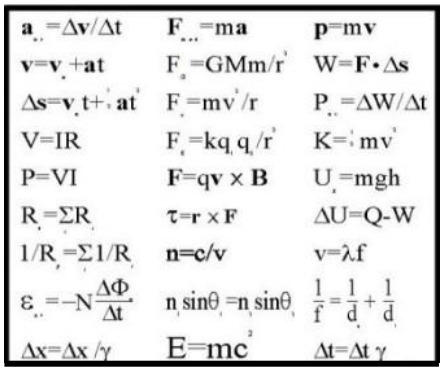

Weekly Sheet for M$2/ H$1b PHYSICS

Michael Dixon (MD^2)

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Week #5, Week of Mon(9/26) to Mon (10/3)

Topics/Content/Skills: Kinematics (Linear and Circular), Intro Dynamics, Review

Skills:

- Identify and calculate the components of a initial velocity vector.
- Identify a velocity and Acceleration graph from a Displacement vs Time graph.
- Solve 1 and 2 step algebra problems for trig.
- Can convert between 2 levels of units.

Vocabulary/Key Terms/Formulas:

Constant Acceleration, Kinematics(d_f eqn), Projectile motion, Components of forces, Vectors, Circular motion ($F_c= mv^2/r$;direction of A and V), Torque (rxF= τ; Review), Impulse ($F\Delta t= \Delta P$)

Homework/Classwork: (All homework is due the next class day unless indicated.)

	In Class	Homework Due in this Class
Monday 9/26	PhET Labs Projectile motion lab Khan Academy Practice(if time)	Sheet #9
Tuesday	Finishing our lab, Graphs	Projectile motion Activity Get Quiz Signed…
Wednesday	Projectile Review *Online Physics lab- Constant Velocity*	Hmwrk sheet #10
Thursday	Test #1	Hmwrk sheet #11
Friday	No Class on Fridays	NA
Monday 10/3	PhET simulation Lab Prezi Practice Khan Academy	Hmwrk sheet #12

Tests/Due Dates: **There will be a 45 min test on Thursday Sept. 29**

Test Topics: *Vector Components, Circular motion, Kinematics, Projectile motion, Torque, Impulse, Atwood machines, 1-**2 Step Algebra problems, STEM Review, Extra ordinary Review, Graphs of DVAJ, Basic Trigonometry.***

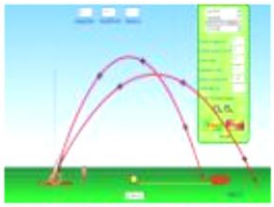
Special Events/News:

6th -10th graders are expected to take the PSAT's and consequently we are having some extra help sessions during academic club time as well as Saturdays 10:00am to 12:30pm Lunch will be provided.

Name _____ **(partner)** _____

Projectile Motion (Intro) PhET Simulations Lab

Due Tuesday!


Projectile Motion

Introduction:

Projectiles travel with two components of motion, X any Y. The acceleration and velocity in the Y direction is independent of the acceleration (if any) and velocity in the X direction. In this module, you will investigate the motion of a simple projectile. Realize that while gravity (acceleration) acts on the projectile in the _____ direction, it does not affect the velocity of the projectile in the _____ direction.

Procedure: *(we will be ignoring air resistance during this lab)*

- Run the PhET Simulations → Play → Motion → Projectile Motion Run Now!
- The cannon can be moved to add or remove initial Y position and X position.
- The cannon can be pivoted to change the firing angle, θ.
- The tape measure can be moved and dragged to measure range to target.
- To fire the cannon, Fire.
- To erase the projectile's path, Erase.

Be sure **air resistance is off** and spend some time firing various projectiles.

- Set the initial speed to a value between 10-15m/s. Choose your favorite projectile.
- Find the range of the projectile at various angles.

θ = _30__ Range (dx) = _____ m

θ = _40__ Range (dx) = _____ m

θ = _50__ Range (dx) = _____ m

Add two more →

θ = _60__ Range (dx) = _____ m

θ = _70__ Range (dx) = _____ m

θ = _80__ Range (dx) = _____ m

θ = _____ Range (dx) = _____ m

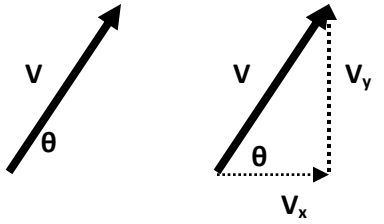
θ = _____ Range (dx) = _____ m

- Measure the distance from the cannon to the target using the tape measure.
- Move the target to 21.0 m from the cannon. Attempt to hit the target with three different angles by changing the firing angle and initial velocity.

