CHM 113 FINAL EXAM
Fall 2020 Dr. Cera

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Show your work!

$M_1 \times V_1 = M_2 \times V_2$

% mass = g solute/g solution

$q = c_p \times m \times \Delta T$

$\frac{P_1 \times V_1}{n_1 \times T_1} = \frac{P_2 \times V_2}{n_2 \times T_2}$ $\quad P = \frac{DRT}{MM}$

Standard Pressure = 1.00 atm = 760. torr
Standard Temperature = 0°C = 273K

$K = °C + 273$ $\quad atm. = \frac{torr}{760.}$

$PV = nRT$ $\quad R = 0.0821 \frac{L \cdot atm}{mol \cdot k}$

$moles = \frac{g}{MM}$ $\quad M = \frac{mol}{L}$ $\quad pH = -\log [H^+]$

A 1) According to kinetic-molecular theory, if the temperature of a gas is raised from 100°C to 200°C, the average kinetic energy of the gas will: (1 pt)

A) increase
B) decrease
C) remain unchanged
D) it depends on the gas
E) not enough information is given

C 2) A mixture of Xe, Kr, and Ar has a total pressure of 6.70 atm. What is the mole fraction of Kr if the partial pressures of Xe and Ar are 1.60 atm and 2.80 atm, respectively? (2 pt)

A) 0.174
B) 0.256
C) 0.343
D) 0.481
E) 0.570

$Kr = 6.70 - 1.60 - 2.80 = 2.3$

$\frac{2.3}{6.7} = 0.343$

A 3) A weather balloon is inflated to 40.0 L and 1.00 atm at 21.3°C. It rises to an altitude where the pressure is 0.280 atm and the temperature is -48.6°C. What is the final volume of the balloon? (2 pt)

A) 109 L
B) 187 L
C) 143 L
D) 30.5 L
E) 62.6 L

$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$

$V_2 = \frac{P_1 V_1 T_2}{T_1 P_2}$

$= \frac{1.00 \text{ atm} \cdot 40.0 L \cdot (273 - 48.6 °C) K}{(273 + 21.3 °C) K \cdot 0.280 \text{ atm}}$

$= 108.92 = 109 \text{ atm L}$

A 4) What is the density of propane gas ($CH_3CH_2CH_3$, 44.1 g/mol) at 25°C and 650 torr? (2 pt)

A) 1.54 g/L
B) 3.55 g/L

$0.855 \text{ atm} = 650 \text{ torr} = \frac{x\,(0.08206 \frac{L \cdot atm}{mol \cdot K})\ 298K}{44.1 g/mol}$

$x = \frac{0.855 \text{ atm}\ (44.1 g/mol)}{(0.08206 \frac{L \cdot atm}{mol \cdot K})(298K)}$

$x = 1.54 g/L$

C) 18.3 g/L
D) 2.05 g/L
E) 1.17 g/L

C 5) How many moles of gas are there in a 50.0 L container at 22.0°C and 825 torr? (R = 0.08206 L atm/mol K°) (2 pt)

A) 2.29×10^4
B) 1.70×10^3
C) 2.23
D) 0.603
E) 18.4

$PV = nRT$

$\frac{825}{760} \cdot 50.0\,L = x\,(0.08206\,\frac{L \cdot atm}{mol \cdot K})\,(273+22)K$

$x = \frac{\frac{825}{760} atm \cdot 50.0\,L}{(0.08206\,\frac{L \cdot atm}{mol \cdot K})(273+22)K} =$

___6) One compound under investigation for use as a lightweight rocket fuel is dimethylhydrazine (60.10 g/mol). It reacts with dinitrogen tetroxide (92.01 g/mol) according to the following reaction:

$$(CH_3)_2N_2H_4(l) + N_2O_4(l) \rightarrow 3\,N_2(g) + 4\,H_2O(g) + 2\,CO_2(g)$$

If 150 g of $(CH_3)_2N_2H_4$ react with excess N_2O_4 at 473 K and 760 torr, what volume of CO2 gas will form? (4 pt)

A) 96.5 L
B) 41 L
C) 193 L
D) 82 L
E) 220 L

C 7) Which set of gases is listed from lowest to highest root-mean-square speed at 25°C? (1 pt)

