteristics: for example, pitch, volume, speed, Doppler effect, sonic boom
- frequency: for example, harmonic, fundamental/natural, beat frequency

First Peoples Principles of Learning:

- Learning involves patience and time.

Learning Targets:

1. Describe the properties associated with waves, including amplitude, frequency, period, wavelength, phase, speed, and types of waves.
2. Use the universal wave equation to solve problems involving speed, frequency (period), and wavelength.
3. Describe and give examples of reflection, refraction, diffraction, interference and Doppler shift.
4. Describe what a standing wave is and identify any nodes present.
5. Relate the medium and frequency to the pitch of sound.
6. Describe the relationship between fundamental and harmonics in a sound wave.
7. Distinguish between instruments that have open ends and closed ends.

Assessments:

Formative:

- Homework checks and review
- Spring activities to demonstrate properties of the wave
- Constructing and candy wave machine and observe its behaviour

Summative:

- Unit Test
- Construction of a recorder or a string instrument and demonstrate the pitch in the design of the instrument supported by calculations.