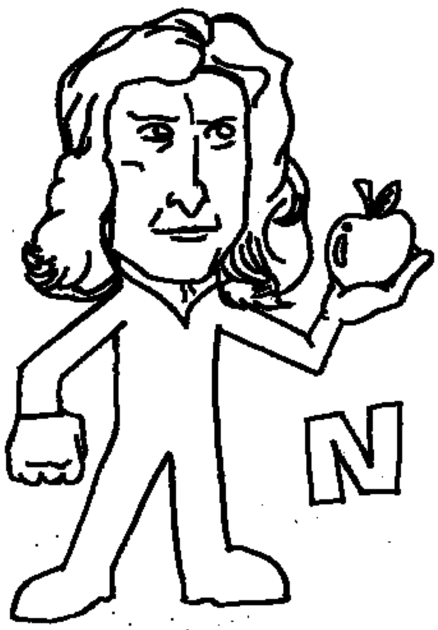
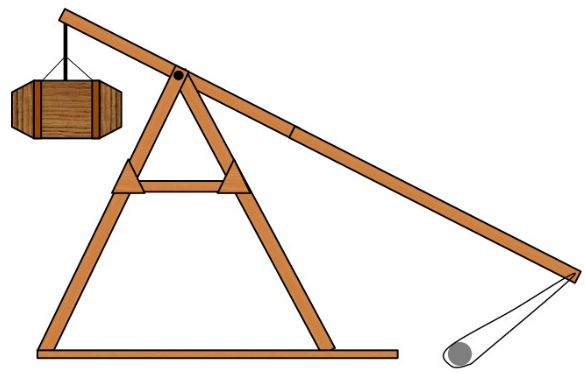
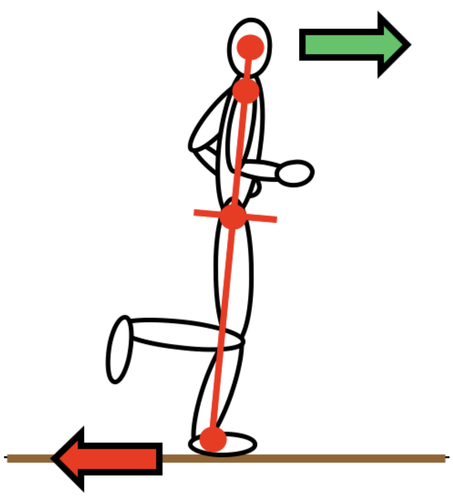
Forces & Newton's Laws

Chapter 4







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ESPN Sport Figures: "That Mu You Do" with Jeff Gordon

1. What do they put in race car tires instead of air?

2. What are a couple of things that friction does to a car?

3. What is between the tires and the road that keeps the car under control?

4. What is the term for when a tire uses friction to grip the road?

5. Name two things that the force of friction depends on.

6. What do we call the characteristic that describes the amount of traction between two surfaces?

7. What are the two types of friction and what is the difference?

8. What symbol is used for the coefficient of static friction?

9. What is the unit for μ?

10. Describe a simple experiment you could do to measure the coefficient of friction for your car tires.

Force Diagrams

Free Body Diagrams (FBD)- Sketch the FBD for each situation

1. A box on a flat floor
2. A stationary box on a tilted ramp
3. A box sliding on a tilted ramp at constant speed
4. A box sliding on a tilted ramp accelerating
5. A sign held up by two evenly space chains
6. A sign held up by a long chain on the right and a short chain on the left
7. A parachutist as he just jumps from a plane
8. A parachutist in freefall
9. An astronaut on a space station is the same as one of these, which one?

<u>Newton's Laws in a Nutshell</u>

"Nothing yet. . . How about you, Newton?"

Newton's First Law (Inertia): In the absence of a net force, an object at rest stays at rest and an object in motion stays in motion at a constant speed in a straight line forever

This means: Things keep doing what they're doing unless there's a leftover force in some direction. If all forces balance, it keeps on keepin' on.

This also means: When F=0, a=o (Follows from F=ma.) If acceleration is zero, it cannot be speeding up, slowing down, or changing directions. Its velocity is constant!!