Range (d_x) = 21.0m θ = _____ Vi = _____

Range (d_x) = 21.0m θ = _____ Vi = _____

Range (d_x) = 21.0m θ = _____ Vi = _____



VERY IMPORTANT

$$v_x = v\cos\theta$$

- A projectile's velocity (v) has an X component (v_x) and a Y component (v_y). The X component (v_x) is found by multiplying the magnitude of the velocity by the ***cosine*** of the angle, θ.
- Similarity, the Y component of velocity is found by multiplying the magnitude of the velocity by the ***sine*** of the angle, θ.

$$v_y = v\sin\theta$$

So, a projectile fired at **20 m/s** at **65°** has an X-velocity of $v_x = 20\cos 65$ or **8.5** m/s.

The projectile would have a Y-velocity of $v_y = 20\sin 65$ or **18** m/s.

So, the projectile would fire as far as one fired horizontally at 8.5 m/s and as high as one fired straight up at 18 m/s.

A projectile fired at 30 degrees with a velocity of 15 m/s would have an x-velocity component of _____ m/s and a y-velocity component of _____ m/s.

Calculate the components of the following projectile's velocities:

1. v = 35 m/s θ = 15° v_x =____ v_y = ____
2. v = 35 m/s θ = 30° v_x =____ v_y = ____
3. v = 35 m/s θ = 45° v_x =____ v_y = ____
4. v = 35 m/s θ = 60° v_x =_____ v_y = ____
5. v = 35 m/s θ = 75° v_x =_____ v_y = ____
6. v = 35 m/s θ = 90° v_x =_____ v_y = ____

- We can reverse the process and combine the two components of velocity back into one velocity fired at an angle.
- The magnitude of velocity is found using the Pythagorean Theorem with v_x and v_y as the legs of a right triangle. For instance, the velocity of a projectile with an x-component of 7.2 and a y-component of 4.8 is $\sqrt{7.2^2 + 4.8^2} = 8.7$ m/s.

- The angle above the horizontal is found using the inverse tangent ($\tan^{-1}$) of the legs v_y/v_x. For instance, the angle of the projectile described above would be $\tan^{-1}(\frac{4.8}{7.2}) = 34^o$.

Calculate the velocity magnitude and angle of the projectiles listed below:

7. $v_x = 5.6$ $v_y = 6.4$ v =_____ θ = _____

8. $v_x = 2.8$ $v_y = 4.9$ v =_____ θ = _____

9. $v_x = 8.1$ $v_y = -7.2$ v =_____ θ = _____

10. $v_x = -1.3$ $v_y = -5.2$ v = ____ θ = _____

Conclusion Questions:

1. Without air resistance, the piano travels *further / the same distance* as the football. (circle)
2. This is due to the fact that velocity in the X-direction *increases / is constant / decreases* as projectiles travel.
3. The Y-component of velocity *increases / is constant / decreases* as projectiles travel.
4. The answers to #2 and #3 are due to the fact that gravity acts *only in the Y / both the X any Y* direction.
5. The path of a projectile is a *linear curve / round curve / parabolic curve*.
6. This is due to the fact that the time component in the free fall equation (dy) is _____.
7. Without air resistance, maximum range of a projectile is obtained with an angle of_____ .
8. The same range can be obtained with angles of _____ and _____.
9. Firing a projectile at 25 m/s at an angle of 35^o is similar to firing a projectile with a speed of _____ straight up and _____ horizontally.
10. A projectile with a horizontal component of 13 m/s and a vertical component of 18 m/s would have an overall velocity of _____ m/s at an angle of _____ above the horizontal.

Name/ Grade:_____/ Date:_____

Homework Sheet #10

1. A car with an oil leak is moving left to right. Match the oil drop pattern with the motion word that most closely describes it.

I. Rest

II. Deceleration

III. constant velocity

IV. acceleration, then deceleration

V. acceleration

a.

b.

c.

d.

e.

