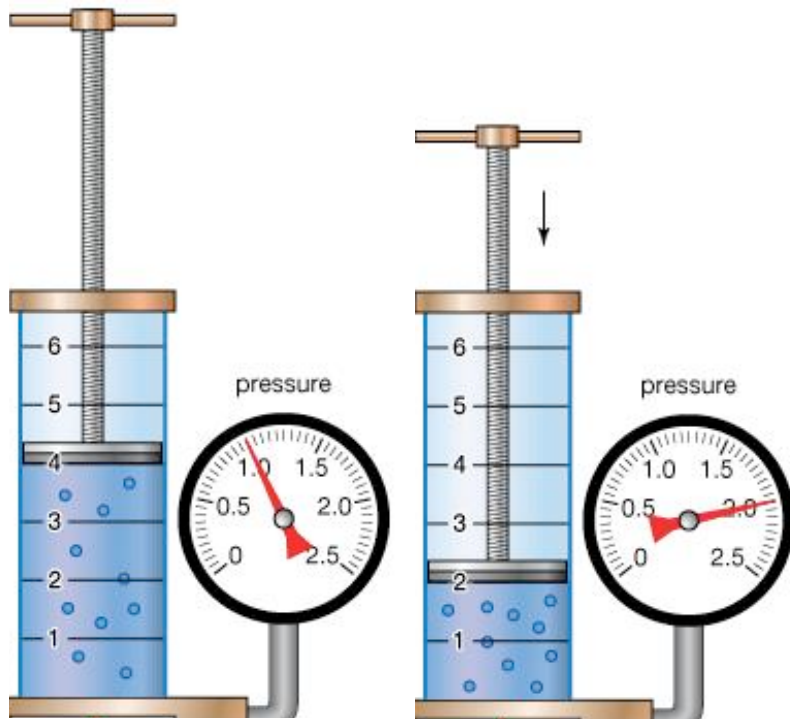


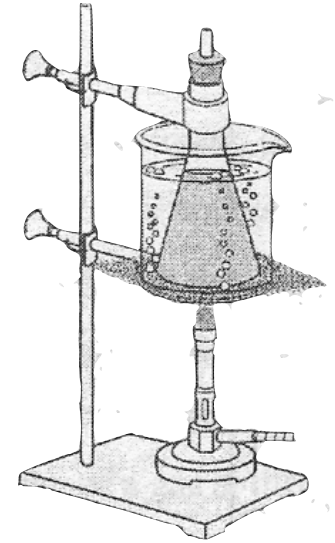
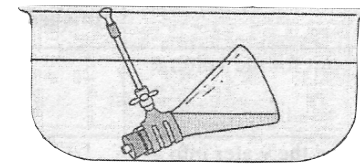
Exp 06: Gas State

Part A: Boyle's Law

- ▶ Explore the relationship between Pressure and Volume.
- ▶ Using data provided your lab book:
 - ▶ Determine $P \times V$ for the data points.
 - ▶ Plot P vs V for the data points.
 - ▶ Answer questions regarding your plot.



Part B: Charle's Law



- ▶ Heat a gas to fill the volume of your flask.
- ▶ Cool the flask, allowing water to fill the volume freed by the compressing gas.
- ▶ Measure the volume and temperature after.
- ▶ Plot the relationship between volume and temperature of a gas.
- ▶ Use your plot to project to the smallest volume, the coldest temperature, matter can occupy.