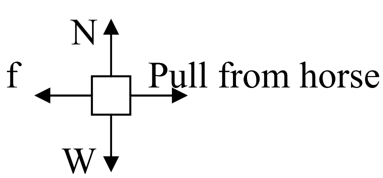
Newton's Second Law (F=ma):
A net force give a mass acceleration. Or, Net force = mass x acceleration.

This means: If there is a leftover force, things will change. It will speed up, slow down, or change directions. That is, it will NOT have constant velocity. Recall that velocity includes direction!

Newton's Third Law (action/reaction):
For every action there is an equal and opposite reaction.

This means: If two objects hit each other, they hit with the same force no matter what their masses or accelerations are. Always. These forces cannot cancel out even though they are the same amount and opposite directions because they aren't on the same object.

<u>**Example**</u>: A horse pulls a cart. The cart pulls the horse with the same force (but opposite direction) that the horse pulls the cart. Yet, the cart <u>can</u> move. Why don't they cancel out? Look at the cart's force diagram.



The fact that the horse has forces on him is <u>irrelevant</u> when trying to determine if the CART is moving. You must <u>only look at the forces on that</u> <u>one object</u> to see if it will change motion. So, if the force of the pull is greater than the force of friction, the cart moves. Otherwise it doesn't.

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Newton's Laws - which fits best/explain/understand?

1. In terms of inertia, what is the disadvantage of a lightweight camera when snapping the shutter? Why is a massive tripod preferred by most photographers?

2. Your empty hand is not hurt when it bangs lightly against a wall. Why is it so painful when you do the same action when carrying a heavy box?

3. In tearing a paper towel or plastic bag from a roll, why is a sharp jerk more effective than a slow pull?

4. What kind of motion does a constant force produce on an object of constant mass?

5. An object is not moving even though there was a force on it. What conclusions can you draw?

6. It gets progressively easier for a rocket to accelerate while it is in space. Why is this?

7. A Mack Truck and a VW bug have a head-on collision.
    a) Which has the greater force on it?

    b) Which has the greater mass?

    c) Which has the greater acceleration?

    d) Which has the greater damage?

8. A toy train with a single car launches a projectile straight up just before the train enters a tunnel along a straight track. Presuming the train does not change its velocity, will the ball land ahead of the train, behind it, or precisely on top of it?

<u>Newton's laws mini-lab</u>

*Visit each station and understand how Newton's laws can explain their behavior. You may get a **<u>lab quiz</u>** on it!*

1. Magic Trick: To get the nuts to land in the flask, pull the hoop quickly. More nuts make it easier to do. Which law best explains this?

   What would happen if you pulled slowly?

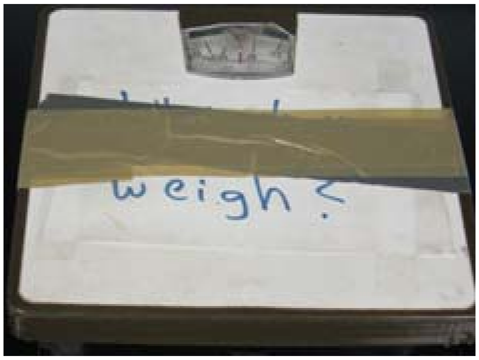
2. With boxes A and B, one has much more mass than the other.

   a. Which one of Newton's laws predicts one is harder to begin moving from rest?
   b. Which one of Newton's laws would predict how much force would be required to give each a 1 m/s^2 acceleration?
   c. Push one so it slides along at constant speed. Are the forces on it balanced?
   d. How do you know?
   e. Draw a FBD showing all vertical and horizontal forces.

