Experiment -1 Hydrostatic Bench

The ***Hydrostatic Bench*** enables the study of the main properties and the behavior of such liquids under hydrostatic conditions, with the aid of some accessories to make the different experiments.

Equipment Description

The equipment consists of a metallic structure assembled on wheels with a panel at the top. In the lower part of the bench there is a tank where water is stored. Water is then sent to a methacrylate tank placed at the upper part of the bench and to other plastic deposit. Two hand-operated pumps are used for such distribution. The methacrylate tank is connected to two communicating tubes on the front panel, enabling to perform some practices; the other deposit placed on the horizontal surface of the bench is necessary for performing the rest of the practices. All water in excess is sent back to the storage tank by the drain. The rest of the equipment consists of the following different elements and independent accessories:

- Barometer (10)
- Thermometer (3)
- Ubbelohde capillary viscosimeter, 0.6-3 cp (0c)
- Ubbelohde capillary viscosimeter, 2-10 cp (I)
- Ubbelohde capillary viscosimeter, 10-50 cp (Ia)
- Ubbelohde capillary viscosimeter, 60-300 cp (IIc)
- 3 graduated cylinders
- Accessory for demonstration of free surface in static conditions (7)
- Bourdon manometers calibration (13)
- Mercury manometers (9)
- Accessory to determine the metacentric height (FME11)
- Accessory for studying Archimedes´ principle
- Accessory for studying the hydrostatic pressure (FME08) (14)
- Fluid level gauge calibrator (16)
- Set of weights (5, 10, 20, 50, 100, 400, 1000, 2000, 5000 gr.)
- Air pump

- 2 water pumps (11 and 12)
- Universal hydrometer (1)
- Chronometer
- Set of measurement cylinders (2 of 600 ml) (4)
- Spare parts for the viscosimeter elements

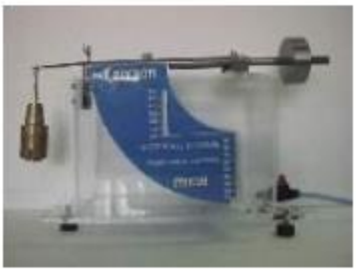


Figure 2.0.1. Main parts of the Hydraulic Bench

Experiment – 1. 1

Density and Specific Gravity Measurements

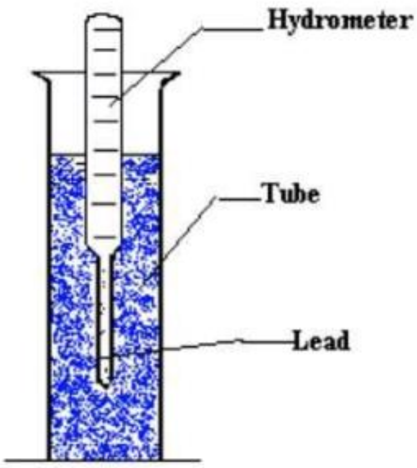
Aim of this Experiment

To determine density and specific gravity.

Necessary devices

Universal hydrometer.

Open precipitate tubes or cylinder



Procedure

1. Fill the precipitate tube or cylinder with water in such a way that the hydrometer floats. Check that the submerged length corresponds to 1.00 in the graduated scale.

2. Fill the other three cylinders with the liquids to work with, and note down the scale mark for each one. This value in the scale indicates the specific gravity.

3. Note down the results obtained in the following graph, taking into account the values of the atmospheric pressure and temperature in the moment of performing the practice.

Pressure .... mm Hg

Temperature .... º C

Sample Test Results

Liquid	Specific gravity	Density
Water		
Glycerine		
Motor oil		
Oil		

Experiment - 1.2

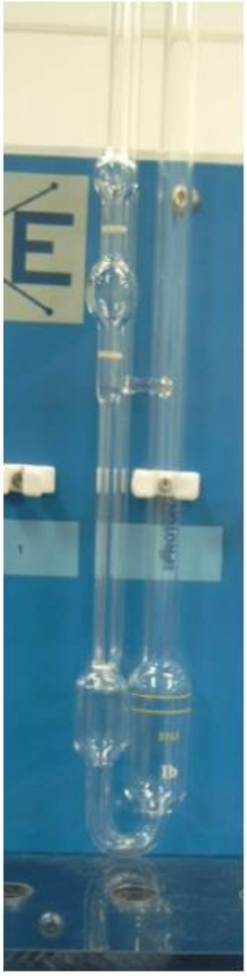
Viscosity measurement

Aim of this Experiment

Determine the viscosity of different liquids at atmospheric pressure and environmental temperature.

