

Key!

Exam 4 Test Prep

Chapter 1: Matter, Energy, & Measurement

Find the mass of 500.0 ml of ethanol. The density of ethanol is 0.789 g/ml.

$$D = \frac{m}{V}$$

$$\begin{aligned} m &= D \times V \\ &= (0.789 \text{ g/ml}) (500.0 \text{ mL}) \\ &= \boxed{394.5 \text{ g}} \end{aligned}$$

Determine the number of sig figs for each number:

0.05843

leading
zeros are
non significant
↓
4

6.92×10^3

↓
3

100

↓
1 trailing
zeros are
non significant

100.090080

↓
9

Determine whether it's a pure element, pure substance, or mixture (homogenous / heterogenous).
different same

Water

Pure
Substance

Air

homogenous
mixture

Soil

heterogenous
mixture

Sulfur

Pure element

Physical Properties: can be observed without changing a substance into another substance
ex: color, density, melting point, boiling point, & hardness.

Chemical Properties: can only be observed when a substance is changed into another substance

flammability, combustion

Intensive Properties: Independent of the amount of the substance that's present.
ex: density, B.P., color (what helps identify)

Extensive Properties: depend upon the amount of the substance present.

ex: mass, volume, energy.

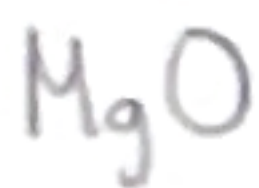
Chapter 2: Atoms, Molecules, and Ions

Calculate how many protons, neutrons, and electrons are in each compound

Name	Protons	Neutrons molar mass - # of protons	Electrons
Germanium	32	41 73-32	32
Cation → Sr^{2+} less electrons subtract	38	50	36
Carbon-12	6	6	6
Anion → Cl^- gained electrons add	17	18	18

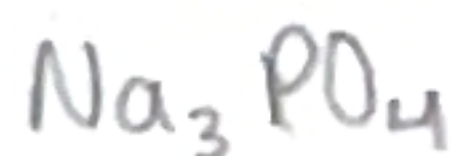
Write the formula for the following compounds:

$\overset{+2}{\text{Mg}}$ $\overset{-2}{\text{O}}$
Magnesium oxide
metal non-metal



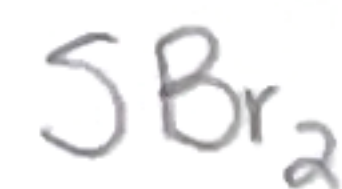
Ionic

$\overset{+1}{\text{Na}}$ $\overset{-3}{\text{PO}_4}$
Sodium phosphate
metal polyatomic ion



Ionic

$\overset{+2}{\text{S}}$ $\overset{-1}{\text{Br}}$
Sulfur dibromide
non-metal non-metal

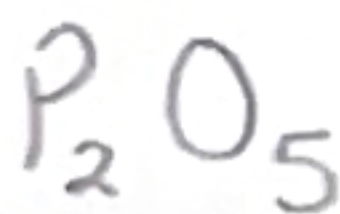


Covalent

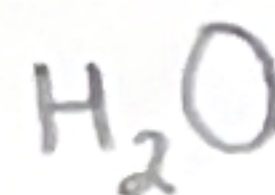
Carbon tetrachloride
4



Diphosphorus pentoxide
5



Dihydrogen monoxide



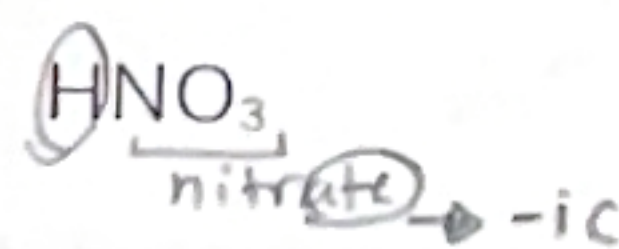
Give the nomenclature of the following compounds:



