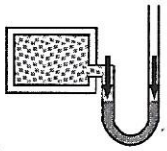
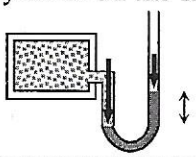
Manometers
Chem Worksheet 13-2

Name Answer Key

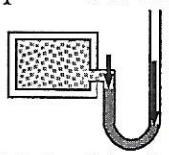
A manometer is a device that measures the pressure of a gas in an enclosed container. It is made from a U-shaped tube filled with mercury. The pressure of the gas in the container is compared to the pressure from the atmosphere. If the gas pressure is the same as the atmospheric pressure the level of mercury in both sides of the U-tube will be the same. If the gas is at a higher pressure than the atmosphere the mercury level on the side open to the atmosphere will be higher. If the gas is at a lower pressure than the atmosphere the mercury level on the side open to the atmosphere will be lower.



Gas pressure is equal to atmospheric pressure



Gas pressure is more than atmospheric pressure



Gas pressure is less than atmospheric pressure

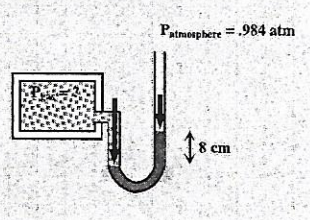
USEFUL EQUATIONS		
1.00 atm = 101300 Pa	1.00 atm = 101.3 kPa	1.00 atm = 14.7 psi
1.00 atm = 760 torr	1.00 atm = 760 mmHg	1 cm = 10 mm

example

An enclosed container of gas is connected to a manometer. The mercury level is 8 cm lower on the side connected to the gas sample. If atmospheric pressure is .984 atm find the pressure of the gas in the container.

- draw a picture
- convert all measurements to mm Hg

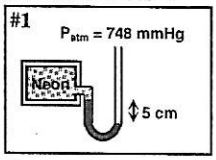
$$\frac{8\ \cancel{cm}}{1}\times\frac{10\ mm}{1\ \cancel{cm}}=80\ mm \qquad \frac{.984\ \cancel{atm}}{1}\times\frac{760\ mmHg}{1.00\ \cancel{atm}}=748\ mmHg$$



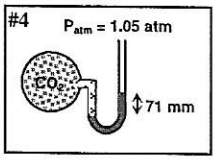
- add or subtract the measurements based on the drawing

748 mmHg + 80 mmHg = 828 mmHg

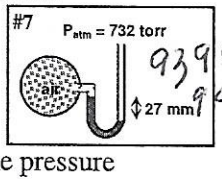
Solve the following problems. Draw a picture of the manometer for each problem.



1. What is the pressure of the neon gas sample in the manometer shown to the right? 698 mm Hg
2. A container of helium is connected to a manometer and the mercury level is 145 mm lower on the side open to the atmosphere. Atmospheric pressure is 775 mm Hg. Find the pressure of the helium. 630 mmHg
3. The mercury in a manometer is 38 mm lower on the side connected to sample of oxygen gas. If the atmospheric pressure is 95.2 kPa determine the pressure of the oxygen. 750 mm Hg



4. What is the pressure of the carbon dioxide in the manometer shown to the right? 869 mm Hg
5. The atmosphere has a pressure of 680 torr. An air-filled container has a pressure of 18.9 PSI and is connected to a manometer. Draw a picture of the manometer and determine the height of the mercury column supported by the air. = 680 mm Hg ht = 297 on right! 977 mm Hg
6. A basketball is attached to a manometer and the mercury is 18 mm higher on the side connected to the atmosphere. The pressure of the atmosphere is 0.95 atm. Find the pressure in the basketball. 740 mm Hg
7. What is the pressure in pascals for the air sample in the manometer pictured to the right? 705 mm Hg x 101300 Pa / 760 mm Hg



93969 ≈ 94000 Pa

8. A gas container is connected to a manometer. The mercury in the manometer is 7.2 cm lower on the side open to the atmosphere. Atmospheric pressure is measured to be 755 mm Hg. What is the pressure of the gas in atmospheres? 0.90 atm

Chem Gas Worksheet #1. Blk ___ Name _____

Data to know & use! 1atm=760.mmHg=101.325kPa=14.7lb/in^2, or by 1989 definition
Standard Pressure = 100.kPa=750.1mmHg=14.5lb/in^2 = 0.987atm= 1Bar.
1mole gas @STP = 22.4L =22,400cm^3. STP=0°C, 1atm. 0 K = -273.15°C = -459.67°F.
1mole gas @ SATP = 24.8L =24,800cm^3, Standard Ambient Temp. & Pressure= 100.kPa, 25°C.