A) $Kr < CO_2 < NO_2 < SF_6$
B) $SF_6 < NO_2 < CO_2 < Kr$
C) $SF_6 < Kr < CO_2 < NO_2$
D) $SF_6 < Kr < NO_2 < CO_2$
E) $CO_2 < NO_2 < Kr < SF_6$

A 8) What is the empirical formula of a compound that contains 29% Na, 41% S, and 30% O by mass? (3 pt)

A) $Na_2S_2O_3$
B) $NaSO_2$
C) NaSO
D) $NaSO_{34}$
E) $Na_2S_2O_6$

Na $0.29\,g \times (\frac{1\,mol}{22.99\,g}) = 0.0126 \rightarrow \frac{0.0126}{0.0126} = 1 \rightarrow \times 2 = 2\,Na$

S $0.41\,g \times (\frac{1\,mol}{32.07\,g}) = 0.0127 \rightarrow \frac{0.0127}{0.0126} = 1.008 \rightarrow \times 2 \approx 2\,S$

O $0.30\,g \times (\frac{1\,mol}{16g}) = 0.0188 \rightarrow \frac{0.0188}{0.0126} = 1.492 \rightarrow \times 2 \approx 3\,O$

C 9) Licopene, a red pigment found in tomatoes, has the empirical formula C_5H_7, and its molecular mass is found to be approximately 537 amu. How many empirical units are in the actual molecular formula? (2 pt)

A) 1
B) 2
C) 4
D) 8
E) 10

C 10) The combustion of ammonia in the presence of excess oxygen yields NO_2 and H_2O:

$$4\,NH_3\,(g) + 7\,O_2\,(g) \rightarrow 4\,NO_2\,(g) + 6\,H_2O\,(g)$$

The combustion of 43.9 g of ammonia produces _____ g of NO_2. (3 pt)

A) 2.58
B) 178
C) 119
D) 0.954
E) 43.9

$NH_3 = 17.03\ g/mol$

$43.9\,g \times \frac{1\,mol}{17.03} = 2.58\,mol$

$2.58\,mol \times 46\,g/mol = 119$

D 11) Solid aluminum and gaseous oxygen react in a combination reaction to produce aluminum oxide:

$$4Al\,(s) + 3\,O_2\,(g) \rightarrow 2\,Al_2O_3\,(s)$$

If 2.5 g of Al and 2.5 g of O_2 react, the limiting reactant is: (3 pt)

A) Al
B) O_2
C) Al_2O_3
D) there is no limiting reactant
E) not enough information is provided

A 12) A mass of 11.60 g of phosphoric acid was produced from the reaction of 10.00 g of P_4O_{10} with 12.00 g water, and the percent yield was 84.25%. What was the theoretical yield of this reaction? (2 pt)

A) 9.773 g
B) 10.4 g
C) 2.92 g
D) 13.77 g
E) 11.60 g

0 13) Which of the following are weak electrolytes? (1 pt)

HCl ✗ $HC_2H_3O_2$ NH_3 KCl ✓

A) HCl, KCl ✗
B) HCl, $HC_2H_3O_2$, NH_3, KCl ✗
C) $HC_2H_3O_2$, KCl ✗
D) $HC_2H_3O_2$, NH_3
E) HCl, $HC_2H_3O_2$, KCl ✗

D 14) When aqueous solutions of $AgNO_3$ and KI are mixed, AgI precipitates. The spectator ions are: (1 pt)

A) Ag^+ and I^-

B) Ag^+ and NO_3^-

C) K^+ and I^-

(D) K^+ and NO_3^-

E) I^- and NO_3^-

E 15) The balanced molecular equation for complete neutralization of H_2SO_4 by KOH in aqueous solution is: (1 pt)

A) $2H^+(aq) + 2OH^-(aq) \rightarrow 2H_2O(l)$ ✗

B) $2H^+(aq) + 2KOH(aq) \rightarrow 2H_2O(l) + 2K^+(aq)$ ✗

C) $H_2SO_4(aq) + 2OH^-(aq) \rightarrow 2H_2O(l) + SO_4^{2-}(aq)$ ✗

$H_2SO_4 + 2KOH \rightarrow H_2O + K_2SO_4$

D) $H_2SO_4(aq) + 2KOH(aq) \rightarrow 2H_2O(l) + K_2SO_4(s)$ ·

(E) $H_2SO_4(aq) + 2KOH(aq) \rightarrow 2H_2O(l) + K_2SO_4(aq)$ ·

D 16) Write the net ionic equation for the reaction that takes place between aqueous copper(II) nitrate and aqueous potassium phosphate. (1 pt)

