PHYSICS 1111 **Warmup 0** **Name: <u>Fold and print name on back</u>**

WarmUp Get to know your book and concepts to brush up on from Section 1.2

Reading Objectives for getting to know your book

- Locate the 9 tables in appendix C and familiarize yourself with this very useful tool.
- Notice that appendix D will be very helpful when connecting symbols with the name/definition of the concept that it stands for.
- Familiarize yourself with the layout of the information from each chapter: Introduction, then sections, then glossary, then section summaries.
- Familiarize yourself with the layout of questions/problems/exercises at the end of each chapter: Conceptual Questions followed by Problems and Exercises.
- Find the student solutions manual on the OpenStax website. Notice that some of the solutions are included, but not all.

1. Use table C1 in appendix C of your text to look up the value of the gravitational constant, ***G***.

2. Use table C6 in your book to look up how many kilometers are in 1 mile.

3. In the preface of the student solutions manual (page 12), what is stated as the worst thing you can do with the solutions manual?

4. Which appendix of the text includes the periodic table?

5. Consider Figure 1.20 in your text. What is shown in the picture?

Warmup Topic: **1 Dim Kinematics, Acceleration, Velocity, Kinematic Eqs.**

- Chapter 2 Sections 2.3, 2.4, 2.5
- Equations 2.5, 2.10, 2.28, 2.29, 2.35, 2.40, 2.46 [2.50 to 2.54]
- Note: equation 2.50 comes from the definition of average velocity and is valid regardless of whether the acceleration is constant or not (it [eq 2.50] should not be grouped with 2.51 to 2.54)
- Definitions of acceleration, velocity, displacement
- Kinematic equations for special case of constant acceleration
- Distinction among initial and final
- Distinction among initial velocity, final velocity, average velocity, change in velocity and speed (all using the symbol "v")

Online Resource: https://www.compadre.org/Physlets/mechanics/intro2.cfm
You may enter values of -20, -5, and 2 for each box. You may play with the graphs (right or left click and see)

1. A car accelerates uniformly from 20.0 m/s to 40.0 m/s in 5.00s. What is the acceleration during this interval (you must include correct units)?

   a=_____________

2. Give a definition of velocity (for one dimensional motion). Give both a verbal definition and a formula.

3. Give the four kinematic equations valid for **constant acceleration** as listed in class notes. I have started you out on each. Find them in class notes.

$v =$

$\overline{v} =$

$\Delta x =$

$v^2 =$

Warmup Topic: 1 Dim Kinematics, ball straight up, simple v vs t plot

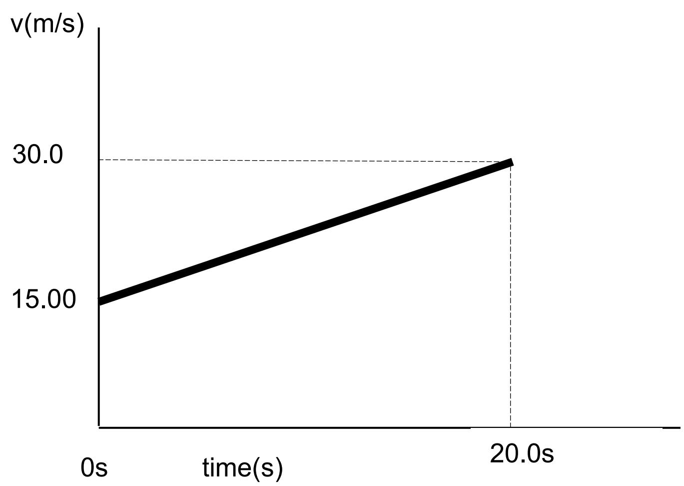
- Chapter 2 sections 2.7, 2.8
- Equations 2.75 to 2.77
- Example 2.14 and figure 2.42
- Example 2.17
- Fig 2.48 b
- Distinguish between acceleration and velocity
- Special application of free fall where acceleration = - g (what is g?)
- Analysis of v vs t plot with constant acceleration
    - Slope, area under, and average

1. A ball is thrown straight upward from the ground with an initial speed of 19.60m/s. When the ball reaches the peak height (at the peak)

    what is the velocity of the ball (at the peak)?____________________

    and what is the acceleration of the ball (at the peak)?_______________________

2 and 3. Refer to the v vs t plot below.



2. What is the average velocity for the trip? The velocity is indicated by the solid sloped line on this plot?

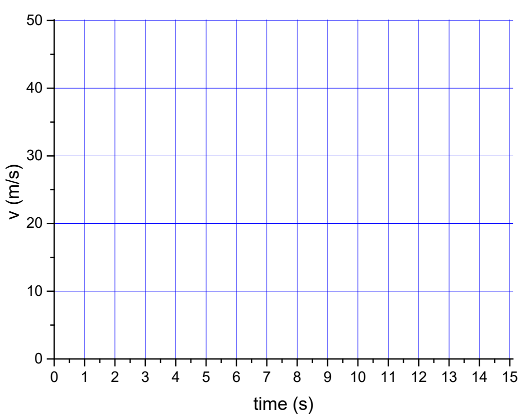
3. What is the constant acceleration during the 20.0s trip (in question 2)?

4. What is the distance traveled for the 20.0s trip?

Cooldown 1 dim kinematics

- Chapter 2 problem using one dimensional kinematics
- Graphical analysis---2 different constant accelerations
- v vs t plot   slope and area
- Displacement (distance, how far)
- Average speed
- Car on a ramp (like our lab, uses "g sin(θ))
    - Distance, speed, acceleration relations
    - Kinematic equations

1. A train conductor travels along and sees a truck parked on the tracks ahead. The train is travelling along the track at a constant 30.00m/s. It takes the train conductor 5.00s to react. The train punches the brakes and has an acceleration of -3.00m/s^2.
    a. Sketch a plot of v vs. t below. Note that t=0 is when conductor first notices the truck ahead.



    b. How far does the train travel while stopping (from t=0 until stopped)?

    c. What is the average speed during the trip?

2. A car initially at rest rolls down a ramp with an acceleration of $4.90 m/s^2$. The car rolls for 30.00cm. (you can look ahead to lab notes to see what angle such a ramp is set to)
    a. How fast is the car going as it passes the 30.0cm mark?

    b. How much time did the car take to travel the 30.0cm?

3. The same car as in problem 2 is now rolled upward along the same ramp with an initial speed of 0.980m/s.
    a. How much time does it take the car to reach the peak position (turning point)?

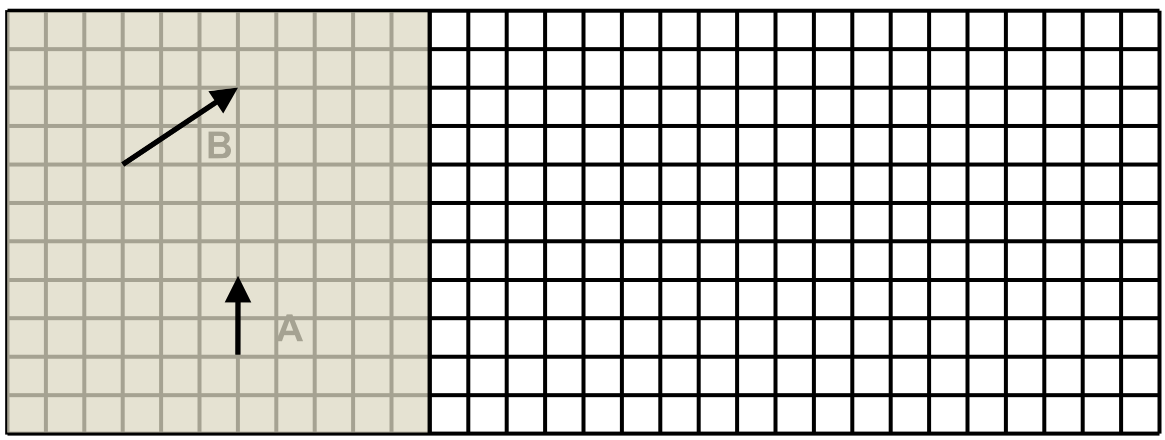
    b. What is the distance traveled by the car by the time it reaches the peak position?

    c. What is the average speed the car has during its trip upward to the turning point.

Warmup Topic: Vector Addition

- Chapter 3 sections 3.1 to 3.3
- Figure 3.17 to 3.19, 3.32
- Eqs 3.6, 3.7, 3.10, 3.11, 3.12, 3.13
- Example 3.3
- Graphical vector addition
- Analytical vector addition
- Resultant, Magnitude, Direction of vector.

1. In the figure below there are two vectors $\vec{\mathbf{A}}$ and $\vec{\mathbf{B}}$. Draw/sketch (on the grids somewhere outside the gray box) a vector $\vec{\mathbf{R}}$ that is the sum of the two, (i.e. $\vec{\mathbf{R}} = \vec{\mathbf{A}} + \vec{\mathbf{B}}$). Clearly label the resultant vector as $\vec{\mathbf{R}}$.



2. Use the grid from problem 1 to determine the horizontal and vertical components of the resultant vector (R_x and R_y respectively). Consider each box to be 1.00m by 1.00m.

R_x=

R_y=

3. For the vector given in problems 1. and 2. find the magnitude and direction (angle) of the resultant vector.

4. A ball is thrown initially at 40.0m/s in a direction of 30º above the horizontal. What are the initial horizontal and vertical components of velocity? Use appropriate symbols and units.

PRINT NAME:________________________

Warmup Topic: 2 Dim Motion Projectile

- Chapter 3 Section 3.4
- Equations 3.29 to 3.32 written for both "x" and "y"
- Example 3.4 and 3.5
- Note: What is the vertical acceleration? (for projectile motion….free fall)
- What is the horizontal acceleration? (for projectile motion….free fall)
- Velocity, acceleration at peak (this is 2 dimensional motion)

1. A ball is thrown initially at 20.0m/s in a direction of 60º above the horizontal. What are the initial horizontal and vertical components of velocity?

$V_{x\ init}=$	
$V_{y\ init}=$	

2. For the ball thrown in problem 1, **one of the four kinematic equations** is used to determine the time it takes for the ball to reach the peak. Write out the equation first (using symbols), and then plug in the numbers. DO NOT SOLVE— DO NO ALGEBRA

Kinematic equation:

Equation with numbers:

3. What is the velocity of the ball from problem 1 at the peak height (careful---it is not zero)?

4. What is the average vertical speed for the time interval from launch until the ball is at the peak?

Name:__________________

Warmup Topic: 2 Dim Motion Projectile

- Chapter 3 Section 3.4
- Equations 3.29 to 3.32 written for both "x" and "y"
- Example 3.4 and 3.5
- Note: What is the vertical acceleration? (for projectile motion….free fall)
- What is the horizontal acceleration? (for projectile motion….free fall)
- Velocity, acceleration at peak (this is 2 dimensional motion)

1 Spiderman releases his webbing and launches into the air moving at 50.0m/s at an angle of 40^{o} above the horizontal. He is trying to clear a wall that is 100 m ahead of him and a height of 60.0m.

a. What are the horizontal and vertical components of velocity?

b. Spidey is either going to clear the wall or fall short. At what time is Spiderman at the wall?

c. By how much does Spiderman (boy? Whichever spiderverse) make it over or miss clearing the wall?

d. What is the velocity vector of Spiderman as he passes (or hits) the wall? (magnitude and direction).

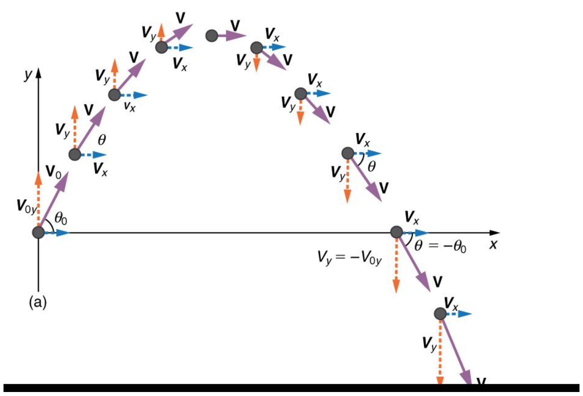
Name:___________________________________

Cooldown **Two dim projectile motion**

- Chapter 3 Section 3.4
- Equations 3.29 to 3.32 written for both "x" and "y"
- Example 3.4 and 3.5
- Note: What is the vertical acceleration? (for projectile motion….free fall)
- What is the horizontal acceleration? (for projectile motion….free fall)
- Velocity, acceleration at peak (this is 2 dimensional motion)
- Problem relates to lab—marble rolling off table

1. In a daring movie stunt, a 1966 Ford Thunderbird drives off a cliff launching horizontally at a launch speed of 50.0m/s. The cliff is 100.0m above the ground below.

   a. On the figure below, which "v" (circle) best describes what is happening at the time the care drives off the cliff?



   b. How long does it take for the car to reach the ground (assume all safety precautions are used- --somehow)?

   c. How far has the car landed from the edge of the cliff in the horizontal direction?

d. What is the vertical component of the cars velocity as it strikes the ground (not after)?

e. What is the velocity vector of the car as it strikes the ground?

Name:_____________________________

Warmup **start forces**

- Sections 4.1-4.5
- Newton's laws
- Free body diagram(s) (figures throughout chapter) (Fig. 4.15)
- Weight, Normal force
- See example 4.5 but get rid of friction

1. Consider the cart you used in lab sitting on a ramp. Tilt the ramp at 30^o from the horizontal. The carts have a mass of 0.500kg. What is the acceleration of the mass on the ramp (you know this from your lab) and what is the net force on the cart (remember how net force and acceleration are related)

2. In problem 1 sketch a free body diagram of the forces acting on the cart.

3. What is the weight (magnitude of force due to gravity) acting on the cart in problem 1?

4. What is the normal force acting on the cart?

Name:______________________________

Warmup **Ramp simple**

- Example 4.5
- Newton's 2^{nd} law (Isaac not Professor)
- Apply 2^{nd} law, Weight, determine acceleration

1. A 50.00kg box sits on a frictionless ramp. The ramp is at an angle of 20.0^{o} above horizontal. Sketch a free body force diagram for the box.

