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1. To what temperature (°C) would 12.3 g of He have to be cooled to fit in a 34.0 L tank at 1.17 atm?

$P = 1.17$ atm
$V = 34.0$ L
$n = 12.3\ g \times \frac{1\ mol}{4.00\ g} = 3.08$
$T = ?$ K

$PV = nRT$

$(1.17)(34.0) = (3.08)(R)(T)$

$T = 157\ K - 273 = -116°C$

Ans: $-116°C$

2. What would be the density of CH_4 at 132°C and 725 mmHg? atomic weight of CH_4

$P = 725\ mmHg \times \frac{1\ atm}{760\ mmHg} = 0.954$ atm
$V = ?$ L
$n = 1$ mol
$T = 132°C + 273 = 405$ K

$PV = nRT$
$(0.954)(V) = (1)(R)(405)$
$V = 34.9$ L

$D = \frac{m}{V} = \frac{16.0\ g}{34.9\ L}$

Ans: $0.458\ g/L$

3. A gas sample occupies a volume of 34.8 L at 2.56 atm. What volume would it occupy at 3.47 atm?

$P = 2.56$ atm
$V = 34.8$ L
$T = $ —

$P = 3.47$ atm
$V = ?$ L
$T = $ —

$PV = PV$
$(2.56)(34.8) = (3.47)(V)$
$V = 25.7$ L

Ans: 25.7 L

4. A 2.79 g sample of gas occupies a space of 735 mL at 1.78 atm and -21°C. What is the molecular weight of the gas? What gas might it be: H_2, Ne, or CO_2?

$P = 1.78$ atm
$V = 0.735$ L
$n = ?$ mol
$T = -21°C + 273 = 252$ K

$PV = nRT$
$(1.78)(0.735) = (n)(R)(252)$
$n = 0.0632$ mol

$M.W. = \frac{g}{mol} = \frac{2.79\ g}{0.0632\ mol} =$

44.0 — closest fit

Ans: $44.1\ g/mol$ Ans: CO_2

5. If Ne particles are moving with an average velocity of 17.4 m/sec, how fast would the CH_4 particles be moving? How about the CO_2? *(all gases are in the same container & therefore the same temp!)*

Graham's Law: $m_1v_1^2 = m_2v_2^2$

$(20.2)(17.4)^2 = (16)(v^2)$
$v^2 = 382.2$
$v = 19.6$

$(20.2)(17.4)^2 = (44.0)(v^2)$
$v^2 = 139$
$v = 11.8$

Ans: 19.6 m/s Ans: 11.8 m/sec

6. **The gas laws & relationships among the variables**

- Boyle's Law states that pressure and volume are inversely related to each other. This is why a balloon expands in a vacuum.
- Charles's Law states that volume and temperature are directly related to each other. This is why a balloon shrinks when liquid nitrogen is poured on it.
- Gay-Lussac's Law states that pressure varies directly with temperature. This is why areosol cans become colder when the pressure is released.

Ans #6: colder directly nitrogen pressure released vacuum

Ans (IRO) #1-5: -115, 0.458, 11.8, 19.6, 25.7, 44.0, 52.4 ***UNITS***: °C g/L L g/mol m/sec

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7. In the "wet dry ice lab", we placed a sample of dry ice (which is actually solid CO_2, not water) in a plastic pipet and placed a metal clamp around the stem, then squeezed down on this with a pair of pliers. This helped keep the pressure in the pipet as the dry ice sublimed, thus building up the pressure and taking the sample to the triple point, that unique temp. and pressure on the phase diagram where all three phases (solid, liquid and gas) can exist together and where all three processes (melting, boiling and subliming) can occur at the same time.

8. Bobby wanted to boil some acetone (a liquid which is somewhat more volatile than water, meaning it evaporates more quickly). Remembering what he learned in ~~Spanish~~ chemistry class, that a liquid will always boil when its vapor pressure matches ~~atmospheric~~ pressure, Bobby decides there are two ways he can boil the liquid: he can increase the temp to 75 °C, at which point its vapor pressure would equal the standard 14.7 psi, or he could decrease the pressure to around 4.8 psi, at which point the liquid would boil.

room temp

temp (°C)	v.p. of acetone (psi)
25	4.8
50	7.4
75	14.7
100	27.9

room pressure

9. Suzi does the "Boyle's Law lab" and collects the data at right. Use any two data lines to determine what value she gets for atmospheric pressure.
(any 2 data lines will work)

$$(42.1 + x)(2.9) = (31.5 + x)(3.6)$$
$$122.09 + 2.9x = 113.4 + 3.6x$$
$$8.69 = 0.7x$$
$$12.4 = x$$

Ans: 12.4 psi

gauge press. (psi)	vol. (mL)
42.1	2.9
31.5	3.6
22.7	4.5
17.9	5.2

10. 13.5 g of CO_2, 13.5 g of Ne and 13.5 g of CH_4 are all placed together in a tank at 762 mmHg. What is the partial pressure of the CO_2, the Ne, and the CH_4?

$13.5\ g\ CO_2 \times \frac{1\ mol}{44.0\ g} = 0.307\ mol\ CO_2$

$13.5\ g\ Ne \times \frac{1\ mol}{20.2\ g} = 0.668\ mol\ Ne$

$13.5\ g\ CH_4 \times \frac{1\ mol}{16.0\ g} = 0.844\ mol\ CH_4$

ADD → 1.819 mol total

$p CO_2 = \left(\frac{0.307}{1.819}\right)(762) = 129\ mmHg$

$p Ne = \left(\frac{0.668}{1.819}\right)(762) = 280\ mmHg$

$p CH_4 = \left(\frac{0.844}{1.819}\right)(762) = 354\ mmHg$

Ans: 129 mmHg Ans: 280 mmHg Ans: 354 mmHg

11. Which gas in the tank above is moving the fastest?? CH_4 (it's the lightest)

Ans (IRO+3): 4.8 12.6 14.7 15.7 75 77.3 129 216 280 354 atmospheric boil boil boiling chemistry clamp CH4 CO2 decrease dry force gas gas ice increase liquid liquid melting more O2 phase pipet pliers point pressure pressure pressure pressure pressure quickly solid sublimed subliming temp. temp. triple vapor vapor
Units (IRO): atm psi mmHg mmHg mmHg