A) $Cu(NO_3)_2(aq) + K_3PO_4(aq) \rightarrow CuPO_4(s) + K_3(NO_3)_2(aq)$ ✗

B) $3Cu(NO_3)_2(aq) + 2K_3PO_4(aq) \rightarrow Cu_3(PO_4)_2(s) + 6KNO_3(aq)$ ✗

C) $Cu^{2+}(aq) + PO_4^{3-}(aq) \rightarrow CuPO_4(s)$ ✗

(D) $3\,Cu^{2+}(aq) + 2\,PO_4^{3-}(aq) \rightarrow Cu_3(PO_4)_2(s)$

E) $3\,Cu^{2+}(aq) + 2\,PO_4^{3-}(aq) \rightarrow 3\,CuO(s) + P_2O_5(s)$ ✗

B 17) How many moles of K^+ are present in 343 mL of a 1.27 M solution of K_3PO_4? (2 pt)

A) 0.436

(B) 1.31

C) 0.145

D) 3.70

E) 11.1

$343\,mL \times \frac{1.27\,mol}{1000\,mL} = 0.436$

$0.436 \times 3 = 1.31$

C 18) What is the concentration (M) of aqueous methanol produced when 0.200 L of a 2.00 M solution is diluted with water to 0.800 L ? (2 pt)

A) 0.800 M

B) 0.200 M

(C) 0.500 M

D) 0.400 M

E) 8.00 M

$2.00M \times 0.200L = x \times 0.800L$

$x = 0.500\,M$

E 19) A 25.5 mL aliquot of HCl (aq) of unknown concentration was titrated with 0.113 M NaOH (aq). It took 51.2 mL of the base to reach the endpoint of the titration. The concentration (M) of the acid was: (2 pt)

$x\,(25.5\,mL) = (0.113\,M)(51.2\,mL)$

$x = 0.227\,M$

A) 1.02
B) 0.114
C) 0.454
D) 0.113
E) 0.227

E 20) In which species does sulfur have the highest oxidation number? (2 pt)

A) S_8 (elemental form of sulfur) 0
B) H_2S -2
C) SO_2 +2
D) H_2SO_3 +4
E) K_2SO_4 +6

B 21) In which reaction does the oxidation number of hydrogen change? (1 pt)

A) $HCl\,(aq) + NaOH\,(aq) \rightarrow NaCl\,(aq) + H_2O\,(l)$
B) $2\,Na\,(s) + 2\,H_2O\,(l) \rightarrow 2\,NaOH\,(aq) + H_2\,(g)$
C) $CaO\,(s) + H_2O\,(l) \rightarrow Ca(OH)_2\,(s)$
D) $2\,HClO_4\,(aq) + CaCO_3\,(s) \rightarrow Ca(ClO_4)_2\,(aq) + H_2O\,(l) + CO_2\,(g)$
E) $SO_2\,(g) + H_2O\,(l) \rightarrow H_2SO_3\,(aq)$

D 22) Given the data in the table below, what it the value of $\Delta H°_{rxn}$ for the reaction (4 pt)

$Ca(OH)_2 + 2\,H_3AsO_4 \rightarrow Ca(H_2AsO_4)_2 + 2\,H_2O$

-986.6 -900.4 -2346.0 -285.9

Substance	$\Delta H_f°$ (kJ/mol)
$Ca(OH)_2$	-986.6
H_3AsO_4	-900.4
$Ca(H_2AsO_4)_2$	-2346.0
H_2O	-285.9

$(-2346.0) + (-285.9)\times 2 - (-986.6) - (-900.4)\times 2$

$= -130.4\ kJ/mol$

A) -744.9
B) -4519
C) -4219
D) -130.4
E) -76.4

A 23) Calculate the ΔH for the following reaction (4 pt)

$$IF_5\,(g) \rightarrow IF_3\,(g) + F_2\,(g)$$

given the data below.