A. Pressures. Show a unit cancellation setup. WATCH SIG. FIGS.

a. 412 mmHg = 0.542 atm.

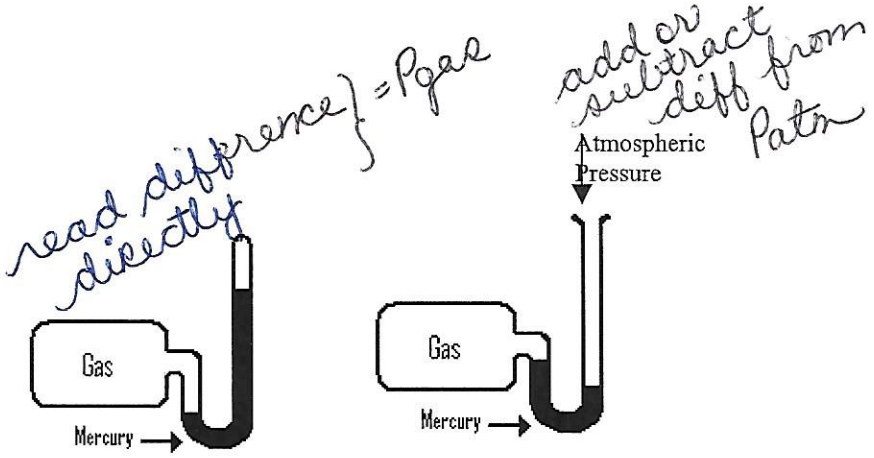
b. 760. KPa = 5700 mmHg

c. 14.7 atm = 1490 kPa

d. 101.325 lb/in^2 = 698.246 kPa

e. 22.4 mmHg = 2.99 kPa

B. Manometers.



Closed end manometer Open end manometer

a. In a closed end manometer, the mercury level was 690. mm higher on the closed end than on the gas side. What was the pressure of the gas?

690. mmHg

b. In a closed end manometer, the Hg levels were 419 mm different. What was the gas pressure?

419 mmHg

c. In a closed end manometer, the Hg levels were 1273 mm different. What was the gas pressure IN ATM? $1273\ mmHg \times \frac{1\ atm}{760mm\ Hg} =$ 1.675 atm

d. Open end manometer: atmospheric pressure 760. mmHg, and the mercury level was 120. mm higher on the right side than the left. What was the gas pressure? air side ∴ gas "winning" $760.mmHg + 120.mmHg$

880. mmHg

e. Open end manometer, atmospheric pressure 755 mmHg, Hg level 75 mm higher on the left. What was the gas pressure? gas losing $755mmHg - 75mmHg = 680.mmHg$

680. mmHg

f. Open end manometer, with the atmospheric pressure 97.2 kPa. Mercury level 35 mm higher on the left. What is the gas pressure? gas losing $35mmHg \times \frac{101.3kPa}{760mmHg} = 4.7kPa$ $97.2\ kPa - 4.7kPa$