2. A force F_1 pushes on an object of mass 5 kg with a force of 100 N to the right. A force F_2 pushes on the same object with a force of 150 N to the left.

   a. What is the net force on the object? _____

   b. What is the acceleration of the object? (Choose from below)

(A) 0.3 m/s^2 to the left
(B) 0.5 m/s^2 to the left
(C) 1 m/s^2 to the left
(D) 1.5 m/s^2 to the left
(E) 10 m/s^2 to the left

3. Match the distance vs time graph with the motion phrase that most closely

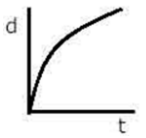
I. An object at rest

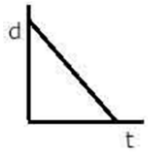
II. constant positive velocity

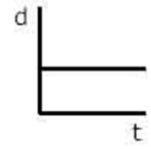
III. increasing velocity

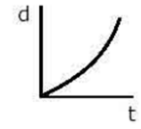
IV. decreasing velocity

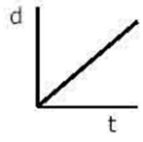
V. constant negative velocity

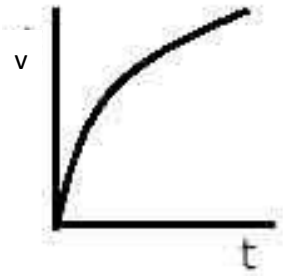
A. 

B. 

C. 

D. 

E. 

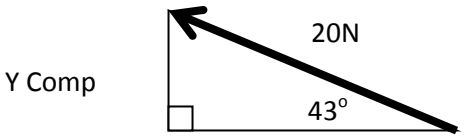
4. 

For this Graph of v vs t. Draw the acceleration vs time graph.

5. Fermi: Estimate how many times have you have opened a door? *Show work for Credit and give answer to the nearest order of magnitude (power of 10).*

Physics Review Questions of the Week

6.



a. What is the x component of 20 N vector ?_____

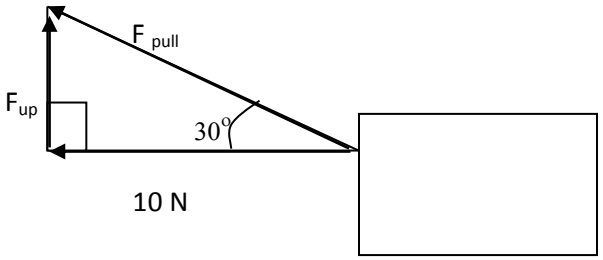
b. What is the y component of the 20 N vector ?_____

Basic Derivatives:

1. D=_____
   a. V= $2t^3$
   b. A=_____
   c. What is A if t = 4 seconds?_____
2. V= $50t^9$
   a. A= _____
   b. D= _____ (be careful)
3. A= $10 m/s^2$
   V=_____

Basic Trigonometry: Level:_____

7.



a. What trig function would you use to solve for F up?

Cos θ Sin θ Tan θ

(Circle one)

b. *What is F_{up}?*

c. *What is F pull?*

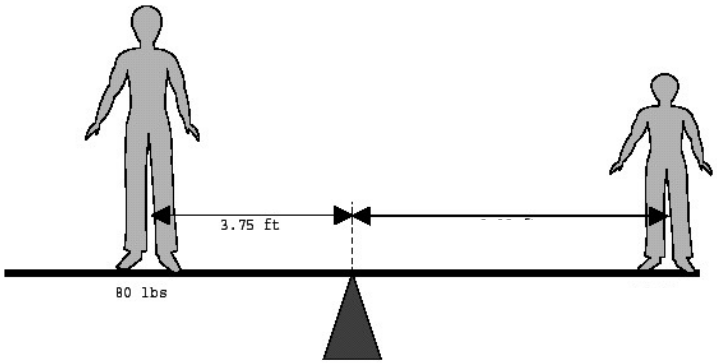
d. *If the box does not move off of the ground, What is the weight of the box?*