$$IF\,(g) + F_2\,(g) \rightarrow IF_3\,(g) \quad \Delta H = -390\ kJ$$

$$IF\,(g) + 2\,F_2\,(g) \rightarrow IF_5\,(g) \quad \Delta H = -745\ kJ$$

A) +355
B) -1135
C) +1135
D) +35
E) -35

$IF_{5(g)} \rightarrow \cancel{IF_{(g)}} + \cancel{2F_{2(g)}}$ $\Delta H = 745\ kJ$ (F_2)

$\cancel{IF_{(g)}} + \cancel{F_{2(g)}} \rightarrow IF_{3(g)}$ $\Delta H = -390\ kJ$

$IF_{5(g)} \rightarrow IF_{3(g)} + F_{2(g)}$

$745\ kJ + (-390\ kJ) = 355\ kJ$

E 24) For which one of the following reactions is the value of $\Delta H°_{rxn}$ equal to $\Delta H_f°$ for the product? (1 pt)

A) 2 C (s, graphite) + 2 H_2 (g) → C_2H_4 (g)
B) 2 NO (g) → N_2 (g) + O_2 (g)
C) 2 H_2 (g) + O_2 (g) → 2 H_2O (l)
D) 2 H_2 (g) + O_2 (g) → 2 H_2O (g)
E) none of the above

B 25) An 8.29 g sample of calcium carbonate [$CaCO_3$ (s)] absorbs 50.3 J of heat, upon which the temperature of the sample increases from 21.1 °C to 28.5 °C. What is the specific heat of calcium carbonate? (2 pt)

A) 0.63 J/g-°C
B) 0.82 J/g-°C
C) 1.1 J/g-°C
D) 2.2 J/g-°C
E) 4.2 J/g-°C

D 26) The units of of molar heat capacity are: (1 pt)

A) K/J or °C/J
B) J/K or J/°C
C) J/g-K or J/g-°C
D) J/mol-K or J/mol-°C
E) g-K/J or g-°C/J

B 27) Which of the following statements is false? (1 pt)

A) Internal energy is a state function.
B) Enthalpy is an intensive property.
C) The enthalpy change for a reaction is equal in magnitude, but opposite in sign, to the enthalpy change for the reverse reaction.
D) The enthalpy change for a reaction depends on the state of the reactants and products.
E) The enthalpy of a reaction is equal to the heat of the reaction.

D 28) Which one of the following is an exothermic process? (1 pt)

A) ice melting
B) water evaporating
C) boiling soup
D) condensation of water vapor
E) Ammonium thiocyanate and barium hydroxide are mixed at 25 °C: the temperature drops.

A 29) The value of ΔE for a system that performs 43 kJ of work on its surroundings and gains 17 kJ of heat is _____ kJ. (2 pt)

$\Delta E = q + w$
$= (-17) + 43$
$=$

A) 26
B) -26
C) -60
D) 60
E) 17

B 30) Sodium does not occur in nature as Na (s) because: (1 pt)

A) it is easily reduced to Na^-
B) it is easily oxidized to Na^+
C) it reacts with water with great difficulty
D) it is easily replaced by silver in its ores
E) it undergoes a disproportionation reaction to Na^- and Na^+

B 31) In the following list, only _____ is not an example of a chemical reaction. (1 pt)

A) dissolution of a penny in nitric acid
B) the condensation of water vapor
C) a burning candle
D) the formation of polyethylene from ethylene
E) the rusting of iron

D 32) The enthalpy change for the following reaction is -483.6 kJ: (2 pt)

$$2\,H_2\,(g) + O_2\,(g) \rightarrow 2\,H_2O\,(g)$$

Therefore, the enthalpy change for the following reaction is:

$$H_2O\,(g) \rightarrow H_2\,(g) + 1/2\,O_2\,(g)$$

A) -483.6
B) 483.6
C) -241.8
D) 241.8
E) 967.2

C 33) Which solution contains the largest number of moles of chloride ions? (2 pt)

A) 10.0 mL of 0.500*M* $BaCl_2$

B) 4.00 mL of 1.000*M* NaCl

C) 7.50 mL of 0.500*M* $FeCl_3$

D) 25.00 mL of 0.400*M* KCl

E) 30.00 mL of 0.100*M* $CaCl_2$

C 34) What is the result of the following operation: (1 pt)

(2.5732 + 36.9) / 11.78

$= \frac{39.4732}{11.78}$

$= 3.350$

A) 3.4

B) 3.35

C) 3.350

D) 3.3509

E) 3.35086

B 35) What is characteristic of a compound? (1 pt)