2. In problem 1 give the magnitude of each of the forces.

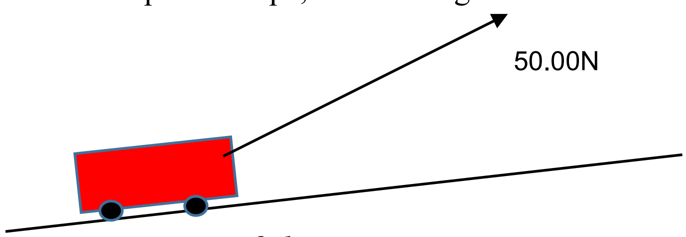
3. give the magnitude and direction of acceleration

Name:____________________________

Cooldown **Wagon on a ramp**

- Ch. 4 Newton's laws
- Vector addition, free body diagram
- Weight, normal, pulling forces

You pull on the handle of a 30.00kg loaded Radio Flyer red wagon with a pulling force of 50.00N. This causes the wagon to accelerate. You are pulling the wagon on a hill with a 10^{o} upward slope, and the wagon handle is at an angle of 30^{o} **above the ramp**.



a) Draw a ***careful*** **free body force diagram** indicating (with labels) all the forces acting on the wagon. There are 3 forces (F_{pull}, and the other two being gravitational force and normal)

b) What is the weight of the loaded wagon?

c) What is the acceleration perpendicular (normal) to the ramp?

d) Using an x axis pointing up along the ramp, fill in a vector addition table for the three forces. After you have a table you may write out the x and y component of Newton's 2^{nd} law.

e) What is the magnitude of acceleration of the wagon, and is it up or down the ramp (remember that the "x" axis should be along the ramp)?

f) What is the normal force acting on the wagon? (it is not equal to the weight)

Name:__________________

Warmup Forces Elevator Example

- Example 4.9
- Figure 4.24 b
- Forces in one dimension
- Acceleration non-zero
- Apparent Weight (bad term for force due to scale)

1. You are carrying a bag full of biology books, giving you total weight (you and the books) of 980N while standing on a scale in an elevator at rest. Later, when the elevator is moving upward at a constant velocity the reading on the scale has: (circle best answer)

   Increased

   Decreased

   Remained the same

2. While the elevator was increasing speed from rest to the constant velocity in part 1, the reading on the scale:

   Increased

   Decreased

   Remained the same

3. The cable breaks, and you find yourself in desperate trouble. What is the reading on the scale while in free fall? Use Newton's 2^{nd} law explicitly to show your result.

4. Along comes assistance, your friendly neighborhood spiderman grabs the cable and pulls up with the greatest force he can. You (being completely unfazed by events) note the reading on the scale is now 735N. What is the acceleration of the elevator?

Warmup Friction

- Section 5.1
- Eqs. 5.2,3, 4
- Free Body Force diagram
- Newton's 2^{nd} law

1. Your car sits on a level road surface. You push on the car which was accidentally left in park. Sketch a free body diagram indicating all the forces acting on the car (use appropriate symbols for all).

2. Given a 1.00kg sitting **at rest** on a level table with coefficient of friction equal to 0.500, with no additional forces pushing horizontally, what is the static frictional force acting on the mass?

3. In question 2, you now apply a horizontal force of 4.00N to the mass. What is the acceleration?

4. The coefficient of friction given in question 2 was “static”. How hard do you need to push on the object to just make it accelerate?

5. Continuing with the object in question 2, are you able to determine the acceleration of the object if you push twice as hard as you found in question 4? Explain why or why not?

Warmup circular motion Phys1111 Fall 2019 Dr. Colbert
Ch. 6 Section 2 (partly)
Ch. 6 Section 3
Centripetal Acceleration Equation 6.17
Centripetal Force (**Really Net Force**)
Equations 6.23 and 6.24

1. In section 6.3 of your text. What is the first full sentence of the 2nd paragraph in the section? What one THREE letter word is critical in that sentence?

2. A 100 kg student sits in a roller coaster car making an inside loop with 20.0m radius at a speed of 30.0m/s. Sketch a free body force diagram for this situation when the student is at the top of the loop?

3. In problem 2, what is the net force acting on the student? (both magnitude and direction)

Name:_________________

Warmup Universal Gravitation and orbits Phys1111 Fall 2019
Dr. Colbert

Section 6.5
Equations 6.40, 6.41, 6.42, 6.43
Equations 6.52, 6.54
Equation 6.61
Universal Law of Gravitation, Centripetal force.

NOTE: WHEN I GIVE GRAVITATION PROBLEMS-----I WILL GIVE PLANET MASSES IN UNITS OF "EARTH MASSES" AND DISTANCES IN UNITS OF "EARTH RADII".

1. You (a typical 75.0kg physics student) are pushed out of the airlock (from the Heart of Gold spaceship) at a distance of 3.00Earth radii from a planet with twice the mass of the Earth. What is the gravitational acceleration at your location? Also give the gravitational force acting on you? (YOU SHOULD NOT NEED "G" "M_{EARTH}" or "R_{Earth}" to do this.

2. If you are lucky in problem 1 you might be well preserved if you have the right speed and direction to maintain a circular orbit. What speed is required (for conditions of problem 1)? You will need to know the radius of the Earth which is ~6400km.

3. For problem 2, assuming you achieve orbit, what is the centripetal acceleration and centripetal force acting on you (two answers)?

Name:________________

Warmup 14 PHYS1111 Work/Energy Name:_____________

Fall 2019 Dr. Colbert

- Equation 7.1 Definition of Work done by a ***particular force F***
- Equation 7.11 **Net** Work causes a change in Kinetic Energy
    - This statement leads to other more useful conservation of energy statements
- Equation 7.13 Definition of Kinetic Energy KE
- Gravitational Potential Energy $\Delta PE = mg\Delta y$ up defined as positive
    - We often say "mgh"
    - EQUATIONS 7.34 AND 7.35 SHOULD NOT BE WRITTTEN THIS WAY. THERE SHOULD BE SUBSICRIPTS INDICATING INITIAL OR FINAL HEIGHT, AND INITIAL OR FINAL SPEED. THERE SHOULD ALSO BE ZERO'S FOR THE OTHER TERMS.
    - 7.35 THIS WAY. "KINETIC ENERGY AT ONE TIME CAME FROM THE POTENTIAL ENERGY AT ANOTHER TIME".
- Mechanical Energy is Kinetic plus Potentials (KE+PE). In many problems this is the Total Energy (E or E_{tot})

1. A 1.00kg object is lifted at a constant velocity by from ground to a height of 10.00m? The object was then placed at rest on a window ledge at that height. How much work was done to lift the object?

2. What is the gravitational potential energy of the object at the 10.00m height?

3. The object falls off the ledge and passes by you looking out your window at a height of 3.00m?
    a. What is the total mechanical energy of the object as it passes 3.00m?
    b. What is the gravitational potential energy as the object passes 3.00m?
    c. What is the Kinetic energy as the object passes 3.00m?
    d. What is the speed of the object as it passes 3.00m?

Warmup Momentum Phys1111 Fall2019 Dr. Colbert

- Eq 8.1---Definition of momentum
- Equation 8.7 NEWTON'S SECOND LAW RESTATED
- The sentence below equation 8.17---definition of "IMPULSE"
- 8.31 Conservation of Momentum (same as 8.33 and 8.34)
- Inelastic Collision -Example 8.5

  Note that in "PERFECTLY INELASTIC" collisions the objects stick together
  If objects stick together that means the final velocity is the same for each object

1. Define both impulse and also momentum.

2. You are sitting still in deep space (perfectly still) in your space suit enjoying your view. You are wearing a space suit making your total mass 100.00kg. You notice another astronaut headed your way at a speed of 10.00m/s (this is either Matt Damon or Sandra Bullock—your preference). The other astronaut has the same mass as you. You successfully catch the other astronaut rescuing them from oblivion.

   i) What is the other astronaut's magnitude of momentum prior to your catching them?

   ii) What is the combined momentum of you and the other astronaut after you catch them?

3. While conservation of momentum is universally correct, it is primarily used in physics to describe what type of physics events (one word here)?

Name:_________________

Warmup Momentum and Energy
Perfectly Inelastic Collision: PHYS1111 Fall 2019 Dr. Colbert

1. In a quick-draw contest, wearing full protective gear, you fire a Potato gun at your lab partner (don't do this for real). Your lab partner also wearing perfectly frictionless roller skates. The potato weighs 1.00 kg and is moving 25.0m/s when it strikes your 49.0 kg lab partner who is initially at rest. The potato sticks to your lab partner, who is now rolling along.

    a) What is the initial momentum of the potato?

    b) What is the momentum of your lab partner/potato immediately after the collision?

    c) What is the speed of the potato/person immediately after the collision?

    d) What is the kinetic energy of the potato immediately before the collision?

    e) What is the kinetic energy of the potato-person immediately after the collision?

f) What is the ratio of the kinetic energy before to kinetic energy after (this is simply dividing)

g) Was energy conserved during this collision—explain your answer (briefly)?

h) In part f, what characteristics of this experiment/event determine the ratio that you get for the end result?

Name:___________________________

Warmup Angular Kinematics Phys1111 Fall 2019 Dr. Colbert

- I am covering chapters 9 and 10 as one unit-Rotation
- First-Sections 10.1 and 10.2 on rotational kinematics (think of this like kinematic equations for one dimensional motion)
- Table 10.2 ---**<u>should also have equation 10.20 in it.</u>**
- Know symbols, names and definitions for each quantity
- Know arc length and distance around a circle—also see table 10.1
-

1. Give the symbols used for angular displacement, angular speed (or velocity), and angular acceleration.

2. Given a circle with radius 0.100m, what is the angle around the edge of a quarter circle, and what is the distance around a quarter circle (what units should you use for angle)?

3. List the five kinematic rotational equations (similar to our linear kinematics) for constant angular acceleration (see my bullet points above bold and underlined statement).

4. Your bicycle wheel has a radius of 0.300m and an initial angular speed of 10.00Radians/s. The bicycle comes to rest in 1.00s.
    a. How much angle does the wheel travel through in this time?

    b. How far does the bicycle travel?

    c. What is the average angular speed?

    d. What is the angular acceleration?

Name:_________________

Warmup 18 Torque and moment of inertia Phys1111 Fall2019 Dr. Colbert

- Eqs 9.3, 9.4, 9.5 definitions of torque and lever arms
- Fig 9.26 (remember CG and CM effectively mean the same thing)
- EQ 10.43 (this is like F(net)=ma---similar)
- Figure 10.12 (what is most like your arm?)
- EQ 10.60 and conservation of energy (like we did in lab).

1. You hold your arm (0.75m long) straight out and level. Your arm is uniform and weighs 5.00kg. What is the torque applied by gravity on your arm (think about where the force is applied)?

2. Your shoulder muscles holding up your arm in problem 1 get tired and completely collapse. Your arm starts falling from the initial position (rotating about an axis at one end---your arm does not fall off your shoulder). What is the angular acceleration your arm has **initially** (the angular acceleration is not constant)?

3. What is the moment of inertia of your arm?

4. As your arm falls, gravitational potential energy (OF WHAT POINT) gets converted to rotational kinetic energy. What is the angular speed of the arm as it swings through the vertical position? (YOU MUST USE ENERGY CONSERVATION FOR THIS).

Name:_________________

Warmup 19 Springs 1 Phys1111 Fall 2019 Dr. Colbert

- Equilibrium Position
- Energy 16.33, 34, 35
- Speed vs position 16.39 (I call big X—Amplitude, A)
- Time period 16.56

A 0.500kg mass on a spring is released at a distance of 10.0cm from the equilibrium position.The spring constant is 50.0N/m.

1 What is the maximum speed of the mass?

b) As the mass moves through 4.00cm position, what is the total energy of the system?

c) What is the time period for one full oscillation of this system?

d) What is the speed of the mass as it passes the position in part b?

Name:________________

Warmup 20 Springs 2 Phys1111 Dr. Colbert

- Time period 16.56
- Motion of mass on spring
    - x(t) v(t) a(t)
        - Equations 16.20, 21, 22---
        - I use ‘A” for amplitude rather than big “X”.
-

A 0.2500kg mass is pulled 20.00cm from equilibrium while on a spring with spring constant 1.00N/m. The mass is released from rest at t=0 from the maximum displacement (20.00cm).

1 What is the time period for the oscillation?

2 Where is the mass located at 0.500s?

3 How fast is the mass moving at the time given in part b?

4 What is the acceleration of the mass at the time given in part b?

Name:_________________

PHYSICS 1111 **Name: ______________________________**

WarmUp 1 - Get to know your book and concepts to brush up on from Section 1.2

Reading Objectives for getting to know your book

- Locate the 9 tables in appendix C and familiarize yourself with this very useful tool.
- Notice that appendix D will be very helpful when connecting symbols with the name/definition of the concept that it stands for.
- Familiarize yourself with the layout of the information from each chapter: Introduction, then sections, then glossary, then section summaries.
- Familiarize yourself with the layout of questions/problems/exercises at the end of each chapter: Conceptual Questions followed by Problems and Exercises.
- Find the student solutions manual on the OpenStax website. Notice that some of the solutions are included, but not all.

1. Use table C1 in appendix C of your text to look up the value of the gravitational constant, ***G***.

2. Use table C6 in your book to look up how many kilometers are in 1 mile.

3. In the preface of the student solutions manual (page 12), what is stated as the worst thing you can do with the solutions manual?

4. Which appendix of the text includes the periodic table?

5. Consider Figure 1.20 in your text. What is shown in the picture?

PHYSICS 1111 **Name: ____________________________**

WarmUp 2 - Due 19 August

Review of unit conversions and intro to velocity and acceleration.

Reading Objectives for Textbook section 1.2

- Review unit conversion (know how to convert from one unit to another i.e. km to miles)
- Review metric prefixes and scientific notation

Reading Objectives for Textbook section 2.1

- Understand how to identify the displacement of an object in an example
- How is displacement different from position? How is it different from distance traveled?
- **Reading Objectives for Textbook section 2.2**
- Pay special attention to the definition and discussion of the term **vector.**

Reading Objectives for Textbook section 2.3

- Understand the difference between t and Δt. When are they the same?
- Notice that equation 2.5 and 2.6 are the same equation, just t_0 is taken to be t=0.
- Be sure to notice the author's discussion of the difference between velocity and speed. Which one is a vector and which is only a magnitude?

Reading Objectives for Textbook section 2.4

- Know the definition of acceleration and how to calculate a simple example
- What two things might be changing when an object is accelerating

1. My 2012 Hyundai Elantra is quicker from "zero-to-sixty" than my Ford Escort. In fact, it can accelerate from 0 to 60mph in just 6 seconds.

a. How fast is 60mph in SI units (meters/second or m/s)? Show your work.

b. What is the *acceleration* of my car (use metric SI units)? See section 2.3 and watch those units!

2. If it takes me 30 minutes to run a 5k (that is 5.0 kiolmeters) then what is my average velocity in units of m/s?

PHYSICS 1111 **Name: ____________________________**

WarmUp 3 – Due 21 August

Reading objectives for section 2.3

- Understand the definition of average velocity and know how to use equation 2.5
- Understand the meaning of instantaneous velocity and how it is different from average velocity
- Notice that initial velocity and final velocity are both types of instantaneous velocity

Reading objectives for section 2.4

- Understand the definition of acceleration
- Notice that equation 2.10 involves average acceleration
- Know the difference between average acceleration and instantaneous acceleration (they are the same when the acceleration is constant)
- Think about which way the acceleration vector points when an object is speeding up and which way it points when an object is slowing down.

