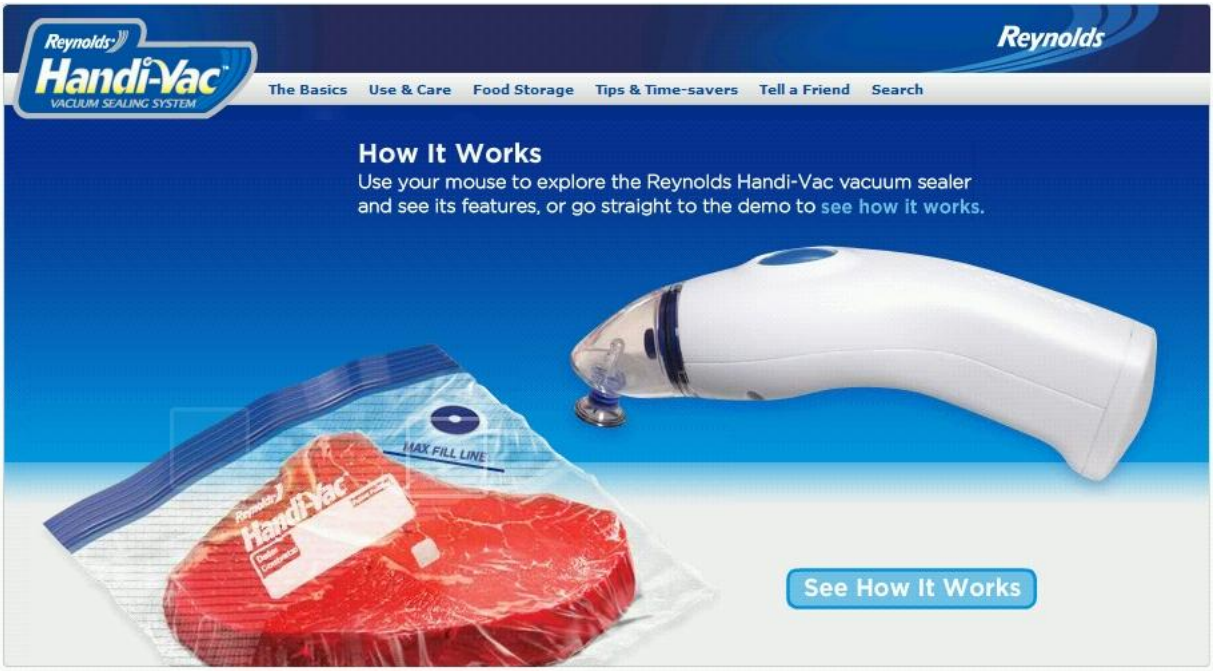
Reynolds Food Storage Handi-Vac Pump



Here are several vacuum science demonstrations using the Reynolds battery operated food storage pump.