92.5 kPa

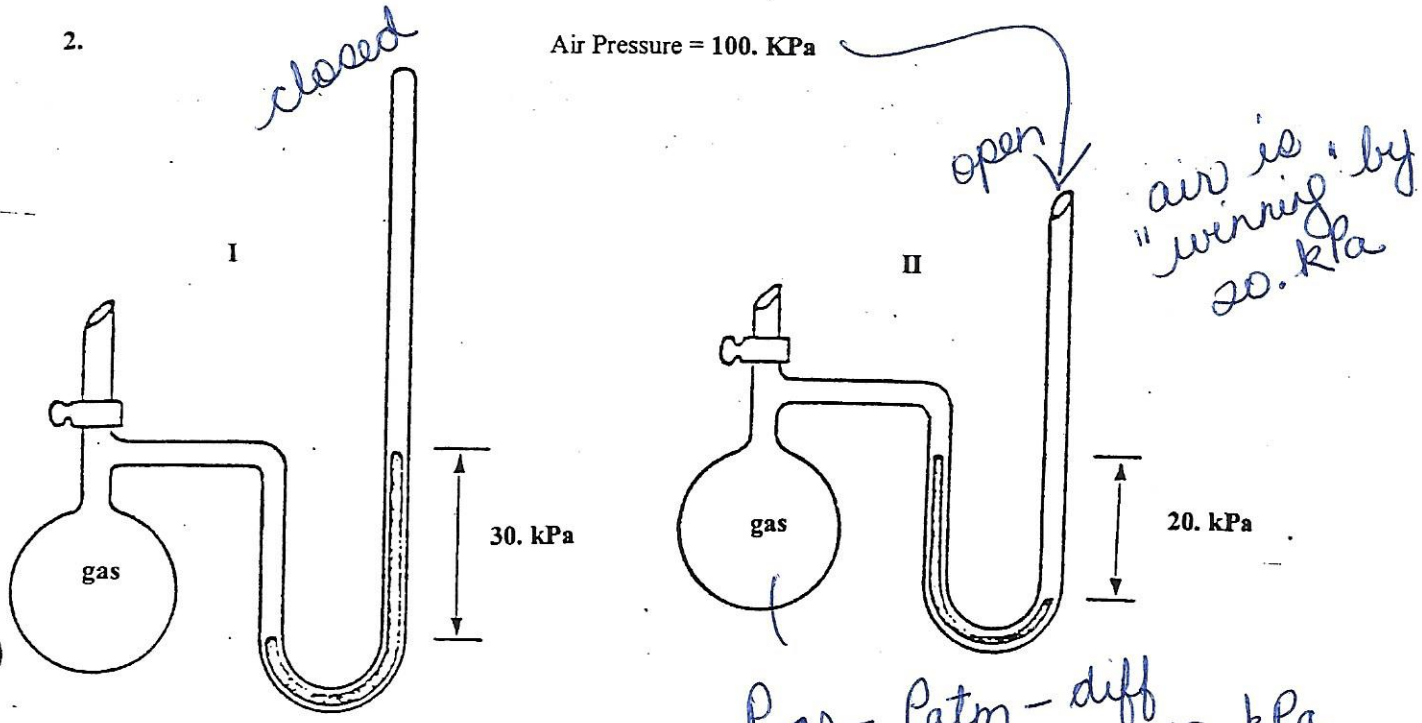
C. Temperatures. a. 25°C = 298 K b. -147°C = 126 K c. 926K = 653 °C

d. 35.2K = -240.5 °C e. –2.8°C = 270.2 K f. 12,780,000K = 12779727 °C

atmospheric

1. A barometer measures air pressure. A manometer measures gas pressure. There are 2 types of manometers. They are close ended and open ended. The close ended manometer is read directly.

2.



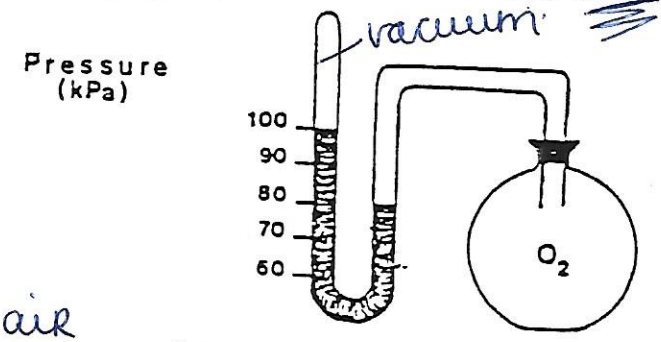
air is "winning" by 20. kPa

In figure I the gas pressure = 30. kPa

In figure II the gas pressure = 80. kPa

$P_{gas} = P_{atm} - diff$
$= 100.\,kPa - 20.\,kPa$
$P_{gas} = 80.\,kPa$

3. A sample of oxygen gas is placed in a container attached to a closed end manometer as represented below:



100 kPa − 80 kPa = 20 kPa O_2

air

If the external pressure is 100 kPa, what is the pressure exerted by the oxygen gas in the vessel?

a) 20 kPa
b) 80 kPa
c) 100 kPa
d) 120 kPa

useless info!

