**Academic Physics with Mr. Lanik**

**Study Guide for Semester 1 midterm exam**

**January, 2016**

Hi. I hope that you aren’t too stressed out about mid-term exams in general, or the Academic Physics exam in particular. I have prepared these notes to help you understand what you need to know for our mid-term exam, and to describe how you should go about studying for the exam. The most important pieces of information for you to keep in mind as you get ready for the exam are that a) the exam is open-note, and b) you will need to take time to organize your notes prior to the exam in order to do well on the exam. The questions and comments on this study guide are intended to let you know what I think are the most important Academic Physics ideas that you’ve learned over the past 4 months. By the time you sit down to take the exam, you should be able to come up with a quality response to EACH of the items listed in this study guide. That is your goal while you prepare for the mid-term exam.

Please use the following guide to help you prepare your notes for the exam. As you work through each unit topic, create a new page of notes in your notebook/ binder that summarizes the important ideas and information about that topic. Use the notes, activities, websites, and assignments that we worked on during the semester to help summarize each subject. Once you have worked through this study guide and ***prepared/organized a new set of notes based on this study guide***, you should arrange all of your study materials in your binder so that you can find the information quickly and easily when you sit down to take the exam. In addition to these notes, you should also bring the rest of our work from the semester with you in case you want to look it over during the test—just be sure to organize it all so that you don’t get lost trying to use it on the exam.

**Please note that preparing and bringing notes (using this guide) will give you a boost of up to 10 points on your Final Exam score!!! *These points will be earned only if you produce new notes for the exam (you need to do more than just organize previous notes from the semester).***

Remember, I am confident that you learned a lot this semester, and that you can demonstrate what you’ve learned on this exam. And if you get stressed or anxious while working on the exam, remember to take deep breaths and relax… it’s all gonna work out just fine in the long run. Trust me on that. Good luck!!!!

**The Nature of Science:**

In science, what is an observation?

In science, what is an inference?

What is the role of each in the process of science, and what is an example of each?

**The Standard Model:**

Identify and locate the key features of the atom as described in the Bohr Model.

What is a “fundamental” particle, and which parts of the atom are fundamental?

Identify the four fundamental forces of nature.

Use a diagram to outline and describe the primary features of the Standard Model.

Compare quarks and leptons.

What holds a neutron together? What makes neutrons bind together with other neutrons and protons in the nucleus?

**Kinematics and Motion:**

Clearly explain the differences between scalars and vectors.

How are distance and displacement similar? Different?

How are speed and velocity similar? Different?

Define acceleration in words, and also using math equations.

Provide an example that explains the difference between a positive velocity and a negative velocity.

Provide an example that explains the difference between a positive acceleration and a negative acceleration.

Use a graph of distance vs time to determine the average speed of an object.

Use a graph of speed vs time to find the average acceleration of an object.

Use the equations of constant acceleration to solve kinematics problems.

What is the difference between horizontal motion and vertical motion for a projectile?

How do you use vector addition to find the initial and final velocities of a projectile?

What is a “vector component”?

What is *g*, and what does it tell you about falling objects?

**Forces and Newton’s Laws of Motion:**

What is the difference between mass and weight?

What are the units of mass? Of force?

What is a “net force”?

What equation is used to find the weight of an object on the Earth’s surface?

Clearly and succinctly state Newton’s Laws of Motion.

What is a free-body force diagram, and what should/shouldn’t be included in one?

How can a free body force diagram be used to answer a question about motion?

What is a “centripetal force”?

What is the equation for centripetal force?

Compare the directions of the force, acceleration, and velocity vectors for an object moving along a circular path.

Write the Universal Law of Gravitation, and describe what each term in the equation means.

Use the Universal Law of Gravitation to find the gravitational force between the moon and the Earth.

What happens to the size of the gravitational force between two objects when the distance between the objects is doubled?

What would happen to the gravitational force that the Sun exerts on the Earth if all of the Sun’s mas collapsed into its center to form a Black Hole?

Explain what a Black Hole is.