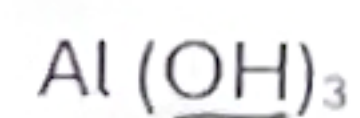
Nitrogen dioxide



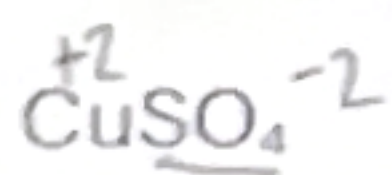
Magnesium bromide



Nitric Acid



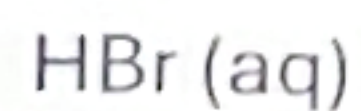
Aluminum hydroxide



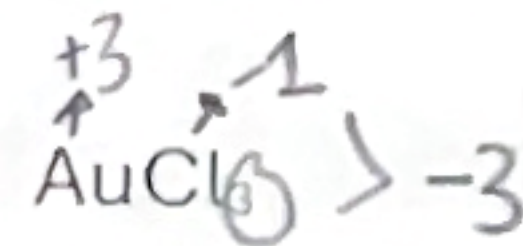
Copper(II) sulfate



Phosphorus pentachloride



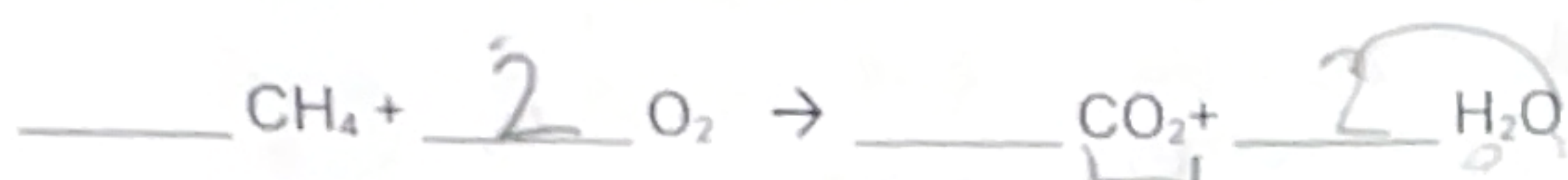
Hydrobromic acid



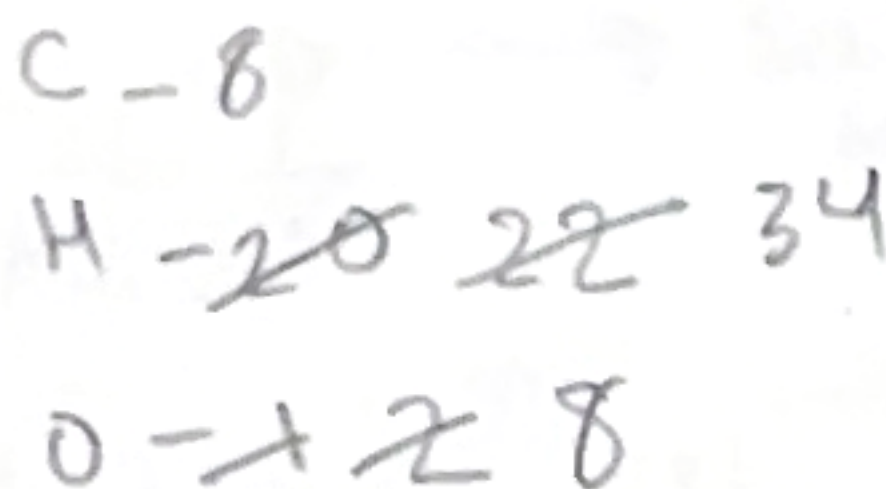
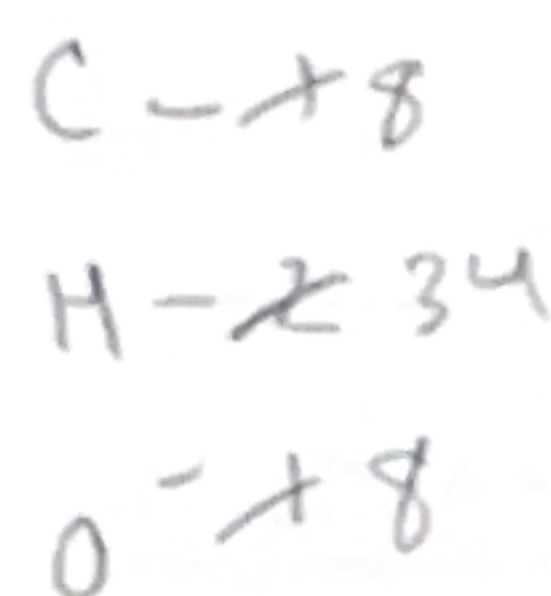
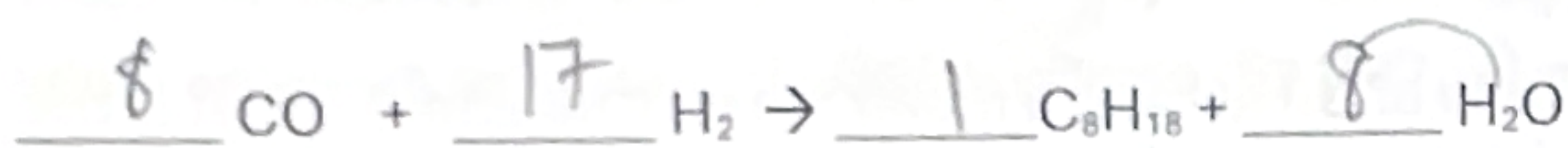
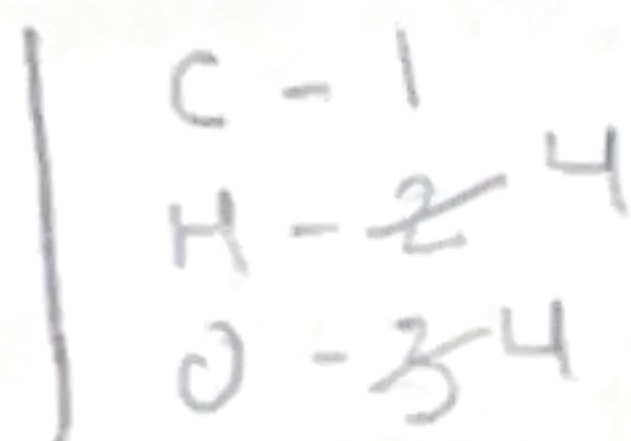
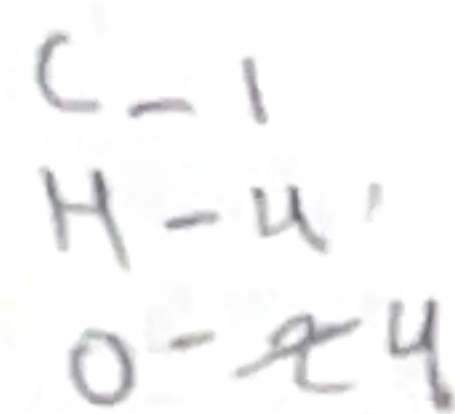
Gold(III) chloride

