

INTRODUCTION TO PHYSICS

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Introduction

Introduction to physics, class code PHY 114 at college of Staten Island covers general physics concepts by using very simple algebraic calculations. Topics may include scientific measurements, significant figures, estimation, units, linear and rotational motion, vectors, forces, energy, momentum, collision, impulse, projectile motion, circular motion, thermodynamics, oscillating waves, electricity and magnetism, properties of lights, reflection, refraction, atomic nuclei, and radioactivity. This course is designed to teach general concepts and laws of physics to everyday life enforcing student's critical thinking, logical pattern, organization, and everyday life applications. In this document, all the class materials including lectures, worksheets, homework assignments, quizzes, and concepts questions are presented as Open Education Resources. Course learning objectives (CLO) are mentioned below.

At the end of this course, students will be able to:

CLO 1: Describe physics concepts verbally, graphically, and mathematically by identifying and defining physical quantities to explain major laws of Physics and its applications by using mathematical models for quantitative reasoning and describing physical reality.

CLO 2: Apply knowledge of linear motion, rotational motion, forces, energy, momentum, circular motion, sound waves, fluid mechanics and thermodynamics, electricity, magnetism, electromagnetic waves, nucleus and radioactivity to explain natural physical processes and related technological advances including critical analytical skills to evaluate physical phenomena and their effects

CLO3: Demonstrate the understanding of algebraic mathematics along with physical principles to effectively solve problems encountered in everyday life, applicable to biological activity and health care, and further study in science, and professional world.

CLO 4: Design and demonstrate experiments and acquire data in order to explore physical principles, effectively, communicate results, and critically evaluate related scientific studies including detail data analysis technics.

The course is structured to teach in different modalities: In -person, hybrid synchronous or totally asynchronous.

Asynchronous lectures: Lecture slides are prepared and presented asynchronously. The goal is to use assigned class time 55 minutes effectively. Asynchronous lectures are required to watch during the assigned time interval or student's own pace. The lectures will provide the key content knowledge to be conveyed in this course. Students should take notes and complete the related lecture summary assignment while watching it and submit to learning management system (LMS) on time.

Asynchronous/synchronous problem solving: The goal of this component is to use learnt concepts in E-lectures to problem solving or real-world applications. This component of the course is very important. Class time one hour is assigned for students, they watch recorded problem solving or attend the session to work together. Students should understand the working problems and rewrite them and submit them to LMS on time.

Synchronous Group work: In this work, students get problems set to work as a group. They are assigned to submit individually or as a group in different semesters. All members of the group should attend, work equally,

agree on the final product, and understand all the work. This will help students to contribute equally to all aspects of learning, communicating, organizing, and collaboration.

Lecture materials:

The goal of this part of the course is to provide the key content knowledge of the crucial concepts that will be used during the rest of the class structure. E-lecturing is assigned to complete 55 minutes period of the class. Learners are supposed to complete a given following task while watching the recorded lectures and submit it before they participate or complete the problem-solving session. E-lecture gives freedom to learn the material within an individual schedule. Learners can expose themselves to the subject matter by exploring crucial concepts that are needed to apply for problem-solving. E-lecturing allows them to revisit and review class material as much as needed.

YouTube link for lectures: https://www.youtube.com/playlist?list=PLv_BVWnieP4004Y431yUkU95m1iDcMq2z

PHY 114 Lecture Notes-This should be completed before starting the worksheet. This is graded for following the given structure and the completeness.

Date: _____

Student Name: _____ Last 4 digits of Student ID#: _____

Take your notebook handwrite above information. Then, start to watch the **Lecture** video and answer to each part [a], [b], [c], [d], and [e] below at the same time. Your answers should be **handwritten with more than 20 words long** including important concepts that were discussed. This can be used as a short note for your worksheet, groupwork and quizzes.

[a] between 0:00 and 15:00 minutes of the video? **(20 points)**

[b] between 15:01 and 25:00 minutes of the video? **(20 points)**

[c] between 25:01 minutes and the end of the video? **(20 points)**

[d] Write all fundamental formulas and constants discussed in the lecture. These can be used to solve problems and should be the formulas on the formula sheet only. **(20 points)**

[e] Summarize the most important or interesting thing you learn towards your education or day today life from this lecture? **(20 points)**

Figure 1: Lecture notes task: Learners will complete this simple task in their notebooks by watching the E-lectures.

Contents are divided into four-unit modules in learning management system (LMS). Each E-lecture describes the subject matter with crucial concepts and derives or introduces mathematical formulas that will be used for problem-solving. The learners get an opportunity to revisit the lecture or refer to the textbook for more information on materials. A small task for each lecture as shown in Figure 1 is given to complete as lecture notes. This assignment must be completed while watching the E-lectures. Students have to hand-write the answers in their notebooks by following the model and submit it to LMS before the problem-solving session.

Unit 1:

Lecture 1: Introduction: Science, Measurement, Significant, Estimation, units, and unit conversion

Lecture 2: Linear Motion: Speed, velocity, acceleration, instantaneous velocity, and acceleration, graphical representation, Vectors, Scalars, and vector addition.

Lecture 3: Dynamics: Newton's laws of Motion, free body diagram, Forces, Newton's 2nd law to find acceleration and force, friction, frictional force, and various kind of forces in real life.

Unit 2:

Lecture 4: Linear Momentum: Conservation of momentum, Collision, impulse and Work and Energy: Energy, Conservation of energy, power.

Lecture 5: Rotational motion: Angular Quantities, Rolling motion, the moment of inertia, torque, the center of mass of the rigid bodies.

Lecture 6: Kinematics and dynamic of Circular motion, banked- unbanked roads, uniform, and non-uniform circular motion universal law of gravitation, Kinematics in two dimensions, Projectile motion, circular Satellite motion, Kepler's law of planetary motion.

Unit 3:

Lecture 7: Atomic nature of matter, solid, liquid, gas, phases of matter, the periodic table, ionization, molecules, isotopes, and compounds.

Lecture 8: Fluids: Pressure, Pascal principle, Buoyant force; float, submerge and sink of the objects inside fluid.

Lecture 9: Temperature, heat, and expansion; heat transfer, thermodynamics and Oscillations and Waves: Harmonic and Wave Motion, Resonance, Sound, Intensity, Quality and Interference of Sound.

Unit 4:

Lecture 10: Coulomb's Law, Electric charge, Conductors and Insulators, Electric Fields & field lines. Capacitors, Current resistance, Resistivity, and resistance Ohm's law, Direct current, and Power in circuits.

Lecture 11: Magnetic force, Magnetic field lines, Motion of charged particles in magnetic fields, Magnetic force on a current-carrying wire., Sources of Magnetic fields, Faraday's law of induction.

Lecture 12: Electromagnetic Waves, Sinusoidal waves, Reflection, and refraction, Dispersion, Types of images, Reflection by plane and spherical surfaces, Refraction by thin lenses and the atoms and quantum particles, The atomic nucleus and radioactivity, nuclear fission and fusion.

Problem solving strategies and Worksheets:

This component is assigned 1 hour and 55 minutes of the class period to use the learned concepts in E-lectures toward problem-solving and real-world applications. This component of the course is very important for students to learn how to apply what they learn and develop problem-solving strategies by working with a given set of problems. At the end of the class, completed work is supposed to be submitted for a completion grade.

The technique was investigated under mandatory attendance policy and choice-based attendance policy in two separate semesters to check the progress and effectiveness. The problem-solving recitation session allows learners to build a bridge between what they heard and learned in E-lecture to real-life problem-solving and applications by making sense of the content and its relevance.

YouTube link for problem solving:

https://www.youtube.com/playlist?list=PLv_BVWnieP4004Y431yUkU95m1iDcMq2z

There is a worksheet for each lecture. In these recordings, problems are discussed in detail with detailed answer discussions that help students to think about critically to new problems and variations.

Homework Assignments:

After completion of the worksheet or problem-solving strategies, students have to complete the homework assignment for each lecture individually. They will get about a week to submit after the worksheet discussion. Homework questions are very similar to worksheet questions. Since we are not using expensive published homework systems, I have to grade homework submissions digitally through Blackboard. This was tested by adding grading and ungraded categories. Questions are kept updating and testing in a different way to get maximum learning output from students.

PHY 114 homework # X: Lecture X

Please work with your group, learn from each other, revisit the concepts and requirements together, connect physics to all disciplines and make a great friendship. Always bring any questions to the office hours.

- All should be handwritten in your notebook, then scan and submit it as a single pdf file to the blackboard.
- Please don't print or save the assignment, it will be always available and updated on the blackboard.
- All answers should be handwritten clearly, spaced, explained, and ordered starting from question one.
- Use only the fundamental formulas and concepts you learn from this class; no random variables or formulas are allowed.
- Use ChatGPT as a learning tool only, don't write generated answers without your effort and understanding.
- If you do not follow the requirements, you will receive no credit for the assignment, check the grading rubric.
- Use significant rules throughout the assignment and use units for all answers.
- To start: handwrite the following statement, names, IDs, start date, lab section, and attendance on it:

"On my honor, I attest that I will follow the letters and spirit of all of this assignment's rules."

Date: _____

Student Name: _____ Last 4 digits of the ID #: _____

Use the last digit of of your ID numbers and add them all: _____. This is **A**.

Add 10 to **A**: _____. This is **B**.

Add 100 to **B**: _____. This is **C**.

Write the value of **A**, **B**, and **C** to one decimal place. You may refer to some or all these numbers later in this assignment.

A= _____ **B**= _____ **C**= _____

Figure 2: First page for all homework assignments that shows class requirements for students to follow.

Homework assignments are implemented with several different methods to minimize academic dishonesty issues. Homework assignments are integrated with Students' last four digits of the ID as shown in Figure 2. The ID-integrated questions will provide personalized questions for each student. This makes it not possible to share homework answers between students because every student gets a different answer. Therefore, this method forces students to work individually. Also, at the top of the paper student must write the honor statement by hand by providing a psychological effect on students' minds to think that they have to do it individually, follow assignments requirements, and feel about their own work and learning. Video recordings of the homework requirements and the way of completing the assignments are posted on the blackboard which shows a step-by-step process. All requirements are noted on the top of each assignment as in Figure 2 and restate them with penalties on the rubric to force students to follow the rules and learn better through the designed process of personalized learning. This page is displayed in each homework assignment.

PHY 114 HW1 – Lecture 01: Please follow the instructions given above about the requirements, rules, and submissions.

