Lesson Plan

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| Subject: Physics | Grade: 11 | Course Code: SPH3U0 |
| Lesson Topic: Conservation of Energy | Duration: 60 min | Date: Nov 8, 2012 |

Pre-requisite Knowledge/Skills:

Students should be able to:

* Find gravitational potential energy, kinetic energy, and work done
* Use the famous five equations to solve for v2 given v1, displacement, and g acceleration

Overall Expectations:

D2: investigate energy transformations and the law of conservation of energy, and solve related problems;

D3: demonstrate an understanding of work, efficiency, power, gravitational potential energy, kinetic energy, nuclear energy, and thermal energy and its transfer (heat).

Specific Expectations:

D2.1: use appropriate terminology related to energy transformations, including, but not limited to: *mechanical energy, gravitational potential energy,* *kinetic energy, work, power, fission, fusion, heat, heat* *capacity, temperature,* and *latent heat*

D2.2: solve problems relating to work, force, and displacement along the line of force

D2.3: use the law of conservation of energy to solve problems in simple situations involving work, gravitational potential energy, kinetic energy, and thermal energy and its transfer (heat)

D3.1: describe a variety of energy transfers and transformations, and explain them using the law of conservation of energy

D3.2: explain the concepts of and interrelationships between energy, work, and power, and identify and describe their related units

D3.4: identify, qualitatively, the relationship between efficiency and thermal energy transfer

D3.5: describe, with reference to force and displacement along the line of force, the conditions that are required for work to be done

Agenda:

1. Kinetic Energy/Potential Energy Activity
2. Mechanical Energy
3. Conservation of Energy
4. Sample Problems
5. Homework

Lesson Learning Goals:

Students will be able to:

Assessment – Indicators of Learning:

Accommodations and/or Modifications:

No IEPs

Resources and Materials Required/Safety Considerations:

* Class set of activity (8 copies – for groups of 3/4)
* White Board
* Projector
* Microsoft Excel (enter each Ek, Eg, and total)

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| Time | Lesson Sequence/Instructional Strategies | Assessment Opportunities |
| 2 min | Introduce student’s to activity   * Explain that students are going to be using the famous five equation in order to determine the kinetic energy and the potential energy of a diver * Each group will have a different displacement going down and they will have to find the speed at that height and then find Ek and Eg * Distribute the handout to each group | Direct teaching and explanation of instruction |
| 18 min | Have students solve for the Eg and Ek of the diver at their given height and then add them together   * Record their answers in a spreadsheet (for Ek, Eg and Etot.) | Groups of 3. Each will work on and answer the same question (the displacement is different for each group so |
| 5 min | Set up of Mechanical Energy   * What did you notice about the total energy? * Do you think the total energy will always be the same or was this just a fluke? | Socratic Questioning |
| 5 min | Mechanical Energy   * This is the total of the kinetic and potential energy (Em = Ek + Eg) * It is always a constant * This is considered the “useful” energy (the energy we can use to do work.) | Check in with students and make the parallel that mechanical energy is the “total” we found in the activity |
| Brief | Pendulum Demo   * Show a pendulum. * The mechanical energy will be the kinetic and the potential energy * If the mechanical energy is constant why does the pendulum stop?   (friction and heat)   * Does the pendulum “lose” energy? | Socratic questioning and think pair share |
| 5 min | Law of Conservation Energy   * The total amount of energy in the universe is conserved. New energy cannot be created or destroyed it is just transferred from one form to the other * In an isolated system the total amount of energy never changes * METAPHOR: imagine you are in a sealed room with your friend. You can make as many money transfers as you like but the total amount of money will stay the same. If your friend goes outside though it is no longer an isolated system and * **This is a BIG deal in physics. We can use this law in many practical ways! It is one of the few principles that unifies the sciences!** * We can solve kinematics and forces questions with energy! (Why is this easier than forces? – because energy is a scalar) * Energy at any point in a system is always constant. We can use this fact | Ask students what does this mean in the context of the pendulum demo?  Friction is causing some of the energy to be “lost” as heat energy  Air resistance  Ask: what would happen if we did the pendulum experiment in a perfect vacuum? |
| 10 min | Sample Problem 1: Kinematics?  You shoot a bullet straight up into the air at 896 m/s. How high will the bullet travel relative to where it was fired? | Draw a picture of the situation and show that the energy total at A should equal the energy total at B.  Try to have students provide the steps you need in solving the equation. |
| 10 min | Sample Problem 2: going bananas!  A 5kg banana falls out of a tree and lands on the ground 3 m below. Find the banana’s   1. Potential energy at the top (relative to ground) 2. Kinetic energy at the bottom 3. Speed at which the banana hits the ground | Have students note that they could have solved for speed without a mass!  Point out the dangers of solving a problem this way. Sometimes it’s better to isolate for what you’re looking for first! |
| 5 min | Consolidation   * MIP * Energy is ALWAYS conserved |  |
| Applying Learning in Class/At Home   * Conservation of Energy Homework * Think of a real life example where students’ converted one energy to a different form (kinetic to potential or vice versa.) | | |