Chapter 3: Chemical Reactions & Reaction Stoichiometry

Balance the chemical equations:



complete combustion
Rxn.



Magnesium is 79% ^{24}Mg , 11% ^{25}Mg , and 10% ^{26}Mg . Calculate the average atomic mass.

% $\rightarrow$ dec.

79% $\rightarrow$ 0.79

11% $\rightarrow$ 0.11

10% $\rightarrow$ 0.10

$$= \sum (\text{fraction of isotope} \times \text{atomic mass of isotope})$$

$$(0.79 \times 24) + (0.11 \times 25) + (0.10 \times 26)$$

$$= \boxed{24.31 \text{ amu}}$$

Boron is 80.1% ^{11}B and 19.9% ^{10}B . Calculate the average atomic mass of boron.

$$(0.801 \times 11) + (0.199 \times 10) = 10.80 \text{ amu}$$

Calculate the percent composition on aluminum in Al_2O_3 ?

$$\text{Al} = 26.98 \text{ g/mol}$$

$$\text{O} = 16.00 \text{ g/mol}$$

$$(2 \times 26.98) + (3 \times 16.00) = 101.96 \text{ g/mol}$$

molar mass of Al_2O_3

$$53.96$$

$$\frac{\text{Part}}{\text{Whole}} = \left(\frac{53.96}{101.96} \right) \times 100 = \boxed{52.9\%}$$

Given the following reaction: $2 \text{NaClO}_3 \rightarrow 2 \text{NaCl} + 3 \text{O}_2$

How many grams of O_2 will be formed from 5.00 grams of NaClO_3 ?