3. The old table-cloth trick....pull a paper from a full water bottle.

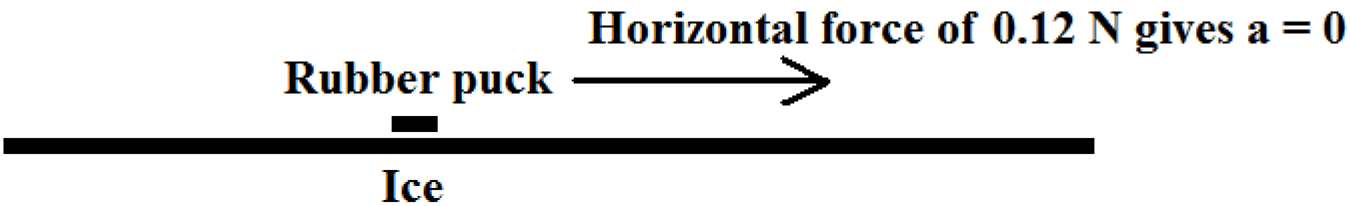
   a. Which one of Newton's laws explains this best?
   b. Using this same law, would it be easier or harder to do this trick with a very full or very empty bottle? Why?
   c. What force will tend to make the bottle tip over?

4. Cooperative pushing...push with a 10 lb. force with a partner.



   a. Can you do this without someone or something pushing back?
   b. Is it possible to have a single, isolated force?
   c. Which one of Newton's laws explains this best?

Friction Practice Problems



Friction force: $f = \mu N$

There are two horizontal forces acting on the puck shown. First, a force is applied using a fish scale and it's found that when pulling the puck at **constant** velocity, a horizontal force of 0.12 N is indicated on the scale.

1. If the velocity is constant, what is the acceleration of the puck?

2. What is Newton's 2nd law?

3. According to Newton's 2nd law, if acceleration of anything is zero (say a hockey puck for instance), then what is the net force?

4. If the net force on the puck is zero and there is a horizontal force of 0.12 N to the right, then what left-ward force exists and what is its magnitude?

5. Assume the mass of the puck is 80 g, how many newtons does the puck weigh?

6. State the equation we learned for friction?

7. What is the normal force and what is its magnitude and direction for out example problem?

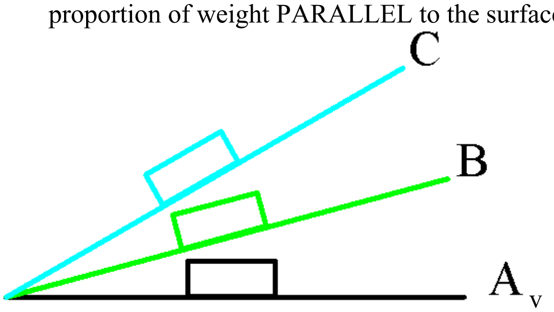
8. Do you have enough information to find the coefficient of friction of ice?

9. What is μ for the problem above?

10. In general, what do you know when acceleration is zero?

11. Check if you understand: Student A.J. applies a 12 N force to push a heavy box full of Lou Malnati's pizza across a table at a constant speed of 0.34 m/s. If the delicious large, buttercrust cheese pizza has a mass of 1800 g, then what is the experimental COF for cardboard/table surfaces?

12. Normal means perpendicular. The normal force is a REACTIONARY force perpendicular to the surface. As an inclined plane is tilted from position A to B to C (angle increases), what happens to the force proportion of the mass' weight pushing perpendicular to the surface? As the normal forces decreases, what happens to the friction force according to $f = \mu N$? What happens to the proportion of weight PARALLEL to the surface (the weight component trying to make it slide down)?



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FRICTION LAB

Introduction: Do they choose rubber as a material for tires because it has "high friction"? If that sounds logical, then consider this: Your rubber tires act very differently on wet ice in the winter than they do on a dry day. Obviously, the friction a tire experiences depends on what material the rubber tire is rubbing against.

Friction is a force that resists two objects from sliding by each other.It always acts opposite to the motoin of an object. In this lab we will investigate the effect of the type of materials that slide by each other as well as the effect of the normal force. Friction is also different depending on whether an object is sliding (already in motion), or is resisting a stationary object from beginning motion (static friction). Static friction is generally more than sliding friction and is never less. In other words: $F_{\textbf{static}} \geq F_{\textbf{sliding}}$.

Part I: Static vs. Sliding Friction: Effect of materials

You will using a sliding block, spring scale and a two weights for your investigation. Use your spring scale to find the weight of the block and the heavier weight. Newton's 3rd law says that if an object is resting on a surface, that surface will exert a force equal to the weight of the object. This response force is perpendicular to the surface and we call this reactionary force the normal force since normal means perendicular. You are using a horiztonal surface so the normal force must be equal to the weight of the object. Coefficient of friction is is the ratio of the applied force to the normal force and uses the symbol: μ. μ is a property of two surfaces and has no meaning for a single surface. After all, how could you specify μ for rubber when rubber behaves so differently rubbing on ice compared to rubbing on dry pavement?