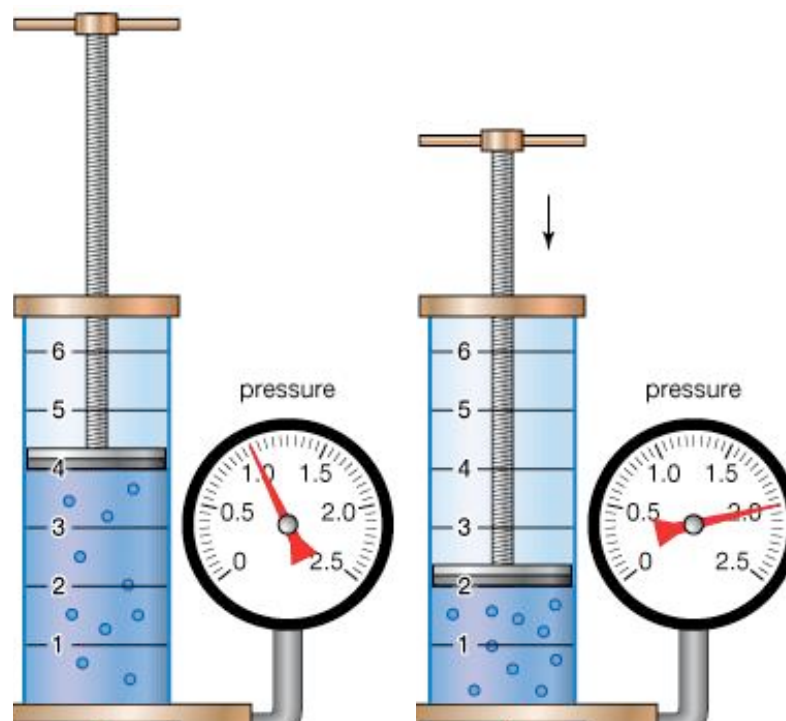


Exp 06: Gas State

Part A: Boyle's Law

Boyle's Law Lab - Data

Trial	Volume (mL)	Pressure (kPa)
1	30.00	99.49
2	29.00	101.94
3	28.00	105.07
4	27.00	108.44
5	25.00	116.12
6	23.00	123.91
7	20.00	139.06
8	18.00	149.73
9	15.00	172.11
10	10.00	229.40
11	33.00	91.68
12	35.00	86.99
13	37.00	82.70
14	40.00	77.19
15	42.00	73.70
16	45.00	69.40
17	47.00	66.80
18	50.00	63.81
19	52.00	61.39
20	55.00	58.66
21	57.00	56.66
22	60.00	54.10

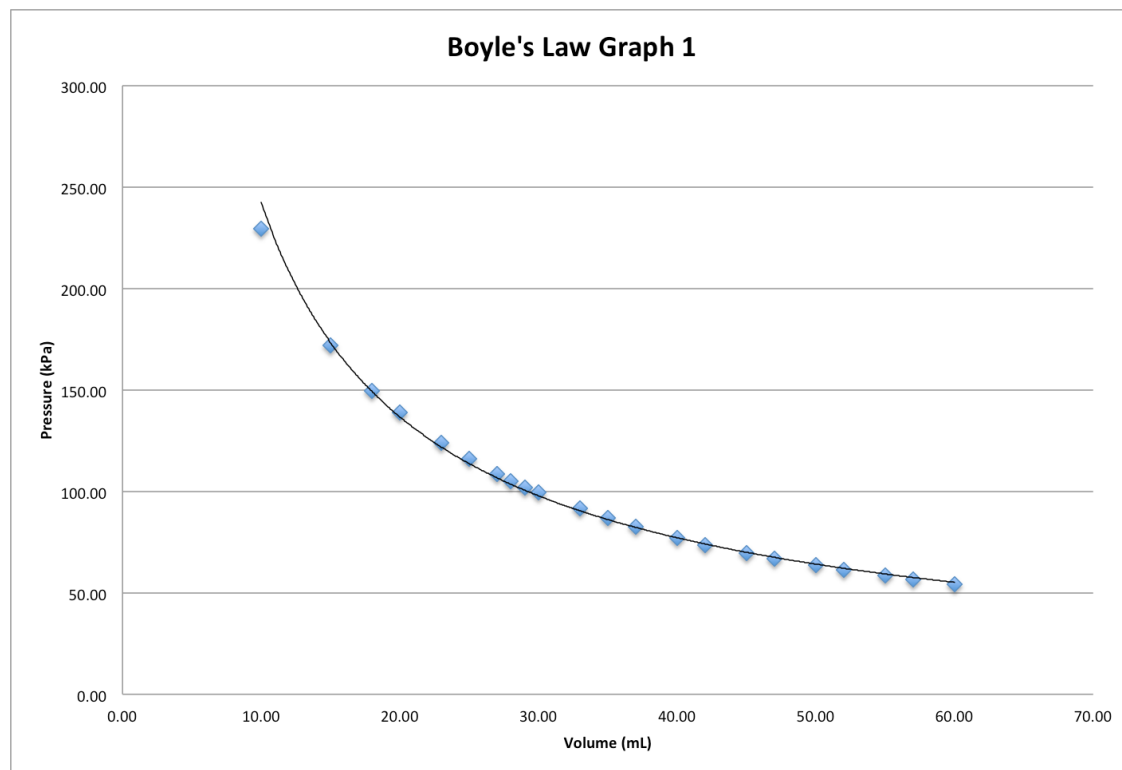


Exp 06: Gas State

Part A: Boyle's Law

Boyle's Law Lab - Data

Trial	Volume (mL)	Pressure (kPa)
1	30.00	99.49
2	29.00	101.94
3	28.00	105.07
4	27.00	108.44
5	25.00	116.12
6	23.00	123.91
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8	18.00	149.73
9	15.00	172.11
10	10.00	229.40
11	33.00	91.68
12	35.00	86.99
13	37.00	82.70
14	40.00	77.19
15	42.00	73.70
16	45.00	69.40
17	47.00	66.80
18	50.00	63.81
19	52.00	61.39
20	55.00	58.66
21	57.00	56.66
22	60.00	54.10