Show all work with all effort. This will be graded with detailed feedback (75 points):

1. What is the final correct answer for $B+5.105 \times 11.2465$? (15 points)
2. Convert B mph (miles per hour) to SI unit? If you drive at this speed, do you exceed the speed limit of 25 m/s? (20 points)
3. If you use the ruler to measure the length of your pen in terms of cm, what would be the correct measurement of this length with correct decimal places and units? (20 points)
4. A certain physical quantity, P is calculated using formula $P=2BC^2$. What will be the SI unit and the value of P to correct significant and accuracy? Consider your B in kg and C are in m/s. (20 points)

Do for practice and earn (25 points) for completion:

5. Take the value of B and multiply that by 100000. Write your final answer in scientific notation. How many significant are in your final answer?
6. Take the value of B and divide that by 100000. Write your final answer in scientific notation. How many significant are in your final answer?
7. What is the final correct answer for $C+5.112$?
8. What is the final correct answer for $C \times 5.112$?
9. What is the final correct answer for $C-5.105 \times 2.2465$?
10. A certain physical quantity, X is calculated using formula $X=B/C$. What will be the SI unit and the value of X to correct significant and accuracy? Consider your B in kg and C are in m/s.

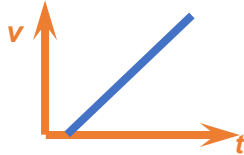
PHY 114 HW2 – Lecture 02: Please follow the instructions given above about the requirements, rules, and submissions.

Show all work with all effort. This will be graded with detailed feedback (75 points):

1. You run horizontally at B m/s in vertically falling rain at B m/s.
 - a. Draw the vector diagram (tail to head)? (10 points)
 - b. Calculate the resultant vector (magnitude and direction)? (10 points)
2. a. At a particular instant a free-falling object has a velocity of A m/s. Exactly 3.0 s later its velocity will be? (20 points)

b. A stone is dropped from a tall building. After $C/100$ s of free fall, what is the displacement of the stone? **(20 points)**

c. The graph of velocity versus time for a car is given below. What can you say about the velocity of the car over time? What can you say about the acceleration of the car? **(15 points)**



Do for practice and earn (25 points) for completion:

3. Define a vector and provide a real-life example. Represent a velocity vector of A with 30° respects to x-axis.

4. If a train travels at a speed of C km/h, you walk in the same direction with speed of A km/h inside the train.

a. What is the speed of you with respect to your friend sitting on the ground?

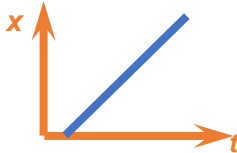
b. What is the speed of you with respect to your friend sitting inside the train?

5. A car travels at a velocity of B m/s. Suddenly the car begins to slow down with an acceleration magnitude is $B/5$ m/s². What is the velocity of the car when the displacement of the craft is $C/5$ m?

6. A ball thrown straight down with velocity of A m/s. Exactly 2.0 s later its velocity will be?

7. A stone is thrown straight down with velocity A m/s from the top of a tall building. After 2.0 s of free fall, what is the displacement of the stone? **(10 points)**

8. The graph of displacement versus time for a car is given below. What can you say about the displacement, velocity and acceleration of the car over time?



PHY 114 HW3 – Lecture 03: Please follow the instructions given above about the requirements, rules, and submissions.

Show all work with all effort. This will be graded with detailed feedback (75 points):

1. A box of mass B kg is resting on the smooth horizontal surface of the table.

a. Determine the weight of the box? **(10 points)**

b. Find normal force exerted on it? **(10 points)**

c. Draw the free body diagram? **(10 points)**

d. Now you push the box right with the force of C N. Explain what will happen and calculate the acceleration of the box. (No friction) **(25 points)**

e. Consider static friction coefficient as 0.50 and kinetic friction coefficient as 0.30, Calculate static friction force and kinetic friction force? **(20 points)**

Do for practice and earn (25 points) for completion:

2. A solid cylinder of unknown metal has mass A kg. The cylinder radius is 1.50 cm and height is 5.50 cm. Take earth gravitational acceleration as $g=9.80 \text{ m/s}^2$ and that of the moon as $1/6 g$. From this data,
 - a. Calculate the density of unknown metal?
 - b. What is the weight of the cylinder?
 - c. What will change if you bring the cylinder to the moon (Mass or Weight), Why?
3. There is a sledder of A kg on a horizontal ground,
 - a. What are the forces acting on the sledder if your friend pushes you with applied force?
 - b. Draw FBD.
 - c. Calculate force of gravity? Calculate force of normal?
 - d. If the coefficient of kinetic friction is 0.15 what is the kinetic frictional force acting on the sledder?
 - e. If the coefficient of static friction is 0.35 what is the static frictional force acting on the sledder?
4. When you push your shopping cart on the ground at a constant speed, what can you say about the force of friction between the cart and the ground compared to your push? What law is this, why do you think your answer is correct?
5. Consider a cart pushed along a track with a certain force. If the mass remains the same while the force of the cart is triple, what will happen to the acceleration of the cart now? What fundamental law do you use here?
6. Consider a cart pushed along a track with a certain force. If the mass is double while applying the same force, what will happen to the acceleration of the cart now?

PHY 114 HW4 – Lecture 04: Please follow the instructions given above about the requirements, rules, and submissions.

Show all work with all effort. This will be graded with detailed feedback (75 points):

1. You are holding a mass of B kg on top of the 10.0 m height building.
 - a. What is the potential energy of the object with respect to the ground. **(10 points)**
 - b. Now you decide to drop the object to the ground, calculate the velocity when it hits the ground by using energy conservation. **(10 points)**
 - c. What happens to the initial potential energy when the object lands on the ground? **(15 points)**
 - d. If the object drops on to the spring of spring constant $C+1000 \text{ N/m}$, calculate the compress distance of the spring by considering all energy convert to spring potential energy? **(20 points)**
2. A ball slides with initial velocity $\frac{B}{10} \text{ m/s}$ on a frictionless surface and collides with another ball of three times the mass of the first ball at rest. The balls stick together after the collision. What is the final velocity of the balls? **(20 points)**

Do for practice and earn (25 points) for completion:

3. Explain kinetic energy in your words, including information about vector, scalar, units, sign and so on. What is the kinetic energy of a **B** g bullet traveling at **C** m/s?
4. Explain work done in your words, including information about vector, scalar, units, sign and so on. How much network is required to accelerate a **C** kg car from velocity **A** m/s to **B** m/s?
5. Explain gravitational potential energy in your words, including information about vectors, scalars, units, sign and so on. What is the potential energy of a **B** kg person in a skyscraper if it is **C** m above the street by considering the potential energy zero on the level of street?
6. Explain spring potential energy in your words, including information about vector, scalar, units, sign and so on. What is the potential energy stored in the spring of spring constant **C**+1200 N/m that compresses **A** cm distance from its equilibrium?
7. a. Explain momentum in your words, including information about vectors, scalars, units, sign and so on.
 - b. A ball slides with initial velocity **A** m/s on a frictionless surface and collides with another ball with twice of mass at rest. The balls stick together after the collision. What is the final velocity of the balls?
 - c. Calculate the impulse of the light ball if it's mass is 0.5 kg?
 - d. What can you say about the impulse of the other ball? What fundamental principle is this?

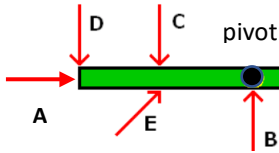
PHY 114 HW5 – Lecture 05: Please follow the instructions given above about the requirements, rules, and submissions.**Show all work with all effort. This will be graded with detailed feedback (75 points):**

1. A friend sits halfway between the rotational axis and the outer edge of the merry-go-round.
 - a. The friend has a tangential speed of **A** cm/s, what will be tangential speeds of you if you sit at the outer edge? **(10 points)**
 - b. When it rotates with speed of **B** RPM (revolution per minute), what is the rotational speed in rad/s? **(10 points)**
2.
 - a. If you lift the shopping bag of **B** kg by hand by bending the elbow only, calculate the torque at the elbow point if the distance from elbow to hand is 30.0 cm. **(15 points)**
 - b. There are two objects separated by **B** cm distance. One object of **C** g in mass on the left and the other one **B** g in mass at the right, find the center of mass point of the system from the right mass? **(20 points)**
 - c. Calculate the moment of inertia of the solid and hollow spheres if mass is **B** kg and radius is 2.00 cm? **(20 points)**

Do for practice and earn (25 points) for completion:

3.
 - a. A friend sits 1/3 way between the rotational axis and the outer edge of the merry-go-round.
 - b. The friend has a tangential speed of **B** cm/s, what will be tangential speeds of you if you sit at the outer edge?
 - c. When it rotates with speed of **B** RPM (revolution per minute), what is the rotational speed in rad/s?
 - d. What will be the rotational speed of you and your friend?

4. In which of the cases shown below is the torque provided by the applied force about the rotation axis biggest? For all cases the magnitude of the applied force is the same and it is **B** N. Calculate maximum torque if the distance from pivot to force in that case is **A** m.



5. A hoop and a disk which have the same mass and radius are released from the top of an incline at the same time. Which one will reach the bottom first? Explain why?
6. Two solid cylinders rotate about an axis that passes through the center of both ends of each cylinder. Cylinder 1 has **B** g mass, and a radius 2.0 cm. Cylinder 2 has twice the mass and the same radius as cylinder 1, they have the same rotational kinetic energy. What is the ratio of the angular velocities, ω_1/ω_2 , for these two cylinders?
7. There are two objects separated by **B** cm distance. One object of **C** g in mass on the left and the other one **B** g in mass at the right, find the center of mass point of the system from the left mass?

PHY 114 HW6 – Lecture 06: Please follow the instructions given above about the requirements, rules, and submissions.

Show all work with all effort. This will be graded with detailed feedback (75 points):

1. A 0.5 kg rock swings in a circle of radius **C**/100 m, if its constant speed is **B** m/s what is the centripetal acceleration and centripetal force on the rock? (10 points)
2. You throw a ball upward of velocity **B** m/s with an angle of 30° from horizontal ground. Assuming negligible air resistance,
 - a. What can you say about the horizontal velocity component along the path of the projectile? Calculate (10 points)
 - b. What can you say about the vertical component of the velocity Calculate (15 points)
 - c. Which component of the velocity will be zero at the highest point? (20 points)
 - d. What can you say about the acceleration components (20 points)

Do for practice and earn (25 points) for completion:

3. If the masses of two planets are each somehow doubled, what will happen to the force of gravity between them?
4. If the distance between two planets is somehow doubled, what will happen to the force of gravity between them?
5. Calculate the force between two objects of mass **B** kg, apart from 100.0 m distance? Take $G = 6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$
6. Determine the speed of the Space Telescope orbiting at a height of **C** km above the earth's surface. Take $G = 6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$, M of the Earth is $5.98 \times 10^{24} \text{ kg}$ and radius of the Earth is $6.38 \times 10^6 \text{ m}$.
7. When an elevator accelerates upward, downward, and free fall what can you say about your weight reading on a scale?

8. Football player punts the ball with some velocity with some angle. The velocity of the projectile can be represented by horizontal and vertical components. Assuming negligible air resistance,
- What can you say about the horizontal velocity component along the path of the projectile?
 - What can you say about the acceleration component in horizontal and vertical direction?
 - What can you say about the velocity component in vertical direction?
 - Which velocity will be zero at the highest point?
 - If the ball did not reach the end of the court what are your suggestions for the player to reach the ball to the end of the court?

