Chemistry I Review Group Quiz: Unit 10-11
Gas Laws and Thermochemistry

Unit 10: Gas Laws

P & V ⇒ Boyle's Law: $P_1V_1 = P_2V_2$

1) A gas occupies a volume of 0.7 L at 10.1 kPa. What volume will the gas occupy at 101kPa?

(V_1 = 0.7 L, P_1 = 10.1 kPa, V_2 = ? L, P_2 = 101 kPa)

A) 4 L B) 0.7 L C) 7 L (D) 0.07 L

$(10.1)(0.7) = (101)V_2$

$0.07\,L = V_2$

2) As the temperature of a gas in a balloon decreases, _____.

A) the pressure increases ✓
B) the volume increases ✓
C) the average kinetic energy of the gas decreases ✓
(D) all of the above

$T\uparrow \Rightarrow P\uparrow$ direct

$T\uparrow \rightarrow V\uparrow$ direct

3) At constant temperature and pressure, gas volume is directly proportional to the _____.

(A) number of moles of the gas
B) density of the gas at STP
C) rate of diffusion
D) molar mass of the gas

$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$ ∴ $\frac{V_1}{n_1} = \frac{V_2}{n_2}$ (Avogadro)

4) What type of relationship is seen between pressure and volume for gas laws? $P_1V_1 = P_2V_2$ (inverse)

A) direct (B) inverse C) exponential D) positive Boyle's

5) A reaction at 86.0°C in a 250 mL expandable container. What will be the temperature if the volume is increased to 500.0 mL.

(T_1, V_1, V_2, T_2 = ?; T & V)

A) 100k B) 172 K (C) 718 K D) 1467 K

$T_1 = 86.0°C + 273 = 359k$

Charle's law: $\frac{V_1}{T_1} = \frac{V_2}{T_2} \Rightarrow \frac{250}{359} = \frac{500.0}{T_2} \Rightarrow T_2 = 718\,K$

6) Convert 1.25 atm to mmHg.

A) 126.6 mmHg B) 608 mmHg (C) 950. mmHg D) 81.06 mmHg

$1.25\,atm \cdot \frac{760\,mmHg}{1\,atm} = 950.\,mmHg$

7) A sample of gas contains 0.875 moles of a gas at 0.900 atm and 20.0°C. What is the volume of this gas?

(n = 0.875, P = 0.900, $T = 20 + 273 = 293k$)

A) 2.21 x 10^{-4} L (B) 23.4 L C) 2.92 x 10^{-4} L D) 1.60 L

Ideal gas law: $PV = nRT \rightarrow (0.900)V = (0.875)(0.0821)(293) \rightarrow V = 23.39\,L$

0.0821 (gas constant)

8) Which of the following conditions would cause a gas to LEAST likely be considered an "ideal gas"? Think about the 2 conditions.

A) High temperature and low pressure
(B) Low temperature and high pressure
C) Low temperature and low pressure
D) Gases ALWAYS behave ideally

Most ideal = High T. & Low P.

9) At STP, which gas would have the highest rate of effusion? Smallest mass = fastest

A) nitrogen monoxide (B) nitrogen gas C) krypton D) chlorine gas

NO = 30.01 g/mol N_2 = 28.01 Kr = 83.80 Cl_2 = 70.9

Ideal gas law ? g convert moles → mass

10) What is the mass, in grams, of 0.215 L of nitrogen monoxide at STP? Temp = 273 K, Press = 1 atm

A) 0.030 g
B) 0.288 g
C) 1.47 g
D) 9.59 g

$PV = nRT$

$(1)(0.215) = n(0.0821)(273)$

$n = 0.0096 \text{ mol NO}$

convert mole → mass:

$0.0096 \text{ mol NO} \cdot \frac{30.01 \text{ g NO}}{1 \text{ mol NO}} = 0.288 \text{ g NO}$

Unit 11: Thermochemistry

11) How much heat does it take to warm 16.0 g of pure water from 90.0 °C to 100.0 °C? (Specific heat of water = 4.18 J/g °C)

$\Delta T = 10\,^{\circ}C$ → still in liquid phase

A) 160 joules B) 16.0 joules C) 669 joules D) 66.9 joules

$Q_l = m C_l \Delta T \rightarrow (16.0)(4.18)(10) = 668.8 \text{ J}$

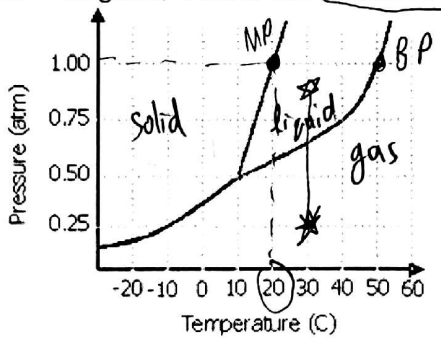
12) As the temperature of a sample of matter is increased, what happens to the average kinetic energy of the particles in the sample?

as temp ↑, K.E. also ↑

A) It does not change.
B) It increases.
C) It decreases.
D) Not enough information.

