Physics 1/2   Name: _____

Cumulative End of Year Physics Project Rubric   Theme:_____

- **Define**: For all variables must also include labels and proper units shown.
- **EP**- **Example Problems** All should be themed and unique with picture(s) and use the GUESS method to solve for the final answer (SN/SD also apply).

Cover Page and Table of Contents ①②③④⑤⑥⑦⑧⑨		/15
The Physics Toolkit and Vectors	**Reviewed By:**	/25

□ Write the Greek Alphabet in both upper and lower case, also include the phonetic spelling.
□ List all of the SI units of measurement. Include an appropriate example item that can be measured with each SI unit and approximately how big it is (ex. My desk is approximately 1.3 m wide)
□ Write the common 'base 3' names in order from +15 to -15 in order including 10^{-2}.
   o Create **your own** acronym to remember the prefixes in order from +9 to -9 including 10^{-2}.
□ Write the equation for error analysis (**EA**). Create an **EP** (remember to follow your theme on all EP).
□ Write and define the density equation. Create an **EP.**
□ Create an **EP** that requires the use of scientific notation for the final answer. (May be combined with density)
□ Draw a vector and determine the magnitude and direction of the vector using a ruler and a protractor.
   o Using the same vector, determine the components of the vector using a ruler only.
   o Using the same vector, determine the components of the vector using trigonometry.
□ Create an **EP** combining a vector variable with a scalar variable.

1D Kinematics	**Reviewed By:**	/25

□ State the difference between distance, position and magnitude. Include a picture (following your theme!).
□ State the difference between velocity and speed. Include a picture.
□ Summarize the equations for kinematics (should be copied from the notes).
   o Make Three **EP**: Each must be solved using a different kinematic equation.
□ Draw a position-time graph that shows positive velocity and positive acceleration.
□ Draw a position-time graph that shows positive velocity and negative acceleration.
□ Draw a position-time graph that shows positive velocity then no acceleration.
□ Draw a velocity-time graph that shows a minimum of three intervals with varying velocities.
   o Determine the total displacement.
   o With different colors: above each segment label Δv as either negative, positive or zero for each interval.
   o With different colors: below each segment label the ā as either negative, positive or zero for each interval.
□ Create an **EP** that requires the use of the acceleration due to gravity.

Forces and Gravity	**Reviewed By:**	/25

□ List the six basic types of forces. Draw a simple free body diagram to illustrate a themed use of each.
□ Write each of Newton's Three Laws. Include a picture after each.
□ Create an **EP** with at least four forces. The forces must be balanced.
□ Create an **EP** solving for the acceleration. Two forces must be imbalanced. A frictional force must be included in your problem.
□ Create an **EP** of an object on an inclined plane moving at a constant velocity.
   o Determine the coefficient of kinetic friction (μ) to keep the object moving at constant velocity.
□ Write and define Hooke's Law equation. Create an **EP**.
□ Write and define the pressure equation. Create an **EP**.
□ Write and define Pascal's Law equation. Create an **EP**.
□ Write and define Gravitational Attraction. Create an **EP** (two objects).
□ Find your proportional weight on a celestial object other than the Earth or Moon (Example Problem #3).

2D Kinematics, Forces and Gravity	Reviewed By:	/25

- □ Create an **EP** where an object is at rest with a minimum of three forces (two must not be cardinal).
- □ Create an **EP** using projectile motion.
    - o Determine the time of travel for the object during the displacement.
    - o Determine the range (horizontal displacement) of the object.
    - o Determine the maximum height of the object.
- □ Summarize the equations for circular motion. Define period, frequency, displacement, velocity, acceleration and force. Create an **EP** for circular motion.
- □ Summarize Kepler's three laws. Include diagrams. Create an **EP** for Kepler's Third Law.

Impulse and Momentum	Reviewed By:	/25

- □ Write and define the momentum equation. Create an **EP**.
- □ Write and define the impulse equation. Create an **EP**.
- □ Write and define the Impulse-Momentum theory equation. Create an **EP**.
- □ Write and define the Law of Conservation of Momentum. Create an **EP**.
    - o Create an **EP** that requires the use of CMom in an elastic collision.
    - o Create an **EP** that requires the use of CMom in an inelastic collision.
- □ Write and define the center of mass equation. Create an **EP**.
- □ Make a hypothesis as to the location for the Center of Mass of the Solar System assuming all eight planets are aligned to the right side of the Sun. Solve and state the validity of your hypothesis (**EA**).