PHY 114 HW7 – Lecture 07: Please follow the instructions given above about the requirements, rules, and submissions.

Show all work with all effort. This will be graded with detailed feedback (75 points):

- From electron, proton, and neutron
 - Which of them has the greatest mass? **(10points)**
 - Which of them is smaller in size? **(10points)**
 - Which of them is negatively charged? **(15points)**
- A spring extends to **A** cm when a 1.0kg load is suspended from it. What would be the extended length if a 3.0kg load were suspended from it? **(20points)**
- A nucleus with an atomic number of **B** and a mass number of **C** must have how many electrons, neutrons and protons? **(20points)**

Do for practice and earn (25 points) for completion:

- If you add an electron to the nucleus of an atom, what do you produce, what is the sign of it?
- If you release an electron from the nucleus of an atom, what do you produce, what is the sign of it?
- Is the atomic mass of an atom defined in terms of its number of electrons, protons, neutrons or together?
- Give Isotopes of Fe (iron)? Do they have the same number of electrons, protons, or neutrons?
- Which of the following has the greatest density? **B** g of lead or **B** g of aluminum? Explain why you chose one of them? Which one has the greater volume?
- Explain terms molecule, element, compound, isotopes, and mixture in your words?
- Explain the behavior of atomic size, atomic number and mass number from left to right on periodic table?

PHY 114 HW8– Lecture 08: Please follow the instructions given above about the requirements, rules, and submissions.

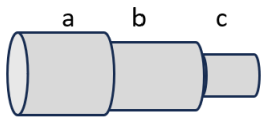
Show all work with all effort. This will be graded with detailed feedback (75 points):

- Calculate the pressure at **B** m below the sea level compared to atmospheric pressure of sea level? Use density of water 1000 kg/m^3 , Gravity, $g = 9.80 \text{ m/s}^2$. **(10 points)**
 - Explain what will happen to the pressure above **B** m from sea level? Use density of air 1.2 kg/m^3 , Gravity, $g = 9.80 \text{ m/s}^2$. **(10 points)**

2. a. A nurse needs to inject liquid medicine into your body by exerting a $A/5$ N force onto a hypodermic syringe. If the barrel of the syringe is 5.0 millimeters in diameter and the syringe's needle is 0.25 millimeters in diameter, how many newtons of force does the medicine come out from the needle into your body? **(15 points)**
- b. What fundamental principle do you use here. **(20 points)**
3. The height of mercury in one barometer is 0.761 m above the reservoir of mercury. If a second barometer is brought to the same location that has a liquid with a density of $C+800$ kg/m³, what is the height of the fluid in the second barometer? **(20 points)**

Do for practice and earn (25 points) for completion:

4. Water flows smoothly through the pipe shown in the figure. Rank the four numbered sections of the pipe according to the flow speed and water pressure by using $>$, $<$, and $=$ notations. Explain why you rank that way.



5. The ground water pump is used to extract water from a well. A pipe extends from the pump to the bottom of the well. Calculate the maximum depth from which water can be pumped? Use density of water 1000 kg/m³, Gravity, $g = 9.80$ m/s²
6. Two solid blocks of identical size are submerged in water. One block is lead and the other is aluminum. Which block has the greater buoyant force? Explain why?
7. When you visit the doctor's office, a nurse calls out your blood pressure as "**B/C**." in systolic blood pressure where **C** is the upper bound, and **B** is the lower bound. What will be this value in Pascals, and do you have unhealthy blood pressure?
8. A hydraulic lift pushes the left piston with **A** N which has a cross-sectional area of 0.50 m². The right piston can be used to lift a car of 8000 N weight. What will be the cross-sectional area of the right piston that can lift the car?
9. If you create a barometer by using a liquid with a density of $C+1000$ kg/m³, what will be the height of the fluid if you keep barometer on the atmosphere?

PHY 114 HW9 – Lecture 09: Please follow the instructions given above about the requirements, rules, and submissions.

Show all work with all effort. This will be graded with detailed feedback (75 points):

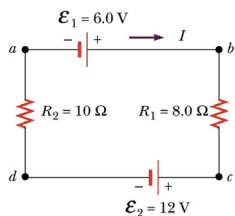
1. Find the equilibrium temperature if you pour 500 g of liquid water at **A** °C to the 10 g of ice bucket of 0°C. Specific heat of water is 4186 J/kg C, latent heat of ice $L_f = 3.33 \times 10^5$ J / kg **(20 points)**
2. How much energy is needed to convert **C** g of water at 15 °C into 100 °C steam? Specific heat of water is 4186 /kg C and latent heat of vapor $L_v = 2.26 \times 10^6$ J / kg **(20 points)**
3. A wave of wavelength **B** m and time between crests of 0.05 second is traveling in water. What is the period, wavelength, frequency, and the wave speed? **(15 points)**
4. What is the period of oscillation of a **A** cm long pendulum? If you extend the pendulum to **B** cm, compare the periods (calculate the ratio of the periods). **(20 points)**

Do for practice and earn (25 points) for completion:

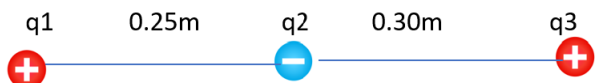
- An absolute zero on the Kelvin temperature scale is 0 K. What is absolute zero on the Celsius and Fahrenheit temperature scale? Convert **B** °C to Fahrenheit and Kelvin.
- Find the equilibrium temperature if you pour 1000 g of liquid water at 90 °C to the 100 g of ice bucket at -20°C. Specific heat of water is 4186 J/kg C, latent heat of ice $L_f = 3.33 \times 10^5$ J / kg.
- You hear thunder **A**/10 s after you see a lightning flash. How far away is the lightning? speed of the sound is 330 m/s.
- Calculate the ratio of the period of two simple pendulums with the same mass but length of **B** cm and **5B** cm.
- Calculate the period of two spring pendulums with the same mass but spring constant of **C** N/m and **2C** N/m.
- If you blow across the opening of a partially filled soda bottle, you hear a tone. If you take a big sip of soda and then blow across the opening again, how will the frequency of the tone change? Explain by drawing harmonics of two cases.

PHY 114 HW10 – Lecture 10: Please follow the instructions given above about the requirements, rules, and submissions.**Show all work with all effort. This will be graded with detailed feedback (75 points):**

- The force between two charges separated by a distance x is **A** N. If the charges are pushed together to a distance $x/2$, what is the force on each charge now? **(20 points)**
- You are sitting a certain distance from a point charge, and you measure an electric field of **A** N/C. If the charge is doubled, what is the electric field strength now? **(20 points)**
- Draw three resistors with resistance **B**, **B+1.0**, and **B+2.0** Ω in series to each other. Find equivalent resistance of all? **(15 points)**
- Determine the current in the circuit, use Kirchoff's rule. **(20 points)**

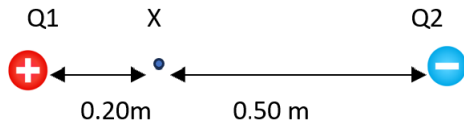
**Do for practice and earn (25 points) for completion:**

- Determine the magnitude and direction of the net force on q_1 if $q_1 = \mathbf{B} \mu\text{C}$, $q_2 = \mathbf{A} \mu\text{C}$ and $q_3 = \mathbf{B}/2 \mu\text{C}$ (All are positive charges)



- The force between two charges separated by a distance d is $\mathbf{A}/2$ N. If one of the charges is double without changing the distance between them, what is the force on each charge now? Do both charges have the same force or not? Explain.

7. At location X in below figure, find the total electric potential.

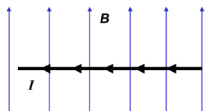


8. Draw three capacitors of capacitance \mathbf{B} , $\mathbf{B}+1.0$, and $\mathbf{B}+2.0$ μF in series to each other. Find equivalent capacitance?
9. Draw three capacitors of capacitance \mathbf{B} , $\mathbf{B}+1.0$, and $\mathbf{B}+1.0$ μF in parallel to each other. Find equivalent capacitance of all?
10. Draw three resistors with resistance \mathbf{B} , $\mathbf{B}+1.0$, and $\mathbf{B}+2.0$ Ω in parallel to each other. Find equivalent resistance of all?

PHY 114 HW11– Lecture 11: Please follow the instructions given above about the requirements, rules, and submissions.

Show all work with all effort. This will be graded with detailed feedback (75 points):

1. If the current of the wire is $\mathbf{A}/10$ Amps upward, calculate magnetic field from $\mathbf{B}/100$ m away from the wire? What is the direction of the magnetic field? **(20 points)**
2. What is the direction of magnetic force acts on the following example? If current is $\mathbf{A}/10$ Amps to the left and the magnetic field $\mathbf{B}/100$ Tesla upward as shown, calculate magnetic force on 0.25 m length wire? **(20 points)**



3. If there is a proton moving with velocity \mathbf{C} m/s upward inside the rightward magnetic field of $\mathbf{B}/100$ Tesla, calculate magnetic force and the direction of the proton? **(15 points)**



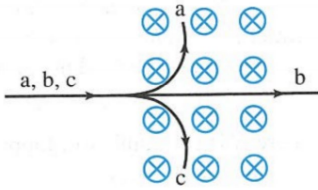
4. If Q3 particle is electron what will be the direction of the electron? If it is neutron what will be the direction? **(20 points)**

Do for practice and earn (25 points) for completion:

5. Draw magnetic field lines on the bar magnet, explain what you know about those lines? Why are they different from electric field lines you learnt in lecture 10?
6. Explain the shape of the magnetic field lines around the current carrying wire. Explain the right-hand rule you use to find the direction of magnetic field lines.
7. Two straight wires run parallel to each other, each carrying a current in the opposite direction. The two wires experience a force. Which direction they will? If they have current in the same direction, which way the wires bend?

8. Explain Faraday's law as you understand?

9. If three particles travel through a region of space where the magnetic field is in to the page, as shown in the figure. What are the signs of the charges of these a, b and c particles?



PHY 114 HW12– Lecture 12: Please follow the instructions given above about the requirements, rules, and submissions.