Online resources you might want to try

www.kahnacademy.org go to science > physics > One-dimensional motion > Displacement, velocity, and time > What is velocity?

www.physicsclassroom.com go to Physics-Interactives > 1-D-Kinematics : Try name that motion

1. P.F. Newton is ready to get going in his vintage Lightning McQueen battery operated car. He starts at rest and hits the gas and starts to speed up with a constant acceleration. 10 seconds later he is traveling at a brisk 3.0 m/s. What are the values of his initial velocity, final velocity, average velocity, change in velocity, and his acceleration?

2. Briefly explain in your own words, the difference between final velocity and average velocity. When are the two the same?

PHYSICS 1111 **Name: ______________________________**

WarmUp 4_ Due Friday, 23 August

Reading objectives for section 2.5

- Know your 5 kinematic equations: equations 2.50 – 2.54 (You should practice writing these from memory every time you sit down to practice working problems. The sooner you know these equations, the sooner you will become proficient at working out sample problems.)
- Pay special attention to equations 2.24. These are definitions and the notation is used interchangeably in different parts of this chapter.
- Note the assumption made in equation 2.25. This assumption is used throughout this section and is needed for the 5 kinematic equations to be valid.
- Notice that all of the other kinematic equations included in this section are rearrangements of these 4 equations.
- Pay attention to figure 2.27 and how it relates to equation 2.50. Also notice that equation 2.50 is just a rearrangement of equation 2.26 which was the definition of average velocity.

On a previous warmup, I impressed you with the acceleration capability of my 2012 Hyundai Elantra, because it went from zero to sixty in just 6 seconds. But if you *really* want to be impressed, imagine that my car is hoisted by a large crane and dropped from rest. If you ignore air resistance….

1. How long will it take to reach 60mph (~25m/s) under the influence of gravity? (Recall that the acceleration due to gravity is $9.8 m/s^2$ towards the ground.)

2. During that time, how far does it fall?

PHYSICS 1111 **Name: ____________________________**

WarmUp 5 – Due 26 August

Reading Objectives for Section 2.7

- Note the definition of free fall. What forces are acting on an object in free fall.
- Pay special attention to the definition in equation 2.74. This is a magnitude. The sign on this value depends on whether you call up or down positive.
- Notice that equations 2.75 – 2.77 are not new equations. They are 3 of our 5 kinematic equations that we know by heart now, with x's replaced by y's and "a" replaced with "g".

A rock is dropped into a well and it takes 7.0 seconds before you hear the splash below.

1. How deep is the well?

2. What is the impact velocity with which the rock hits the water?

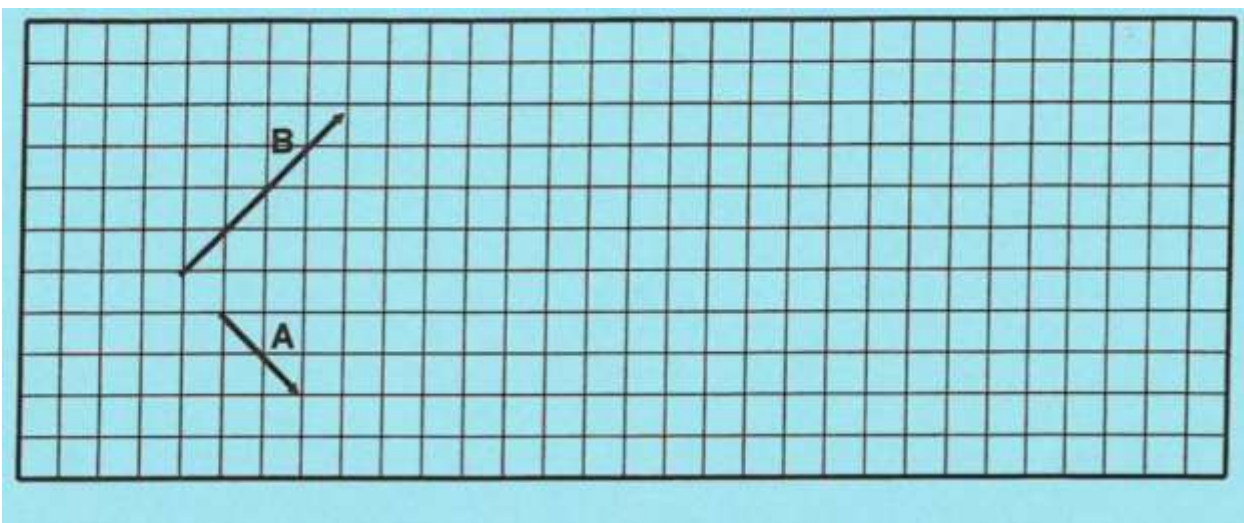
PHYSICS 1111 **Name: ____________________________**

WarmUp 6 – Due Wednesday 28 August

Reading Objectives

- Section 3.1 does a great job of introducing the idea of a vector and the concept of vector components.
- Figures 3.4 and 3.5 are the take home message. Walking 9 blocks east and then 5 blocks north results in the same final position as walking 5 blocks north and then 9 blocks east, which also results in the same final position as "flying" straight to the destination. In which case do you travel the least distance? Don't forget your Pythagorean Theorem.
- Notice that a vector has both a magnitude ("how long is it?") and a direction ("which way is it pointing?")
- Section 3.2 gives you everything you need to know to work the WarmUp below. When adding two vectors together you add them head to tail. Take vector B and move its tail to the head of vector A. Try thinking about it two ways : the head to tail method and the counting boxes method ("how many up/down and how many right/left?")

In the figure below there are two vectors **A** and **B**. Draw a vector R that is the sum of the two vectors. (i.e. **R** = **A** + **B**)



PHYSICS 1111 **Name: __________________________**

WarmUp 7 for 30 August

- Understanding how to break a vector into components is a key skill you will need for the remainder of this course. The take home picture is shown in Figures 3.26 and 3.27.
- Once you have a vector broken into components, you can add multiple vectors by simply adding there components as shown in Figure 3.31
- Get a good handle on calculating components **now** and it will save you tons of time and frustration later.
- Read through beginning of Section 3.4. You should take away what is meant by projectile motion and pay special attention to the values for a_x and a_y for an object in projectile motion.

1. A cannonball is launched with a muzzle velocity of 100m/s. During this particular launch, the barrel of the howitzer is at an angle of 37^o with respect to level ground. What are the initial components (horizontal and vertical) of the velocity?

2. During a stunt, a car is driven off a high cliff. Ignoring air resistance (see section 3.4 in the text), what is the horizontal component of its acceleration? What is the vertical component of its acceleration?

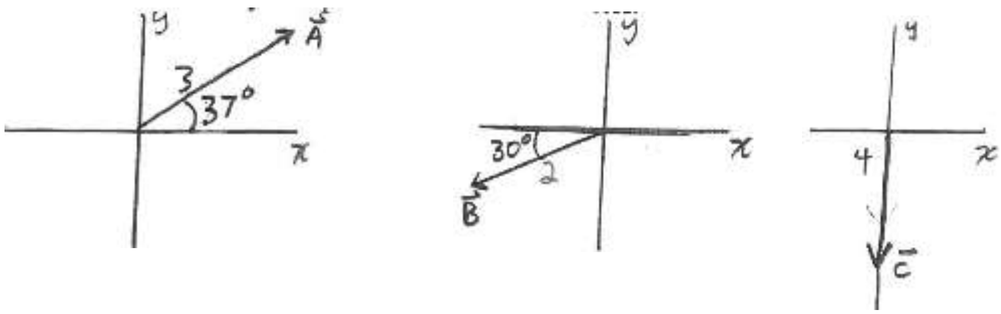
PHYSICS 1111 **Name: ________________________**

WarmUp 8 for 04 September

Reading Objectives

- **I want you to go back through your notes from class and make sure that you can reproduce all of our work from the vector components and vector addition pink sheet.**
- **Be sure to be able to go both ways with vectors. You need to be able to find x and y components given a vector's magnitude and direction and you need to be able to calculate the magnitude and direction of a vector given the components.**
- **There are a lot of great resources for learning about working with vectors at:**
  - **www.phet.colorado.edu or www.physicsclassroom.com or www.khanacademy.com**
- **Maybe try a couple of these vector addition interactive simulations at: (you can also get to the webpages by starting from the main page above and clicking to the specific topic.**
  - **https://phet.colorado.edu/en/simulation/vector-addition**
  - **https://www.physicsclassroom.com/Physics-Interactives/Vectors-and-Projectiles/Vector-Addition/Vector-Addition-Interactive**

1. Find the ***x*** and ***y*** components of each vector.



Show your work for #2 on the back of the page.

2. What is the vector sum D = A + B + C ? Use a vector table. (Remember to add your components together and then find the final magnitude and direction once you have the components.)

PHYSICS 1111 – Fall 2019 **Name**____________________________________

WarmUp 9 due 06 September

Reading Objectives

- We are continuing to practice projectile motion and trying to learn an approach for solving these problems.
- Remember that we can ask: How far? How long? How high? How fast?
- Try going through examples 3.4 and 3.5 in section 3.4 of your text. Can you set up the table of known values and values you for which you are solving for both x and y directions?

1. A cannon, elevated 40^{o} above the horizontal, is fired at a castle wall 720m away on level ground. The initial speed of the cannonball is 100m/s.

a. What are the initial horizontal (x-direction) and vertical (y-direction) components of the velocity?

b. How long will it take for the cannon ball to hit the wall?

c. How high on the wall does the cannon ball hit?

PHYSICS 1111 **Name: ____________________________**

WarmUp 10 due 09 August

- Read through Section 4.1 and pay special attention to the concept of a free body diagram (FBD)
- Free body diagrams (FBD) will be our first step in any force problem, so let's get drawing.
- Section 4.2 walks us through Newton's 1st Law. There are many ways to say this, but the main takeaway is that v is constant if F = 0.
- Section 4.3 introduces us to Newton's 2nd Law. Equations 4.3-4.5 are the main takeaway here. Notice that there is really no need for the 1st Law, since it is a special case of this 2nd Law.
- One special tricky catch to notice is equation 4.7. Notice the definition of weight. Weight is a force and is different from mass. Weight will always be calculated using equation 4.7, regardless of the specific example you are working on.

1. My truck is parked on a hill. Name the three types of forces that act on the truck.

2. A coffee filter is dropped and is falling straight down toward the floor. Name the two forces acting on the coffee filter. What is the direction of each of these forces? Draw the free body diagram.

3. A box weighing 800N is dragged across a level floor at a constant speed (what does this mean about the acceleration?) Draw the free body diagram. There should be 4 forces acting on this box. What is the magnitude of F_{net} ?

4. The engine of my Ford Escort produces a net force of 15,000N. The mass of the car (and occupants) is 1500kg. What is the acceleration of the car? Include units on your answer.

PHYSICS 1111 **Name: _________________________**

WarmUp 11 for 11 September

- Look back at equations 4.3 – 4.5. Notice the key work is net! What is meant by a net force?
- If Fnet = 0 in equation 4.5, then we are in equilibrium. What is true about acceleration if your system is in equilibrium?
- There are two types of equilibrium: Static equilibrium occurs when an object is not moving and dynamic equilibrium occurs when an object is moving, but with a constant velocity.

1. Assume that you have two forces that are not pointing in opposite directions. Is it possible to add these forces together to produce an $F_{net} = 0$? Explain your anwer.

2. Are the objects described in the following examples in static equilibrium, dynamic equilibrium, or no equilibrium?

a) A rock is in free fall off the edge of a cliff

b) An elevator is lifting you at a constant speed

c) A diver has hit the water and is slowing down

d) Your lazy lab partner is sleeping through prelab lecture.

e) P.F. Newton's back pack stays attached to him as he slams on the brakes to his scooter.

f) The coffee filter that you will drop later this semester has reached terminal velocity and is falling at a constant speed.

PHYSICS 1111 **Name: ___________________________**

WarmUp 12 for 13 September

- Section 4.5 walks us through two very important forces. The normal force and tension force. It is important to understand how to use both of these.
- Consider Figure 4.12 and notice that the magnitude of the normal force is equal to the magnitude of the weight of the bag, so there is no acceleration. However, in Figure 4.13, the magnitude of the normal force is not equal to the weight of the skier and there is an acceleration. What direction is the acceleration? What is the magnitude of the normal force on the skier?
- Section 4.5 does a great job of introducing the force of tension. Notice how the rope in Figure 4.15 pulls on the hand and on the mass. Look at how the free body diagram is only concerned with the tension force pulling on the mass. In this case, the magnitude of tension is equal to the weight of the object.
- Now have a look at figure 4.17 and notice how we will now need to find the components of the forces of tension left and right, since there is not just one tension acting on the object to hold up the weight.

1. What would be the magnitude and direction of the normal force on the bag in figure 4.12 if the the bag had a mass of 15 kg?

2. What would be the magnitude of the acceleration of the skier if the ramp angle were increased to 35 degrees in Figure 4.13

PHYSICS 1111 **Name: ________________________**

WarmUp for 18 September

- Section 5.1 walks us through the concept of friction.
- The take home equations are equations 5.2 and 5.5. Notice that the force of friction is always proportional to the normal force acting on the object.
- Example 5.1 is a good one. Pay special attention to the way the axes are chosen and notice that the components of F_{weight} parallel to the ramp (x-component) and perpendicular to the ramp (y-component) look exactly the same as we discussed in class. These will always look the same when an object is on a ramp.
- What direction will our friction force always point?

1. Write the equation for static friction and kinetic friction from section 5.1 in your book.

2. What is the difference between static friction and kinetic friction?

3. Which type of friction will always have the same magnitude regardless of the horizontal component of the force applied to the object?

4. Which type of friction has a maximum value which can be overcome?

PHYSICS 1111 **Name: ________________________**

WarmUp 14 for 20 September

- This warmup is a much simpler example than Example 5.1 in your book. There is no ramp and all forces lie along the x and y axes.
- This warmup looks just like the bike and dog pulling on the wagon on exam 1. So just rename the forces to match this example.
- In addition to this warm up, I would go back over my exam and make sure that I understand everything that I missed if I were you.

A box weighing 800N is dragged across a level floor at a constant speed under the influence of a 60N applied force. What is the <u>coefficient of sliding friction</u> between the box and the floor? Sketch a free body diagram – you should include <u>four forces</u> for full credit.