e. *What is the normal?*

7. Explain how projectile motion works:_____

Name/ Grade:_____/ Date:_____

Homework Sheet #11



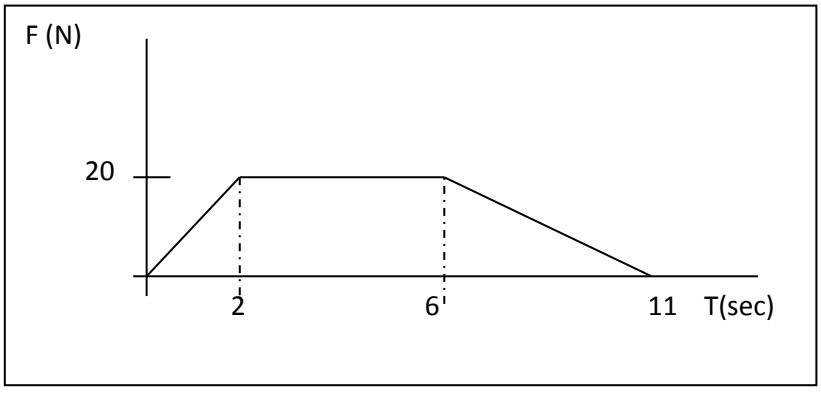
1. Frank a ~ 80lb, 7th grader is on a see saw with a Georgette a 3rd Grader. Frank is 3.75 feet from the pivot and the Georgette is 5 feet from the pivot.

a. Label the Forces of the students

b. Label the direction of the torque for each student.

c. Solve for the weight of the 3rd grader_____

2.



a. What is the Impulse from 0-2 seconds?

b. What is the Impulse from 2-6 seconds?

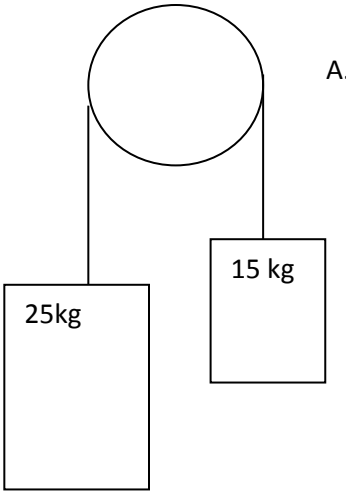
c. What is the Impulse from 6-11 seconds?

d. What is the total Impulse from 0-11seconds?

e. A runner(30 kg) had this impulse and she started from rest how fast would she be moving after 11 seconds? _____

f. How fast would she be running after 20 seconds?

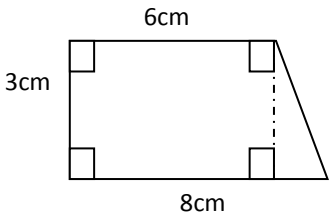
g. How far would she have travelled from 11 seconds to 20 seconds?_____

3. 

A. What is the magnitude of Acceleration of the blocks?_____

B. What is the Tension on the String?_____

Equations/Units Memory:

1) For Newton's 2nd law If you triple the mass and double the acceleration what do you get compared to the original force (F_o)?	2) **Unit** for momentum =_____	3) Draw the FBD of a 5kg at rest on a table. Label all forces on it.
4) Impulse=_____x_____ or =_____x_____ Unit=_____	5) Torque=_____x_____ or =_____x_____ Unit=_____	6) Area of a Trapezoid= 
7) Describe an Atwood machine is_____ _____	8) Spring Potential Energy =	9) If AxB=C If you keep B constant and half A, what happens to C?
10) Spring Force = _____ Unit=_____	11) The slope of the displacement vs. Time graph is called _____	12) The Area (Sum) under the Force vs time graph is: _____

Name/ Grade:_____/ Date:_____

Homework Sheet #12

1. A ball is Thrown straight off a 10 m building at 20 m/s .
   - Draw a picture of what is happening:

   - How long does it take to hit the ground?_____
   - How far away from the base of the building is the ball when it lands?_____

2. A ball is shot at 30^{o} from the horizontal at 20 m/s on a flat surface.
   - Draw a picture of what is happening

   - What is the initial Vel. Comp up ?_____
   - What is the initial Vel. Comp Forward ?_____
   - What is the time of flight?_____
   - What is the range ?_____

4. Write 2 of your own projectile problems and solve them.

5.

A 3.5 kg block is pushed along a horizontal floor by a force P = 15 N that makes an angle θ = 40° with the horizontal, as shown in the figure. The coefficient of kinetic friction between the block and the floor is 0.25. Calculate (a) the frictional force exerted on the block and (b) the acceleration of the block.