Show all work with all effort. This will be graded with detailed feedback (75 points):

1. A concave mirror is used to reflect light from an object placed **B** cm in front of the mirror. The focal length of the mirror is **A** cm. Find the location of the image and the magnification by using calculations and draw the ray diagram by using two defined rays. (25 points)
2. A light ray strikes a water/unknown surface at an angle of **B** degrees with respect to the normal. Find the angle of refraction when the direction of the ray is from water to unknown media. The refractive index of water is 1.33 and for the unknown is **C/100**. (25 points)
3. An object is located **B** cm to the left of a *converging lens* that has a focal length of **A** cm. Use analytical calculation and consider a carefully drawn ray diagram for this situation to find image location and magnification? (25 points)

Do for practice and earn (25 points) for completion:

4. If you keep a big J letter 12 cm in front of the plain mirror, what do you see as an image? Draw and explain the distance from mirror to image, image orientation, size and real or virtual?
5. Calculate reflection and refraction angles if you send the light to air/water media with an incident angle **B** degree? The refractive index of air is 1.00 and water is 1.33.
6. What is the speed of light?
7. A convex mirror is used to reflect light from an object placed **B** cm in front of the mirror. The focal length of the mirror is **C** cm. Find the location of the image and the magnification by using calculations and draw the ray diagram by using two defined rays.
8. An object is located **B** cm to the left of a *diverging lens* that has a focal length of **C** cm. Consider a carefully drawn ray diagram for this situation. Find image location and magnification?
9. A concave mirror is used to reflect light from an object placed **A** cm in front of the mirror. The focal length of the mirror is 10 cm. Find the location of the image and the magnification by using calculations and draw the ray diagram by using two defined rays.
10. An object is located **A** cm to the left of a *converging lens* that has a focal length of 15 cm. Use analytical calculation and consider a carefully drawn ray diagram for this situation to find image location and magnification?

Groupwork Assignments:

Redesigning individual student learning activities into group learning activities will benefit various ways of education by building each other's support, connection, and communication. Unloading individual homework and loading in-class group work during a synchronous classroom setting will benefit all levels of individual learning effectively. Assigning most of the classwork to be completed during class time has potential benefits since Students are more likely to be engaged and focused effectively individually and grouply by sharing and communicating ideas together within the class. Therefore, I create group work for personalized classrooms by integrating students' college IDs and a set of specific rules to follow for best learning, imposing a list of roles as below. Each group member has a role and following ground rules related to justice, equity, and diversity inclusion (JDEI) are imposed to facilitate the group work effectively.

List of roles:

- 1: Distribute the roles and ask all to write them on the top.
- 2: Take attendance and ask all to note on their work. Ask them to introduce themselves to the first session.
- 3: Explaining the assignments rules and requirements. Be responsible for explaining them.
- 4: In charge of the ground rules related to justice, equity, diversity inclusion (JEDI) below.
- 5: Listen to instructor carefully and manage given time and distribute among members.
- 6: Help everyone to submit a single PDF file to BB for all assignments.

JEDI (justice, equity, and diversity inclusion) ground rules:

- One person should speak at a time
- Provide reasons when you make statements
- Raise a hand or signal when you have something to say
- Listen carefully to what other people are saying
- Respect other people and their ideas
- Should not interrupt others
- Should not speak too long and give the opportunity to others
- Should not bias in gender, color, major, body shape, college, and all other diversities and demographics

Figure 3: Group work assignment roles and JEDI ground rules to follow.

There are 4-6 students in the group, we met each week during 55 class time to do group work through Zoom breakout rooms and group settings through LMS system. This follows the same process as homework, but problems are using all students' IDs. The first page of each groupwork represents what students need to follow and write before starting problem solving. This structure needed to be practice as a group since all quizzes are followed by the same structure but using individual IDs.

Group work # X- Lecture XXX

Please work with your group, learn from each other, revisit the concepts and requirements together, connect physics to all disciplines and make a great friendship. Always bring any questions to the office hours or during group work sessions. Although you work in a group, individual work should be submitted to BB with self-grading in red color.

- All should be handwritten in your notebook, then scan and submit it as a single pdf file to the blackboard.
- Please don't print or save the assignment, it will be always available and updated on the blackboard.
- All answers should be handwritten clearly, spaced, explained, and ordered starting from question one.
- Use only the fundamental formulas and concepts you learn from this class; no random variables or formulas are allowed.
- Use ChatGPT or AI as a learning tool if you wish to, don't write generated answers without your effort and understanding.
- If you do not follow the requirements, you will receive no credit for the assignment, check the grading rubric.
- Use significant rules throughout the assignment and use units for all answers.
- To start: handwrite the following statement, names, IDs, date, Group #, roles and attendance on it:

"On our honor, we attest that we will follow the letters and spirit of all of this assignment's rules."

Date: _____ Group Number: _____

Students' Names:	Last 4 digits of the ID #:	Attendance:	Roles:
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____

Use the last digit of all of your ID numbers and add them all: _____. This is **A**.

Add 10 to **A**: _____. This is **B**.

Add 100 to **B**: _____. This is **C**.

Write the value of **A**, **B**, and **C** to one decimal place. You may refer to some or all these numbers later in this assignment.

A= _____ **B**= _____ **C**= _____

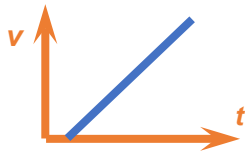
Figure 4: First page for all groupwork assignments that shows class requirements for students to follow.

PHY 114 GW1 – Lecture 01: Please follow the instructions given above about the requirements, rules, and submissions.

1. What is the final correct answer for $B+5.105 \times 10^{11} \cdot 2465$? **(20 points)**
2. Convert A mph (miles per hour) to SI unit? If you drive at this speed, do you exceed the speed limit of 25 m/s? **(20 points)**
3. If you use the ruler to measure the length of your pen in terms of cm, what would be the correct measurement of this length with correct decimal places and units? **(20 points)**
4. A certain physical quantity, P is calculated using formula $P=2 \times B \times C^2$. What will be the SI unit and the value of P to correct significant and accuracy? Consider your measurement are taken as B in kg and C in m/s **(20 points)**
5. Discuss an example of addition, subtraction, multiplication, and division separately to review significance rules. **(20 points)**

PHY 114 GW2 – Lecture 02: Please follow the instructions given above about the requirements, rules and submissions.

1. You run horizontally at B m/s in vertically falling rain at A m/s.
 - e. Draw the vector diagram (tail to head)? **(15 points)**
 - f. Calculate the resultant vector (magnitude and direction)? **(15 points)**
2. a. At a particular instant a free-falling object has a velocity of A m/s. Exactly 3.0 s later its velocity will be? **(15 points)**
 - b. A stone is dropped from a tall building. After $C/100$ s of free fall, what is the displacement of the stone? **(15 points)**
 - c. The graph of velocity versus time for a car is given below. What can you say about the velocity of the car over time? What can you say about the acceleration of the car? **(20 points)**



- d. if the above graph is displacement versus time for a car. What can you say about the displacement, velocity, and acceleration of the car over time? **(20 points)**

PHY 114 GW3 – Lecture 03: Please follow the instructions given above about the requirements, rules, and submissions.

1. A box of mass B kg is resting on the smooth horizontal surface of the table.
 - f. Determine the weight of the box? **(10 points)**
 - g. Find normal force exerted on it? **(15 points)**
 - h. Draw the free body diagram? **(15 points)**
 - i. Now you push the box right with the force of C N. Explain what will happen and calculate the acceleration of the box. (No friction) **(15 points)**

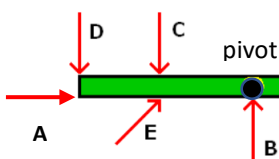
- j. Consider static friction coefficient as 0.50 and kinetic friction coefficient as 0.30, Calculate static friction force and kinetic friction force? **(15 points)**
- k. If the box of mass triple somehow, what force you should box to the right to have the same acceleration as in part d? **(15 points)**
- l. If you bring this box to the moon that has $1/6$ th Earth gravity, what does change? Weight or Mass, explain! **(15 points)**

PHY 114 GW4 – Lecture 04: Please follow the instructions given above about the requirements, rules, and submissions.

1. You are holding a mass of **B** kg on top of the 10.0 m height building.
2. What is the potential energy of the object with respect to the ground. **(10 points)**
3. Now you decide to drop the object to the ground, what is the kinetic energy of the mass, how did you find it? What happens to the above potential energy? **(10 points)**
4. Calculate the velocity when it hits the ground by using energy conservation. **(15 points)**
5. If the object drops on to the spring of spring constant **C**+1000 N/m, calculate the compress distance of the spring by considering all potential energy is converted to spring potential energy? **(15 points)**
6. A ball of mass 0.5 kg slides with initial velocity **A** m/s on a frictionless surface and collides with another ball of three times the mass of the first ball at rest. The balls stick together after the collision.
 - a. Calculate the initial momentum of the system of ball? **(10 points)**
 - b. What is the final momentum of the system, explain how and why? **(10 points)**
 - c. Calculate the final velocity of the balls? **(15 points)**
 - d. Calculate the impulse of the mass 0.5 kg? **(15 points)**

PHY 114 GW5-Lecture 05: Please follow the instructions given above about the requirements, rules and submissions.

1. A friend sits halfway between the rotational axis and the outer edge of the merry-go-round, and you sit on the outer edge.
 - a. The friend has a tangential speed of **A** cm/s, what will be tangential speeds of you? **(15 points)**
 - b. When it rotates with speed of **B** RPM (revolution per minute), what is the rotational speed in rad/s? Is it the same for you and your friend? **(20 points)**
2. a. If you lift the shopping bag of **B** kg by hand by bending the elbow only, calculate the torque at the elbow point if the distance from elbow to hand is 30.0 cm. **(15 points)**
 - b. In which of the cases shown below is the torque provided by the applied force about the rotation axis biggest? For all cases the magnitude of the applied force is the same and it is **B** N. **(15 points)**



- c. A hoop and a disk which have the same mass and radius are released from the top of an incline at the same time. Which one will reach the bottom first? Explain why? **(15 points)**

d. There are two objects separated by C cm distance. One object of A g in mass on the left and the other one B g in mass at the right, find the center of mass point of the system from the left mass? **(20 points)**

PHY 114 GW6-Lecture 06: Please follow the instructions given above about the requirements, rules and submissions.

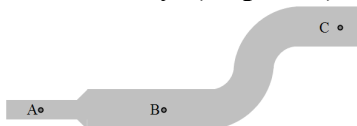
- a) a. A 0.5 kg rock swings in a circle of radius $C/100$ m, if its constant speed is B m/s what is the centripetal acceleration and centripetal force on the rock? **(15 points)**
- b. Determine the gravitation force between Earth and Moon if $G = 6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$, mass of the Earth is 5.98×10^{24} kg and mass of moon is 7.34×10^{22} kg and distance between them is 3.84×10^5 m. **(15 points)**
- c. If the distance between the two is somehow doubled, what will happen to the gravitational force between them? **(10 points)**
- b) You throw a ball upward of velocity A m/s with an angle of 30° from horizontal ground. Assuming negligible air resistance,
- What can you say about the horizontal velocity component along the path of the projectile? Calculate **(15 points)**
 - What can you say about the vertical component of the velocity? Calculate **(15 points)**
 - Which component of the velocity will be zero at the highest point? **(10 points)**
 - What can you say about the acceleration components **(10 points)**
 - If the ball did not reach the expected height, what would be your suggestion to the player to reach the expected height? **(10 points)**

PHY 114 GW7-Lecture 07: Please follow the instructions given above about the requirements, rules and submissions.