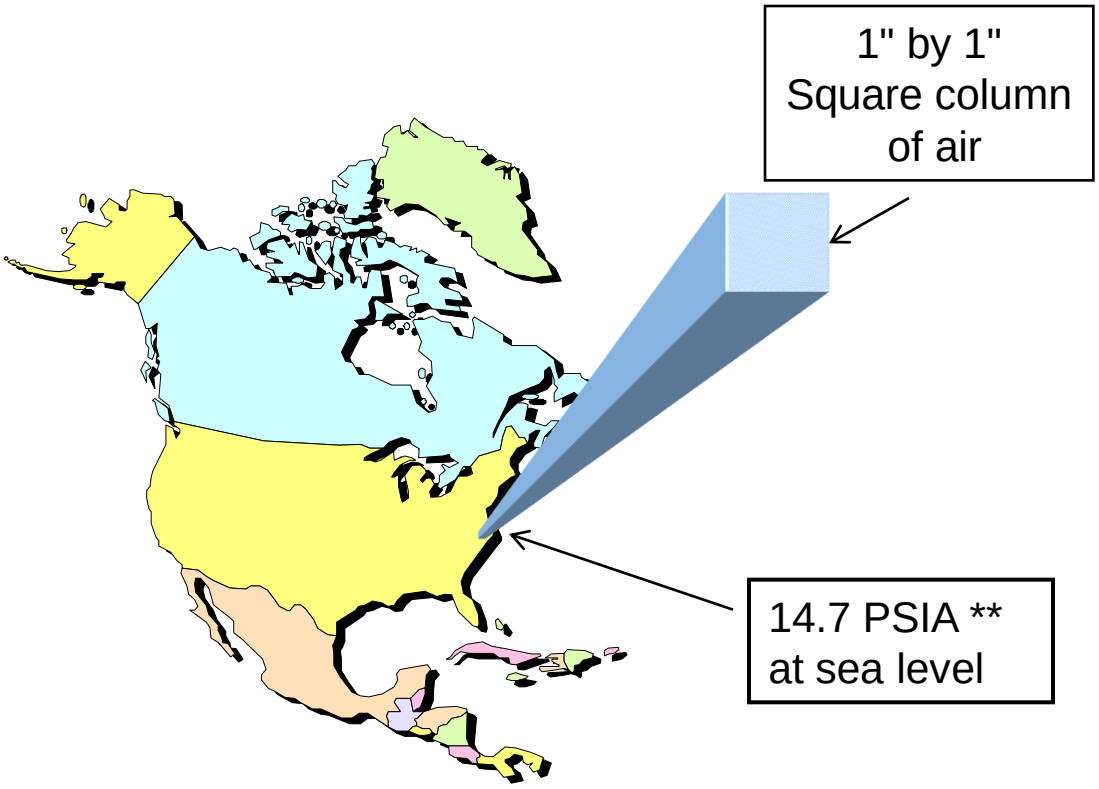
Introduction

Although the Reynolds Handi-Vac Pump was sold as a food storage device, it can also be used to demonstrate some interesting phenomena in Earth Science, Chemistry and Physics. The Reynolds Handi-Vac is used to remove air from specially sealed food storage bags. By removing the air inside the bag, the food product stays fresher for longer periods of time.

We can use the Handi-Vac Pump to demonstrate the effects of vacuum on various materials . We can also demonstrate how atmospheric pressure can do some work for us.
All that is required is the Handi-Vac Pump and some small items that can be purchased at the local supermarket and hardware.

Author: Tom Stec
NCCAVS Education Committee Member
October 2010

Atmospheric Pressure and Vacuum Primer



Atmospheric Pressure

The air we breathe applies a pressure on the earth's surface. This could be simply considered as due to the weight of the air above us, but is actually due to the force produced by the collision of gas molecules. Standard atmospheric pressure at sea level is -

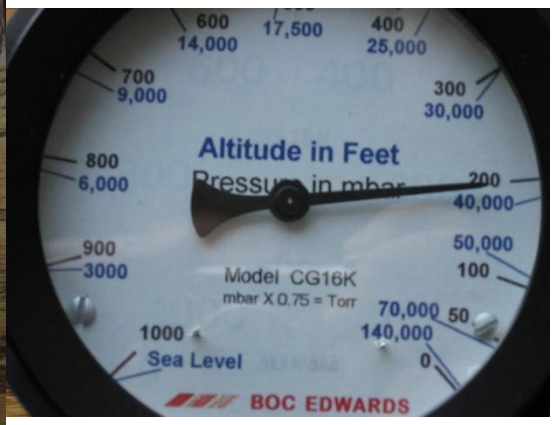
**** 14.7 Pounds Per Square Inch Absolute**

Vacuum Definition

A vacuum is a space in which the pressure is below the surrounding atmospheric level.

Derivation:
Latin - meaning empty.

If we use the Handi-Vac to to remove some air from a container or a food storage bag, we will have reduced the pressure in the bag to whatever vacuum level the Handi-Vac is capable of producing.



Vacuum produced by Handi-Vac is 200Mbar
Converting 200 Mbar we get 2.9 PSI.

By definition 2.9 PSI is below 14.7 PSI.
Handi-Vac has created a ***vacuum.***

Putting the Handi-Vac to Work Using Atmospheric Pressure

1. Soft sponge demonstration
2. Atmospheric pressure applied to your hand.
3. Bottle crush demonstration

Using the Handi-Vac to Show the Effects of Vacuum on Various Materials

1. Marshmallow / balloon demonstration
2. Aneroid Barometer in a vacuum demonstration

Soft Sponge demonstration

1. Review equipment required. **(See overview on next page.)**

2. Place soft sponge in Handi-Vac bag**

3. Press the seal strip on bag.

4. Hypothesize what you think will happen when you apply the Handi-Vac Pump to the storage bag. What will happen to the sponge when you unseal it?