A) it can be decomposed by physical means

B) it can be decomposed by chemical means

C) its empirical formula is identical to its molecular formula

D) it is a liquid at room temperature

E) it is a solid at room temperature

E 36) Work is defined as: (1 pt)

A) the heat lost by a system

B) the heat gained by a system

C) the pressure of a gas

D) force per area ×

E) the energy used to move an object against a force

B 37) Which of the following is a strong base? (1 pt)

A) KCl

B) KOH

C) H_2O

D) NH_3

E) HCl

B 38) Which of the following is a is a weak acid? (1 pt)

A) HCl

B) $HClO_4$

C) H_2O

D) NH_4^+

E) NH_3

C 39) What is the molar mass of phosphorus pentachloride (PCl_5)? (2 pt)

A) 177.3 g/mol
B) 190.3 g/mol
C) 208.2 g/mol
D) 172.8 g/mol
E) 202.8 g/mol

P = 30.974 g/mol

Cl = 35.45 × 5 = 177.25 g/mol

30.974 + 177.25 = 208.224 g/mol

= 208.2 g/mol

D 40) Identify the set of stoichiometric coefficients that balance the reaction equation for the combustion of octane. (2 pt)

$$C_8H_{18}(\ell) + 12.5\,O_2(g) \rightarrow 8\,CO_2(g) + 9\,H_2O(\ell)$$

16

×2 25 16 18

A) 1, 25, 8, 9
B) 1, 17, 8, 9
C) 2, 34, 16, 18
D) 2, 25, 16, 18
E) 1, 9, 8, 9

C 41) For a hypothesis to be considered a valid scientific theory, it must: (1 pt)

A) summarize experimental data without trying to predict future results.
B) be impossible to prove wrong by experiment.
C) explain widely observed phenomena based on extensive testing.
D) never be modified or expanded.
E) be voted on by the scientific community and accepted by all.

A 42) Which of the following photons has the lowest frequency? (1 pt)

A) a photon from a Nd:YAG laser with λ = 1064 nm
B) a photon from an Ar^+ laser with λ = 514.5 nm
C) a photon from a Kr^+ laser with λ = 647 nm
D) a photon from an ArF laser with λ = 193 nm
E) a photon from a He–Ne laser with λ = 633 nm

D 43) An electron cannot have the quantum numbers n = ___, l = ___, m_l = ___. (1 pt)

A) 2, 0, 0
B) 2, 1, -1
C) 3, 1, -1
D) 1, 1, 1
E) 3, 2, 1

D 45) The ground-state electron configuration of _____ is $[Ar]4s^1 3d^5$. (1 pt)

A) V
B) Mn
C) Fe
D) Cr
E) K

D 46) Of the following, which gives the correct order for atomic radius for Ca, K, As, Ge and Kr? (1 pt)

A) Ca > K > As > Ge > Kr
B) K > Ge > As > K > Ca
C) Ge > As > Kr > K > Ca
D) K > Ca > Ge > As > Kr
E) Kr > As > Ge > Ca > K

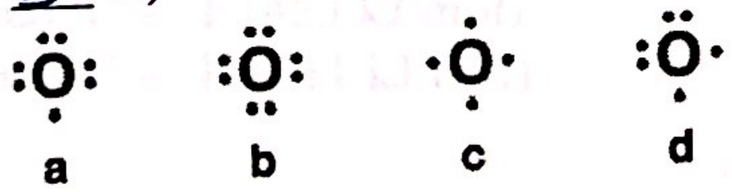
E 47) Which of the following correctly represents the second ionization of aluminum? (1 pt)

A) $Al^+ (g) + e^- \rightarrow Al (g)$
B) $Al (g) \rightarrow Al^+ (g) + e^-$
C) $Al^- (g) + e^- \rightarrow Al^{2-} (g)$
D) $Al^+ (g) + e^- \rightarrow Al^{2+} (g)$
E) $Al^+ (g) \rightarrow Al^{2+} (g) + e^-$

D 48) As the number of covalent bonds between two atoms increases, the distance between the atoms _____ and the strength of the bond between them _____. (1 pt)

A) increases, increases
B) decreases, decreases
C) increases, decreases
D) decreases, increases
E) more information is needed to answer.