- From electron, proton, and neutron
 - Which of them has the greatest mass? **(10points)**
 - Which of them is smaller in size? **(15 points)**
 - Which of them is negatively charged? **(15points)**
 - A nucleus with an atomic number of B and a mass number of C must have how many electrons, neutrons and protons? **(15points)**
 - Is the atomic mass of an atom defined in terms of its number of electrons, protons, neutrons or together? **(15points)**
 - If you add an electron to the nucleus of an atom, what do you produce, what is the sign of it? **(15points)**
 - A spring extends to $A/10$ cm when a 1.0kg load is suspended from it. What would be the extended length if a 3.0kg load were suspended from it? **(15points)**

PHY 114 GW8-Lecture 08: Please follow the instructions given above about the requirements, rules and submissions.

1. a. Calculate the pressure at **B** m below the sea level compared to atmospheric pressure of sea level? Use density of water 1000 kg/m^3 , Gravity, $g = 9.80 \text{ m/s}^2$. **(15 points)**
- b. Explain what will happen to the pressure above **B** m from sea level? Use density of air 1.2 kg/m^3 , Gravity, $g = 9.80 \text{ m/s}^2$. **(15 points)**
- c. A nurse needs to inject liquid medicine into your body by exerting **A**/5 N force onto a hypodermic syringe. If the barrel of the syringe is 50 mm^2 in cross sectional area and the syringe's needle is 10 mm^2 in cross sectional area, how many newtons of force does the medicine come out from the needle into your body? **(15 points)**
- d. The height of mercury in one barometer is 0.761 m above the reservoir of mercury. If a second barometer is brought to the same location that has a liquid with a density of **C**+ 800 kg/m^3 , what is the height of the fluid in the second barometer? **(15 points)**
- e. Water flows smoothly through the pipe shown in the figure. Rank the four numbered sections of the pipe according to the flow speed and water pressure by using $>$, $<$, and $=$ notations. Explain why you rank that way. **(20 points)**



- f. Two solid blocks of the same mass are submerged in water. One block is lead and the other is aluminum. The density of lead is higher than aluminum. Which block has the greater buoyant force? Explain why? **(20 points)**

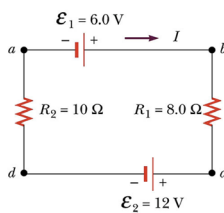
PHY 114 GW9-Lecture 09: Please follow the instructions given above about the requirements, rules and submissions.

Use specific heat of water $=4186 \text{ J/kg C}$, specific heat of ice $=2090 \text{ J/kg C}$, latent heat of ice $L_f = 3.33 \times 10^5 \text{ J / kg}$, latent heat of vapor $L_v = 2.26 \times 10^6 \text{ J / kg}$ for following questions.

1. Find the equilibrium temperature if you pour 800 g of liquid water at **B** °C to the **C**g of ice bucket of 0°C. **(15 points)**
2. How much energy is needed to convert **C** kg of ice at $-15 \text{ }^\circ\text{C}$ into $100 \text{ }^\circ\text{C}$ steam? **(20 points)**
3. A wave of wavelength **B** m and time between crests of 0.05 second is traveling in water. What is the period, wavelength, frequency, and the wave speed? **(15 points)**
4. What is the period of oscillation of **A** cm long pendulum? If you extend the pendulum to **B** cm, compare the periods (calculate the ratio of the periods). **(15 points)**
5. You hear thunder **A**/10 s after you see a lightning flash. How far away is the lightning? The speed of the sound is 330 m/s . **(15 points)**
6. If you blow across the opening of a partially filled soda bottle, you hear a tone. If you take a big sip of soda and then blow across the opening again, how will the frequency of the tone change? Explain by drawing harmonics of two cases. **(20 points)**

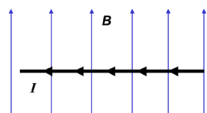
PHY 114 GW10-Lecture 10: Please follow the instructions given above about the requirements, rules, and submissions.

1. The force between two charges separated by a distance x is $A/10$ N. If the charges are pushed away from each other to a distance $2x$, what is the electric force on each charge now? **(15 points)**
2. You are sitting a certain distance from a point charge, and you measure an electric field of B N/C. If the charge is doubled, what is the electric field strength now? **(15 points)**
3. Draw three resistors with resistance B , $B+1.0$, and $B+2.0$ Ω in series to each other. Find equivalent resistance of all? **(15 points)**
4. Draw three resistors with resistance B , $B+1.0$, and $B+2.0$ Ω in series to each other. Find equivalent resistance of all? **(15 points)**
5. Draw three capacitors of capacitance A , $A+1.0$, and $A+2.0$ μF in series to each other. Find equivalent capacitance? **15 points)**
6. Draw three capacitors of capacitance A , $A+1.0$, and $A+1.0$ μF in parallel to each other. Find equivalent capacitance of all? **15 points)**
7. Determine the current in the circuit, use Kirchhoff's rule. **(10points)**



PHY 114 GW11-Lecture 11: Please follow the instructions given above about the requirements, rules, and submissions.

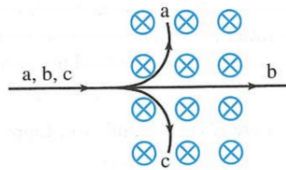
1. If the current of the wire is $A/10$ Amps upward, calculate magnetic field from $B/100$ m away from the wire? What is the direction of the magnetic field? **(15 points)**
2. What is the direction of magnetic force acts on the following example? If current is $A/10$ Amps to the left and the magnetic field $A/100$ Tesla upward as shown, calculate magnetic force on 0.25 m length wire? **(15 points)**



3. If there is a proton moving with velocity 2×10^5 m/s rightward inside the magnetic field of $A/100$ Tesla pointing inward, calculate magnetic force and the direction of the proton? **(15 points)**



4. If question 3 particle is electron what will be the direction of the electron? If it is neutron what will be the direction? **(15 points)**
5. Explain the shape of the magnetic field lines around the current carrying wire. Explain the right-hand rule you use to find the direction of magnetic field lines. **(15 points)**
6. Two straight wires run parallel to each other, each carrying a current in the opposite direction. The two wires experience a force. Which direction they will bend? If they have current in the same direction, which way do the wires bend? **(15 points)**
7. If three particles travel through a region of space where the magnetic field is into the page, as shown in the figure. What are the signs of the charges of these a, b and c particles? **(10 points)**



PHY 114 GW12-Lecture 12: Please follow the instructions given above about the requirements, rules, and submissions.

1. A light ray strikes a water/unknown surface at an angle of **A** degrees with respect to the normal. Find the angle of refraction when the direction of the ray is from water to unknown media. The refractive index of water is 1.33 and for the unknown is **C/100**. **(20 points)**
2. A concave mirror is used to reflect light from an object placed **B** cm in front of the mirror. The focal length of the mirror is **A** cm. Find the location of the image and the magnification by using calculations and draw the ray diagram by using two defined rays. **(20 points)**
3. An object is located **B** cm to the left of a *converging lens* that has a focal length of **A** cm. Use analytical calculation and consider a carefully drawn ray diagram for this situation to find image location and magnification? **(20 points)**
4. A convex mirror is used to reflect light from an object placed **B** cm in front of the mirror. The focal length of the mirror is **A** cm. Find the location of the image and the magnification by using calculations and draw the ray diagram by using two defined rays. **(20 points)**
5. An object is located **B** cm to the left of a *diverging lens* that has a focal length of **A** cm. Use analytical calculation and consider a carefully drawn ray diagram for this situation to find image location and magnification? **(20 points)**

Unit wise Quizzes:

Unit quizzes are assigned to do at the end of each unit. The problems of the unit quizzes are like the worksheet and homework/ group work problems and are also integrated with the last 4 digits of the student's ID to vary the problem and individualize the conclusion. Quizzes are done synchronously and proctored via a video conference system. The following are the quizzes for one of the semesters as samples to show here. They are updating each semester to balance academic integrity. Figure is provided as first page for all quizzes with formula sheet.

PHY 114 QuizX – Lecture XXX-XXX

This is a test; you should do it individually. You will receive zero if I found you work with someone else or plagiarize in any other way. You can use only my class materials and complete it during class time.

- It is very important that your internet connection is stable to take the quiz.
- If you are not sure how to follow requirements, please read below and watch the quiz guide on the blackboard.
- All should be handwritten in your notebook, then scan and submit it as a single pdf file to the blackboard.
- Please don't print or save the assignment, The test will be available on the blackboard when you are ready to take.
- All work should be shown and handwritten clearly, spaced, explained, and ordered starting from question one.
- Starting the work to each question by writing the fundamental formulas and concepts you learn from this class; no random variables or formulas are allowed.
- If you do not follow the requirements, you will receive no credit, please check the grading rubric for more information.
- Don't use ChatGPT or AI, don't write generated answers for this exam, it should be your own work.
- Use significant rules throughout the assignment and use units for all answers.
- To start: handwrite the following statement, sign, and date on it:

"On my honor, I attest that I will follow the letter and spirit of all of this assignment's rules."

Date: _____ Signature: _____

Student Name: _____ Last 4 digits of Student ID#: _____

Use the last four digits of your ID number and add them all: _____. This is **A**.

Add 10 to **A**: _____. This is **B**.

Add 100 to **B**: _____. This is **C**.

Write the value of **A**, **B**, and **C** to one decimal place. You may refer to some or all these numbers later in this assignment.

A=_____ **B**=_____ **C**=_____

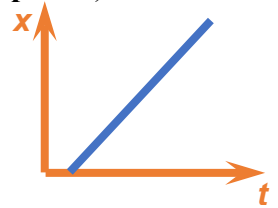
Figure 5: First page for all quizzes that shows class requirements for students to follow.

PHY 114 Quiz1-Lecture 1-3: Please follow the instructions given above about the requirements, rules, and submissions.

1. Vectors: You run horizontally at 10.0 m/s in a vertically falling rain at $\frac{B}{10}$ m/s.
- Define a vector and draw it to show vector representation? (5 points)
 - Draw the vector diagram (tail to head) for the above problem that you run on the rain? (10 points)
 - Calculate the resultant vector in magnitude? (5 points)
 - Relative to you, the raindrops are falling at an angle of? (5 points)

c) Linear motion

- What is the distance fallen after $\frac{C}{100}$ s for a freely falling object started from rest? (5 points)
- What is the speed of the object if it falls $\frac{B}{10}$ m down started from rest? (5 points)
- The graph of position versus time for a car is shown on the right.
What can you say about the velocity of the car over time? (5 points)
What can you say about the acceleration of the car over time? (5 points)



- d) Newton's laws: A box of mass **B** kg is resting on smooth horizontal surface of the table (no acceleration).
- Draw the free body diagram? (5 points)
 - Calculate the weight of the box? (5 points)
 - Calculate the normal force exerted on it? (5 points)
 - Now you push the box right with the force of **C** N. Calculate the acceleration of the box? (No friction) (10 points)
 - Calculate kinetic frictional force by considering kinetic friction coefficient as 0.35 (5 points)
4. Measurements: A solid cylinder of mass **C** g has a radius of 0.50 cm and height **B**/10 cm. From this data,
- Calculate the volume of the cylinder? (10 points)
 - Calculate the density of the material made up the cylinder? (5 points)
 - Calculate the weight of the cylinder? (5 points)
 - Calculate the force of gravity of the cylinder? Is it different from part c? (5 points)

PHY 114 Quiz2-Lecture 4-6: Please follow the instructions given above about the requirements, rules, and submissions.