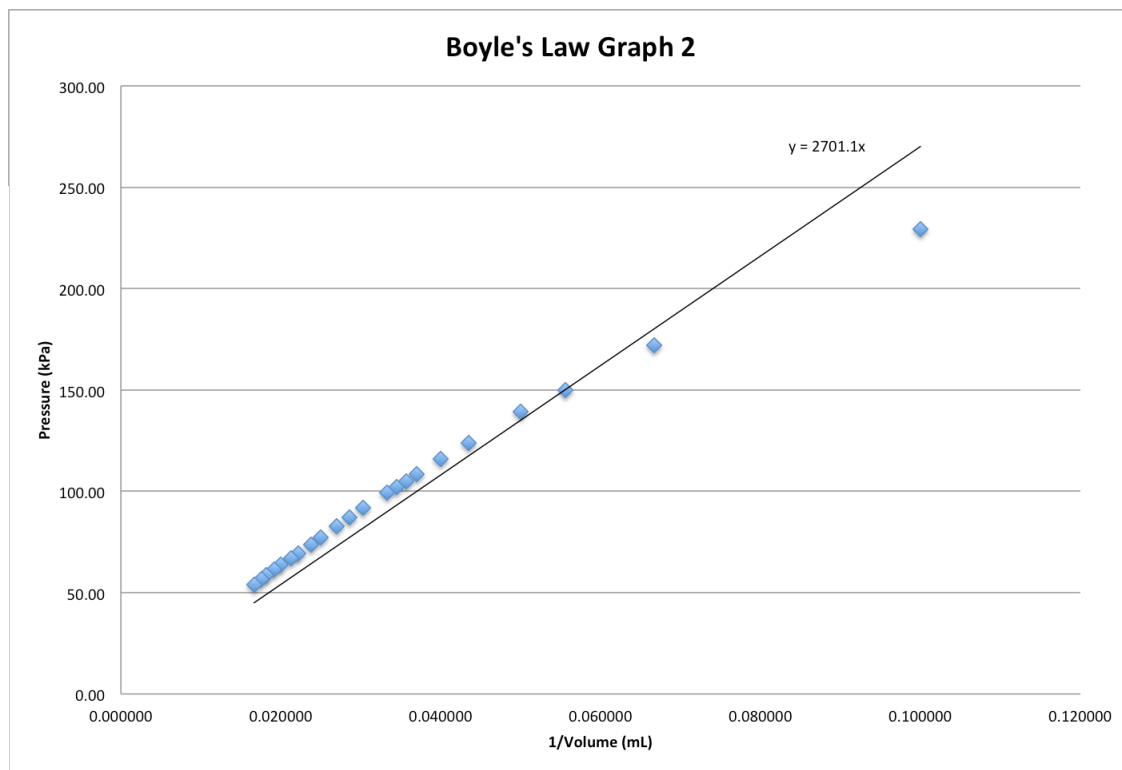


Exp 06: Gas State

Part A: Boyle's Law

Boyle's Law Lab - Data

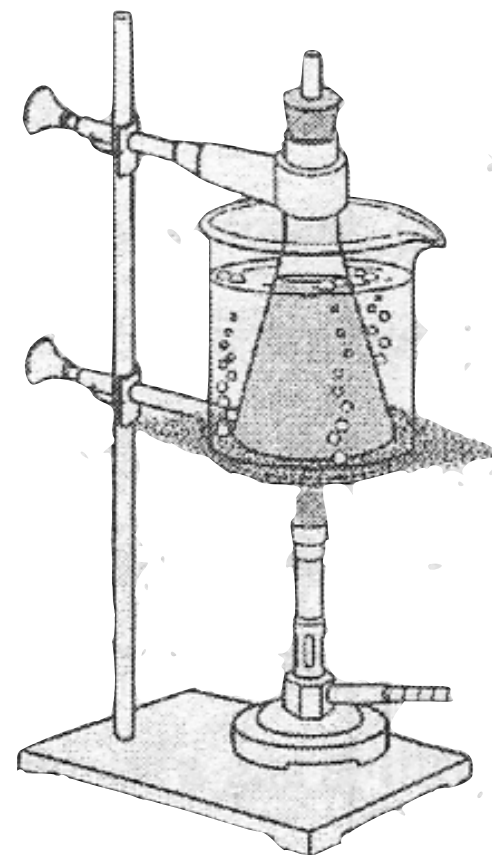
Trial	Volume (mL)	Pressure (kPa)	1/Volume (1/mL)
1	30.00	99.49	0.033333
2	29.00	101.94	0.034483
3	28.00	105.07	0.035714
4	27.00	108.44	0.037037
5	25.00	116.12	0.040000
6	23.00	123.91	0.043478
7	20.00	139.06	0.050000
8	18.00	149.73	0.055556
9	15.00	172.11	0.066667
10	10.00	229.40	0.100000
11	33.00	91.68	0.030303
12	35.00	86.99	0.028571
13	37.00	82.70	0.027027
14	40.00	77.19	0.025000
15	42.00	73.70	0.023810
16	45.00	69.40	0.022222
17	47.00	66.80	0.021277
18	50.00	63.81	0.020000
19	52.00	61.39	0.019231
20	55.00	58.66	0.018182
21	57.00	56.66	0.017544
22	60.00	54.10	0.016667