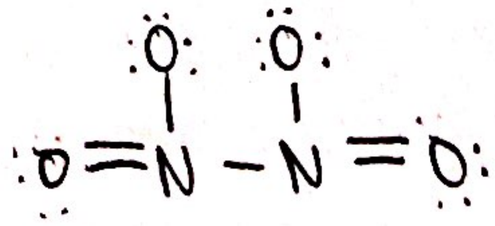
B 49) Which of the following is the correct Lewis symbol for the oxide anion (O^{2-})? (1 pt)



A) a
B) b
C) c
D) d

A 50) How many lone-pair electrons are on each of the nitrogen atoms in the Lewis structure for dinitrogen tetroxide (N_2O_4)? (2 pt)

A) 0
B) 1
C) 2
D) 3
E) 4



A 51) Which of the following bonds is most polar? (1 pt)

Element	*Electronegativity*
C	2.5
O	3.5
H	2.1
Li	1.0

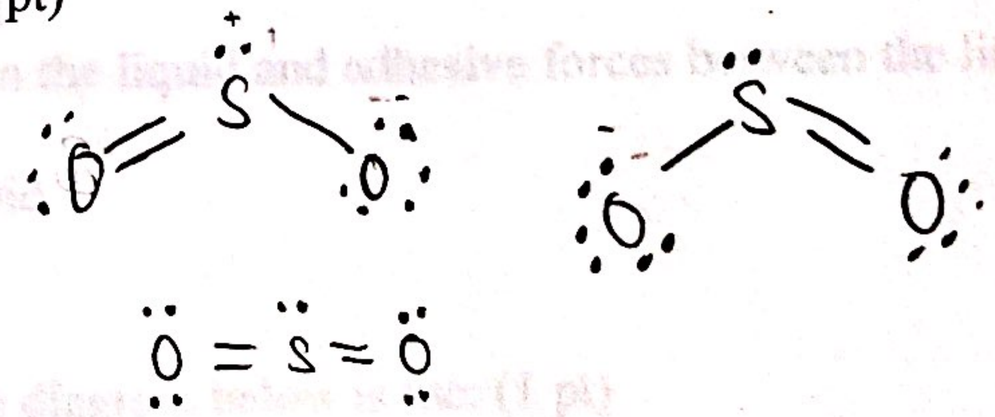
A) Li — C
B) Li — H
C) Li — O
D) Li — Li
E) C — O

A 52) In terms of the enthalpy of formation, which of the following compounds is most stable relative to its elements under standard conditions? (1 pt)

A) $PbBr_2(s)$, $\Delta H_f^\circ = -277.4$ kJ/mol
B) $O_3(g)$, $\Delta H_f^\circ = +142.3$ kJ/mol
C) $SO_2(g)$, $\Delta H_f^\circ = -269.9$ kJ/mol
D) $H_2Se(g)$, $\Delta H_f^\circ = +29.7$ kJ/mol
E) $ICl(g)$, $\Delta H_f^\circ = +17.8$ kJ/mol

C 53) How many equivalent resonance forms can be drawn for SO_2 without expanding octet on the sulfur atom (sulfur is the central atom)? (2 pt)

A) 0
B) 2
C) 3
D) 4
E) 1



D 54) Which of the following is the shortest bond? The number in parentheses is the bond energy. (1 pt)

A) C — C (348 kJ/mol)
B) C — F (453 kJ/mol)
C) C — H (411 kJ/mol)
D) C — Cl (339 kJ/mol)
E) C — O (358 kJ/mol)

C 55) The electron-domain geometry and molecular geometry of ammonia are _____ and _____, respectively. (2 pt)

A) octahedral, T-shaped
B) trigonal bipyramidal, T-shaped
C) tetrahedral, trigonal pyramidal
D) octahedral, trigonal planar
E) T-shaped, trigonal planar

C 56) In VSEPR theory, molecular geometry is determined by: (1 pt)

A) electron–proton attractive forces.
B) electron–electron attractive forces.
C) electron–electron repulsive forces.
D) proton–proton repulsive forces.
E) electron–nucleus attractive forces.