1. Work and Energy: There is a trampoline which is connected to spring of spring constant 1200 N/m on the bottom to the ground. You, a mass of **B** kg is staying 5.00 m above the trampoline.
- What is your potential energy with respect to the trampoline. (10 points)
 - Now you decide to jump (zero velocity) onto the trampoline, what is the kinetic energy of you when you reach the trampoline? What principle do you use here? (10 points)
 - Calculate the velocity when you hit the trampoline (5 points)
 - If trampoline spring compresses **B** cm down, calculate the spring potential energy (5 points)

2. Momentum, torque, and center of mass

- a. A ball with mass 0.5 kg slides with initial velocity $\frac{B}{5}$ m/s on a frictionless surface and collides with another identical ball of mass 0.5 kg at rest. The balls stick together and move forward direction after the collision.

Calculate initial momentum of the system? **(5 points)**

What is the final momentum of the system, what principle did you use here? **(5 points)**

Calculate the final velocity of the balls? **(10 points)**

- b. If you lift the patient of mass **B** kg by bending your back joint only, calculate the torque you created on the back? Take straight distance from the object to your back as 100.0 cm **(10 points)**
- c. There are two objects separated by 50.0 cm distance. One on the left is $\frac{B}{10}$ kg in mass and the other one is on the right with $\frac{C}{50}$ kg in mass. Calculate the center of mass point of the system from the left object? **(10 points)**

3. Rotational and centripetal motion

- a. You sit halfway between the rotational axis and the outer edge of the merry-go-round. If your tangential speed of $\frac{B}{5}$ m/s, what will be tangential speed of your friend who sits at the outer edge? **(10 points)**
- b. A 8.0 kg rock swings in a circle of radius 35.0 cm, if its constant speed is $\frac{C}{50}$ m/s calculate the centripetal acceleration? Calculate the centripetal force? **(10 points)**
- c. You are throwing a basketball, and the ball takes the path of the projectile. Neglect air resistance. What can you say about the horizontal and vertical components of the acceleration along the path of the projectile? Do you know the values? If so, write them with correct decimal and units. **(10 points)**

PHY 114 Quiz3-Lecture 7-9: Please follow the instructions given above about the requirements, rules, and submissions.

1. Atomic structure and Oscillation

- a. A nucleus with an atomic number of **B** and a mass number of **C** must have how many electrons, neutrons, and protons? **(10 points)**
- b. What are the parameters that affect the period of simple pendulum? There are two same mass pendula but different lengths: one has length $\frac{C}{10}$ m and the other has $\frac{C}{5}$ m. To compare the periods, find period ratio $\frac{T_1}{T_2}$ **(10 points)**
- c. The hanging spring extends $\frac{B}{10}$ cm when a 1.0 kg load is suspended from it. What would be the extend length if a 0.5kg load were suspended from it? **(10 points)**
- d. You blow into one end of an open pipe and produce a tone. What happens to the frequency of the tone if you close one end of the pipe and blow into it again? Explain how you prove this by drawing and using frequency ratio **(10 points)**

2. Pressure

- Find the pressure at **B** m below the sea level with compared to sea level pressure. Use density of sea water as 1023.6 kg/m^3 , gravity, $g = 9.80 \text{ m/s}^2$ **(10 points)**
- A nurse injects liquid medicine into your body by exerting 3.0 N force onto a hypodermic syringe. If the barrel of the syringe is $\frac{B}{5} \text{ mm}^2$ and syringe's needle is $\frac{B}{15} \text{ mm}^2$ in cross sectional areas, how many newtons of force does the medicine come out from the needle into your body? **(10 points)**
- If you built a barometer by using a liquid density **C** $+ 1150 \text{ kg/m}^3$, what is the height of the liquid if you use it to measure the atmospheric pressure. (Atmospheric pressure is $1.013 \times 10^5 \text{ Pa}$)? **(10 points)**

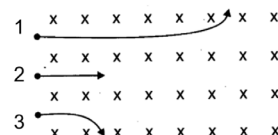
3. Heat and Temperature

- How much energy is needed to convert $\frac{B}{5} \text{ kg}$ of ice at -10°C degree into 20°C water? Specific heat of water is 4186 J/kg C and latent heat of vapor $L_v = 2.26 \times 10^6 \text{ J/kg}$, specific heat of ice is 2090 J/kg C and latent heat of ice is $L_f = 3.33 \times 10^5 \text{ J/kg}$. **(10 points)**
- Find the equilibrium temperature if you pour 500 g of liquid water at **A** $^\circ\text{C}$ to the **B** g of ice bucket at 0°C . Specific heat of water is 4186 J/kg C and latent heat of vapor $L_v = 2.26 \times 10^6 \text{ J/kg}$, specific heat of ice is 2090 J/kg C and latent heat of ice is $L_f = 3.33 \times 10^5 \text{ J/kg}$. **(10 points)**
- Convert **B** $^\circ\text{C}$ to Fahrenheit and Kelvin scales? **(10 points)**

PHY 114 Quiz4-Lecture 10-12: Please follow the instructions given above about the requirements, rules, and submissions.

1. Consider following circuits:

- Draw three resistors **B**, **B+2**, and **B+4** Ω series to each other and connect to a battery of 12 V . **(5 points)**
 - Calculate equivalent resistance of the three resistors? **(5 points)**
 - Calculate the total current of the circuit? **(5 points)**
 - Draw the same three resistors parallel to each other and connect to the battery of 12 V . **(5 points)**
 - Calculate equivalent resistance of the three resistors parallel to each other? **(5 points)**
 - Draw three capacitors **A**, **A+2**, and **A+4** μF series to each other and connect to the battery of 12 V **(5 points)**
 - Calculate the equivalent capacitance of the circuit. **(5 points)**
 - Draw the same three capacitors parallel to each other and connect to the battery of 12 V **(5 points)**
 - Calculate the equivalent capacitance of the circuit. **(5 points)**
- If three particles (neutral, proton and electron) project through a region of space where the magnetic field is into the page as shown right. Label the particle names for path 1, 2 and 3 and explain why you choose them that way **(10 points)**

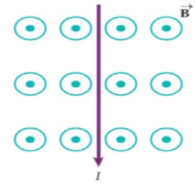


b. What direction is the magnetic force acting on the right

figure (magnetic field pointing out and current downward)?

If current $I = \frac{B}{10}$ Amps and magnetic field, $B = \frac{C}{100}$ Tesla, and wire length

is 0.75 m calculate the magnetic force (**15 points**)



3. a. An object is located **B** cm to the left of a *concave mirror* that has a focal length of **A** cm. Use analytical calculation to find image location and image magnification (**10 points**)
- b. By careful drawing of ray diagram for part **a.**, find image location and magnification from the ray diagram. Use colorful, scale drawings with other discussed information to receive full credits? (**10 points**)
- c. A light ray strikes a glass/water surface at an angle of **B** degrees with respect to the normal. Calculate the angle of refraction of the ray to the glass. The refractive index of water is 1.33 and for glass is 1.55. (**10 points**)

Sample Concepts Questions from Slido or LMS:

I develop my own conceptual questions that measure students' understanding of the materials. They keep updating each semester to balance academic integrity and provide students to work and think conceptually how to navigate the materials and what they really need to learn to apply for problem solving. Following is the sample questions for one previous semester.

Lecture 1:

1. How many significances in 30.26
 - a. 1
 - b. 2
 - c. 3
 - d. 4
2. How many significances in 30.00
 - a. 1
 - b. 2
 - c. 3
 - d. 4
3. How many significances in 0.026
 - a. 1
 - b. 2
 - c. 3
 - d. 4
4. How many significances in 30260000
 - a. 3
 - b. 4
 - c. 6
 - d. 8

5. What is answer for 2.00×3.5
 - a. 7
 - b. 7.0
 - c. 7.00
 - d. 7.000

6. What is the answer for $152.00 + 35.5$
 - a. 187.5
 - b. 187.50
 - c. 188
 - d. 187

7. Choose the answer which is not in SI units?
 - a. m
 - b. s
 - c. kg
 - d. g

8. If the physical parameter, P is calculated by using the $P=A/B$ formula if A is measured in units of m, B is measured in s, what will be the units of P?
 - a. m/s
 - b. s/m
 - c. kg/s
 - d. s/kg

9. What is the final answer for $32.5 + (2.000 \times 50.00)$
 - a. 132.50
 - b. 132.5
 - c. 133
 - d. 132.5000

10. What is the correct reading of the ruler?
 - a. 32.50 cm
 - b. 32.5 cm
 - c. 33 cm
 - d. 32.51 cm

11. If you find the area of a square of length 1.25 cm, it will be
 - a. 1.56 cm^2
 - b. 1.56 cm^3
 - c. 1.56 cm
 - d. 1.5625 cm^2

12. If you calculate the density of material that has mass 20.0 g and volume 8.00 cm^3 , it will be
 - a. 2.5 g/cm^3
 - b. 2.50 g/cm^3
 - c. 2.500 g/cm^3
 - d. 2.50 g/cm

Lecture 2:

1. What is not true about the Vector?
 - a. has a direction.
 - b. has a magnitude.
 - c. has a unit.
 - d. has a time.
2. Which one of the following is a vector?
 - a. You travel 10 miles to the North.
 - b. speedometer value of your automobile.
 - c. Falling rain
 - d. Winding
3. What is true about a scalar quantity?
 - a. has a magnitude
 - b. has a direction
 - c. never has a unit
 - d. it is always positive value
4. Which one of following is not a scalar quantity?
 - a. temperature
 - b. speed
 - c. force
 - d. mass
5. If you travel 8 meters to the left and another 6 meters to the left. What is the resultant displacement?
 - a. 14 meters to the left
 - b. 14 meters to the right
 - c. 2 meters to the left
 - d. 2 meters to the right
6. If you travel 8 meters to the left and 6 meters to the right. What is the resultant displacement?
 - a. 14 meters to the left
 - b. 14 meters to the right
 - c. 2 meters to the left
 - d. 2 meters to the right
7. If you travel 8 meters to the East and 6 meters to the North. What is the resultant displacement?
 - a. 10 meters, angle greater than 45 degrees w.r.t +X
 - b. 10 meters, angle less than 45 degrees w.r.t +X
 - c. 14 meters, angle less than 45 degrees w.r.t +X
 - d. 14 meters, angle greater than 45 degrees w.r.t +X
8. If you travel 8 meters to the East and 8 meters to the North. What is the resultant displacement direction?
 - a. less than 45 degrees
 - b. greater than 45 degrees
 - c. exactly 45 degrees
 - d. none of the above
9. What is true about velocity?
 - a. It is the slope of the displacement as a function of time
 - b. It is the slope of the velocity as a function of time
 - c. It is the slope of the acceleration as a function of time

10. If you drive at constant velocity, what will be your acceleration?
 - a. increasing
 - b. decreasing
 - c. Constant-but zero
 - d. Constant-but non zero
11. If you drop the object, what is its initial speed?
 - a. 9.80 m/s
 - b. zero
 - c. 10.0 m/s
 - d. Can't be determined.
12. What is acceleration of a free fall object?
 - a. 9.80 m/s² upward
 - b. zero
 - c. 9.80 m/s² downward
 - d. It is changing with time
13. When you drop the ball from some height, what will be the best description about velocity?
 - a. Stay constant.
 - b. Increasing linearly in downward direction
 - c. decrease linearly in a downward direction.
 - d. no linear increase or decrease.
14. When you drop the ball from some height, what will be the best description of the distance it travels?
 - a. keep increasing but non-linear.
 - b. keep increasing but linear.
 - c. not changing
15. When you drop the ball from some height, what will be its velocity after one second?
 - a. zero
 - b. 9.80 m/s
 - c. 19.6 m/s
 - d. Can't be determined.

