

The Virginia Instructors of Physics

[www.vast.org/vip](http://www.vast.org/vip)

*VIP's mission is to foster communication among teachers of physics and physical science as well as to provide unique learning experiences for teachers and their students.*

March 2007 Edition

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Hi all! I hope your school year has been wonderful and that you are looking forward to an invigorating spring VIP meeting. My apologies for the lack of VIP newsletters – like everyone, my schedule has only become more hectic. As I mentioned at the 2006 spring meeting, the time has come for me to step down from the position of president of VIP. I am finding that other challenges are calling and taking my time and attention away from VIP and feel the group could prosper under another's leadership. I have benefited a great deal from my association with VIP and it is a group I am VERY proud of. There is no other organization I belong to or know of that conducts itself in a more professional manner. I will continue to call myself a member of VIP and will continue to attend and contribute as I am able. As always, our spring meeting will start with business and election of officers. This year the business meeting will begin with a look at the physics standards of learning and the schedule for review and revision of the physics standards. After our business meeting we will elect our two officers – President and Vice-President.

### ***VIP/VAST Spring Meeting Information***

**Who:** Physical Science teachers and Physics teachers and professors

**When:** April 21st (time agenda below) 8:30 – 4:00

**Where:** the physics building, Jesse Beams Laboratory. There is a good web map at <http://www.virginia.edu/webmap/>. Click on “G” The physics building is #41. You may want to park behind #38 off of stadium road.

**Why:** ‘Cause it’s a fun way to become better at what you do!

**Sponsor:** This meeting is hosted by the Physics Department of the University of Virginia and supported by funds from the Virginia Association of Science Teachers.

### ***RSVP IF ATTENDING – FIRST 24 GUARANTEED MAKE AND TAKE EQUIPMENT – [ajackson@harrisonburg.k12.va.us](mailto:ajackson@harrisonburg.k12.va.us)***

Agenda

8:30 – 9:00 Hellos and Juice, Coffee, and Danish

9:00 -10:00 Business and election of officers

10:00 – 11:30 Share Session – bring an idea and 35 copies the write up to share!

12:45 – 4:00 Make and Take on “Station Education”

High Speed Filming of High Interest Events

Bring a lesson, idea, piece of equipment- bring a friend! We will head to local restaurants for lunch together (but as far as cost – you’re on your own)

## ***Station Education***

This spring's Make and Take is on "Station Education". "Station Education" is an approach to lab teaching that Tony Wayne and I have both found highly effective-effective in terms of time, cost, equipment, and student outcomes. At the spring meeting we will have several rooms set up as if for a class of students to run through a lab set up in the "stations" approach. Attendees will be invited to work their way through the stations to get a feel for how a lab works with this approach. Our Make and Take will then supply you with the great majority of the equipment and materials needed to go home and conduct these labs in your classroom. In other words our goal is for you to return home with 'ready to teach' labs oriented to the 'station education' approach for momentum and Bernoulli's principle.

## ***Physics of Phast!***

A whole universe of physical phenomena exists at the edges of our perceptions. Events that happen in the blink of an eye or a magicians flick of the wrist. Modern digital equipment offers unprecedented opportunity to explore the world of phast physics.

At the spring VIP meeting you will have the chance to record an event or demonstration which you have always wished you could see in super slow motion. What does a ball look like when it is rebounding off of the floor? What does a bubble look like as it is popping? Bring something with you to the next meeting and we will try to capture the event with a high speed video camera. Let us know what you plan to bring through the VIP listserve. This will prevent people from bringing duplicate items and hopefully spark new ideas as well as allowing us to plan the type of lighting and space we will need.

The camera we will be using is capable of capturing video at 500 fps (frames per second), 2 milliseconds between frames with a maximum shutter speed of .0002 sec/frame. The camera has a resolution of 640/480 pixels and the frames are greyscale, no color. As an example of what is possible, the nominal impuse time of a golf ball on a club is approx 7 milliseconds. That means at 500 fps, we would get 3 or 4 frames of the impact. I have posted a few examples of the cameras capabilities on google video. Here are some links to a few videos on google video which will give you an idea of what the camera is capable of:

<http://video.google.com/videosearch?q=phys+312>

<http://video.google.com/videoplay?docid=4440956821015945595&hl=en>

I will be posting links to other examples on the VIP listserve as they become available.

-Mike Timmins

## ***Fall Meeting 2007 – Williamsburg Nov 8-10***

Once again we will have our fall meeting in association with VAST. This will be in Williamsburg on November 8th – 10<sup>th</sup>. Last fall VIP was responsible for five well attended sessions. Thanks to all who made it possible! At the VAST meeting awards are given to outstanding teachers. This past fall our very own Tony Wayne received the "Award for Outstanding Teaching" in Physics. As everyone who has attended a VIP meeting in the past 20 years knows – this is well deserved! Congratulations Tony!