C 57) Which of the following compounds is non polar? (1 pt)

A) CF_2Cl_2 ✗
B) CF_3Cl ✗
C) CF_4
D) $CFCl_3$ ✗
E) $CHFCl_2$ ✗

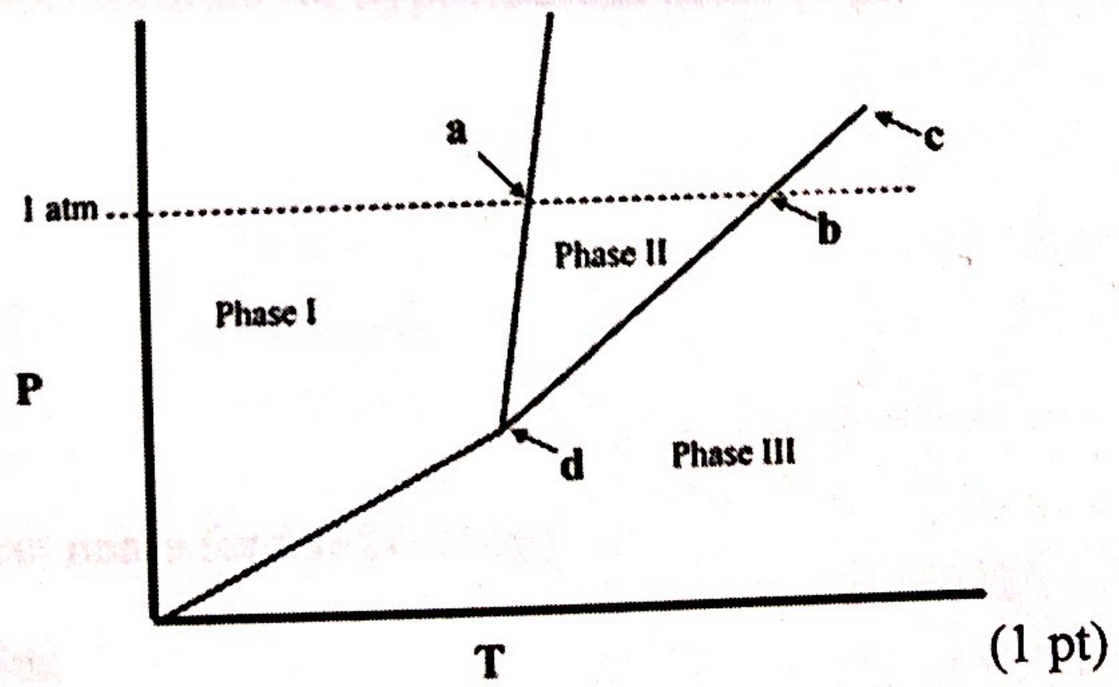
C 58) Which type of intermolecular forces are responsible for the solubility of oxygen gas in water? (1 pt)

A) Hydrogen bonds
B) Dipole-dipole
C) Dipole-induced-dipole
D) Ion-dipole
E) Dispersion forces

C 59) The shape of a liquid's meniscus is determined by: (1 pt)

A) the viscosity of the liquid
B) the type of material the container is made of
C) the relative magnitudes of cohesive forces in the liquid and adhesive forces between the liquid and its container
D) the amount of hydrogen bonding in the liquid
E) the volume of the liquid

B 60) The temperature at point b in the phase diagram below is the: (1 pt)



A) Freezing point
B) Boiling poin
C) Sublimation point

D) Triple point ✗
E) Critical point ✗

B 61) If 6.2 g of NaCl are dissolved in 43.5 g of water, the percent of NaCl by mass would be (2 pt)

$$\%\,mass = \frac{6.2\ g\ NaCl}{6.2 + 43.5} \times 100 = 12.5\%$$

A) 14.3%
(B) 12.5%
C) 7.01%
D) 85.7%.
E) 49.7%

E 62) Which compound below is likely to have the highest boiling point? (1 pt)

A) CH_3CF_3
B) CH_3CN
C) $(CH_3)_2CO$
D) CH_3CH_2SH
(E) CH_3CH_2OH

D 63) Which compound below is most likely to dissolve in CCl_4? (1 pt)

A) NaCl
B) sugar
C) HCl
(D) C_6H_6
E) CH_3CH_2OH

B 64) Which is the correct formula for hypochlorous acid? (1 pt)

A) HCl
(B) HClO
C) $HClO_2$
D) $HClO_3$
E) $HClO_4$

A 65) What is the correct name for $CrCl_3$? (1 pt)