Necessary devices

- Ubbelohde capillary viscosimeter, 0.6-3 cp
- Ubbelohde capillary viscosimeter, 2-10 cp
- Ubbelohde capillary viscosimeter, 10-50 cp
- Ubbelohde capillary viscosimeter, 60-300 cp
- Chronometer
- Hydrometer
- Thermometer



Procedure

The liquids to be studied are:

- Car Motor oil
- Glycerol
- Castor oil

1. Find in tables four liquids of known viscosity, each one inside the measurement range of each viscosimeter.
2. Fill each Ubbelhode capillary viscosimeter, with the same volume of liquid of known viscosity and density, and write down the time used by the liquid of going down the viscosimeter.
3. Make four problem samples aliquots, with the same volume as used with known viscosity solutions. Measure their falling time in each viscosimeter. In some cases the liquid will fall too fast to take any measurement, and in others it will probably spend too much time. Avoid these liquids.

4. Write down the existing atmospheric pressure and temperature in that moment in the laboratory. With the aid of the data and expressions given hereafter, complete the following table:

Barometric Pressure .... mm Hg

Temperature .... º C

Car Motor oil density (depending on the manufacturer) ....g/cm^3

Glycol density 125 g/cm^3

5. Write down in next table the values obtained with solutions of known viscosity and density.

Liquid	Viscosity (cP=10^{-2}g/cm·s)	Density (g/cm^3)	Time (s)
A (range 0.6-3 cp)			
B (range 2-10 cp)			
C (range 10-50 cp)			
D (range 60-300 cp)			

6. Now, repeat again the experience, with the problem samples, and fill next table with the obtained values, using previous obtained data and equations.

Liquid	Time (s)	Density (g/cm^3)	Viscosity ($cP=10^{-2} g/cm \cdot s$)
Motor car oil			
Glycerol			
Castor oil			

Experiment -1.3

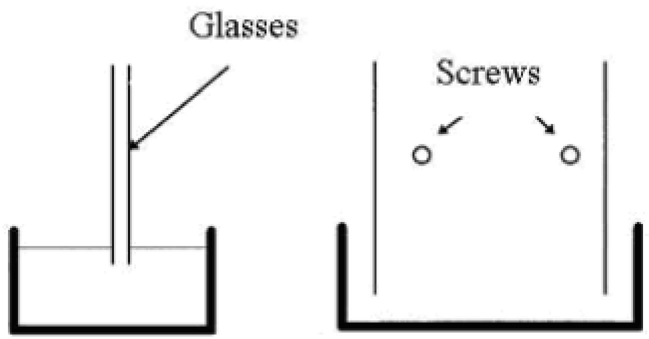
Capillarity effect observation

Aim of this Experiment

To observe the effect of the space between two plane surfaces with a capillary raising.

Necessary devices

- Parallel Plates Capillary Device.



Procedure

1. Clean carefully both glasses.
2. Loosen slightly the screws and vertically place strips between the glasses (These can be just pieces of paper).
3. Tighten carefully the screws.
4. Place the two glasses in the support guides.
5. Submerge in water.
6. Observe that where the space is smaller the raising is higher, and where the space is wider the raising is lower.
7. Do the same thing with other strips of different thickness.

Appendix – I Useful Data

Table 1. Table of the atmospheric pressure in function of the height

HEIGHT (m)	LEVEL OF THE VARIABLE	HEIGHT (m)	LEVEL OF THE VARIABLE	HEIGHT (m)	LEVEL OF THE VARIABLE
0	760	680	700.8	1360	645.2
20	758.2	700	698.9	1380	643.6
40	756.4	720	697.3	1400	642
60	754.6	740	695.5	1420	640.4
80	752.9	760	693.9	1440	638.8
100	751	780	692.4	1460	637.2
120	749.2	800	690.7	1480	635.6
140	747.4	820	689	1500	634
160	745.7	840	687.2	1520	632.5
180	744	860	685.5	1540	630.9
200	742.1	880	683.9	1560	629.4
220	740.2	900	682.4	1580	627.9
240	738.4	920	680.7	1600	626.4
260	736.8	940	679	1620	624.9
280	735	960	677.2	1640	623.3
300	733.4	980	675.6	1660	621.8
320	731.8	1000	674	1680	620.3
340	730	1020	672.4	1700	618.8
360	728.3	1040	670.8	1720	617.3
380	726.5	1060	669.1	1740	615.7
400	724.7	1080	667.5	1760	614.2
420	723	1100	666	1780	612.7
440	721.3	1120	664.3	1800	611.2
460	719.5	1140	662.6	1820	609.7
480	717.7	1160	661	1840	608.2
500	716	1180	659.3	1860	606.6
520	714.2	1200	657.9	1880	605.2
540	712.5	1220	656.4	1900	603.6
560	710.9	1240	654.8	1920	602.1
580	709.3	1260	653.2	1940	600.6
600	707.5	1280	651.6	1960	599
620	705.8	1300	650	1980	597.5
640	704.1	1320	648.3	2000	596
660	702.5	1340	646.7		