Work, Power, Energy and Simple Machines	Reviewed By:	/35

Write and define the work equation. for the following:
    - o Create an **EP** with Force and displacement acting in the same direction.
    - o Create an **EP** with the Force is acting at a non-zero angle to the direction of the displacement.
- □ Write and define the power equation. Create an **EP**. Using dimensional analysis convert answer to HP.
- □ Write and define the Work/Energy Theorem. Create an **EP**.
- □ Write and define the Kinetic Energy equation. Create an **EP**.
- □ Write and define the Gravitational Potential Energy equation. Create an **EP**.
- □ Write and define the Elastic Potential Energy equation. Create an **EP**.
- □ Write the Law of Conservation of Energy using both words and equations. Create an **EP**.
- □ Create an **EP** to solve for the energy and momentum during an inelastic collision.
- □ Draw and label the following pulleys: Moving, Fixed and Block and Tackle
- □ Draw and label the three classes of levers. Draw and Label real life example of each.
- □ Write and define the MA, IMA, and Efficiency equations.
    - o Create an **EP** using one machine and solving for MA, IMA and Eff.

Thermodynamics	Reviewed By:	/25

- □ List the three common temperature scales, with critical points. Define how to convert between each.
- □ Write and define the linear expansion equation. Create an **EP**.
- □ Write and define the volumetric expansion equation. Create an **EP**.
- □ Write and define the specific heat equation. Create an **EP** which solves for Specific Heat.
- □ Write and define the latent heat equation. Create an **EP**.
- □ Create a diagram showing the relationship between solid, liquid and gas. Include transitional names.
- □ Choose a pure metal and create a heating phase state diagram (minimum half sheet).
    - o Label all critical points and known variables.
- □ Define the three forms of heat transfer.
    - o Create a single diagram showing the relationship between the three forms of heat transfer.

Waves and Sound	Reviewed By:	/25

- □ Sketch the three types of mechanical waves: Transverse, Longitudinal, Surface and EM Waves.
  - ○ If appropriate label: Amplitude, wavelength, crest, trough, compression, rarefaction, baseline, direction of wave, and direction of vibration.
- □ Write and define the wave equation. Create an **EP**.
- □ Write and define the Doppler Shift equation. Create an **EP.**
- □ Sketch a picture(s) showing both constructive and destructive waves.
- □ Write and define the diffraction equation. Create an **EP**.
- □ Write and define the beats equation. Create an **EP**.
- □ Sketch a standing transverse wave and label critical points.
- □ Sketch standing longitudinal waves. Include formulas for both open and closed tubes.
  - ○ Create an **EP** for a both an open and a closed tube.

Light and Color	Reviewed By:	/25

- □ Illustrate the entire electromagnetic spectrum. Include both wavelength and frequency.
  - ○ Expand and illustrate the entire visible light spectrum.
- □ Create an **EP** that requires the use of the speed of light.
- □ Illustrate both Color Addition and Color Subtraction of Light.
- □ Make three Squares. Put a hue in the middle, tint on the left, shade on the right. Label each color.
- □ Draw two two-colored pictures: one with only complementary colors, one with analogous colors.
- □ Define and show with drawings: Concave, Convex, Focal Length, and Center of Curvature.
- □ Complete the lens diagram packet.
- □ Write and define the Index of Refraction equation. Create an **EP**.
- □ Write and define the Snell's Law equation. Create an **EP**.
- □ Write and define the Apparent Depth equation. Create an **EP**.
- □ Write and define the Critical Angle equation. Create an **EP**.

Unit	Raw Score	Final Score
General: Cover (6), Chapter Tabs (1 each)		/15
The Physics Toolkit and Vectors		/25
1D Kinematics		/25
Forces and Gravity		/25
2D Kinematics, Forces and Gravity		/25
Impulse and Momentum		/25
Work, Power, Energy and Simple Machines		/35
Thermodynamics		/25
Waves and Sound		/25
Light and Color		/25