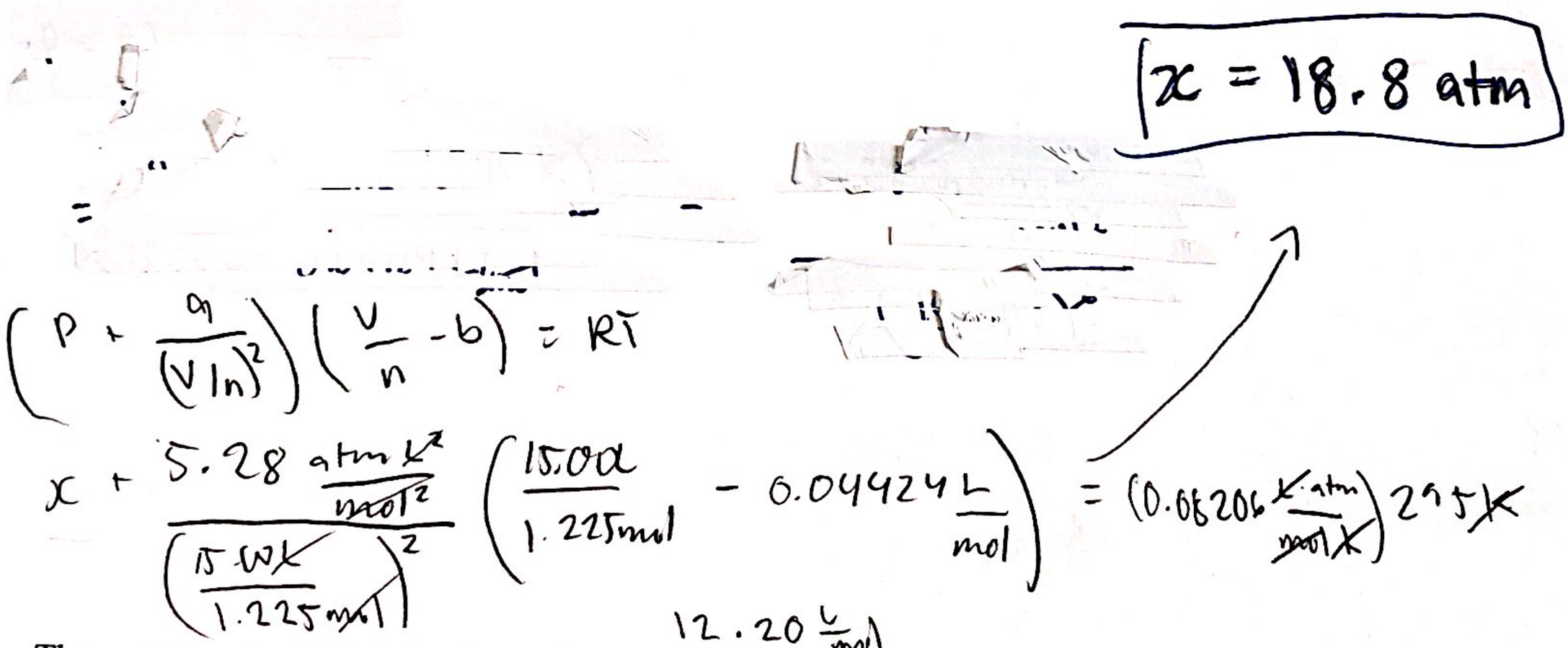
(A) chromium(III) chloride
B) Chromium trichloride
C) chromium(VI) chloride
D) chromium(VI) trichloride
E) Chromium chloride

B 66) Table sugar (sucrose, $C_{12}H_{22}O_{11}$) dissolves in water. This process: (1 pt)

A) is a chemical change
B) is a physical change
C) produces a heterogeneous mixture
D) is a chemical property of sucrose
E) converts sucrose to carbon dioxide and water

BONUS

- The van der Waals constants for NO_2 are $a = 5.28$ atm L^2/mol^2 and $b = 0.04424$ L/mol. What is the pressure of 56.33 g of NO_2 in a 15.00 L container at 22.00°C when it is treated as a real gas? (5 pt)



- The pressure exerted by a column of liquid is equal to the product of the height of the column times the gravitational constant times the density of the liquid, P = *ghd*. How high a column of methanol (d = 0.79 g/mL) would produce the same pressure as a 713 mm column of mercury (d = 13.6 g/mL)? (5 pt)