Method for measuring Static frictional force: Attach your spring scale to the sliding block. Pull the sliding block horizontally tugging harder and harder until the block moves. The highest reading you see on the spring scale is the force required to begin motion. This is the static frictional force.
Method for measuring Sliding frictional force: Attach your spring scale to the sliding block. Pull the sliding block at a constant speed so the spring scale is steady. This steady value is the force required to maintain motion so the frictional force exactly balances the force applied by the spring scale and $F_{\textbf{net}}$ is zero. This is the sliding frictional force.

Record your data below and answer the questions:
$f_{\textbf{static}} = \mu_{\textbf{static}} * F_{\textbf{Normal}}$ $f_{\textbf{sliding}} = \mu_{\textbf{sliding}} * F_{\textbf{Normal}}$

Surfaces	Normal force (N)	Static Frictional force (N)	Sliding Frictional force (N)	$\mu_{\textbf{static}}$ (dimensionless)	$\mu_{\textbf{sliding}}$ (dimensionless)
Rubber/table					
Wood/table					
Rubber/carpet					
Wood/carpet					

1. Circle one: The frictional force always opposes the (applied force/motion)
2. The units for cofficient of friction are:
3. Circle one: The normal force is always (perpendicular to the surface/parallel to the motion/depends on the surfaces)
4. Can you tell what material has the highest value for μ and if so, what is its value?

Part II: Static vs. Sliding Friction: Effect of normal force

Imagine placing a small child on a piece of carpet and pulling her across the living room floor. She is only moving horizontally, so you are not lifting her up, you are just applying a force to resist friction of the carpet against the floor. Now imagine putting a big football player on the same carpet. Would it be so easy to pull him along the floor? You haven't changed the materials for the coefficient of friction (μ) hasn't changed. Obviously, since you're resisting friction and friction has gone up, something else caused it to happen. It turns out that the normal force has an effect on frictional force. Investigate this relationship by varying both the normal force and the frictional force below.

Record your data below and answer the questions:

Percent more = 100% * (Heavy value – Light value)/Light value

Surfaces	Light weight (N)		Heavy weight (N)		Percent more (%) Heavy compared to light	
	Normal force	Frictional force (sliding)	Normal force	Frictional force (sliding)	Normal force	Frictional force (sliding)
Rubber/table						
Wood/table						
Rubber/carpet						
Wood/carpet						

1. Which goes up more percentage-wise: Normal force or frictional force?

2. If the football player weighs six times that of the small child, how much harder would you have to pull the football player?

3. Draw a free body diagram of the football player and the child below showing both vertical and horizontal forces. Remember, magntude of force is shown by arrow length in free body diagrams.

4. Sketch the basic graph shape of frictional force versus normal force. Label the X and Y axes and point out the MEANING of the slope (hint: look at the equation for friction!)

PhET Forces & Friction Lab

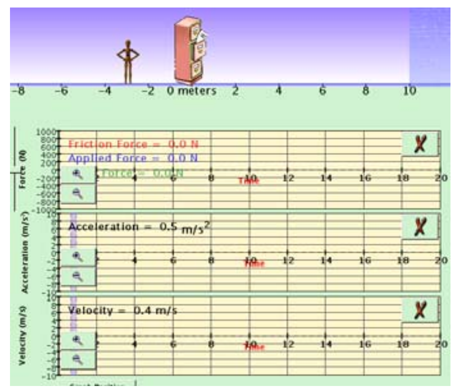
Purpose: The goal of this lab sim is to see the effects of applied, gravitational, normal, and frictional forces effect the acceleration of everyday objects using free body diagrams.

1. To start the lab off go to http://www.colorado.edu/physics/phet/web-pages/simulations-base.html. Once you are here select the tab for the Motion sims and click on the sim "Forces in One Dimension".
2. Familiarize yourself with the buttons and what they do. Specifically the buttons for the different graphs, the force slider, and the button to turn friction on and off.