13) Using the following phase diagram, what is the normal melting point of the substance?

A) 20 °C
B) 50 °C
C) 10 °C
D) 55 °C



@ standard pressure: 1 atm or 760 mm Hg or 101.3 kPa

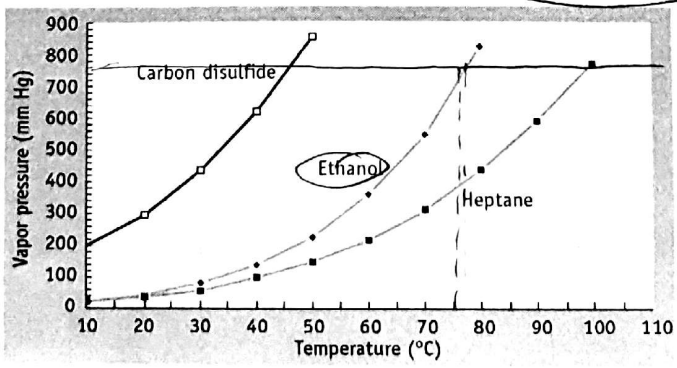
14) Using the same phase diagram from above, what phase change will occur as a liquid at 0.80 atm and 30 °C undergoes a pressure drop to 0.25 atm?

liquid → gas

A) Vaporization B) sublimation C) melting D) condensation

15) Using the diagram below, what is the boiling point of ethanol at normal pressure? Give an approximation.

@ 760 mm Hg



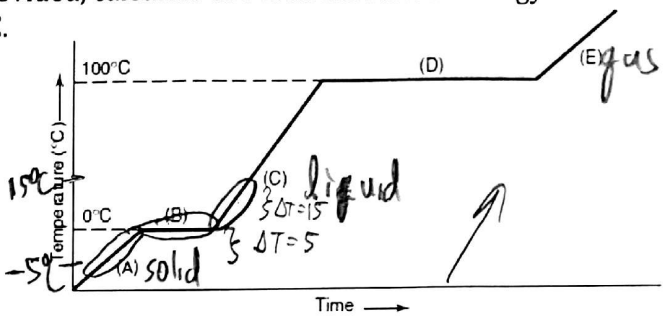
A) 45 °C B) 55 °C C) 65 °C D) 75 °C

Multi-step

16) Using the heating curve and the information provided, calculate the total amount of energy required to raise 10.0 grams of H_2O from -5 °C to 15 °C.

$H_f = 334$ J/g
$H_v = 2260$ J/g

$C_{solid} = 2.06$ J/g°C
$C_{liquid} = 4.18$ J/g°C
$C_{gas} = 2.02$ J/g°C



3-steps

A) 836 J B) 3540 J C) 4070 J D) 4588 J

$Q = m C_s \Delta T = (10.0)(2.06)(5) = 103\text{ J}$ ← temp. change

$Q = m H_f = (10.0)(334) = 3340\text{ J}$ ← phase change

$Q = m C_l \Delta T = (10.0)(4.18)(15) = 627\text{ J}$ ← temp. change

$+ 4070\text{ J}$ = endo

17) Using the same heating curve above, determine which of the following statements is correct. ← temp. change

A) Letters A, C, and E represent phase changes
B) Letters B and D represent freezing
C) Letters B, C, and D represent changes in temperature
D) Letters B and D represents phase changes

18) A pan of water is placed in the oven for a few minutes at a high temperature. When you reach in, you almost burn your hand on the metal pan, but the water is barely warmed. What is the best way to explain this?

Temp. does not change much → Temp. changes A LOT

A) Water has a high specific heat and metal has a low specific heat
B) Water has a low specific heat and metal has a high specific heat
C) Water and metal both have fairly high specific heats
D) Water is a conductor and metal is an insulator

19) In which system does entropy ***decrease*** (ΔS = -)? → more order / stable

A) ice melting $\Delta S = +$
B) liquid iodine vaporizing $\Delta S = +$
C) methane gas crystallizing to become solid methane $\Delta S = -$ $(g \rightarrow s)$
D) salt melting at high temperatures $\Delta S = +$

20) Using the information below, what is the heat (enthalpy) of reaction for this equation?

$\Delta H = \Sigma P - \Sigma R$

$2H_2S(g) + 3O_2(g) \rightarrow 2H_2O(l) + 2SO_2(g)$

A) -1122 kJ Exothermic
B) -603 kJ Endothermic
C) +561 kJ Exothermic
D) +1122 kJ Endothermic

Compound	ΔH_f (kJ/mol)
$H_2S(g)$	−21
$H_2O(l)$	−285
$SO_2(g)$	−297

elements are zero

$\Delta H = [2(-285) + 2(-297)] - [2(-21) + 3(0)]$

$= [-1164] - [-42] =$ ~~-1122 kJ~~ exo