Boyle's law lab

- Purpose: to investigate mathematical relationship between pressure and volume
- Sample calculations:

  Diameter of piston $\cong$ 2.40 cm (2.30-2.50)

  Radius $\cong$ 1.20 cm

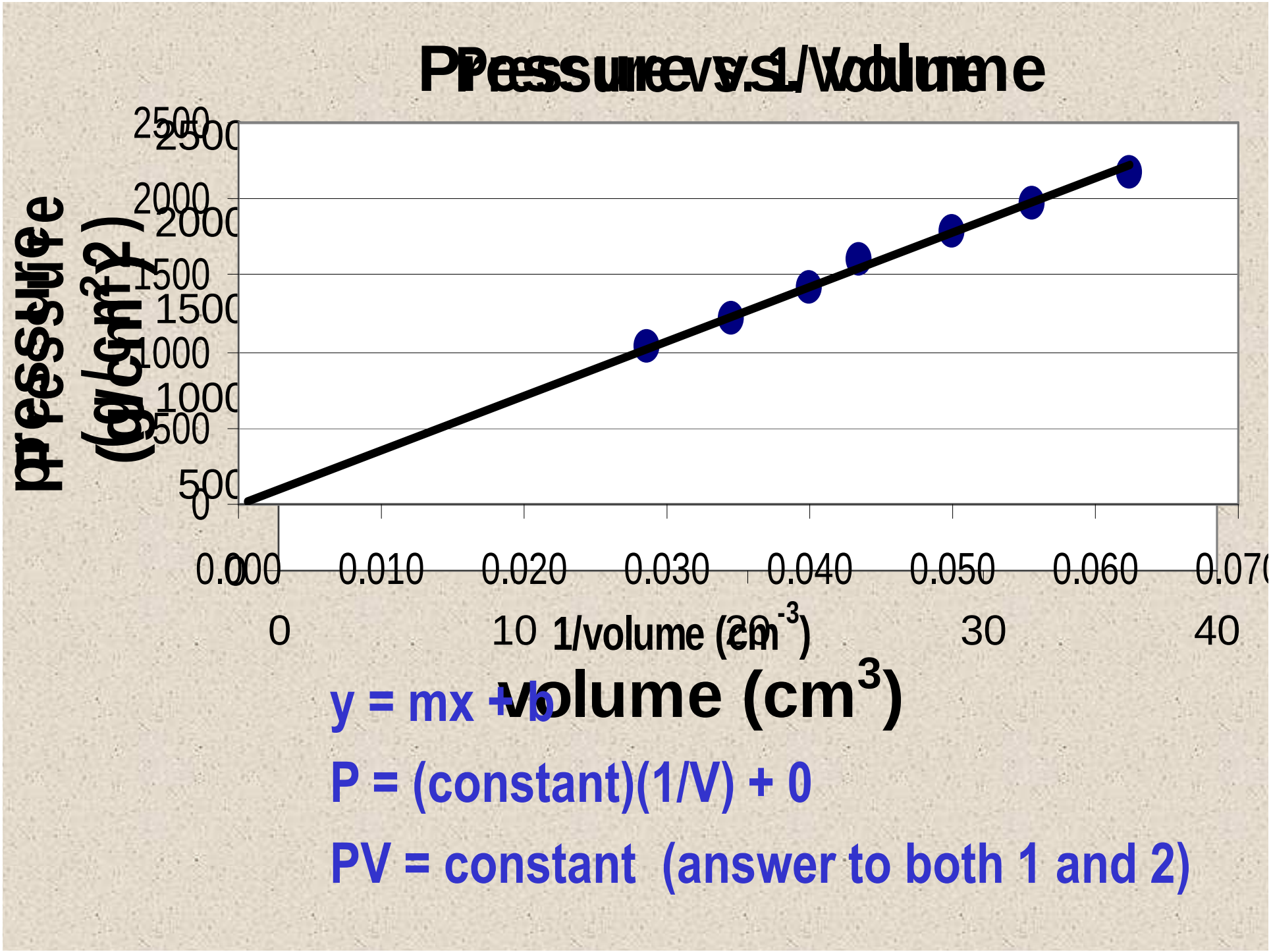
  Area $\cong \pi r^2 \cong$ 4.52 cm^2 (4.15 - 4.91)

  Book pressure $\cong \frac{\text{average book weight}}{\text{area of contact}}$

  $\cong$ 850 g / 4.52 cm^2

  $\cong$ 188 g / cm^2 (173 - 205)

PV column should be 36,000 all the way down



$y = mx + b$

$P = (\text{constant})(1/V) + 0$

$PV = \text{constant}$ (answer to both 1 and 2)

Conclusions and Questions

3. If P doubles, V is cut in half. If P is tripled, V becomes 1/3 of its original value.
4. "As the pressure on a gas increases, the volume of the gas decreases proportionally, provided that the temperature and amount of gas remain constant". I.e. $\mathbf{P_1V_1 = P_2V_2}$.
5. As volume decreases, there are more collisions with the side of the container per unit of time, thus the pressure increases.
6. P_1=103 kPa, V_1=5.2 L, P_2=400 kPa, V_2=?
   Using Boyle's law: $P_1V_1 = P_2V_2$,
   103 kPa x 5.2 L = 400 kPa x V_2
   V_2= (103 kPa x 5.2 L) / 400 kPa = **1.34 L**

7. P_1= 700 mm Hg x 1 atm / 760 mm Hg = **0.921 atm**, V_1= 200 ml, P_2= ?, V_2= 950 ml

   Using Boyle's law: $P_1V_1 = P_2V_2$

   0.921 atm x 200 ml = P_2 x 950 ml

   P_2= (0.921 atm x 200 ml)/950 ml =**0.194 atm**

Conclusion

- By comparing values in the PV column and via the graph we see that PV = constant
- This is called Boyle's law (after the scientist that first discovered the relationship)
- We will be looking more closely at Boyle's law
- For example, using the form $P_1V_1 = P_2V_2$
- Read "Results of Boyle's Law Experiment" on handout. Do questions 1 – 6.