This year the theme of the VAST Professional Development Institute is Celebration of Exploration. Make sure you schedule now to come explore your profession with VAST and VIP. If you have never presented at the VAST PDI please consider joining up with VIP for either the VIP Table Top Demos or the VIP Share Session. It is an easy and exciting way to try out your skills at sharing what works for you with your professional colleagues. The 2007 VAST PDI is shaping up to be an exciting event. One thing you will not want to miss is our Celebration of Exploration at Busch Gardens! Friday night's dinner, entertainment, and unlimited rides on Big Bad Wolf, Curse of DarKastle, and the Bumper Cars are all included in your registration thanks to a partnership between VAST and Busch Gardens. Enjoy dinner and experience the physics of Busch Gardens with your VIP friends.

## ***VAST & VIP***

Let me take a few lines to explain our relationship with VAST. VIP is an official affiliate of VAST. By being an affiliate, we have a non-voting voice on the VAST board – Andy Jackson, representing VIP. For the past several years Andy has also been the Physics Standing Committee Chair on the VAST board and is thus a voting member of the board. This past November, Andy was elected president-elect of VAST and will serve as the PDI chair for 2007. With this change of responsibility, Tony was chosen by the VAST board to serve as the VAST Physics Chair. What does being an affiliate mean? Well, like I mentioned, we have a voice on the VAST board and for the last several years VAST has provided seed money for our Make and Take sessions at our spring meetings. For the past two years and again this year, VAST is supplying VIP with \$700 to purchase materials for our spring meeting. In turn, the presence of VIP at the VAST conferences has grown steadily. I remember a time when there was only one or two Physics related sessions. Now it is a matter of choosing which I would like to go to the most. VIP and VAST serve each other well and I hope and plan for our affiliation to continue to benefit both organizations.

## ***Station Education: Fluids – An Independent Study***

Earlier in the newsletter I mentioned "Station Education". This is a name I'm giving to a technique that I have applied and developed for myself over a number of years. It is nothing terribly unique, and I don't claim credit for it in anyway. It is just something that has worked for me and Tony says is working for him. Just like "Inquiry based learning" you can take this approach to any degree you'd like. I use it for three or four units and

find it particularly useful when I want to cover many concepts quickly (and in a relatively shallow manner) or when equipment is at a premium. What follows is a unit that takes about five 90 minute blocks for my students to complete. This is the “Station Education” approach taken to the extreme – students are responsible for reading, labs, and problem solving all on an independent basis. Chaotic? OF COURSE! Effective? I believe so. Flexible? Highly flexible and easily allows for differentiating how much help I provide each individual student.

## Va. SOL:

- PH.7 The student will investigate and understand properties of fluids. Key concepts include
- density and pressure;
  - variation of pressure with depth;
  - Archimedes’ principle of buoyancy;
  - Pascal’s principle;
  - fluids in motion; and
  - Bernoulli’s principle.

## Topic/Concept – Fluid mechanics Materials

35 mm film canister w/ lid	2 kg mass
500 ml beaker of water	Container w/ 30 cm deep of salt water – rubbermade trashcan
Beach sand	50 cm stick
Electronic balance	Clear flexible tubing 1.5 m per set up
Ruler	Plastic funnel that can fit into tubing
Hydraulic lift kit	Grocery bags
Spring scales or force probe 0-30 N	shopvac
	Clear duct tape

**Safety Considerations-** Shopvac can send small bits of mater flying w/ injurious speed.

This set of four labs allows students to examine the various fluids laws and principles at an independent pace. The write up presented here is correlated to my Honors Physics text book – [Holt Physics](#).

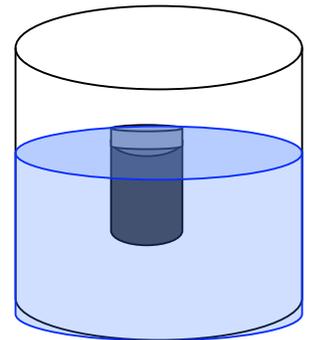
## Fluids Unit – Independent Study

Complete the following and prepare for a 50 point test.

Read sections 9.1 in [Holt Physics](#) Solve 9A-2



Obtain a film canister and determine by measurement and calculation (not trial and error) the mass of sand needed to barely make it float in water. Fill the canister with this amount of sand and then test it. Provide a neat example of work and report the results (quantitatively) of your test. Explain what fluid principals are employed in this experiment. – 5 pts GET DATA SIGNED WHEN YOU TEST YOUR WORK.