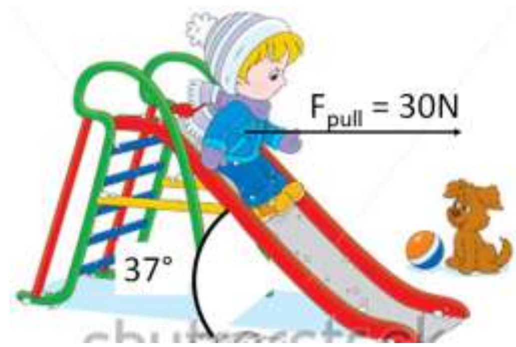
PHYSICS 1111 **Name: ________________________**

WarmUp 14 for 23 September

- Be sure to go back through your notes from class and make sure that you can set up the free body diagram for an object on a ramp.
- Which way do we always choose our axes? In the direction of what?
- Note the component of weight along the ramp is always the same. We don't have to reinvent the wheel as long as we know how to find it. It will come out the same every time.

Warm Up

A 20kg child wants to slide down the slide, which is inclined at an angle of 37° above the horizontal. In an effort to make the ride more thrilling, the evil babysitter pulls on the child with a **horizontal** rope which exerts a 30N force as shown in the diagram. Draw a free body diagram and include the 4 forces, including friction, which are acting on the child. Be sure to include your choice of x and y axes as well. What is the magnitude of the normal force acting on the child? Do not forget your force table.



PHYSICS 1111 **Name: __________________________**

WarmUp 16 for 25 September

- Let's jump back a couple sections to Section4.4 and carefully look at Newton's 3rd Law. This is one of the most misunderstood, yet simple Laws in all of physics. The take home message is "When I push on you, you push back on me."
- Every force exerted by an object, is also paired with a force exerted back on that object.
- The forces are equal in magnitude, opposite in direction, act on different objects (this means they will never both show up on a single F.B.D.) and are the same type of force.
- This means that when the leash pulls (tension) on Sir Isaac, my dog, he is also pulling on the leash (tension).

1. Review the well-known 3rd Law of Newton and then consider a head-on collision between two vehicles on an icy, frictionless road. Don't worry - the collision was done as part of a government safety test - the only passengers were crash test dummies. The first vehicle is a tiny 800 pound *Tonka Treehugger*. The second is the new oversized sport utility vehicle - the monstrously massive 6500 pound, 26 foot long, gas guzzling, environment destroying, ozone depleting, greenhouse gas producing, Hummer H200.

a. (1) Which vehicle experiences the greater force during the collision?

The Tonka *The Hummer* *Neither - they are the same* *Can't Tell*

b. (1) Which vehicle has the greater acceleration during the impact?

The Tonka *The Hummer* *Neither - they are the same* *Can't Tell*

c. (1) Which vehicle has the greater change in velocity?

The Tonka *The Hummer* *Neither - they are the same* *Can't Tell*

---

2. A box weighing 20N is in free fall toward the earth. What is the reaction force? A complete answer will give a magnitude and direction of this reaction force. On what object does this reaction force act?

PHYSICS 1111 **Name: __________________________**

WarmUp 17 for 27 September

- Section 6.3 introduces us to the concept of uniform circular motion. This section would be much better served to be entitled "uniform circular motion".
- We will move away from using the term "centripetal force". It means a force directed toward the center, **but it is a net force**, and should be thought about differently from the other forces we have talked about. Some real force must produce this net force in order for an object to move in uniform circular motion.
- In class, we will write equation 6.24 as $F_{net} = mv^2/r$. Which is what you will need to use for today's warm up question below

1. A 1 kg mass is tied to a 2 m long rope and is being swung around in uniform circular motion with a tangential velocity of 400 m/s. The tension in the rope is supplying the net force toward the center of the circle that is required for the uniform circular motion. You may assume that no other forces are acting on the mass (That is ignore gravity and ignore any air resistance.) What is the magnitude of the force of tension in the rope? (Recall that when we hear u.c.m. we immediately can right down the equation for the net force towards the center.)

PHYSICS 1111 **Name: ___________________________**

WarmUp 18 for 30 September

Reading Objectives

- Section 6.5 introduces us to the Universal Law of Gravitation. It's kind of a big deal.
- Equation 6.40 is the take home message. Notice that the denominator has an r^2 in it. So any changes in distance between the two objects are magnified by the squared in the exponent.
- Equations 6.42 -6.45 walk us through why $g = 9.8 m/s^2$ is the value we have always used for the magnitude of the acceleration due to gravity here at the surface of the earth.
- What do you think might happen if the magnitude of the gravitational force between two objects, as defined by equation 6.40, were exactly equal to mv^2/r, the net force required for an object to travel in uniform circular motion?

Warm Up

Write down the equation for the magnitude of the force of gravity between two objects with masses m_1 and m_2, which are a distance r apart from each other.

What is the numerical value of the gravitational constant, G? Be sure to include units.

What happens to the magnitude of the force of gravity if the distance between the two masses is cut in half?

What happens to the force of gravity if the distance between the two objects is increased by a factor of 10?

PHYSICS 1111 **Name: ____________________________**

WarmUp 19 for 02 October

Reading Objectives

- Have a look at equations 6.42 – 6.45. This is how one can use the universal law of gravity to find the value of g that connects with equation 4.7. This is the value of the acceleration due to gravity **at the surface of the earth**.
- For this warm up, let's try to walk through this same procedure and find the acceleration due to gravity **at the surface of the moon**. What values will you need to plug know for the moon in order to do this?

Warm Up

Calculate the value of the acceleration due to gravity on the surface of the moon. Now use this value to calculate the weight of a person on the surface of the moon who weighs 1000N here on earth.

PHYSICS 1111 **Name: __________________________**

WarmUp 20 for 04 October

- Section 7.1 gives us the definition of work. The take home message is equation 7.3. Be sure to carefully read all the text in the box, both above and below equation 7.3.
- Example 7.1 is a great example and should help with today's warm up. Just know that in this warm up, $\theta = 0$, since the force and the displacement point in the same direction.
- Section 7.2 introduces us to the concept of kinetic energy. Equations 7.7 – 7.11 show how we move from work, to kinetic energy. The work energy theorem is crucial to understand.
- Section 7.3 introduces us to gravitation potential energy. We are always looking at a change in potential energy (though the language used often drops the "change in") and this occurs when work is done on an object.

Section 7.1

1. A 20N horizontal force pushes an object across a level frictionless surface. The object moves 6m while the force acts. How much work was done by the force?

Sections 7.2 and 7.3

2. An airplane having mass 10,000kg and moving at 200mph (that's about 90 m/s) is at an altitude of 15,000m. What are the airplane's kinetic energy (see equation 7.12) and potential energy (see equation 7.27)? Include units on your answer.

PHYSICS 1111 **Name: ________________________**

WarmUp 21 for 07 October

- Section 7.4 walks us through the concept of conservative forces and potential energy (PE). For a conservative force, the work done by the force only depends on the starting and ending positions.
- The force of gravity and spring forces are both examples of conservative forces. This means that we can write down the equation for the change in PE as long as we know the starting and ending positions. See equation 7.27 for PE gravity and equation 7.42 for PE spring.
- The major take home message that we will be using over and over again this semester is summed up in Equation 7.48.

1. 1. If you drop a ball from rest at a height of 10 meters, it will have all potential energy to start with. Let's assume it has 100 J of gravitational potential energy to start. We know energy is conserved!

a. How much potential energy will the ball have at the instant it hits the ground? (Don't get cute. You know what this is asking. I mean just before we have to consider any collisions with the ground)

b. How much kinetic energy will the ball have at the instant it hits the ground?

c. How much potential energy will the ball have when it is at a height of 5 meters (that's halfway!)

d. How much kinetic energy will the ball have when it is at a height of 5 meters (that's halfway!)

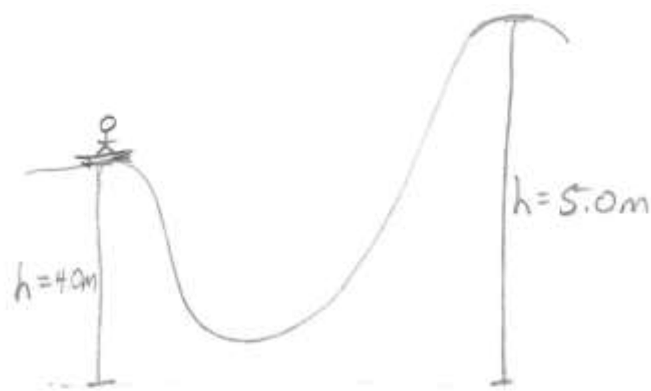
2. A spring is stretched 20cm. The spring constant is 500N/m. How much energy is stored ?

PHYSICS 1111 **Name: __________________________**

WarmUp 22 for 09 October

- Section 7.4 walks us through how to use conservation of energy in a system where there is only kinetic energy and potential energies to consider.
- Equation 7.48 is the result of conservation of energy.
- Jumping to section 7.5, equation 7.58 is our all purpose energy equation (APEE) and the one we will use over and over and over again for the rest of the semester.
- For purposes of this warm up, assume that $W_{nc} = 0$, and we will discuss why in class.

1. Consider the skier on frictionless slopes in the figure below. How fast must the skier be moving at the top of the 4.0m hill, if she wants to just reach the top of the 5.0 m hill?



PHYSICS 1111 **Name: __________________________**

WarmUp 23 for 16 October

- Section 7.7 is all about Power. It is not hard, so let's not make it hard.
- Equation 7.69 is the take home message. Power is the rate at which work is done.

1. A force of 100N pushes a block 5m. The entire effort takes 25s. What is the power output? Make sure you include <u>units</u>.

PHYSICS 1111 **Name: __________________________**

WarmUp 24 for 23 October

Reading Objectives

- Section 8.1 introduces us to the concept of linear momentum.
- Equation 8.2 is the definition of linear momentum and will become a very important concept for us.
- Section 8.2 introduces us to the concept of impulse. The sentence between equations 8.17 and 8.18 is where the definition of impulse is hidden.
- We will use J as the symbol for impulse and we have $J = F_{net} * \Delta t$.
- We can then connect the impulse with changes in linear momentum via equation 8.18
- This brings us to the take home message of the chapter: IF THERE IS NO IMPULSE (J=0) THEN MOMENTUM IS CONSERVED ($mv_i = mv_f$).

Warm Up

1. A car having a mass of 20kg moves <u>to the left</u> at 3m/s. What is its momentum? Include units on your answer.

2. A force of 500N acts for 10ms (that's milli-seconds). What is the impulse delivered? Include units on your answer.

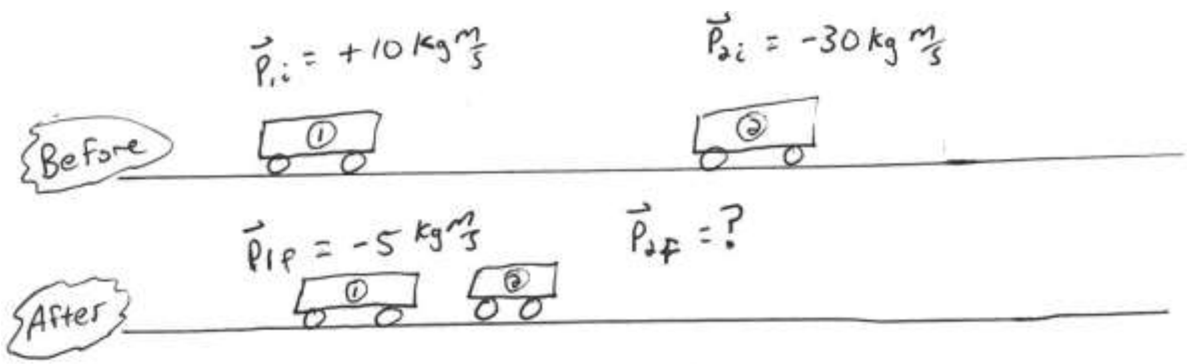
PHYSICS 1111 **Name: ________________________**

WarmUp 25 for 23 October

Reading Objectives

- Section 8.3 walks us through the concept of conservation of momentum. When is momentum conserved in a system?
- Note that if we have a collision, there are two objects and we have to conserve the total momentum of the system, which is described in equations 8.28 - 8.31 and highlighted in Equation 8.32
- **<u>If we have a COLLISON, we will ALWAYS be using conservation of MOMENTUM!!!</u>**
- In a collision, we will not always be able to keep up with where all the energy has gone, but we can keep track of all the momentum.

Review the Law of Conservation of Momentum. Use it to determine the momentum of object 2 after the collision shown in the diagram below. Include units on your answer.



PHYSICS 1111 **Name: ________________________**

WarmUp 26 for 28 October

- Section 8.4 is all about elastic collisions. What is conserved in an elastic collision? What two things do we know how to keep up with in a perfectly elastic collision.
- Section 8.5 is all about inelastic collisions. If a collision is inelastic, what is no longer conserved? What is conserved because it is a collision?
- What does a perfectly inelastic collision mean? How does this simplify the final equation?

1. Consider two collisions. The first collision is perfectly elastic and the second is perfectly inelastic. For which of these two collisions will the total kinetic energy be conserved (that means $K_i = K_f$)?

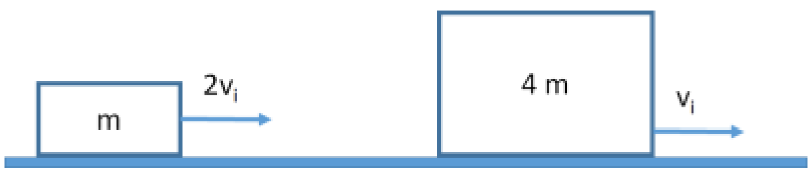
2. If kinetic energy is not conserved in a collision, then where does it go?

PHYSICS 1111 **Name: __________________________**
WarmUp 27 for 30 November

- Section 8.6 takes everything we have learned about collisions and conservation of momentum and applies it to 2 dimensions.
- Our equations now become $p_{ix} = p_{fx}$ and $p_{iy} = p_{fy}$. We will of course need to be able to compute components, so good thing we have had some much practice at that with forces.

This is a review problem. We will work on 2D collisions in class!!
Consider the perfectly inelastic collision below!

