Physics (Grade 1, Semester 2)

Fluid Mechanics

PH.1.08: Weeks: Week 01 - Week 03

Use pressure difference between two points of a fluid and Newton's laws to analyze behavior of that fluid.

Concepts	Skills
•1. Fluids •2. Pressure •3. Manometer •4. Pressure gauge •5. Units of pressure •6. Effect of atmospheric pressure on boiling point of water •7. Change in atmospheric pressure with altitude •8. Pressure difference and force •9. Archimedes Principle 10. pascal principle	•1. Determine pressure change as function of height in columns of fluid •2. Explain how a mercury barometer measures atmospheric pressure •3. Determine atmospheric pressure as a function of altitude •4. Convert between different pressure units (such as: kPa, atm, mm Hg) •5. Explain how a straw works •6. Explain how a manometer works •7. Measure the gauge pressure of a trapped gas •8. Use manometers & barometers •9. Explain different boiling points of water at different altitudes •10. Measure the apparent weight of an immersed object. •11. Determine the Buoyant force on a submerged, or floating object •12. Use Archimedes principle to explain why large ships do not sink 13- apply pascal principle in some life applications like hydraulic brakes, hydraulic lift (press).

Essential Question(s): •How does a vacuum cleaner work?
•If you are in a car that is submerged in a flood, how hard will it be to open your door? What is the best way to open the door?
•Why does a physician typically measure blood pressure in your upper arm?
•Is it easier or harder to boil water when on top of a very high mountain?

Big Idea:
Power of nature can be transformed into energy that benefits man.

Comments:
Important here to stress that liquids and gases are considered "fluids"

Also, the simplifying assumption of homogeneous substances, i.e. density is constant.

This is a good module to talk once again about fictitious forces. Similar to the centrifugal force idea

discussed in Semester 1, hear we have the vacuum force. Many think that there such thing as suction, as if something in your vacuum cleaner reaches out, grabs some dust, and pulls it up the vacuum hose. Vacuum cleaners, and drinking from straws, etc., is only possible when there is a pressure difference (and the force this causes can overcome gravity to pullet up and/or in.

Archimedes should be used in a variety of situations - from holding heavy objects underwater to how to design hot-air balloons

Textbook and Resource Materials:

Holt Ch. 8 & Halliday CH 14

Evidence of Learning:

quizzes, check points, assignments& discussions

Capstone Connection:

Using gas and steam pressure to generate energy in traditional and alternative energy applications

SEC Topic:

pressure, buoyant force, apparent weight

Fluid Dynamics

PH.1.09: Weeks: Week 04 - Week 06

Apply principles of fluid dynamics to determine pressure and velocity in a variety of typical fluid systems

Concepts	Skills
•1. General properties of Fluids •2. Continuity equation •3. Laminar vs Turbulent Flow •4. Pascal's Principle •5. pdv = Work •6. Work-Energy Theorem •7. Conservation of Energy in fluids •8. Bernoulli Equation. 9- viscosity.	•1. Apply Bernoulli's Principle in daily life •2. Explore alternative energy applications of fluid dynamics such as windmills, hydrological dams, tidal generation. •3. Determination of mass flow rate. •4. Determination of volume flow rate. •5. Solve problems on flow rate. •6. Explain some phenomena on equation of continuity. •7. Explain some applications on Bernoulli's equation. 8. identify factors affect viscosity 9. describe some life application on viscosity ad continuity equation 10- solve problem about viscosity

Essential Question(s): •How do planes stay in the air?
•If an artery starts narrowing due to thickening of the arterial walls, what happens to the blood pressure inside the artery?
•How much pressure is needed at the base of an apartment building to provide adequate shower pressure on the 10th floor?
•How does the perfume sprayer work?

Big Idea:
Power of nature can be transformed into energy that benefits man.

Comments:
After covering continuity and pascal principle, this section will be the first in which energy stuff is described in more than a passing way.

This is the beginning of a spiral approach to work and energy...