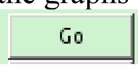
Part 1. Forces without Friction

1. In the upper right-had corner of the screen is the button for selecting friction. Turn it off.
2. Select an object on the right side of the screen by clicking on it and record the mass: ____________________.

3. You can adjust the Force$_{in}$ (applied) by moving the slider on the left half of the screen or by entering a number in the force applied window. Enter a force with a round number (i.e. 100 N, 200 N…).
Record your force:___________________________



4. In the center of the screen you will find the tabs for the different graphs. Have open the graphs for the forces, velocity, and acceleration.

5. Push the 

button and observe carefully.

6. Press the 

and 

and this time around pay close attention to the values being displayed on the graphs for both acceleration and velocity. Describe what you see for both measurements.

7. Write down the values you obtained for the force, the mass and the acceleration.

Q 1: What mathematical equation can you derive based on this comparison for acceleration in terms of force and mass? *(Hint: make sure that the friction was turned off when you take your measurements.)*

8. Select a new object to push and repeat steps 3 through 7.

Q 2: Does your hypothesized equation remain the same?

Q 3: What mathematical equation can you derive for force?

Part 2. Forces with Friction

1. Turn the friction of the system on by selecting the ☐ Friction button.
2. Select the smallest of the masses and again apply a particular force to it.
3. This time you will only need the have open the forces and acceleration graphs.
4. Apply a force of 50 N and press go.
5. Record the required data in the table.
6. Repeat steps 4 and 5 with all the other objects increasing the applied force by 50 N at a time until the object starts to accelerate.

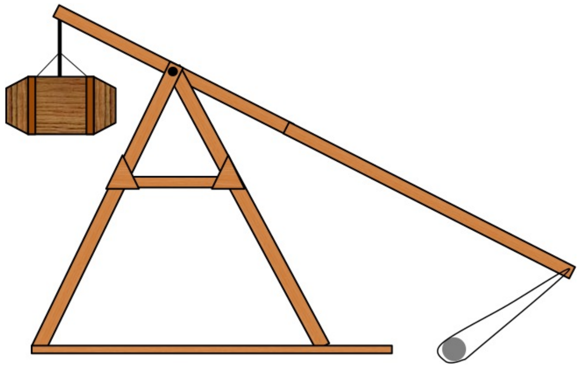
Object	mass (kg)	applied force (N)	Acceleration (m/s^2)	Force of friction (N)
book				
dog				
file cabinet				
crate				
refrigerator				

7. Make a graph of the mass vs. force of friction.

Q 1: What generalization can you make about the relationship between the mass of an object and its frictional force?

Q 2: If you were to increase the mass of an object would that increase or decrease the force of friction that the object could feel?

Option 1: Projectile launcher!



Idea: You are a carpenter during the Middle Ages. The King requests all carpenters to build him a miniature scale model of a boulder launcher to knock down fortress walls. The King sets up a competition to find the most accurate and powerful launcher. Your team must build from scratch a device that will launch a small & safe ping pong projectile into the air to hit **a** target (about 1/2 x ½ x 1/2 m) at distance set by you. Your score depends both on accuracy and total distance, so you want to get it to go far but still hit the target! Read the grade rubric & rules!

Rules:

1. It's a trebuchet not a catapult! So no elastics, springs, etc. A falling weight makes it fly!
2. No kits. They're not very good. You will have better ideas! Total cost should be < $40
3. Keep it small: - no larger than 50 x 50 x 50cm in size when in ready-to-fire position
4. Do it safely- -- follow all school rules. If in doubt, discuss with your teacher before building!
5. Work together! Teams up to 4. Your grade can be lowered by your teammates if they agree you did less than your share.
6. Have a data table. Vary one factor (falling weight, angle, string length etc) and see how that affects your target distance.
7. No cheating. Once you announce your target distance, no changes. Launcher must stay on start line.
8. Keep it real. You're allowed one touch to release your trebuchet. The falling weight must be the only power source.
9. The launcher should fling the projectile upward, this make a long firing range possible.
10. Turn in everything as indicated in the rubric