① Find molar mass $\text{NaClO}_3 = 106.45 \text{ g/mol}$

② grams $\rightarrow$ moles $= \frac{5.00 \text{ g NaClO}_3}{106.45 \text{ g/mol NaClO}_3} = 0.0469 \text{ mol NaClO}_3$

③ mol $\text{O}_2 \rightarrow$ gram O_2 $\frac{0.0469 \text{ mol NaClO}_3}{2 \text{ mol NaClO}_3} \times \frac{3 \text{ mol O}_2}{1 \text{ mol O}_2} = 0.07035 \text{ mol O}_2 \cdot \frac{32.00 \text{ g}}{1 \text{ mol O}_2} = \boxed{2.25 \text{ g O}_2}$

A compound has an empirical formula of $\text{C}_2\text{H}_5\text{O}$ and a molar mass of 90 g/mol. What is the molecular formula of the compound?

C: $12.00 \text{ g} \times 2 = 24.00 \text{ g/mol}$
 H: $1.008 \text{ g} \times 5 = 5.04 \text{ g/mol}$
 O: $16.00 \text{ g} \times 1 = 16.00 \text{ g/mol}$
 Add $\frac{45.04 \text{ g/mol}}$

$\frac{90 \text{ g/mol}}{45.04 \text{ g/mol}} \approx 2$

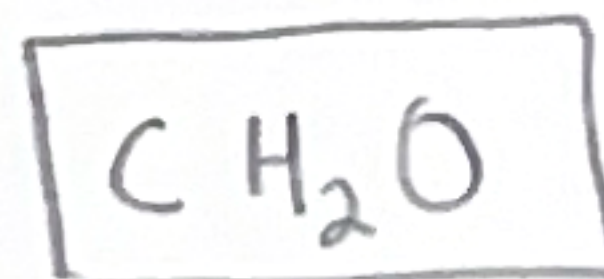
$2 \times (\text{C}_2\text{H}_5\text{O}) = \boxed{\text{C}_4\text{H}_{10}\text{O}_2}$
 molecular formula

What is the empirical formula of a compound that has 40% C, 6.71% H, and 53.29% O?

C: 40.00 g $\frac{40.00 \text{ g}}{12.00 \text{ g}} = \frac{3.33}{3.33} = 1$

H: 6.71 g $\frac{6.71 \text{ g}}{1.008 \text{ g}} = \frac{6.66}{3.33} \approx 2$

O: 53.29 g $\frac{53.29 \text{ g}}{16.00 \text{ g}} = \frac{3.33}{3.33} = 1$



Balance the reaction then solve: $2 \text{Al (s)} + 6 \text{HCl (aq)} \rightarrow 2 \text{AlCl}_3 \text{ (aq)} + 3 \text{H}_2 \text{ (g)}$

If you have 10.0 g of Al and 18.0 g of HCl, what is the maximum mass of AlCl_3 that can be produced?

Al: 27 g/mol

HCl: 36.45 g/mol

AlCl_3 : 133.35 g/mol

$\frac{10.0 \text{ g}}{27 \text{ g/mol}} = 0.370 \text{ mol Al}$

$\frac{18.0 \text{ g}}{36.45 \text{ g/mol}} = 0.493 \text{ mol HCl}$

$\frac{0.370 \text{ mol Al}}{2 \text{ mol Al}} \times \frac{6 \text{ mol HCl}}{1 \text{ mol Al}} = 1.11 \text{ mol HCl}$

$\frac{0.493 \text{ mol HCl}}{6 \text{ mol HCl}} \times \frac{2 \text{ mol AlCl}_3}{1 \text{ mol HCl}} = 0.164 \text{ mol AlCl}_3$

$0.164 \text{ mol AlCl}_3 \times 133.35 \text{ g/mol} = 21.8694 \rightarrow \boxed{21.9 \text{ g AlCl}_3}$