Exp 06: Gas State

Part B: Charle's Law

- ▶ Explore the relationship between the temperature and volume of a gas.
- ▶ Start with a hot gas.
- ▶ Checkout flask, hot plate and thermometer from stockroom.
- ▶ Dry the flask before using it.
- ▶ Put a 400 mL beaker on your hot plate.
- ▶ Clamp down the 125 mL flask.
- ▶ Add water to the outer, 400 mL beaker and heat the water to boiling.
- ▶ Heat for 10 minutes.
- ▶ Measure the temperature of the water.
- ▶ Clamp the flask closed and turn off the heat.



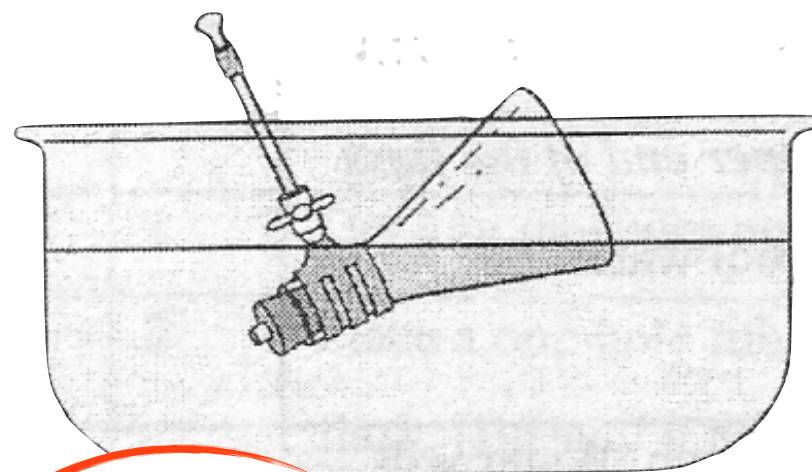
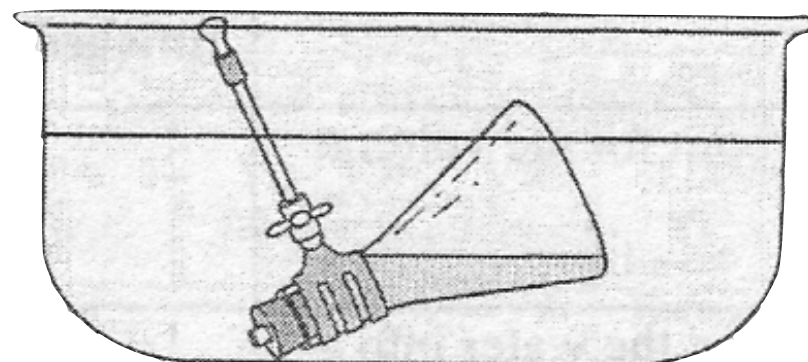
Covert all
temperatures to
Kelvin!



Exp 06: Gas State

Part B: Charle's Law

- ▶ Transfer the clamped flask to one of the water baths.
- ▶ Submerge it and remove clamp.
- ▶ Keep it submerged for at least 10 minutes.
- ▶ Let water be pulled into the flask.
- ▶ After 10 minutes, determine the temperature of the water.
- ▶ Raise the flask so the water lines in and out of the flask match.
- ▶ Re-attach the clamp.
- ▶ Remove the flask.
- ▶ Transfer the volume captured to a graduated cylinder. Record it's volume.
- ▶ Fill the flask with water. Use that water to determine the volume of the full flask.
- ▶ Repeat at 2-3 temperatures.



Covert all
temperatures to
Kelvin!



Exp 06: Gas State

Part B: Charle's Law

- ▶ Record the volume of the hot air.
- ▶ Calculate the volume of the air at each cooled temperature.
- ▶ Plot the vol vs temperature for each set of points.
- ▶ Draw a line through these points.
- ▶ Project temperature at which the volume would be zero.
- ▶ This is value of absolute zero you will conclude.

$$\text{Vol}_{\text{cooled}} = \text{Vol}_{\text{total}} - \text{Vol}_{\text{water}}$$



Questions?