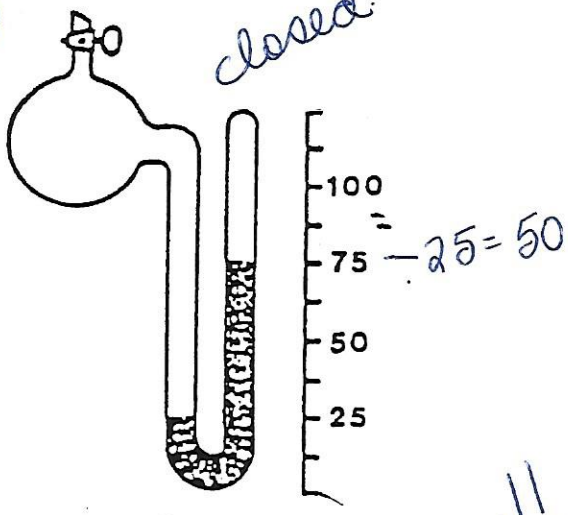
4. With respect to the kinetic energy of SO_2 and CH_4 gas at the same temperature:

a) both have the same ave kinetic energy
b) the kinetic energy of SO_2 is four times that of CH_4
c) the kinetic energy of SO_2 is twice that of CH_4
d) the kinetic energy of SO_2 is half that of CH_4

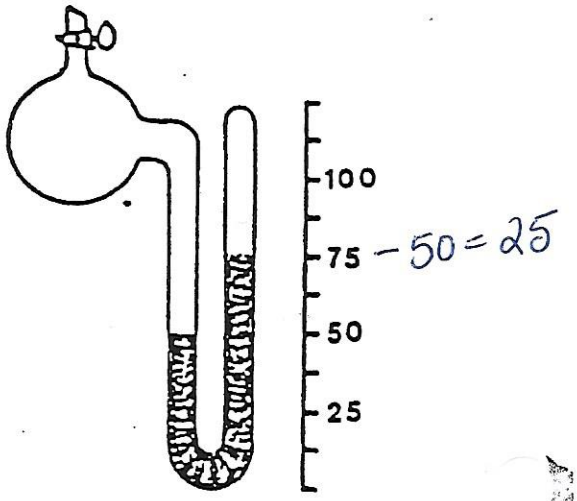
T is a measure of the ave Ek of the particles. So same T = same ave Ek!

5. Identify the diagram which illustrates a gas having a pressure of 50 kPa.

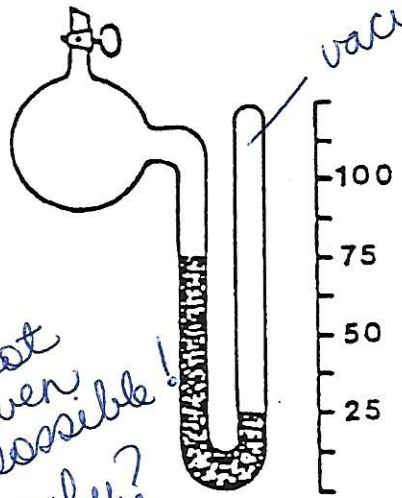
(A)



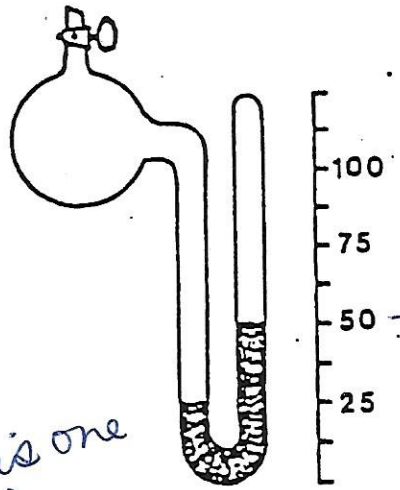
(C)



(B)



(D)



6. Gases can be distinguished from solids and liquids because they are compressible. The kinetic theory explains this characteristic by proposing that in gases:

a) the molecules are continually moving in a straight line T but ...
b) the molecules have large spaces between them T yes
c) the molecules collide with each other and the walls of their container T but ...
d) the collisions of the molecules are elastic T but ...

all T looking but the one for that explains compression