Consider the two blocks below. The smaller block catches up to the larger one and sticks to it. What is the final speed of the two blocks after the collision? Show your work. Guesses will receive no credit.



a. $v_i/2$
b. $6v_i/5$
c. v_i
d. $5v_i/6$
e. $2v_i$

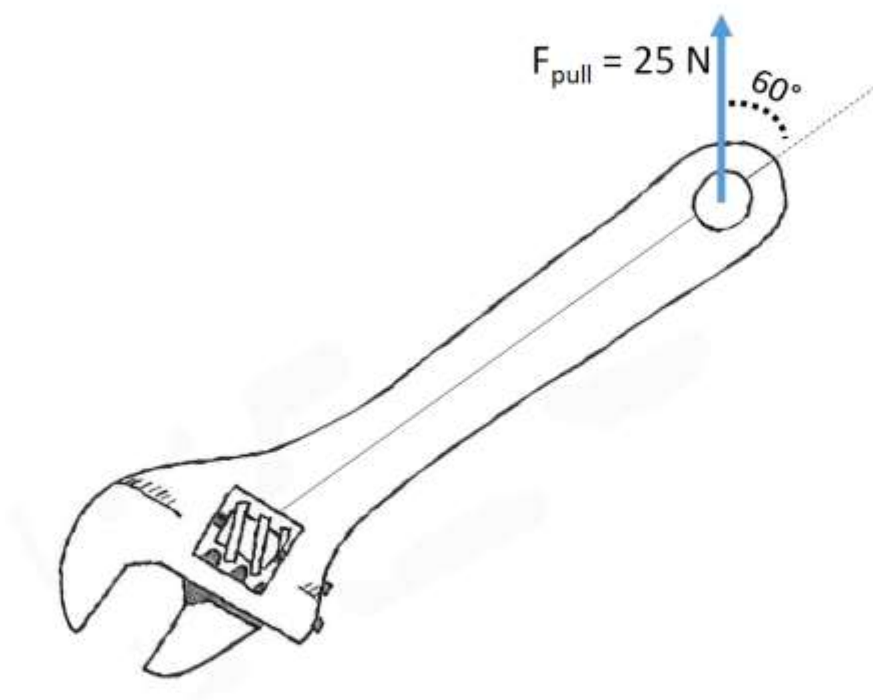
PHYSICS 1111 **Name: ________________________**

WarmUp 28 for 01 October

- Section 9.1 takes us through the first condition for equilibrium: Fnet = 0.
- Before we can discuss the second condition for equilibrium, we must first define torque. This is done in section 2 and the take home message is equation 9.3. Be sure that you understand the definition of □. If you do not know to find the angle between, then you cannot use this equation.
- If you prefer to think in components (just like we did when thinking about work) then equations 9.4 and 9.5 should be really helpful.
- Equation 9.6 gives us the second condition for equilibrium. If net torque = 0, then there will be no rotation.

Warm up

Calculate the torque on the wrench in the figure below if the 25N force is applied to end of the 30 cm long wrench at an angle of 60^o from the wrench axis.



PHYSICS 1111 **Name: __________________________**

WarmUp 29 for 04 November

Reading Objectives

- Example 9.1 in Section 9.2 is a fantastic example of equilibrium. If the see-saw is balanced, then we know $F_{net} = 0$ and $\tau_{net} = 0$. Work through this example on your own and try to understand how the two conditions for equilibrium are used here.
- Now go through Example 9.2 and try to follow the same concepts here as well.

1. Two people are sitting on opposite sides of a see-saw at positions of 3 m from the fulcrum. The person on the left has a mass of 50 kg and the person on the right has a mass of 80 kg.

a. What is the net torque on the see-saw?

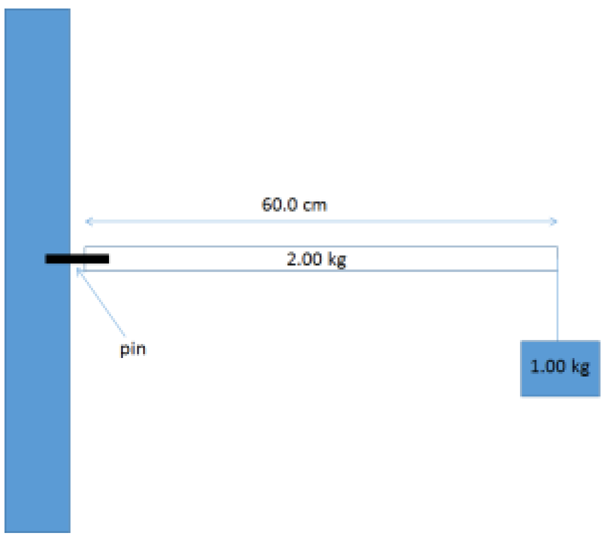
b. Where would a third, 40 kg, person have to sit on the see-saw in order to balance it?

PHYSICS 1111 **Name: ___________________________**

WarmUp 30 for 06 November

- Section 9.6 combines some of the details we have been talking about in class, into biological examples. Have a look through how torques and forces affect our bodies.
- Example 9.4 is a really good one and we will do a very similar example in class.
- Example 9.5 is another really good one to work through yourself and of course remember to lift with legs and not your back. Especially if your tall ??

How much torque must the pin exert in the figure below in order to keep the 60.0cm rod from rotating? Let's choose the pivot point at the left end of the rod, which also happens to be the center of the pin. (I would calculate the total torque from the 2.00 kg rod and the 1 kg mass. The pin must produce the right amount of torque to balance the net torque to 0).



PHYSICS 1111 **Name: ________________________**

WarmUp 31 for 08 November

Reading Objectives

- We are jumping back to section 6.1 for a quick introduction to angle of rotation and how this is connected to the radius and arc length. It is important to note that arc length means the same thing as distance around the perimeter of the circle.
- If you choose your units correctly (this means **WE HAVE TO USE RADIANS**). Then equation 6.1 gives us the very simple and powerful relationship between angle of rotation and arc length.
- Equation 6.6 gives us the definition of angular velocity, ω. This is just how quickly we are changing the angle.
- Equation 6.9 now tells us how angular velocity, ω, and speed around the circle, v, are related. This makes sense, because if I am moving faster around the outside of the circle, I will also be covering a larger angle of rotation per unit time.
- Now jumping ahead to section 10.1 we see that Equations 10.1 – 10.3 are review from section 6.1.
- We can now define an angular acceleration, α, which is given in Equation 10.4. Our angular acceleration, a, is related to our tangential acceleration (how quickly our speed around the outside of the circle is changing), a_t, as seen in equations 10.13 and 10.14
- We are now ready to put it all together and look at the Warm Up exercise below.

Write out the 4 kinematic equations that we used to describe 1 D linear motion with a constant acceleration (chapter section 2.5). Now write out the corresponding 4 angular kinematic equations that relate to the linear kinematic equations. (Remember that everywhere you see an x will be replaced with a θ; everywhere you see a v will be replaced with ω; and everywhere you see an a will be replaced with α).

PHYSICS 1111 **Name: __________________________**
WarmUp for 07 November

Reading Objectives

- Section 10.2 walks us through the derivations of the rotational kinematic equations. Recall your last Warm Up and how you already wrote these down.
- The equations are summarized in table 10.2 along with their analogous counterparts from linear motion.
- The next step is to now use these equations and concepts to talk about torque (Section 10.3), angular momentum (Section 10.5) and rotational kinetic energy (Section 10.4). This is where the fun starts!!!

1. A bug is sitting on the rim of a rotating record (back in the old days, we used vinyl discs called "records" to play music). The record has a radius of 25cm and rotates at 72rpm (that's revolutions per minute).

a. What is the angular speed (in rad/s) of the record?

b. What is the tangential speed of the bug (your answer should be in m/s)?

c. What is the angular acceleration if the rotating disc is slowed to a stop in 6 seconds?

PHYSICS 1111 **Name: ________________________**

WarmUp 33 for 13 November

- Section 10.3 introduces us to the rotational equivalent of Newton's 2nd Law. Fnet = ma now becomes equation 10.43.
- It is very important to understand the meaning of the moment of inertia, I. This is a description of how difficult it is to change an object rotation. In the same way that mass, m is a description of how hard it is to change and objects linear motion.
- Figure 10.12 will be a crucial tool, as it gives us the results for moment of inertia for any of the rotating objects that we will talk about this semester. Refer to this table and learn how to use it.

1. What is the moment of inertia about the central axis of a 6kg solid cylinder having a radius of 20cm? Include units on your answer. Refer to Figure 10.12 as needed.

2. What is the angular acceleration that a 2 kg solid sphere of radius 2.5 m experiences if a net torque of 10 Nm is applied about the central axis of the sphere? (You will need to refer to Figure 10.12 for the moment of inertia of a solid sphere)

PHYSICS 1111 **Name: ________________________**

WarmUp 34 for 15 November

Reading Objectives

- Section 10.4 introduces us to the concept of rotational kinetic energy.
- Equation 10.60 is the take home message for rotational kinetic energy.
- If you consider a rolling object, it will have two types of kinetic energy. It will have translational kinetic energy (that's the $1/2mv^2$ we already know) and rotational kinetic energy given by equation 10.60
- Equations 10.82 – 10.84 show you how to incorporate these two forms of kinetic energy in conservation of energy concepts.
- Example 10.10 is a great one to work through. We will do some similar things in class.

1. A 10 kg hollow sphere with a 5.0 m radius is spinning on an axis which runs through the center of the sphere with an angular speed of 2500 revolutions per minute (rpm). What is the value of the rotational kinetic energy of this sphere?

2. What would be the magnitude of the rotational kinetic energy if the sphere were solid, but still had the same radius, mass and angular speed?

PHYSICS 1111 **Name: ________________________**

WarmUp 35 for 20 November

Reading Objectives

- Section 10.5 walks us through the concept of angular momentum and Equation 10.90 gives us the definition of angular momentum, L.
- If there is no net torque on a system, then angular momentum is conserved and we can use Equations 10.112 and 10.113
- Example 10.14 is a great one to work through. Notice that the skaters angular momentum is conserved, but her rotational kinetic energy is not.

A 6kg solid disk having a 20cm radius does a full rotation once every 4.0 seconds.

1. What is the moment of inertia of the disk? Include units on your answer.

2. What is the angular speed of the disk? Include units on your answer.

3. What is the angular momentum of the disk? Include units on your answer. (You might want to look at 3rd edition page 271 equation 9.20 in your book or 2nd edition page 277 equation 9.21 in your book for the appropriate equation.)

PHYSICS 1111 **Name: ________________________**

WarmUp 36 for 22 November

Reading Objectives

- Chapter 16 introduces us to the concepts of oscillatory motion, which eventually leads to the concept of waves.
- Section 16.1 reminds us about Hooke's Law. We discussed this in class and you measured this in lab. Equation 16.1 is the take home message. Notice that 1). the Force is negative, which means that the spring pulls in the opposite direction that the spring is stretched and 2). the force increases linearly with the distance stretched. This means that there is a linear restoring force.
- Equation 16.4 is the familiar potential energy stored in a spring.
- Section 16.2 gives us two very important definitions: period and frequency. Get to know what these mean and they are easy to apply/use.

1. When a guitar string plays the note "A", the string vibrates at 440 Hz. What is the period of the vibration?

2. In the aftermath of an intense earthquake, the earth as a whole "rings" with a period of 54 minutes. What is the frequency (in Hz.) of this oscillation?

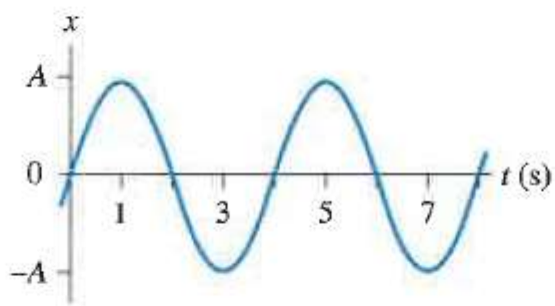
PHYSICS 1111 **Name: __________________________**

WarmUp 37 for 25 November

- Chapter 16.3 introduces us to Simple Harmonic Motion (SHM) and a simple harmonic oscillator. One example of this is an object attached to a spring and sliding on a frictionless surface. The object will oscillate back and forth around the equilibrium position with a constant frequency and therefore period of oscillation.
- Equations 16.15 and 16.16 give us the period and oscillation for the mass attached to a spring on a frictionless surface. What happens to the period if the mass is increased? What if the spring constant is increased?
- We are then introduced to the connection between simple harmonic motion and waves. Equations 16.20-16.22 show us how to describe x(t), v(t) and a(t) in terms of sine and cosine waves.

1. A 4kg mass is attached to one end of a spring having a spring constant of k = 64N/m and set to oscillate (the setup is similar to that shown in Figure 16.9). What is the oscillation frequency and period of the motion? Include units on your answer and use the equations suggested in bold above.

2. Below is a position vs time (x vs t) graph of an object in simple harmonic motion. (This problem is borrowed from Randy Knight's College Physics 2nd Ed.)



   a. At what time or times is the object moving to the right at maximum speed?

   b. At what time or times is the object moving to the left at maximum speed?

   c. At what time or times is the object instantaneously at rest?

PHYSICS 1111 **Name: __________________________**

WarmUp 38 for 02 December

- In Section 16.4 we are introduced to another very simple system which it turns out experiences a linear restoring force and therefore exhibits uniform circular motion. This system is the simple pendulum and small angles (This just means you can't pull it back to a huge starting angle if you want to see u.c.m.)
- Equation 16.29 is the take home message and it shows us that the period of oscillation only depends on the length of the pendulum, not the mass.
- We have already walked through section 16.5 in class, but don't forget that energy is conserved in simple harmonic motion and for the mass on a spring system, we can connect the energy at t = 0 (when it is all potential) with the energy at t = ¼ T (when it is all kinetic) and we arrive at equation 16.42. Recall that in class we used A for the starting displacement at t = 0 and our book uses X.

1. What is the length of a pendulum that has a period of 0.500 seconds?

2. What is the period of a 1.00 meter long pendulum?

3. Consider a spring on a mass system that is started at t = 0, with an initial displacement of A. Write out the functional forms for position, velocity and acceleration at any time after t=0 (that means write down the answers to x(t) = ? v(t)= ? and a(t) = ?) that we produced in class. Recall that these form waves, so you should be using sines and cosines and keep up with what is your amplitude and what should your sign out front be.

PHYSICS 1112 **Name: ______________________________**

Chapter 18 – Warm-Up due Friday August 16th

Reading Objectives:

Read sections 18.1 and 18.2. You should get familiar with the following terms

- Charging by friction/rubbing. Why do you put drying sheets with your laundry in the drying machine?
- Electric charge – connect charging by friction to the atomic level.
- Conductors and dielectrics/insulators
- Electric dipole. In Chemistry you learn that water is a polar molecule…

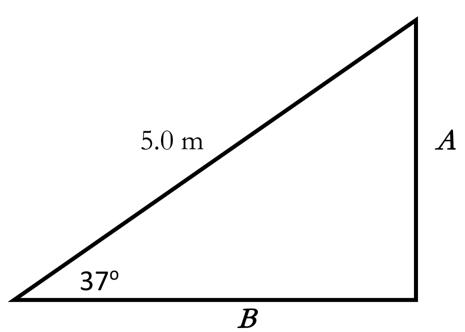
In section 18.3, you will read about the forces between charges and charged materials

- Coulomb's Law is a main take-away from the reading. Why are absolute values in equation 18.3?
- How much charge is on a proton? What about an electron? What are the units of charge?