5. Place the Handi_Vac Pump connection over the round blue seal on the bag. Start pump and observe.

Things to ponder

Bear in mind when the storage bag is evacuated,
The pressure inside is approximately 2.9 PSIA. (force of air pushing out)
The pressure outside the bag is atmospheric pressure, 14.7 PSIA. (force of air pushing in)
The net force is the difference (11.8 PSIA pushing in).
What would happen if we replaced the soft sponge with a piece of wood?

** Reynolds storage bags are getting difficult to find. Most supermarkets do offer a similar vacuum storage bag.

Atmospheric Pressure Sponge Squeeze

Equipment Required:

Reynolds Handi-Vac food storage vacuum pump

Soft sponge

Reynolds 1 gallon vacuum storage bag

1.

Place soft sponge in bag and seal top of bag

2.

Remove the air inside the bag

3.

Observe atmospheric pressure at work

Atmospheric Pressure Hand Squeeze Demonstration

1. Review items required. **(See overview next page.)**

2. Assemble items.

3. Hypothesize what you think will happen to your hand when you apply the Handi-Vac pump to the storage bag.
4. You can stop at any time if you feel the pressure on your hand is too much.

Things to ponder
Bear in mind when your hand is in the evacuated storage bag storage bag, the pressure inside is approximately 2.9 PSIA. (force of air pushing out)
The pressure outside the bag is atmospheric Pressure , 14.7 PSIA. (force of air pushing in)
The net force is the difference. (11.8 PSIA pushing in)

Atmospheric Pressure Hand Squeeze

Equipment Required:

Reynolds Handi-Vac food storage vacuum pump
small length 3/8” ID by ½” OD flex tubing
super market produce storage bag
rubber band

1.

Twist off the vacuum connection and slide 3/8 tubing on vacuum port.

2.

Place hand in bag. Insert tube. Use rubber band to help seal. Remove the air inside the bag

3.

Feel the force of atmospheric pressure

Atmospheric Bottle Crush

1. Review items required. **(See overview next page.)**

2. Assemble items.

3. Hypothesize what you think will happen to the bottle when you apply the Handi-Vac Pump to the rubber stopper (or bottle cap).

4. Apply the Handi-Vac Pump to the rubber stopper, turn on pump and observe.

Things to ponder

As you remove air from the water bottle, the pressure inside will approach 2.9 PSIA. (force of air pushing out)
The pressure outside the bottle is atmospheric Pressure – 14.7 PSIA. (force of air pushing in)
The net force is the difference (11.8 PSIA pushing in).
The only thing separating the two pressures is the thin plastic of the bottle.
What do you think would happen if you replaced the plastic bottle with a metal water bottle?

Water Bottle Crush

Equipment Required:

Reynolds Handi-Vac food storage vacuum pump
Number 4 rubber stopper with hole in center or drill a small hole in the water bottle cap
Several empty water bottles

1.

2.

Place rubber stopper in bottle. Place Handi-Vac on top of stopper.

3.

Remove the air from bottle

Demonstrate the effects of vacuum on various materials.

Marshmallow / Balloon

1. Review items required. **(See overview next page, and making a vacuum container – last page.)**

2. *Place marshmallows to be evacuated in canning jar .*

3. Hypothesize what you think will happen to the marshmallow when you apply the Handi-Vac Pump to the storage bag. What to you think will happen when you admit air back into the storage bag?

4. Place jar into Reynolds 1 gallon vacuum storage bag

5. Apply the Handi_Vac Pump connection over the round blue seal on the bag. Start pump and observe.

Things to ponder

You are now transferring material that has been at atmospheric level into a vacuum environment.
Some things don't do well below atmospheric pressure.
Other things will tolerate the vacuum environment.
Try replacing the marshmallows with a balloon that has been tied off with a little air still inside.

Marshmallow Expansion

Equipment Required:

Reynolds Handi-Vac food storage vacuum pump
Kerr ½ pint canning jar (with holes in lid)
Reynolds 1 gallon vacuum storage bag
Scotch Bright pad
Marshmallow

1.