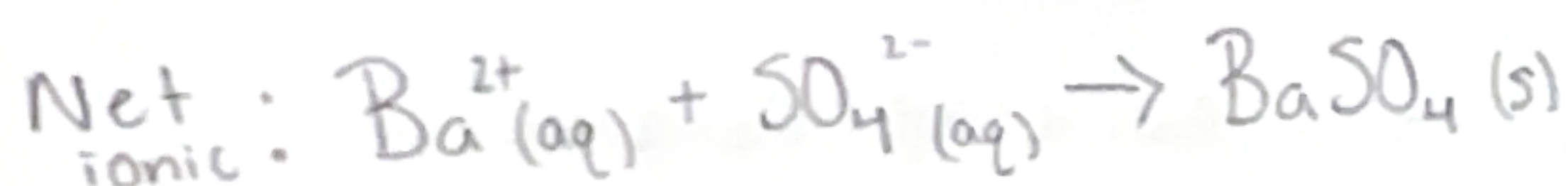
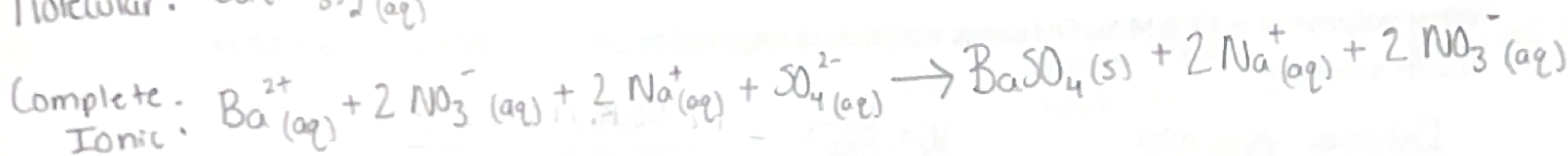
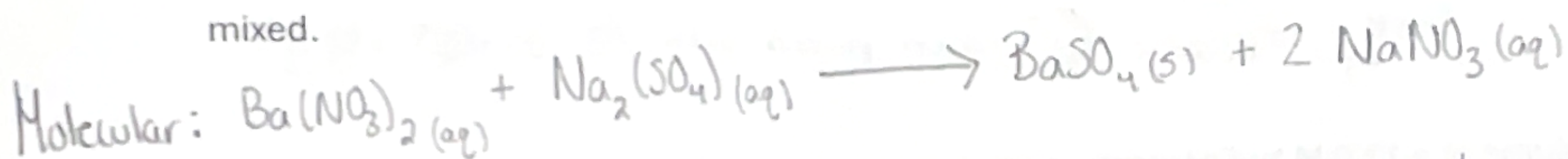
Chapter 4: Reactions in Aqueous Solution:

Determine whether the following compound are strong, weak, or nonelectrolytes.