Read section 9.2 in Holt Physics Solve 9B-1 & 9C-1

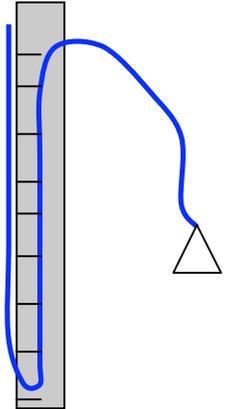
 Hydraulic Lift. For each size syringe determine the force needed, actual mechanical advantage and calculate the efficiency to raise a 2 kg mass w/ the hydraulic lift in class. – 20 pts GET DATA SIGNED WHEN YOU COLLECT YOUR DATA. Turn in a report that has a neat data table with data and results and a brief explanation of how the hydraulic lift accomplishes its mechanical advantage. Explain what fluid principles are being demonstrated with this equipment.

 Use a manometer to measure the pressure (in appropriate SI units) as a function of depth in the tub of salt water. Create an appropriate graph and write up conclusions. Explain what fluid principles are being demonstrated. – 20 pts GET DATA SIGNED

Read section 9.3 in Holt Physics Solve 9D-3

 Use a manometer to determine the speed of the air coming out of the shop vac. To do this you will remove the funnel from the end of the plastic tube. Explore different areas in the stream of air and produce a brief report

 describing the air flow. Explain what principles of fluid dynamics are being demonstrated. – 20 pts. GET DATA SIGNED



Solve & hand in the following problem set. It starts on p 343 1,12,13,16,38 & 61 – 10 pts

## Sources & References

Hydraulic lift can be found at

[http://www.teachersource.com/catalog/page/Physical\\_Science\\_Physics/Physical\\_Science/?id=752b10ed663ce3fb4a6549695c6d613a](http://www.teachersource.com/catalog/page/Physical_Science_Physics/Physical_Science/?id=752b10ed663ce3fb4a6549695c6d613a)  
for \$48.95

## Making the Manometer

The manometer in the fluids lab is a student made device. Take a  $\frac{1}{2}$  meter stick with the 0 cm end down and C-clamp it to a 2 x 4 x 4 block. Take 1.5 m of clear tygon tubing and use clear duct tape to attach one end of the tube to the top of the  $\frac{1}{2}$  meter stick along one edge. Run the length of the tube down the edge of the  $\frac{1}{2}$  meter stick and make a U and head back up the other edge. Tape the tubing as needed. Put a drop of food coloring in some water and pour water into the tubing so it settles into the bottom U of the tube and goes up equally on the two sides to about 20 cm high on each side.

Get a plastic funnel and insert it into the length of tubing that is flopping around. Take a section of plastic grocery bag and stretch it across the wide end of the funnel and use clear duct tape to secure it. Use the tape to make sure it is an air tight seal. Slight pressure exerted on the grocery bag will cause the water to change levels in the tube. This water manometer will read 9.81 Pascals per mm difference in water height. (an exercise for the student!)

## **Notes and Comments on the Independent Fluids labs**

**Floating Film Canister** – This is a pretty straight forward task where the student will utilize the idea that the weight of the water displaced equals the buoyant force – Archimedes principle. Careful measurement will get the canister floating with its lid partially submerged.

**Hydraulic Lift** – This is a commercially available product that is a series of clear plastic tubes and syringes connected with some particle board. In this experiment the student uses the set up to lift a 2 kg mass. They apply their knowledge of efficiency and mechanical advantage from an earlier unit with simple machines and work and energy.



<http://www.teachersource.com>

**Manometer** – You can have the students build their own, or to save time, have a couple already constructed for use. You can tell the students it measures 9.81 Pascals per mm of water difference or have advanced students solve how to read the device. I use a concentrated salt solution for my water to measure Pressure vs Depth because if you use just water, the depth of the funnel should equal the reading on the manometer. Salt water mixes things up a bit. The beauty of Station Education is you only need one or two messy trashcans full of salt water.

**Air Flow** – The funnel is removed from the manometer and air is blown ACROSS the tube opening. Many students are amazed that the water goes the ‘wrong way’ and angle the airflow INTO the manometer tube – a very big – and wet – mistake. Key here is ACROSS the opening and to realize the water will move UP the tube being blown across. Bernoulli in action.