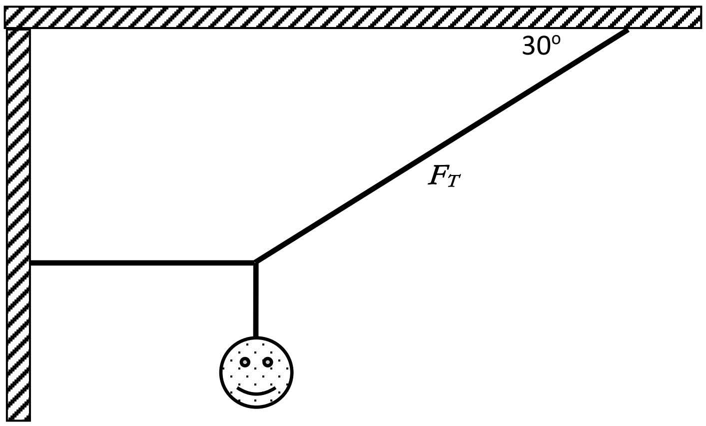
Warm-up

1. Use Coulomb's Law to determine the magnitude of the electric force acting on a 3.0 C charge located 2m away from a -5.0 C charge. Are the charges attracted to one another or repelled? Make sure you include units on your answer.

2. Determine the length of sides ***A*** and ***B*** in the right triangle shown below.



3. A heavy smiley face is suspended by two massless strings as shown in the figure. The smiley face weighs 1000.0 N. What is the tension F_T in the angled string[1]?



[1] This problem will require you to sketch a free body force diagram (there are three forces acting here: two tensions and weight. You should also resolve the forces into their x and y components. Since the suspended object is motionless, these components should sum to zero.

PHYSICS 1112 **Name: ______________________________**

Chapter 18 – Warm-Up due Monday August 19th

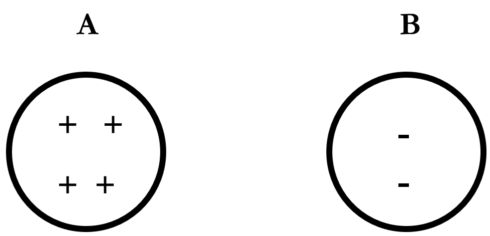
Reading Objectives:

Monday, we will keep talking about electric forces (section 18.3). We'll do some examples that involve more than two charges.

- Coulomb's Law is a main take-away from the reading. Why are absolute values in equation 18.3?
- How much charge is on a proton? What about an electron? What are the units of charge?
- Principle of superposition

Cool-down

1. In the figure below there are two metallic spheres labelled A and B. Sphere A has 4 positive charges and B two negative ones. The two spheres are brought into contact. After that, they were separated again. What is the charge on each sphere? Briefly explain



PHYSICS 1112 **Name:** ______________________________

Chapter 18 – Warm-Up due August 21st

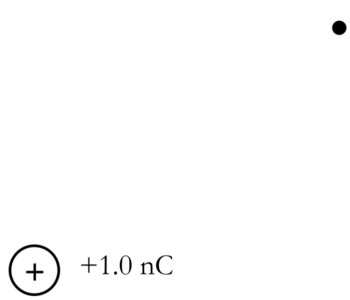
Reading Objectives:

- Electric field is described in section 18.4
- Equations 18.11 and 18.12 are essential take-aways. Make sure you know if the *Q* in that equation is a charge creating the field (i.e. the source of the field) or just experiencing the field (often referred to as "test" charge). Try to relate this to F_{weight}= m g
- Electric field lines (section 18.5) are a tool to visualize the electric field. Everything is easier if we can see it, right? Check figures 18.22 and 18.23

Warm-up

1. What is the electric force (magnitude and direction) acting on a -3 C <u>test</u> charge located in a region of space having an electric field of 20 N/C pointing down (↓)? Example 18.2 will be helpful here.

2. What is the electric field at a point that is 10cm apart from a +1nC charge? Draw an arrow to indicate the direction of the field. Figures 18.22 and 18.23 would be helpful to figure out the direction of the field.



PHYSICS 1112 **Name:** ______________________________

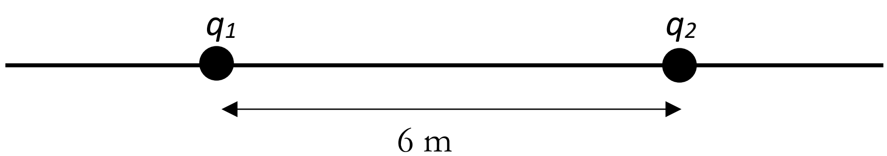
Chapter 18 – Warm-Up due August 23st

Reading Objectives:

- Catch-up with your reading

Cool-down

Two charges (q_1 = 5 C, q_2 = 20 C) are at the fixed positions shown in the figure below. At what distance from q_1 would you put a third charge q (q is also positive)[1], such it suffers a net force equals to zero?



[1] I didn't forget the value of *q*. You don't need it to solve the problem.

PHYSICS 1112 **Name:** ______________________________

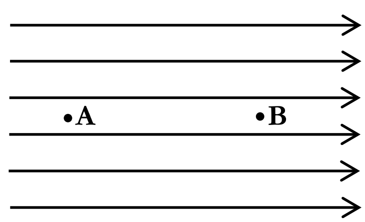
Chapter 18 – Warm-Up due August 26th

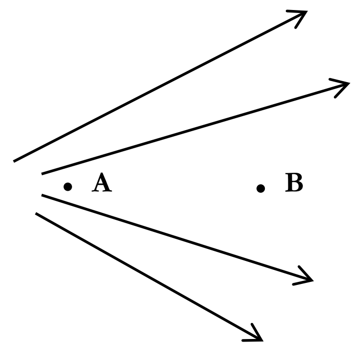
Reading Objectives:

- Keep learning about electric field lines. They are a pretty useful tool to visualize the electric field.
- Remember, equations 18.11 and 18.12 are essential take-aways for the electric field. Make sure you know if the Q in that equation is a charge creating the field (i.e. the source of the field) or just experiencing the field (often referred to as "test" charges). Example 18.4 is pretty similar to what we do in class.

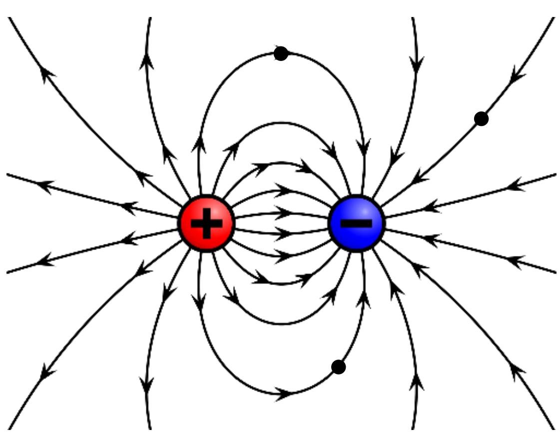
Warm-up

1. Two sets of electric field lines are directed as below. For each figure, rank in order, the strengths of the electric field





2. Below you have the electric field lines created by a dipole. Draw an arrow in the black dots indicating the direction of the electric field. Figure 18.25 should be pretty helpful here.



PHYSICS 1112 **Name: ______________________________**

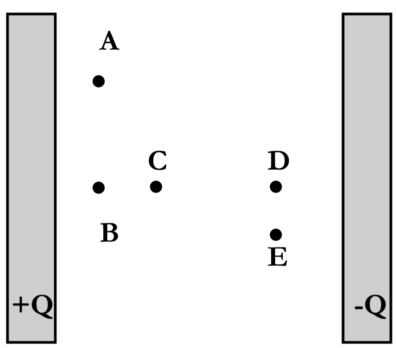
Chapter 18 – Warm-Up due August 28th

Reading Objectives:

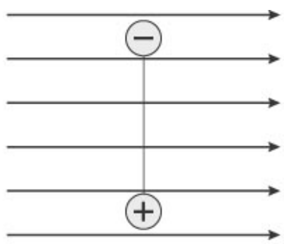
- There are configurations that create uniform electric fields, for example, capacitors. Capacitors are found in all your electronic devices. Read about them in section 18.7
- Conductors in electrostatic equilibrium (also in section 18.7). Here you will learn how a lightning rod works among other things.
- Pay attention to the electric field lines created by conductors in equilibrium.
- Section 18.6 talks about biology and electric fields, ie, DNA and water molecules. We will related this to the concepts of torque and electric field.
- Example 18.5 is pretty interesting. Be sure you work it out.

Warm-up

1. Rank in order, from largest to smallest, the forces F_A to F_E a proton would experiment if placed at points A to E in this parallel plate capacitor.



2. What is going to happen to the dipole inside the electric field?



PHYSICS 1112 **Name: ______________________________**

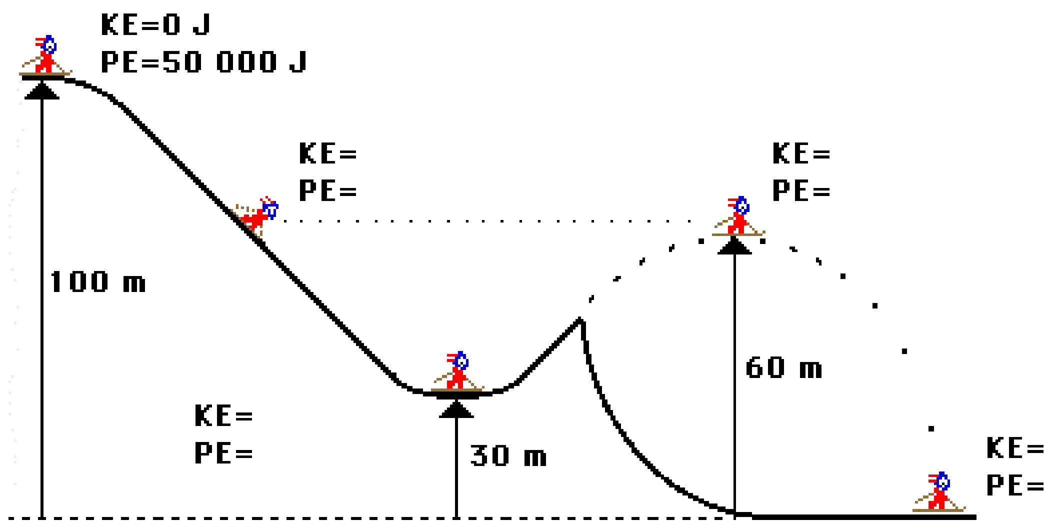
Chapter 19 – Warm-Up due August 30th

Reading Objectives:

- In PHYS1111 you learned about potential energy (PE = m g h). In section 19.1 you will learn about **electric** potential energy. Can you find any similitudes?
- Another important concept you will learn in section 19.1 is electric potential.
- Wow, these two terms sound pretty similar, but they are not. What are the units of the potential energy and electric potential? Equations 19.2 and 19.7 relate these two concepts.
- What is an electron-volt?
- Conservation of energy. Be sure to work out example 19.3

Warm-up

1. Calculate the gravitational potential energy and kinetic energy for each position marked in the figure below. You should have done this in your PHYS1111 class.



www.physicsclassroom.com

Continue on the back

2. Are you doing work in these situations? Also a question from your PHYS1111 class.


(box is not moving)


(walking to the right)


(lifting grocery bag)


(walking to the right)

PHYSICS 1112 **Name: ______________________________**

Chapter 19 – Warm-Up due September 4th

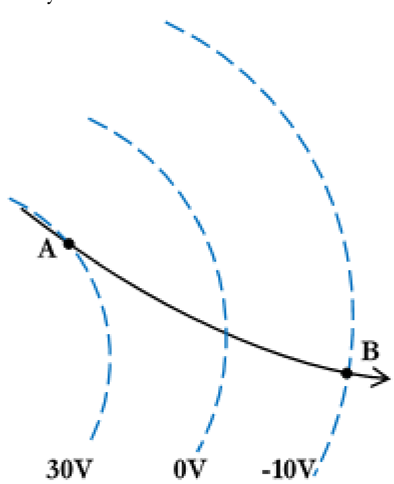
Reading Objectives:

- In section 19.2 you will see how the electric field and the electric potential are related when the electric field is uniform, like inside capacitors. Equation 19.36 is a main take away.
- In section 19.3 you will learn about electric potential created by point charges. Equation 19.37 is a main take away.
- Equipotential lines (not the same than electric field lines, but they are related, of course!)

Warm-up

1. How far from a 1nC charge will you measure a 10V potential?

2. The kinetic energy of a proton is 50 eV at point A. Is the kinetic energy of the proton at point B larger or smaller than in point A? If we had an electron instead of a proton, would your answer change? Explain briefly.



PHYSICS 1112 **Name: ______________________________**

Chapter 19 – Warm-Up due September 9th

Reading Objectives:

- We talked a bit about capacitor in chapter 18. Here we are getting into more detail. Capacitance and equations 19.50 and 19.53 are a main take away.
- What are the units of capacitance? Example 19.8 would help you to solve this warm-up.
- At the end of section 19.5 you will read about dielectrics filling the gap between the plates of a capacitor. You might want to review the concept of polarization that we studied in chapter 18.
- Energy stored in a capacitor

Warm-up

1. 6.0C of charge are stored in a capacitor connected to a 1.5V battery. What is the capacitance? Include units on your answer.

2. What is the capacitance of a parallel plate capacitor having plate area of $10cm^2$ and separated by a single sheet of paper of thickness 0.5 mm. Don't forget about the dielectric constant of the paper, κ!! (You'll need information from Table 19.1 for this.) And watch those units.

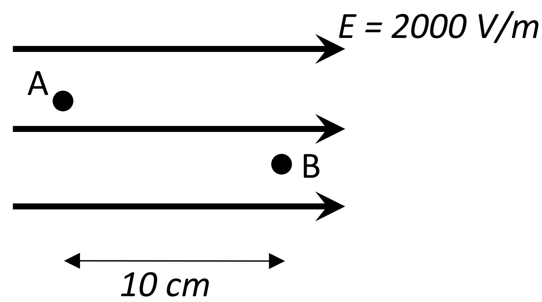
Continue on the back

Cool-down

The electric potential at point A is - 300V.

(a) How is the potential at point B compared to point A, larger or smaller?

(b) Calculate the potential at point B



PHYSICS 1112 **Name:** ______________________________

Chapter 19 – Cool-down due September 11th

An air-filled capacitor is connected to a battery and charged up as usual. While the battery connection is maintained, the distance between the plates is increased. What happens next?