Lecture 3:

1. What is not true about force?
 - a. It is a vector.
 - b. It is pull or push.
 - c. The unit is Newton.
 - d. It is a scalar.
2. What is not true about Newtons first law?
 - a. It is the law of inertia.
 - b. Mass times acceleration is the force.
 - c. Every object stays at rest as long as no net force acts on it.
 - d. Moving objects with uniform velocity is kept moving as long as no net force acts on it.
3. What is not true about Newtons second law?
 - a. Moving objects with uniform velocity is kept moving as long as no net force acts on it.
 - b. Mass times acceleration is the force.
 - c. Force increases when mass is accelerated.

4. If you apply 10.0 N force to 1.0 kg mass, what will be its acceleration?
 - a. 10.0 m/s^2
 - b. 0.0 m/s^2
 - c. 9.8 m/s^2
 - d. Can't be determined.
5. What is true about mass and weight?
 - a. mass and weight are the same.
 - b. mass times g is the weight.
 - c. mass is different in two planets.
 - d. weight is the same in two planets.
6. What is FBD?
 - a. It is the force diagram of the object.
 - b. It is the vector diagram of the object.
 - c. It is the drawing of the object.
 - d. It is a geometrical drawing of vectors.
7. What is not true about the friction?
 - a. Friction force acts when two objects rubbing each other.
 - b. Friction is required for everyday life.
 - c. There are frictionless surfaces.
 - d. Friction force acting on the same direction as object moves.
8. Friction that keeps an object at rest
 - a. Static friction
 - b. Kinetic friction
9. Friction that acts during the motion
 - a. Static friction
 - b. Kinetic friction
10. Which friction coefficient is greater?
 - a. Static
 - b. Kinetic
11. Frictional coefficient is changing,
 - a. when you change the rubbing materials.
 - b. when you change the surface areas.
 - c. When you have different masses
 - d. When object accelerate
12. What is the force of gravity of an object that has 500g mass?
 - a. 4.9 N
 - b. 4900 N
 - c. 9.8 N
 - d. zero
13. If there is an object on the table which has a force of gravity is 10.0 N, what is the normal force that acts on it?
 - a. keep increasing but non-linear.
 - b. keep increasing but linear.
 - c. not changing
14. When an object is sitting on an inclined surface, what can you say about normal force?
 - a. Equal to force of gravity
 - b. Not equal to force of gravity
 - c. There is no normal force.

15. Normal force is
- Always equal to force of gravity
 - Always perpendicular to contact two surfaces.
 - Always downward direction.
 - 9.80 N

Lecture 4:

- In physics, work represents a
 - Work you do everyday
 - Force you applied
 - measurable change in a system, caused by a force.
 - Applying force but object stay at rest
- What is work done
 - Apply force x the distance object moves
 - Apply force x the displacement of the object x cosine angle between force and the displacement
 - Apply force
 - Displacement
- What will be unit of work?
 - Newtons
 - Joules
 - Meters
- Can work done be negative
 - No, it is always positive
 - Yes, it can be negative when object display opposite direction than force
- What is example force that always do negative work?
 - Applied force
 - Friction force
 - Centripetal force
- Kinetic energy is energy of motion, how it can be calculated
 - $\frac{1}{2} \times \text{mass} \times \text{velocity squared}$
 - $\frac{1}{2} \times \text{mass} \times \text{velocity}$
 - Mass x g x height
- Can KE be negative?
 - always
 - never
 - sometime
- Gravitational potential energy is the energy of the position, which formula is correct?
 - $\frac{1}{2} \times \text{mass} \times \text{velocity squared}$
 - Mass x g x vertical height
 - Mass x velocity squared
 - $\frac{1}{2} \times \text{mass} \times \text{g}$
- Can PE be negative
 - Yes, since it is dependent on PE=0 point
 - No, since it is just a value
 -

10. When spring compress, it holds energy, that is the spring potential energy, how do you calculate it?
 - a. $\frac{1}{2} \times \text{mass} \times \text{velocity squared}$
 - b. $\frac{1}{2} \times \text{spring constant} \times \text{velocity squared}$
 - c. $\frac{1}{2} \times \text{spring constant} \times \text{displacement squared}$
11. Can spring potential energy negative?
 - a. Never
 - b. Sometime
 - c. Always
12. What is true about the momentum?
 - a. It is a vector and calculate by mass times velocity
 - b. It is a scaler and calculate by mass times velocity
 - c. It is a vector and calculate by mass times distance
13. What is the unit of momentum
 - a. kg m
 - b. kg/ m
 - c. kg m/s
 - d. N/s
14. Impulse is
 - a. change of momentum
 - b. change of velocity
 - c. change of acceleration
15. Power is work per unit time, what is the unit?
 - a. Joules
 - b. Watts
 - a. c. Newtons

Lecture 5:

1. If you and your friend decide to ride a merry-go-round, who feels faster
 - a. One closer to the center
 - b. One closer to the rim
 - c. Both has the same velocity.
2. when you and your friend ride a merry-go-round, one who sits closer to the rim has greater liner speed, why?
 - a. because of greater radius
 - b. because of larger mass
 - c. because of greater rotation
3. Torque is a twist or turn that tends to produce a rotation, how do you calculate it
 - a. applied force x distance between force and the rotational axis x sine angle between distance
 - b. applied force x distance between force and the rotational axis
 - c. applied mass x distance between force and the rotational axis
4. What is the unit of torque?
 - a. Newtons
 - b. N/s
 - c. Nm

5. The period of oscillation is
 - a. the time for one revolution
 - b. number of revolutions per second
 - c. time between two oscillations
6. The frequency of oscillation is
 - a. number of revolutions per second
 - b. the time for one revolution
 - c. number of oscillations between two time periods
7. You do an experiment by using the same mass but different shaped objects. You decide to roll them all on the inclined surface. They came down at different times, why is that?
 - a. They may have different rotational inertia
 - b. They may have different force of gravity
 - c. They may have different friction
8. When you spin, you decide to bring your arms together, your speed
 - a. will increase
 - b. Will decrease
 - c. stay the same
9. Center of mass of the object is
 - a. mass concentrated point
 - b. where you push the object
 - c. force concentrated point
 - d. Anywhere is the object
10. What is unit of rotational KE?
 - a. Newtons
 - b. Joules
 - c. Kg
11. Can rotational KE be negative?
 - a. Always
 - b. Never
 - c. Sometime
12. You rotate a bicycle wheel 3 rotation per second, What is the frequency of rotation?
 - a. 3
 - b. $1/3$
 - c. 0
13. More moment of inertia means
 - a. more resistance to the motion
 - b. less resistance to the motion
 - c. no resistance to the motion
14. when you and your friend ride a merry-go-round, what is the same for both?
 - a. Angular speed
 - b. Linear speed
 - c. Moment of inertia
 - d. Circumference they move.

15. What is not conserved quantity that you learnt?
- Linear Momentum
 - Mechanical Energy
 - Angular momentum
 - Moment of inertia

Lecture 6:

- Uniform circular motion is
 - motion along a circular path with constant speed
 - motion along a parabolic path with constant speed
 - motion along a circular path with changing speed
- Centripetal force
 - is the force toward object of the circular motion
 - is the force that has no direction
 - is the force toward the center of the circular motion
- Centripetal acceleration is dependent on
 - mass of the object
 - linear velocity
 - rotational speed
 - Moment of inertia
- Centripetal acceleration is calculated by
 - Mass x velocity squared/ radius
 - velocity squared/ radius
 - velocity/ radius
- The gravitational force between two planets is
 - proportional to both masses.
 - proportional to distance between them
 - proportional to both masses.
 - force of gravity on Earth
- Force of gravity at poles are
 - greater than equator
 - less than equator
 - equal to equator value
- Weightlessness is
 - the complete absence of the sensation of weight.
 - the weight of any object falling
 - You feel it when you ride an elevator
- When elevator accelerate up, you feel
 - more weight
 - less weight
 - nothing feels
- What is the discovery of Kepler
 - the motion of planets was not circular; rather, it was elliptical
 - the motion of object on Earth
 - Rotations of object
 - Centripetal force concept

10. If you project the ball that takes a projectile path, what directional velocity will be zero at maximum height?
 - a. x directional
 - b. y directional
 - c. x and y both directional
11. If you project the ball that takes a projectile path, what directional velocity will be stay the same throughout the process?
 - a. x directional
 - b. y directional
 - c. x and y both directional
12. If you project the ball that takes a projectile path, what directional acceleration will stay the same?
 - a. x directional
 - b. y directional
 - c. x and y both directional
13. If you project the ball that takes a projectile path, what directional acceleration will be zero?
 - a. x directional
 - b. y directional
 - c. x and y both directional
14. What is best angle you should punt the ball to reach maximum range?
 - a. 0
 - b. 30
 - c. 45
 - d. 90
15. If you project the ball in 30 degrees, what will be the other angle you should project the ball to reach the same range?
 - a. 0
 - b. 30
 - c. 45
 - d. 60

Lecture 7:

1. Chose best answer about the characteristics of atoms
 - a. Incredibly tiny
 - b. Numerous
 - c. Perpetually in motion
 - d. Ageless
 - e. All of above
2. Atomic structure composed of
 - a. electrons
 - b. protons
 - c. neutrons
 - d. All the above