Projectile Physics Project: *Grade Sheet*

Trebuchet Name:__________________________
Group Members:____

Scoring

Accuracy & Precision – 10 pts

You will do three launches in the physics room from at least 2.5 m away. You will be given the exact distance at launch time (you need to know how to adjust to different target lengths). The target will be a bucket (or something similar, trash can, etc.). You will get NO "warm-up" launches after being given your target distance. Accuracy points are as follows:
10 pts – hit target on the fly all three launches
9 pts – hit target on the fly once and come within 1 m on other two
8 pts – come within 1 m of hitting the target at least twice
7 pts – shoot ping pong at least 1 m all three times
6 pts – shot ping pong at least 1 m once

Workmanship – 10 pts

10 pts – rugged, durable, well-decorated, solidly built (not fragile), steady and does not wobble easily
0 - 9 pts and less: lacking some/all of the above characteristics to varying degrees

Physics – 10 pts

Turn in the following sheets:

1. Hand drawn sketch (this is not art class, but must be reasonable) of your launcher including name of launcher and names of participants.
2. Data table showing various trial runs including the factor that was varied. Trial runs are numbered to make referencing them easy. You should have at least 10 trial runs where your adjusted variable (see #6 in rules) was changed to see its effect. Your data table was typed or very neatly hand-written.
3. Hang time calculation (assume no air resistance). This will include measuring, relative to the floor, the height of release point and maximum height for one of your typical trial launches. In other words, you know Δy, Δx, a_y, v_f on the way up, v_i on the way down. Include a step-1-type SKETCH showing the 8 motion variables up and down.
4. Using the same trial as above, find V_x.

Spirit/Rules/Effort – 10 pts

1. Time given in class was used for this project and/or physics: All members used time in class wisely to work on project (did not over socialize, work on Spanish, say "I did it at home", etc.)
2. All members contributed to project.as agreed upon by fellow group members (your group is satisfied with your contribution)
3. Group was positive and got along with each other and rest of class.
4. Launcher had a cool name, theme and so did group
5. All group members were also polite audience members during other presentations and did not do last minute work on presentation day

TOTAL POINTS :______________ (40 possible)
Grade Percentage:

Comments:

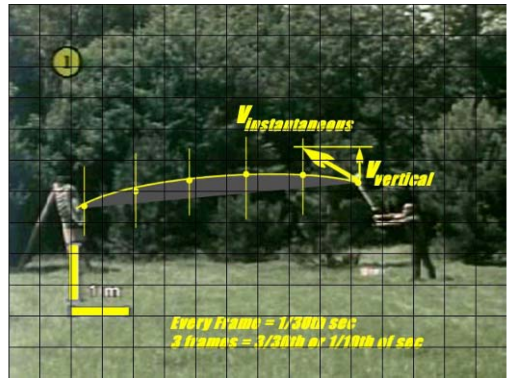
1. Pick an athlete in your group to perform a "projectile stunt". The stunt should last about 1-5 seconds and have a trajectory.

2. Find a digital camera or digital camcorder to use in class only on "video day". (Bring your own props & equipment!)

3. Point the camera so it's 90 degrees (perpendicular) to the athlete's motion (this avoids angle distortion of the distances!)

4. Have a background object of known height so you can later scale the video to the correct distances.

5. It's your responsibility to make a file that will project on the screen for everyone to see. You will use Tracker for this. I have a $50 camera that makes perfectly fine AVI video files that I have used with Tracker dozens of times without fail. I can try to help you with video capture and other technical problems, but it's not my responsibility to make sure your project works. If you're having technical difficulties, be prepared to spend some time after school, waiting along with other students for help. With that said, if you meet your deadlines and show me that your project works on MY computer and the room 187 projector ahead of time, there will be no penalty if it fails to work on presentation day.



6. Find some video footage of a professional athlete doing a similar motion to analyze—digitize if possible for analysis so you can compare your athlete to that of a pro!