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## **Web & Newsletter & Listserve & meetings – Oh My!**

There are so many ways to stay involved with your physics colleagues through VIP. If you would like to correct or add a mailing address for the newsletter please send an email to [ajackson@harrisonburg.k12.va.us](mailto:ajackson@harrisonburg.k12.va.us) with your name, postal address, and name of school with the subject line of **VIP mail**. You can access our web site at <http://vip.vast.org> where you can find archives of the newsletters for the past many years, hints for new teachers, and much much more. Tony Wayne maintains our wonderful website – a huge thanks to Tony! You can also sign up for the email discussion group from the web site. Once you’re on the list serve you can post a question and hear back from one or more of over 200 VIP members including University Physics professors, brand new high school physics teachers, and veterans of the physics classroom with more years of experience than they may care to mention. Ron Revere serves as our list serve moderator – thanks Ron! And of course, come to the meetings! We have VIP meetings in the spring and in association with the VAST PDI. This year we also held a fall meeting with AAPT. Join the excitement and develop your professional skills with VIP!

### **Web based air track simulations**

What's the condition of your air track? Do you have one? Do you have an air source? Do you wish you had make up lab for those students who missed the days you had the air track lab setup? Below is a list of air track simulations from the web along with some notes regarding what they offer.

Michigan State University				
<a href="http://www.msu.edu/user/brechtjo/physics/airTrack/airTrack.html">http://www.msu.edu/user/brechtjo/physics/airTrack/airTrack.html</a>				
Notes: online lab at <a href="http://www.hazelwood.k12.mo.us/~grichert/sciweb/airtrack.htm">http://www.hazelwood.k12.mo.us/~grichert/sciweb/airtrack.htm</a> Elasticity is adjustable.				
X	Input velocity as number		Input velocity as slider/btn	X Java
X	Input mass as number		Input mass as slider/btn	Flash/Shockwave plugin
	S.I. units		Show energies	
X	Elastic Collision		Show momentum	
X	Inelastic Collision		Show momentum vectors	
X	Pre Set scenarios		Show energy vectors	
	Shows center of mass		Show friction effects	

iPhysics from physics lessons.com by Jeff Whittaker –Dearborn Public Schools				
<a href="http://www.physicslessons.com/exp5b.htm">http://www.physicslessons.com/exp5b.htm</a>				
Notes:				
	Input velocity as number	X	Input velocity as slider/btn	Java
	Input mass as number	X	Input mass as slider/btn	X Flash/Shockwave plugin
X	S.I. units	X	Show energies	
X	Elastic Collision	X	Show momentum	
X	Inelastic Collision		Show momentum vectors	
	Pre Set scenarios		Show energy vectors	
	Shows center of mass		Show friction effects	

Physics Virtual Bookshelf				
<a href="http://faraday.physics.utoronto.ca/PVB/Harrison/Flash/ClassMechanics/AirTrack/AirTrack.html">http://faraday.physics.utoronto.ca/PVB/Harrison/Flash/ClassMechanics/AirTrack/AirTrack.html</a>				
Notes:				
	Input velocity as number		Input velocity as slider/btn	Java
	Input mass as number	X	Input mass as slider/btn	X Flash/Shockwave plugin
	S.I. units		Show energies	
X	Elastic Collision		Show momentum	
X	Inelastic Collision		Show momentum vectors	
	Pre Set scenarios		Show energy vectors	
	Shows center of mass		Show friction effects	

Simulation by Walter Fendt					
<a href="http://www.walter-fendt.de/ph14e/collision.htm">http://www.walter-fendt.de/ph14e/collision.htm</a>					
Notes:					
X	Input velocity as number		Input velocity as slider/btn	X	Java
X	Input mass as number		Input mass as slider/btn		Flash/Shockwave plugin
X	S.I. units		Show energies		
X	Elastic Collision		Show momentum		
X	Inelastic Collision	X	Show momentum vectors		
	Pre Set scenarios	X	Show energy vectors		
X	Shows center of mass		Show friction effects		

Simulation by Tony Wayne					
<a href="http://www.mrwaynesclass.com/teacher/Impulse/SimFriction/home.html">http://www.mrwaynesclass.com/teacher/Impulse/SimFriction/home.html</a>					
Notes:					
X	Input velocity as number	x	Input velocity as slider/btn		Java
X	Input mass as number	x	Input mass as slider/btn	X	Flash/Shockwave plugin
X	S.I. units		Show energies		
X	Elastic Collision		Show momentum		
X	Inelastic Collision	X	Show momentum vectors		
	Pre Set scenarios	X	Show energy vectors		
X	Shows center of mass	x	Show friction effects		

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Please put VIP mail in the subject line and tell me what to change. If you are receiving multiple copies, let us know what address to delete. If it comes to you with someone else's name on it – just drop me a line.

*You can know the name of a bird in all the languages of the world, but when you're finished, you'll know absolutely nothing whatever about the bird... So let's look at the bird and see what it's doing -- that's what counts. I learned very early the difference between knowing the name of something and knowing something.*

**Richard Feynman**