3. What is lightest particle in atomic structure

- a. electrons
 - b. protons
 - c. neutrons
4. What is the particle that has no charge?
- a. electrons
 - b. protons
 - c. neutrons
 - d. All the above
5. Composition of living things include
- a. Oxygen
 - b. Carbon
 - c. Hydrogen
 - d. Nitrogen
 - e. Calcium
 - f. All the above
6. Periodic table is
- a. A chart of elements arranged by atomic number
 - b. A chart of elements arranged randomly
 - c. A chart of compounds arranged randomly
7. Diameters of the outer electron shells
- a. gradually increase from left to right across the periodic table.
 - b. gradually decrease from left to right across the periodic table.
 - c. gradually decrease from top to bottom of the periodic table.
8. Negative ion has
- a. an excess of electrons.
 - b. deficiency of electrons
 - c. an excess of protons
 - d. the same number of electron and protons
9. Isotopes are.
- a. Atoms of the same element with different numbers of electrons
 - b. Atoms of the same element with different numbers of neutrons
 - c. Atoms of the same element with different numbers of protons
10. mass number is
- a. total number of protons and neutrons in the nucleus
 - b. total number of protons and electrons in the nucleus
 - c. total number of protons, electrons, and neutrons in the nucleus
11. Which one of the following is the mixture?
- a. salt
 - b. water
 - c. air
12. Density depends upon
- a. mass of the atoms.
 - b. spacing between the atoms.
 - c. Both above

Lecture 8:

1. Pressure is
 - a. force per unit time
 - b. force per unit area
 - c. force per unit distance
2. What is not a Unit of pressure
 - a. Newton per meter squared
 - b. Pascal
 - c. Atm
 - d. Newtons
3. Fluid is
 - a. gas
 - b. liquid
 - c. Both of above
4. If you stand on one foot instead of two?
 - a. create high pressure
 - b. create low pressure
 - c. create high force
 - d. create low force
5. Pressure will
 - a. increase when you go higher
 - b. decrease when you go higher
 - c. decrease when you go lower
6. Pressure at h meter depth on air is
 - a. -density of air $\times g \times h$
 - b. density of air $\times g \times h$
 - c. density of air $\times g$
7. If make a vertical row of holes in your water bottle, which one pumps water to the farthest
 - a. the bottom hole
 - b. the middle hole
 - c. the top hole
8. Which one of the following instruments does not use pressure principle?
 - a. Barometer
 - b. Air pressure meter
 - c. Tire gauge
 - d. blood pressure meter
 - e. blender
9. You have three mercury barometers designed by using different lengths, areas, and masses, what is the correct conclusion of their mercury level?
 - a. every barometer has different levels
 - b. taller one has highest level
 - c. Stay the same as 76.0 cm
 - d. every barometer has different levels
 - e. taller one has highest level
10. Buoyant force is
 - a. always greater than the force of gravity
 - b. always less than the force of gravity

- c. is the force acting upward when any object is in a fluid.
11. Buoyant force is calculated by
 - a. mass of the displayed fluid
 - b. weight of the displayed fluid
 - c. None of the above
 12. Bernoulli's Principle states that
 - a. narrower tubes flow speed is greater, and pressure is less
 - b. pressure is force per unit area
 - c. Buoyant force
 - d. Floating and sinking objects

Lecture 9:

1. Temperature is
 - a. a measure of how hot or cold something is
 - b. a measure of how hot something is
 - c. a measure of how we feel the environment
2. The freezing point of water is 0°C and the boiling point of water is 100°C . What are those values in Fahrenheit?
 - a. 32°F ; 273°F .
 - b. 32°F ; 212°F .
 - c. 52°F ; 212°F .
3. The average normal body temperature is
 - a. usually 57.0 C (128.6 F)
 - b. usually 27.0 C (88.6 F)
 - c. usually 37.0 C (98.6 F)
4. When solid object is heated
 - a. its volume and length expand
 - b. It stays the same size
 - c. it moves
5. Heat is a form of energy, which unit is not the unit of heat?
 - a. Joules
 - b. Calories
 - c. Nm
 - d. Watts
6. The amount of heat required to change the temperature of a material is
 - a. specific heat
 - b. latent heat
 - c. total heat
 - d. proportional to the mass only
 - e. proportional to the mass and to the temperature change
 - f. proportional to the temperature change only
7. Heat conservation law says
 - a. heat lose is specific heat
 - b. heat lose by hotter object equals to heat gain by cooler object

- c. heat gain is latent heat
8. When a substance changes phases without a change in temperature, it is
- specific heat
 - latent heat
 - total heat
9. Heat energy can be transferred from one body to another in three different ways. Which one of following is not a heat transfer technique?
- radiation
 - conduction
 - convection
 - watering
10. Period of simple pendulum is dependent on
- Temperature
 - Length
 - mass
 - pressure
11. Period of spring pendulum is dependent on
- temperature
 - mass
 - pressure
 - value of g
12. Sound can't travel through
- glass
 - water
 - air
 - vacuum
13. Audible range is the range of frequency that human can hear, what is that range?
- 20 Hz to 20,000 Hz
 - above 20,000 Hz
 - below 20 Hz
14. There are two tubes of the same length. Tube A has one closed end and tube B has both open ends. If you blow to these two tubes,
- Both tubes produce the same frequency
 - Tube A produce higher frequency
 - Tube A produce lower frequency

Lecture 10:

1. Coulomb law explains: electric force between two charges

- a. is proportional to the product of the charges and inversely proportional to the distance between them.
 - b. is inversely proportional to the product of the charges and proportional to the distance between them.
 - c. is equal to the product of the charges and to the distance between them.
2. The same sign charges are
 - a. repel each other
 - b. attract each other
 - c. stay at equilibrium
 3. The electric field is
 - a. the force per unit electron
 - b. the force per unit positive charge
 - c. the force
 4. Electric field direction of positive charge
 - a. pointing toward the charge
 - b. pointing outward from the charge
 - c. Just randomly oriented
 5. An equipotential is
 - a. electric field lines
 - b. a line or surface that has the constant potential
 - c. potential zero lines
 6. Capacitor
 - a. stores energy
 - b. produce lights
 - c. produce current
 7. The value of the capacitor is the capacitance, it can be changed by changing
 - a. area of the plates
 - b. distance between plates
 - c. media between plates
 - d. all of the above
 8. Unit of current is
 - a. Ampere
 - b. Coulomb
 - c. Volt
 - d. Watts
 9. The value of the resistor is the resistance, it can be changed by changing
 - a. length of the wire
 - b. cross section area of the wire
 - c. different material of the wire
 - d. All of the above
-
10. When three resistors are connected series to each other, the equivalent resistance is
 - a. greater than each of individual resistance
 - b. less than each of individual resistance

- c. greater than the smallest resistance only
- 11. When three resistors are connected parallel to each other, the equivalent resistance is
 - a. greater than each of individual resistance
 - b. less than each of individual resistance
 - c. greater than the smallest resistance only
- 12. When three capacitors are connected in series to each other, the equivalent capacitance is
 - a. less than each of individual capacitance
 - b. greater than each of individual capacitance
 - c. none of the above
- 13. When three capacitors are connected parallel to each other, the equivalent capacitance is
 - a. less than each of individual capacitance
 - b. greater than each of individual capacitance
 - c. None of the above
- 14. There are two light bulbs that are connected series to each other, if one bulb is burnt
 - a. the other still light up
 - b. the other still light up with low intensity
 - c. the other not light up at all
- 15. There are two light bulbs that are connected parallel to each other, if one bulb is burnt
 - a. the other still light up
 - b. the other still light up with high intensity
 - c. the other not light up at all

Lecture 11:

- 1. Magnets always has
 - a. one pole
 - b. two poles
 - c. zero poles
- 2. If you break a magnet into pieces, each piece should have
 - a. two poles as North and South
 - b. single separated pole
 - c. Only North pole
- 3. Magnetic field lines are
 - a. linear
 - b. circled around
 - c. vertical
- 4. Magnetic force on current carrying wire inside the magnetic field depends on
 - a. current
 - b. length
 - c. magnetic field
 - d. angle between wire and field
 - e. All of the above
- 5. Magnetic force on moving charge particle inside the magnetic field depends on
 - a. charge
 - b. velocity

- c. magnetic field
- d. angle between velocity and field
- 6. e. All of the above
- 6. Magnetic force on moving neutral particle inside the magnetic field is
 - a. zero
 - b. Non zero
 - c. upward
- 7. Two parallel wires will carry the current in opposite directions, they will
 - a. attract each other
 - b. repel each other
 - c. stay the same
- 8. Faraday's law is
 - a. about induced current and voltage
 - b. about power source
 - c. about the voltage of the battery
- 9. Magnetic flux will change when
 - a. magnetic field changes
 - b. angle between field and area changes
 - c. area of the loop changes
 - d. All of the above
- 10. Which of following is not using the concepts of Faradays law
 - a. Transformers
 - b. Induction coil
 - c. electric motor
 - d. microwave
- 11. Faraday explains about induce current or voltage, to induce current or voltage he told something should be changed with time, what is it
 - a. magnetic field
 - b. current
 - c. voltage
 - d. magnetic flux
- 12. The current carrying wire will create magnetic field around the wire, field strength will be stronger
 - a. closer to the wire
 - b. far away from the wire
 - c. independent of the distance

Lecture 12:

1. Law of reflection is
 - a. incident angle equal to reflection angle
 - b. incident angle equal to refraction angle
 - c. it is dependent on the two media
2. Plane mirror creates
 - a. virtual image
 - b. smaller image
 - c. larger image
3. Focal length of spherical mirror is
 - a. the radius
 - b. half of the radius
 - c. twice of the radius
4. Convex mirror always create a
 - a. virtual image
 - b. smaller size image
 - c. upright image
 - d. All of the above
5. Concave mirror can create a
 - a. virtual image
 - b. real image
 - c. smaller image
 - d. larger image
 - e. inverted image
 - f. upright image
 - g. All of the above
6. Diverging lens always create a
 - a. virtual image
 - b. larger image
 - c. inverted image
7. Lenses follow
 - a. reflection law
 - b. refraction law
 - c. both above
8. Converging lens can create
 - a. virtual image
 - b. real image
 - c. Both above
9. Focal point of the convex mirror is
 - a. sitting behind the mirror, therefore it is negative
 - b. Sitting Infront of the mirror, therefore it is positive
 - c. None of the above
10. Focal length of diverging lens is always
 - a. positive
 - b. negative

- c. can be positive or negative
11. Focal length of converging lens is always
 - a. positive
 - b. negative
 - c. can be positive or negative
 12. Refractive index is
 - a. ratio of velocity of light at vacuum to velocity of light in the media
 - b. ratio of velocity of light in the media to velocity of light in the air
 - c. it is independent of velocity of light in vacuum
 - d. a parameter that has units
 - e. unitless ratio
 13. f. always smaller than 1
 13. Snell's law explains about
 - a. lights reflection
 - b. lights refraction
 - c. lights interference
 14. Chromatic dispersion of white light is
 - a. refraction of different color lights in different angles
 - b. light diffraction
 - c. light interference
 - d. light reflection