Suggestion: begin by defining work by constant pressure as pdv. (Is this done in CHM somewhere?) Then define kinetic energy of fluid in terms of density and dv. Then argue for a Work-energy theorem for fluids which are moving in laminar flow in a HORIZONAL pipe.

i.e. begin with a simple derivation of a restricted BErnoulli equation (one at same vertical position wrt earth)

do some horizontal problems...then go vertical, arguing for a term that involves height as well because as fluid goes up there's no way it doewn's lose velocity. In other words, you can get to a full statement of Bernoulli .... and do a bunch of problems using it...remarking that the students will see much more about conservation of energy in YEar 2...

Textbook and Resource Materials:
Holt Ch. 8 & Halliday CH 14
Evidence of Learning:
quizzes, check points, assignments& discussions
Capstone Connection:
Using gas or liquid flowing to generate energy for alternative energy applications.
SEC Topic:
pressure, velocity, kinetic energy

Thermodynamics

PH.1.10: Weeks: Week 07 - Week 10

Design a system for efficient energy production using concepts of temperature, heat and thermal energy.

Concepts	Skills
•1. Temperature •2. Thermal energy •3. Heat •4. Conduction, Convection, Radiation •5. Measuring Temperature •6. Temperature scale •7. Heat capacity •8. Specific heat capacity •9. Blackbody radiation •10. Solar heat collector. •11. Natural sources of heat: sun, geothermal •12. Latent heat	•1. Differentiate between temperature, thermal energy and heat •2. Measure temperature •3. Solve problem of general law of thermometer •4. Describe how temperature changes as a result energy transfer to a system Convert between different temperature scales (k – f - c) •5. Describe the natural sources of heat •6. Explain the idea of solar heat collectors. •7. Identify the uses of solar heat collector in daily life •8. Calculate temperature change fora given amount of a substance for a given energy transfer, or determine the amount of energy required for a given substance to change temperature by a specific amount.

Essential Question(s): •How efficient can a solar collector be?
•Can you make a thermometer without mercury?

Big Idea:
Power of nature can be transformed into energy that benefits man.

Comments:
with 1st law of Thermo coming in the next LO, this LO should focus on heating/cooling properties of different materials as a function of wavelength of incoming radiation

Convection, Conduction, RAdiation should be compared...where possible by experiment.

This should be more of an empirical LO, with simple mathematics involved in design. e.g. a question about how large a solar collector must be given energy needs , efficiency, and incident radiation would be good

Textbook and Resource Materials:
Holt ch 9 & Haliday CH 18

Evidence of Learning:
quizs, check points, assighnments& disccussions

Capstone Connection:
Using light and heat sources to generate other forms of energy

SEC Topic:
temperature, heat, thermal energy

PH.1.11: Weeks: Week 10 - Week 12

Analyze energy flow in typical heating and cooling applications by applying the 1st Law of Thermodynamics.

Concepts	Skills
•1. Conservation of thermal energy •2. Energy graphs •3. Low temperature physics •4. Thermodynamic processes (isothermal – isovolumetric- isobaric- adiabatic) •5. Phase changes	•1. Explain p-v graphs •2. Calculate the work done as gases are compressed/expanded both mathematically and graphically •3. Determine equilibrium temperatures in heating/cooling situation •4. Describe how 1st Law of thermodynamics is applicable for each type of thermodynamic process. •5. Explain methods to produce low temperature near absolute zero. •6. Describe applications for low temperature physics.

Essential Question(s): •What is more efficient at cooling a building in a desert climate: an air conditioner or a heat pump?

•If average temperatures of earth surface increase by 2 degree Celsius, how much ice in Greenland will melt?

Big Idea:

Power of nature can be transformed into energy that benefits man.

Comments:

Be sure to perform experiment to demonstrate conservation of thermal energy ....

domonstrate that area under p-v graph is energy transfer - connection to calculus

Textbook and Resource Materials:

Haliday ch 18

Evidence of Learning:

quizs, check points, assighnments& disccussions

Capstone Connection:

Applying Laws of thermodynamics to types of alternative energy.

SEC Topic:

energy flow, heating, cooling, thermodynamics

Physics

Grade 10

Semester 2