Capacitance

Increases Decreases Stays the same

Voltage

Increases Decreases Stays the same

Stored charge

Increases Decreases Stays the same

Electric field

Increases Decreases Stays the same

2. Imagine having a 4.0F air-filled capacitor with plates separated by 1.0mm. The capacitor is connected to a 5.0V battery.

a. How much charge is stored by the air-filled capacitor? What is the electric field strength between the charged capacitor plates? Include units on your answers.

Now, with the 5.0V battery connected as before, the space between the capacitor plates is filled with a material having a dielectric constant $\kappa = 5.0$.

b. How much charge is stored now? What is the ***net*** (or "resultant") electric field between the plates? What is the strength of the electric field produced by the charges on the plates? What is the electric field due to the polarized dielectric material? Include units on your answers.

PHYSICS 1112 **Name: ______________________________**

Chapter 20 – Warm-Up due September 16th

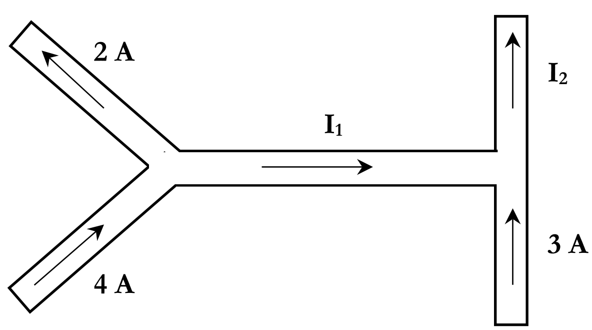
Reading Objectives:

- Go to section 20.1 and read the definition of current. Pay attention to the units. Equation 20.1 is a main take away. You may want to work examples 20.1 and 20.2.
- Current is "conserved" meaning that at any junction of wires, the amount of "flow" going in must be the same as the amount of "flow" going out. Later on, we will call this Kirchhoff junction law
- In section 20.2 you will find the definition of resistance and its units. Also Ohm's law.
- Ohm's law is one of the main principles in electronics. You will use equation 20.14 many times in the following weeks.

Warm-up

1. An electric eel flexes its muscles to create a voltage that stuns its prey. During the discharge, the eel can transfer a charge of 2.0 mC in a time of 2.0 ms. What current, in A, does this correspond to?

2. The wires below carry currents as noted. What are I_1 and I_2?



PHYSICS 1112 **Name: ______________________________**

Chapter 20 – Warm-Up due September 18th

Reading Objectives:

- Section 20.3 describes the concepts of resistance and resistivity. These two words sound similar, but they have different meanings and units. What are the units of resistivity? Pay attention to equation 20.18 and figure 20.11.
- Power and energy. Equations 20.28, 20.29 and 20.30 are the same, and you can go from one to another just using Ohm's law.

Warm-up

1. A 15cm-long copper wire is connected between the terminals of a 1.5 V battery. If the current in the wire is 2.0 A, what is the wire's diameter? Table 20.1 will be helpful to solve this question.

2. What power is supplied to the starter motor of a large truck that draws 250 A of current from a 24 V – battery?

PHYSICS 1112 **Name: ______________________________**

Chapter 21 – Warm-Up due

- Go to section 21.1 and read about combinations of resistors in series and parallel. Pay attention to figure 21.2, look how resistors are connected; are any junctions in between them?
- Equations 21.5 and 21.20 are main take aways.

Warm-Up

1. A 6.0Ω and a 12.0Ω resistor are connected in *series*. <u>Make a sketch below</u>. What is the overall equivalent resistance of this combination?

2. A 6.0Ω and a 12.0Ω resistor are now connected in *parallel*. <u>Make a sketch below</u>. What is the overall equivalent resistance of this combination?

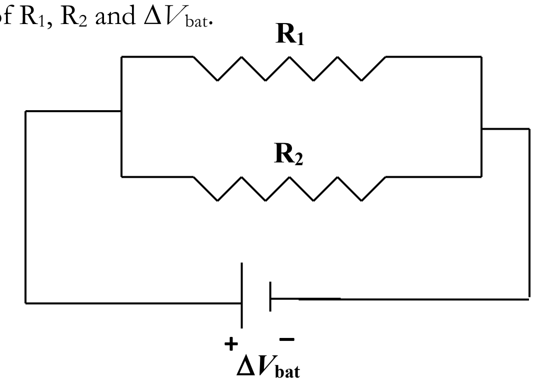
PHYSICS 1112 **Name:** ______________________________

Chapter 21 – Warm-Up due September 23th

- Start at section 21.3, Kirchhoff's rules. These rules are conservation of charge and energy laws.
- Figure 21.24 is an important sign criteria you must remember.

Warm-up

1. In this circuit, $R_1 = R_2$. I_1 is the current flowing through R_1, and I_2 is the current flowing through R_2.
   a. Find algebraic expressions for I_1, I_2 and I_{total}, in terms of R_1, R_2 and ΔV_{bat}.



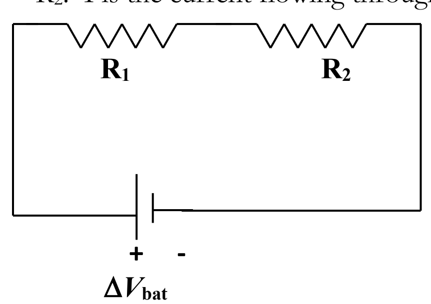
   b. Suppose we add another resistor in parallel (so we have three resistors in parallel, instead of two); we keep the same battery. Will I_{tot}, the total current flowing through the battery,

      increase, decrease, or remain the same?

   c. Suppose we keep adding resistors in parallel. Will the total current

      increase, decrease, or remain the same?

2. In this circuit, $R_1 = R_2$. I is the current flowing through R_1 and R_2.



a. Find algebraic expressions for I, in terms of R_1, R_2 and ΔV_{bat}.

b. Suppose we add another resistor in series (so we have three resistors in series, instead of two); we keep the same battery. Will I_{tot}, the total current flowing through the battery,

increase, decrease, or remain the same?

c. Suppose we keep adding resistors in series. Will the total current

increase, decrease, or remain the same?

PHYSICS 1112 **Name: ______________________________**

Chapter 21 – Warm-up due September 30th

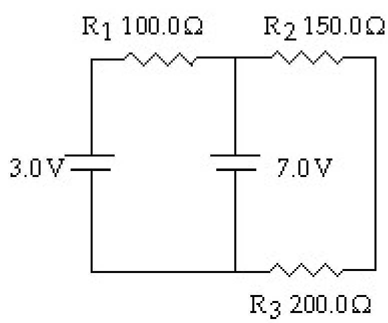
- Read section 21.6 about circuits with resistors and capacitors.
- You'll learn that charging and discharging a capacitor takes time, so time will be now a new variable you have to think about when you solve an RC circuit.
- Equations 21.77 and 21. 79 are main take-aways
- What is e^{-1}? And $(1-e^{-1})$? Use your calculator!
- Example 21.7 shows one of the multiple applications of RC circuits, the defibrillator. Work it out

Warm-up

A 500 Ω resistor, a 1.5 μF capacitor and a 6V battery are connected in series. What is the time constant of the circuit? Don't forget the units.

Cool-down

For each resistor, calculate the voltage drop and current.



PHYSICS 1112 **Name: ______________________________**

Chapter 21 – Cool-down due October 2nd

Provide the answer to problem 21.68

PHYSICS 1112 **Name:** ______________________________

Chapter 22 – Warm-Up due October 14th

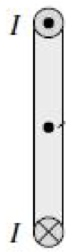
- Read sections 22.1 and 22.2. They are a nice introduction to magnetism and its applications. Notice that magnets seem to always come as a pair (N and S poles). How is this different than electric charge?
- Also, magnets interact via the "Law of Poles" which is summarized in Figure 22.5. How is this similar to Coulomb's Law? How is it different?
- In section 22.3 magnetic fields, lines and forces are described.
- Figure 22.16 shows how magnetic field direction is determined. How is this similar to the use of "test charges" to determine the strength and direction of an electric field? How is this similar to Coulomb's Law? How is it different? How are the lines similar/different to the electric field lines?
- The direction of the magnetic field is given by the right-hand rule (Fig. 22.16 (c)). We'll use this a lot, so this is a main take away.
- Section 22.9 will be key. The long straight wire, the loop of current, and the solenoid are going to be our focus points. Equations 22.24, 22.26 and 22.27 should be on your "need-to-know-for-sure" list.

Warm-up

1. A long straight wire carries a 200A current. What is the magnitude of the magnetic field at a position 1.0cm away from this wire? Include units on your answer.

2. A 50.0cm long solenoid with 500 turns carries a 20.0A current. What is the strength of the magnetic field inside the solenoid? Include units on your answer.

3. The diagram below shows a current loop perpendicular to the page; the view is a “slice” through the loop. The direction of the current in the wire at the top and the bottom is shown. Indicate with an arrow the direction of the magnetic field at a point in the center of the loop?



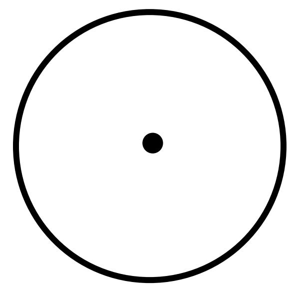
PHYSICS 1112 **Name: ______________________________**

Chapter 22 – Warm-Up due October 16th

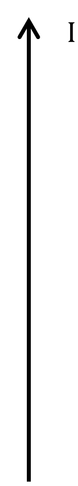
- The direction of the magnetic field is given by the right-hand rule (Fig. 22.16 (c)). We'll use this a lot, so this is a main take away.
- Section 22.9 will be key. The long straight wire, the loop of current, and the solenoid are going to be our focus points. Equations 22.24, 22.26 and 22.27 should be on your "need-to-know-for-sure" list.

Cool-down

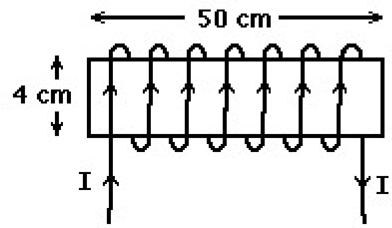
1. A wire carrying a current is shaped in the form of a circular loop of radius 4.0 mm. If the magnetic field strength at its center is 1.1 mT with no external magnetic fields contributing to it, what is the magnitude of the current that flows through the wire? If the magnetic field is pointing out of the page like in the figure, draw an arrow to indicate the direction of the current.



2. How far from the center of a wire carrying a 2.0 A current does the magnetic field that results from the current have a magnitude of 4.0 × 10-5 T? Indicate the direction of the magnetic field at both sides of the wire



3. A solenoid is wound with 470 turns on a form 4 cm in diameter and 50 cm long. The windings carry a current in the sense that is shown. The current produces a magnetic field, of magnitude 4.1 mT, at the center of the solenoid. What is the current in the solenoid? What is the direction of the magnetic field?



PHYSICS 1112 **Name: ______________________________**

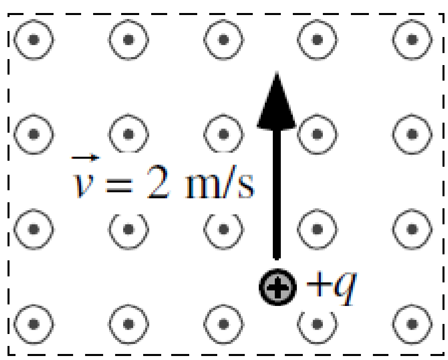
Chapter 22 – *Warm-up* due October 18th.

Reading Objectives

- We have learned how to create magnetic fields using electric current.
- In chapter 18, we learned that a static charge q inside an electric field suffers a force (F = q E). What happens if you have a charge inside a magnetic field? Read section 22.4. Equation 22.1 is a main take away. Can you spot the similarities and differences with the electric force?
- The direction of the magnetic force on a point charge is given by another right hand rule, RHR1 in your book. See figure 22.17 for details.
- Read section 22.5 for more applications. Also, you can see there that magnetic fields can cause moving charges to move in circular (or helical) paths. Pay close attention to figure 22.20 and equations 22.6 and 22.7. This should remain you to circular motion (PHYS 1111)

Warm-up

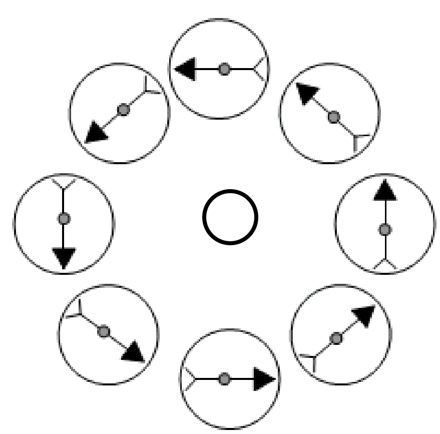
Indicate with an arrow the direction of the magnetic force acting on the charge (**B** is pointing out of the page)



Cool-down

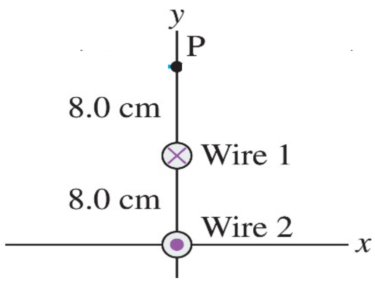
1. A long, straight wire extends into and out of the paper . The current in the wire is?

   A. Into the paper.
   B. Out of the paper.
   C. There is no current in the wire.
   D. Not enough info to tell the direction.



Continue on the back

2. Two long, straight wires lie parallel to each other, as shown in the figure. They each carry a current of 5.0 A, but in opposite directions. What is the magnetic field (magnitude and direction) at point P?



PHYSICS 1112 **Name: ______________________________**

Chapter 22 – Warm-Up due October 21st

- Hall effect is described in section 22.6. This is how most of the probes to measure magnetic fields are made. You will use one of these in the lab.
- If a moving charge inside a magnetic field suffers a force, a wire carrying a current should also suffer a force when they are in a magnetic field. Read section 22.7; equation 22.16 is a main take away
- Try example 22.4

Warm-up

A 3m long wire carries a 25A current. It is in a magnetic field of 1.5T. Determine the maximum magnetic force acting on the wire.

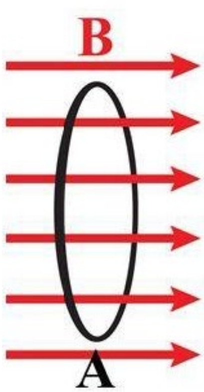
PHYSICS 1112 **Name: ______________________________**

Chapter 23 – Warm-Up due October 25th

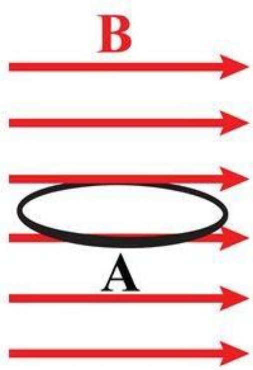
- Symmetry in nature is amazing, an electric field (current) creates a magnetic field, so could a magnetic field create an electric field? Read section 3.1. Figure 23.4 illustrates how a "changing" magnetic field creates an electric field.
- We quantify that change of magnetic field through the variable flux. The expression from flux is equation 23.1 and we will use it extensively. Pay attention to the angle theta. From where is that angle measured?
- What are the units of flux?