<u>Video Analysis:</u> To the whole class on presentation day

1. Show both videos
2. Use Tracker to find meaningful motion variables that affect performance of the sport being analyzed
3. Provide a consultation on how the amateur might change something to perform more like the pro, or better in some way – include how Tracker data helps make this clear. Try to provide at least 3 suggestions and provide a detailed analysis on at least one of those suggestions.
4. Do a physics NIFTY calculation pertaining to the analysis (confirm Tracker data, do a "what if" scenario regarding your suggest amateur's change, etc.)
5. Show research as to your coach's tips (at least three sources with citations)

Grading:

Category	**Description**	**Pts**
Preparation	Project time provided was spent wisely in class on physics. Team showed spirit and got along. All members contributed in a mutually satisfactory way. Raw video clip was handed in on time (a day early to verify it works on teacher computer...yes, this is in both preparation and presentation part!) and if problems were found, students worked diligently to solve them taking responsibility for finding a solution. Time given in class was used for this project and/or physics: All members used time in class wisely to work on project (did not over socialize, work on Spanish, say "I did it at home", etc.) All group members were also polite audience members during other presentations	10 pts
Presentation	• Presentation went smoothly and did not exceed 5 minutes • Analysis was meaningful, audience was involved and interested, positive energy and comments were made throughout • Video files were provided the day before and tested on YOUR TEACHER'S computer and projector (not a similar computer belonging to another teacher or a projector that should work the same).	10 pts
Physics	Physics was used to solve the problem Meaningful physics was done (not trite) No physics errors were made	10 pts
Report	Paper work was neat and organized (in the **same order** as follows!) and included 1. Athlete improvement summary a. Three meaningful suggestions for improvement were made b. At least one of the suggestions included a detailed analysis including motion analysis data to support it c. Three sources were cited regarding coaching tips d. A professional athlete was used as a comparison 2. A NIFTY calculation was done pertaining to analysis (confirm Tracker data, do a "what if" calculation or other related item)	10 pts
Total		**40 pts**

Unit 04 – Vocabulary and Equations – Forces & Newton's Laws

Vocabulary:	**Symbols:**
previous vocabulary force, net force, equilibrium electromagnetic force, gravity, long-range force contact force, field force mass (m), weight normal inertia Newton (N) friction normal force coefficient of friction (COF, μ) static friction, sliding friction, kinetic friction free body diagram (FBD) Newton's law(s) (IFA)	Δ, x, v, t, Δx, Δv, Δt, a, f, i, $f_{s,max}$, f_k, **Equations & constants:** **You get these on test:** $v = \frac{\Delta x}{\Delta t}$ $a = \frac{\Delta v}{\Delta t}$ $\Delta x = v_0 \Delta t + ½ at^2$, $v_f^2 = v_i^2 + 2a \Delta x$ $v = v_0 + a \Delta t$ (v means v_f) $v_x = v \cos\Theta$, $\Delta x = v_x t$, $v_i = v \sin \Theta$, $\Delta y = v_y t$ $F = ma$ $F_f = \mu F_n$ $p = mv$ $I = \Delta P = F\Delta t$ 60 mph = 27 m/s; 60 seconds = 1 min.; 60 min = 1hr.

Unit Objectives - Williams

1. I understand all the vocabulary & math of this unit and all demos, videos, equations, and class assignments
2. I remember objectives & vocabulary from previous units.
3. I understand force is a push or a pull, and can distinguish contact and field forces such as gravity, magnetism and static electricity
4. I can draw/analyze free-body diagrams identifying F_N , F_g, F_A or F_T and F_f and analyze net forces
5. I can break down gravitational force on a surface into parallel and perpendicular components (F_{gx}, F_{gy})
6. I can break down forces into X and Y components and analyze these components independently
7. I can add vectors numerically by X and Y components or graphically using arrow representations
8. I understand that forces ON and object affect the motion of an object; forces BY and object do not
9. I realize that when all forces are balanced, the net force is zero and no acceleration takes place
10. I memorized all three Newton's laws by number. I can come up with examples of each kind and distinguish which law is primarily demonstrated when given sample questions.
11. That a floor can "push you" makes sense and this normal force is necessary or I feel weightless
12. I can compute weight, distinguish mass & weight, understand the universality of mass
13. I know friction always opposes the motion of an object and not necessarily the external forces on the object
14. I know how the normal force effects friction and how tilting surfaces changes normal and frictional force
15. I know what does/doesn't impact friction like μ, weight, normal force, motion, speed, contact area, etc.
16. I know what COF (μ) is, its units, how many surfaces determine it and how motion/stillness affects it
17. I know how the value for static friction varies with applied force, but kinetic friction is constant