Place marshmallows to be evacuated In canning jar.

2.

Place canning jar with Scotch Bright pad into 1 gallon Reynolds bag and evacuate.

3.

Marshmallows under vacuum.

Demonstrate the effects of vacuum on various materials.

Aneroid Barometer

1. Review items required. **(See overview next page.)**

2. Hypothesize what you think will happen to the barometer reading when you apply the Handi-Vac Pump to the storage bag. What do you think will happen when you admit air back into the storage bag?

3. Note the Barometric reading.

4. Place Barometer inside Reynolds 1 gallon vacuum storage bag

5. Apply the Handi-Vac Pump connection over the round blue seal on the bag. Start pump and observe the change in the meter reading.

Things to ponder

The Barometer is normally used to measure very small pressure changes in the atmosphere. By placing it into a vacuum (low pressure) environment, you are taking it beyond its normal pressure reading range.

When you opened the bag, did the Barometer reading return to your first reading?

Note that atmospheric pressure at sea level is equal to 29.92 inches of Mercury. For more information, look up the Torricelli Barometer .

Equipment Required:

Reynolds Handi-Vac food storage vacuum pump

Reynolds 1 gallon vacuum storage bag

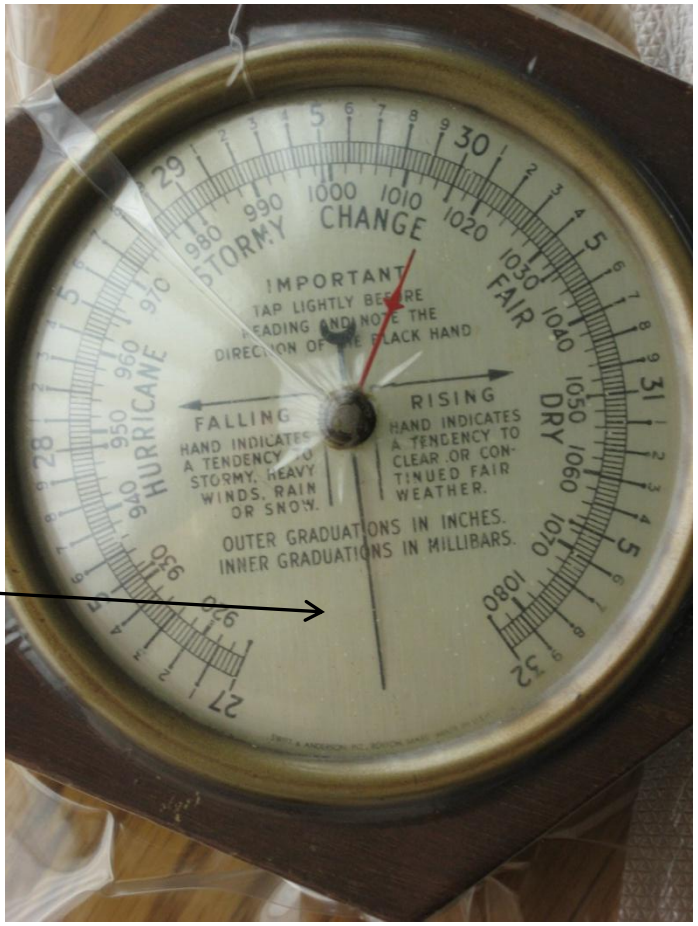
Small Aneroid Barometer

Aneroid Barometer at normal atmospheric pressure

Note pressure reading just under 30 inches of Mercury.

Aneroid Barometer inside evacuated storage bag.

Note pressure reading well below 27 inches of Mercury.



Making A Vacuum Container

Equipment Required:

Reynolds Handi-Vac food storage vacuum pump

Reynolds 1 gallon vacuum storage bag

Kerr ½ pint canning jar

Scotch Bright pad

Drill 6 to 8 holes in jar lid. Holes allow air to escape into vacuum bag.

1 gallon bag

Cut a Scotch Bright pad to fit over holes in lid. Scotch Bright keeps storage bag from sealing holes in lid.

Place items to be evacuated in canning jar. Place canning jar into the Reynolds 1 gallon vacuum storage bag. Use *Reynolds Handi-Vac food storage vacuum pump to remove air from bag.*