Rank in order, from largest to smallest, the flux through the loop. All the loops have the same area A

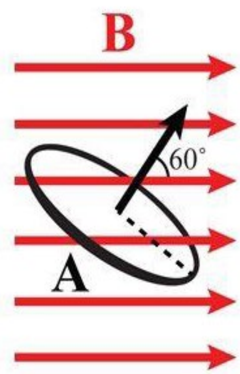
(i)



(ii)



(iii)

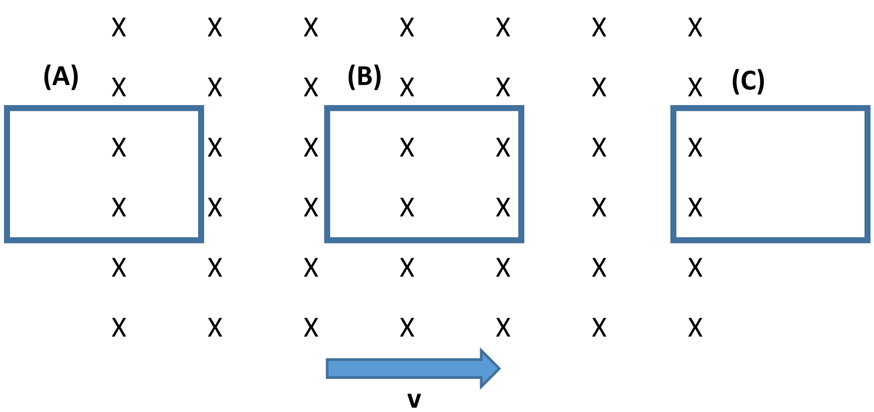


PHYSICS 1112 **Name: ______________________________**

Chapter 23 – Warm-Up due October 28th

- Faraday-Lenz's law (equation 23.2) quantify the potential difference (emf) created by the change of magnetic flux. This is the most important thing you're going to learn in this chapter. Think about, a current creates a magnetic field and a changing magnetic field creates an electric field… Magnetic and electric fields are going to appear together in the form of an electromagnetic wave. More about this in chapter 24.
- The minus sign in the equation indicates the induced current opposes the change of flux
- Try example 23.1

A loop is moving inside an area where a uniform magnetic field is pointing into of the page. What is the direction of the induced current (clockwise, counter clockwise or zero) at each position of the loop: (A) moving into the field, (B) moving inside the field and, (C) moving out of the field.



PHYSICS 1112 **Name:** ______________________________

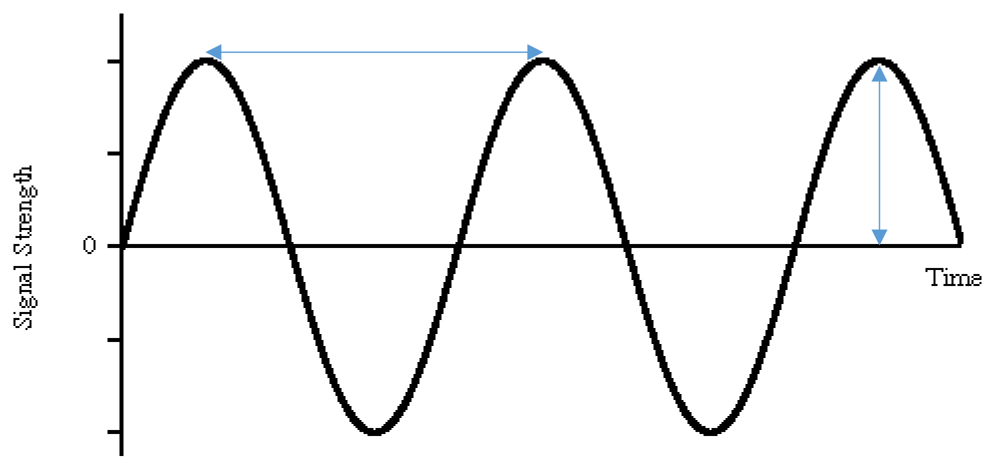
Chapter 24 – Warm-Up due November 1st

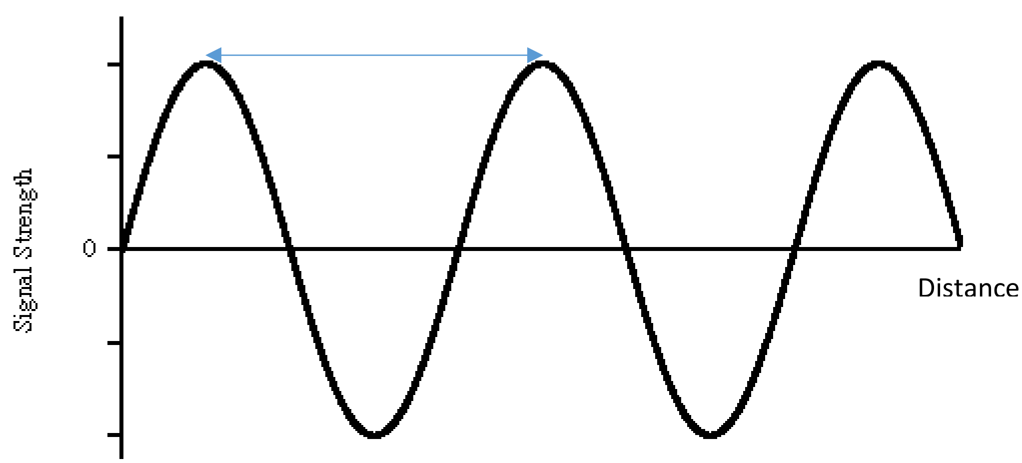
Reading Objectives:

- Maxwell unified the electric and magnetic forces in just one electromagnetic force. This is huge. This still motivate scientists to create a unified theory for all the forces. Read more about this in section 24.1
- We are going to talk about waves a bit in this chapter. It would be a good idea to review the concept of frequency, period and wavelength you studied in PHYS 1111
- Try example 24.2
- In section 24.4 we talked about energy and intensity of an electromagnetic wave. Don't confuse them. Do you know their units?
- Try example 24.4

Warm-up

Write amplitude, period and wavelength in their corresponding places





Cool – down

Provide the solution to problems 3 and 4 (page 946)

PHYSICS 1112 **Name: ______________________________**

Chapter 24 – Warm-Up due November 4th

Reading Objectives:

- In section 24.4 we talked about energy and intensity of an electromagnetic wave. Don't confuse them. Do you know their units?
- Try example 24.4

Cool - dowm

Assume the mostly infrared radiation from a heat lamp acts like a continuous wave with wavelength 1.5 um. If the lamp's 200 W output is focused on a person's shoulder, over a circular area 25cm in diameter, what is its intensity? What is the peak electric field strength? What is the peak magnetic field strength?

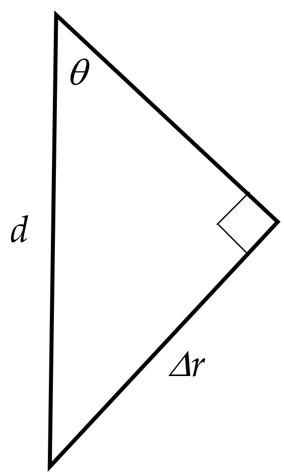
PHYSICS 1112 **Name: ______________________________**

Chapter 27 – Warm-Up due November 11th

- In Chapter 27 we will try to understand the concept of light. The colors in Fig. 27.2 and other experiments can only be understood if we treat light as a wave.
- Section 27.3 presents the most classical experiment to probe the wave character of the light: Young's double slit experiment
- Interference (constructive and destructive) are nicely explained in Fig. 27.11. This is key to understand the double slit experiment.
- Diffraction gratings are describe in section 27.4. These are everywhere, from the wings of a butterfly to monocrhomators in chemistry and biology labs.
- Work example 27.3

Warm-up

Known d and θ, what is Δr?



Continue on the back

Cool-down

What is the wavelength of light falling on double slits separated by 2 μm if the third-order-maximum is at an angle of 60°?

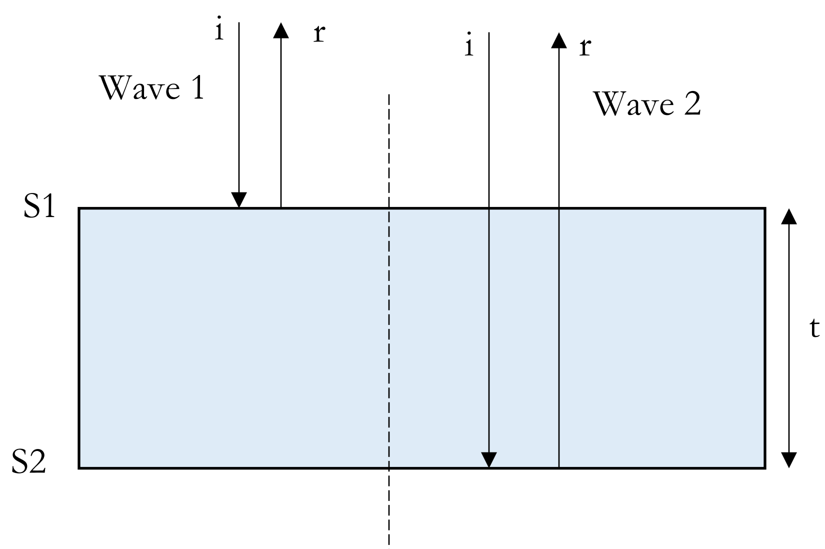
PHYSICS 1112 **Name: ______________________________**

Chapter 27 – Warm-Up due November 13th

- Single slit experiments (section 27.5)
- In section 27.6 we talked about the Rayleigh criterion and what the limits of resolution are
- In section 27.7 we will talked about thin film interference and we could explain the colors in the bubbles in Fig. 27.32. Also, we learn about the antireflection coating of the eye glasses
- Work example 27.6

Warm-up

Two traveling waves with the same wavelength find a material in their path. Wave 1 is reflected at the first interface (S1) meanwhile wave 2 is reflected at S2. How much further does the second wave travel more than the first one?



Cool-down

Light from a helium-neon laser (λ = 633 nm) illuminates two slits spaced 0.4 mm apart. A viewing screen is 2m behind the slits. A bright fringe is observed at a point 9.5 mm from the center of the screen. What is the fringe number m, and how much further does the wave from one slit travel to this point than the wave from the other slit?

PHYSICS 1112 **Name: ______________________________**

Chapter 27 – Warm-Up due November 15th

Cool-down

1. When light travels from air into water,
   a. its velocity, wavelength and frequency all change.
   b. its velocity changes, but its frequency and wavelength do not change.
   c. its frequency changes, but its velocity and wavelength do not change.
   d. its velocity and wavelength change, but its frequency does not change.
   e. its wavelength changes, but its velocity and frequency do not change.

2. What principle is responsible for light spreading as it passes through a narrow slit?
   a. refraction
   b. polarization
   c. diffraction
   d. dispersion

3. Monochromatic coherent light shines through a pair of slits. If the distance between these slits is decreased, which of the following statements are true of the resulting interference pattern? (There could be more than one correct choice.)
   a. The distance between the maxima stays the same.
   b. The distance between the maxima decreases.
   c. The distance between the minima stays the same.
   d. The distance between the minima increases.
   e. The distance between the maxima increases.

4. What do we mean when we say that two light rays striking a screen are in phase with each other?
   a. When the electric field due to one is a maximum, the electric field due to the other is also a maximum, and this relation is maintained as time passes.
   b. They are traveling at the same speed.
   c. They have the same wavelength.
   d. They alternately reinforce and cancel each other.

5. Two beams of coherent light start out at the same point in phase and travel different paths to arrive at point P. If the maximum constructive interference is to occur at point P, the two beams must travel paths that differ by
   a. a whole number of wavelengths.
   b. an odd number of half-wavelengths.
   c. a whole number of half-wavelengths.

6. Two beams of coherent light start out at the same point in phase and travel different paths to arrive at point P. If the maximum destructive interference is to occur at point P, the two beams must travel paths that differ by
   a. a whole number of wavelengths.
   b. an odd number of half-wavelengths.
   c. a whole number of half-wavelengths.

7. When a beam of light that is traveling in glass strikes an air boundary at the surface of the glass, there is
   a. a 90° phase change in the reflected beam.
   b. no phase change in the reflected beam.
   c. a 180° phase change in the reflected beam.
   d. a 60° phase change in the reflected beam.
   e. a 45° phase change in the reflected beam.

8. When a beam of light that is traveling in air is reflected by a glass surface, there is
   a. a 90° phase change in the reflected beam.
   b. no phase change in the reflected beam.
   c. a 180° phase change in the reflected beam.
   d. a 60° phase change in the reflected beam.
   e. a 45° phase change in the reflected beam.

9. The colors on an oil slick are caused by reflection and
   a. diffraction.
   b. interference.
   c. refraction.
   d. polarization.
   e. ionization.

PHYSICS 1112 **Name: ______________________________**

Chapter 25 – Warm-Up due November 18th

- In Chapter 25 we will keep working on light. We will now ignore things like "light bends around corners" (aka diffraction) and consider the "ray model" of light. This model is appropriate when the light interacts with objects larger the wavelength of the light. Check the introduction and section 25.1 for details.
- In section 25.2 you can read about reflection and learn why in many terror movies the monster comes from behind a mirror.
- Index of refraction and Snell's law (equation 25.8) are the main take-aways from section 25.3. Now you know why a straw looks 'bent' inside a glass of water…
- Work examples 25.1 and 25.2
- Total internal reflection (section 25.4) has many applications, from endoscopes to telephones.

Warm-up

A beam of light is incident on the surface of a pool of water at an angle of 30^{o} from the normal. Use Snell's Law to determine the angle of refraction. Include a sketch of the situation and label both the incident and refracted angles on your sketch.

PHYSICS 1112 **Name: ______________________________**

Chapter 25 – Warm-Up due November 25th

- In section 25.6 we will learn about thin lenses. We are surrounded of them, from your eye glasses to the camera in your phone.
- There are two type of lenses, converging and diverging.
- Read about ray tracing and how we can find the images created by a lens graphically.
- Figure 25.34 compares our eyes with a photographic camera…
- Equations 25.26 and 25.27 are main take-aways.
- Work example 25.6

Cool-down

In the figure, the object is 50 cm in front of a converging lens (f = 30 cm). What is the position of the image? Solve this using ray tracing and the thin lens equation