DuPage ROE Objectives

101. I can distinguish between scalar and vector quantities.
201. I can draw a free body diagram.
202. I can identify the Law of Inertia (Newton's 1st Law) to various situations in the real world.
203. I can add force vectors graphically to find net force.
204. I can distinguish the difference between mass from weight.
205. I can recognize net force as the sum of the forces and not a force in itself.
206. I can calculate the net force based on the forces acting on an object in one dimension.
207. I can determine if an object will accelerate depending on the net force acting on it.
208. I can solve problems using Newton's 2nd Law
209. I can identify action-reaction force pairs (Newton's 3rd Law) and the fact that they act on two separate bodies.
210. I can identify the factors that create friction, and how friction will affect an object's motion.
211. I can identify the direction of the velocity, acceleration, and net force on an object undergoing uniform circular motion.

Physics Calendar - Forces & Newton's Laws: 2013-14(Williams) - Chapter 4 (11/16 days)

Bold and underlined means put in journal notes (for any problems: Show your work!);

L	**We:10/02/13**	GOALS: Intro unit: trebuchet project, prep FBD HW, normals • What a force is and field vs. contact forces • Lazy horse and FBD's (common force names) • Start HW	• **(04-01)** Notes: Forces: Contact/field, FBD (F_N, F_g, F_A or F_T and F_f)**:3,4,5,8** • **(04-02)** p. 124: All 8 questions
1	**Th:10/03/13**	GOALS: Go over HW, Newton's laws • Show HW if Q's, Newton's laws (IFA: Bad Italian accent) • Action reaction pairs (identify, examples!) • Fnet = ma example problems • Adding force vectors (yes, hardest thing in the world)	• **(04-03)** Notes: Newton's three laws (IFA), net forces, equilibrium, resolving force vectors (trig), FBD's, practice problems similar to HW**: 6,7,9,10,11** • **(04-04)** p. 128: All 3 questions
2	**Fr:10/04/13 Pep rally**	GOALS: Go over HW and affirm where we are • Go over HW Q's and answer Q's • Group quiz	• **(04-05)** Notes: F_{net} = ma problems**:1**
3	**Mo:10/07/13**	GOALS: Go over quiz & HW • Go over quiz and HW • Do some page 132 problems together • Intro friction (static and dynamic), demo tomorrow's lab	• **(04-06)** Notes: Weight, Friction**:12,13,14,15,16, 17**
4	**Tu:10/08/13**	GOALS: Do friction lab • Do friction lab • Possible short group work, start HW	• **(04-08)** p. 143: All 5
5	**We:10/09/13**	GOALS: Lab quiz & review • Take lab quiz • Review Newton's laws and do some friction (group quiz or clix)	• **(04-09)** p 145+: 1-5, 9, 13, 22, 24, 39
6	**Th:10/10/13**	GOALS: Friction quick lab, Group work • Using timer and block to find COF of block/floor • Group work and/or HW time	• **(04-10)** p 145+: 7, 8, 16, 28, 34
7	**Fr:10/11/13**	GOALS: Intro Trebuchet project • Groups meet, plan project including materials, timing and responsibilities More group review problems	• Celebrate Mr. CC
8	**Tu:10/15/13**	GOALS: Review for Test & Trebuchet time • Go over HW & Clix/sheet • Project time	• **(04-11)** p 145+:18, 27, 31, 36
9PSAT	**We:10/16/13**	• PSAT (juniors, 7:45 - noon?)	• **(04-12)** p 145+:23, 25, 32, 38
10	**Th:10/17/13**	GOALS: Prep for test & continue on project • Class choice	• Study for test
11	**Fr:10/18/13**	• Test: Forces & Newton's Laws	• Work on project (this is your only weekend!)
12	**Mo:10/21/13**	• Project work day	• Work on project
13	**Tu:10/22/13**	• Project work day	• Work on project
14L	**We:10/23/13**	• Project work day	• Work on project
15	**Th:10/24/13**	• Project work day & project presentations	•
16	**Fr:10/25/13 End of Q1**	• Project presentations	•