

## Topics for groups developed activities and lessons:

**Instructions:** Spend some time in your group reviewing the topics listed below. Select three possible topics and rank them in order of preference from 1 to 3. Remember, you are choosing a topic and developing a physics investigation and a math modeling lesson to use in your classrooms in the upcoming school year (Fall 2012 – Spring 2013). One of the goals of the workshop is to develop a working library of activities. It is possible to select a topic another group is working on as long as the activity is different.

1. Projectile Motion – UPI Lab (Lab Assignment 1: Projectile Motion)
  - Simple projectile motion prediction lab, determine initial velocity of ball and then make predictions based on several known variables
  - Math Model – Quadratic Equations with solutions (+ is motion moving forward in time, - is motion backwards in time)
  
2. Circular Motion – UPI Lab (Activity 16: Uniform Circular Motion)
  - Constant velocity buggy pulled on butcher paper with pen attached to mark path
  - Math Model - Centripetal acc and Tangential acc
  
3. Hook's Law – Springs – UPI Lab (Activity 21: Mass-Spring System)
  - Simple spring lab to measure the spring constant of several different springs
  - Math Model – Linear equations, SHM wave equation
  
4. E&M Fields – UPII Lab (Activity 4: Field Maps)
  - Draw the electric field of a charge distribution and calculate the net electric field at a point P, determine the electric potential at point P
  - Math Model – Vector addition and Integration from infinity
  - **\*\*NOTE\*\*** Could look at the work done on a point charge moving through the system – Math Model would be integration
  
5. RC Time Constant – UPII Lab (Activity 14: Measuring an RC Time Constant)
  - Measure the  $v(t)$  curve for an RC circuit

- Math Model – Linearizing data using natural log function ( $\ln(x)$ )
6. Cross-Product – UPII Lab (Activity 18: The Lorentz Force)
    - Showing forces on charged particle in a Magnetic Field (e/m app. or wire in a magnetic field)
    - Math Model – Cross product, tangential acceleration, tangential velocity
  7. Proportionality – Light ( $1/r^2$ ) – ARCH II Lab (Lab 1: Light Intensity)
    - Measure the light intensity of a bulb and compute the power of light to the consumption of electrical energy ratio
    - Math Model – proportionality relationships
  8. Springs SHM – UPI Lab (Activity 21: Mass-Spring System)
    - Simple spring lab to measure the spring constant of several different springs by using the Period of Oscillations
    - Math Model – Diff Eq solutions
  9. Work-Energy Theorem – UPI Lab (Activity 14: Work-Energy Theorem)
    - The change in kinetic energy of a cart is measured and compared to the work done on the cart
    - Math Model – integration
  10. Energy Transfer – UPIII (Activity 6: Specific Heat)
    - Thermal energy – specific heat of a material is measured by observing the temperature change in a calorimeter
    - Math Model – area under a curve, time dependent derivative
  11. Sound Waves – UPIII (Fourier)
    - Look at the fundamental frequency for a sound wave
    - Math Model – FFT (Fast Fourier Transform)
  12. Linear Non-Uniform Motion – UPI (Activity 1: Understanding Motion)
    - Create  $x$  vs.  $t$ ,  $v$  vs.  $t$ , and  $acc.$  vs.  $t$  by moving in front of a motion sensor
    - Math Model – linear, power, and quadratic fits

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RANK (1-3) for top three choices:

- \_\_\_\_\_ 1. Projectile Motion – UPI Lab (Lab Assignment 1: Projectile Motion)
- \_\_\_\_\_ 2. Circular Motion – UPI Lab (Activity 16: Uniform Circular Motion)
- \_\_\_\_\_ 3. Hook’s Law – Springs – UPI Lab (Activity 21: Mass-Spring System)
- \_\_\_\_\_ 4. E&M Fields – UPII Lab (Activity 4: Field Maps)
- \_\_\_\_\_ 5. RC Time Constant – UPII Lab (Activity 14: Measuring an RC Time Constant)
- \_\_\_\_\_ 6. Cross-Product – UPII Lab (Activity 18: The Lorentz Force)
- \_\_\_\_\_ 7. Proportionality – Light ( $1/r^2$ ) – ARCH II Lab (Lab 1: Light Intensity)
- \_\_\_\_\_ 8. Springs SHM – UPI Lab (Activity 21: Mass-Spring System)
- \_\_\_\_\_ 9. Work-Energy Theorem – UPI Lab (Activity 14: Work-Energy Theorem)
- \_\_\_\_\_ 10. Energy Transfer – UPIII (Activity 6: Specific Heat)
- \_\_\_\_\_ 11. Sound Waves – UPIII (Fourier)
- \_\_\_\_\_ 12. Linear Non-Uniform Motion – UPI (Activity 1: Understanding Motion)