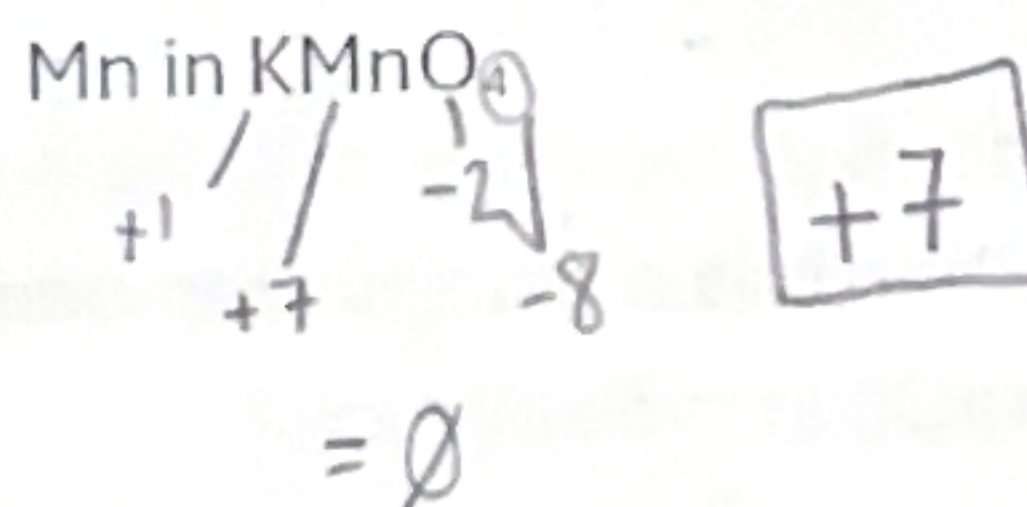
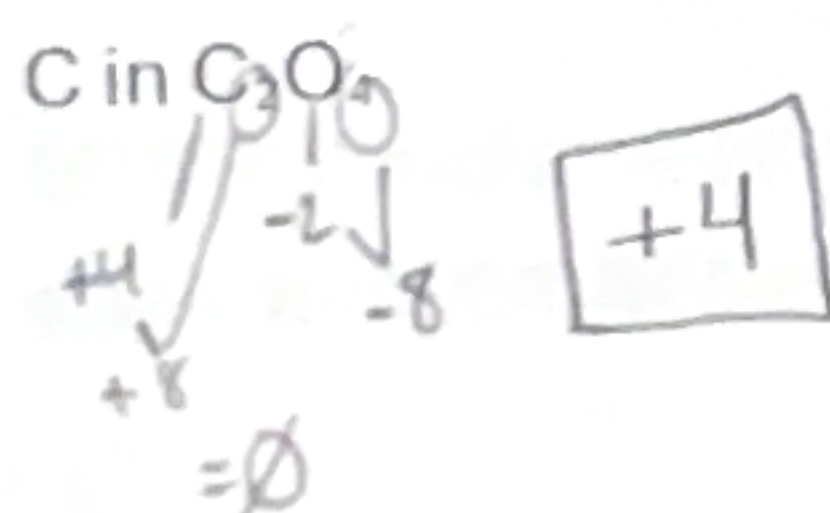
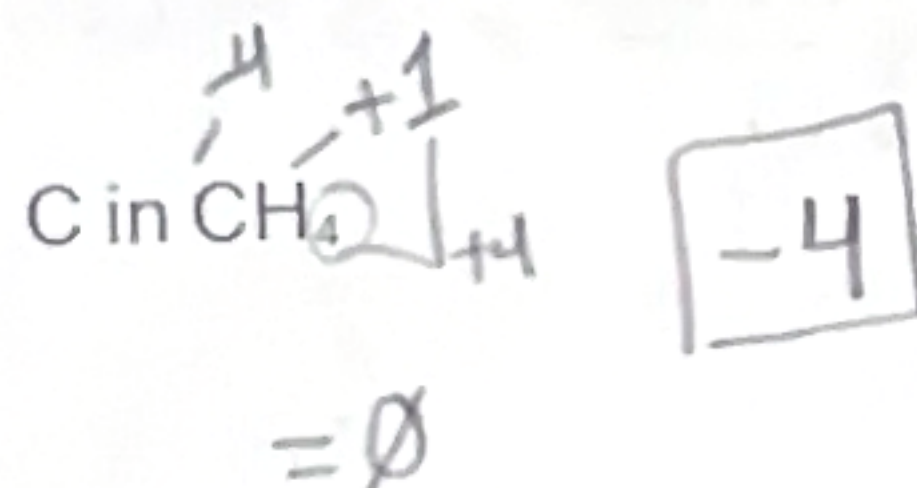
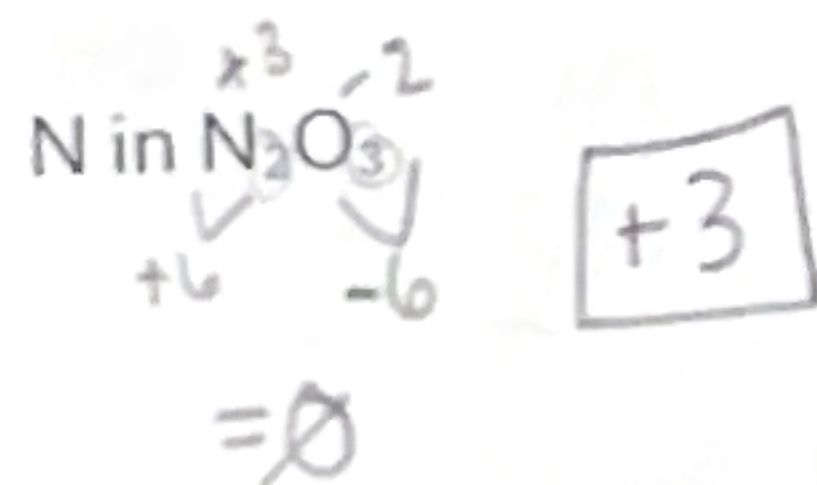
NaOH Strong base Strong electrolyte	CH ₃ COOH Acetic Acid Weak acid Weak electrolyte	H ₂ O molecular compound nonelectrolyte	NaCl Ionic compound strong electrolyte	C ₆ H ₁₂ O ₆ Glucose; molecular compound non electrolytes
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completely dissociated into ions
partially dissociates
won't break off into ions

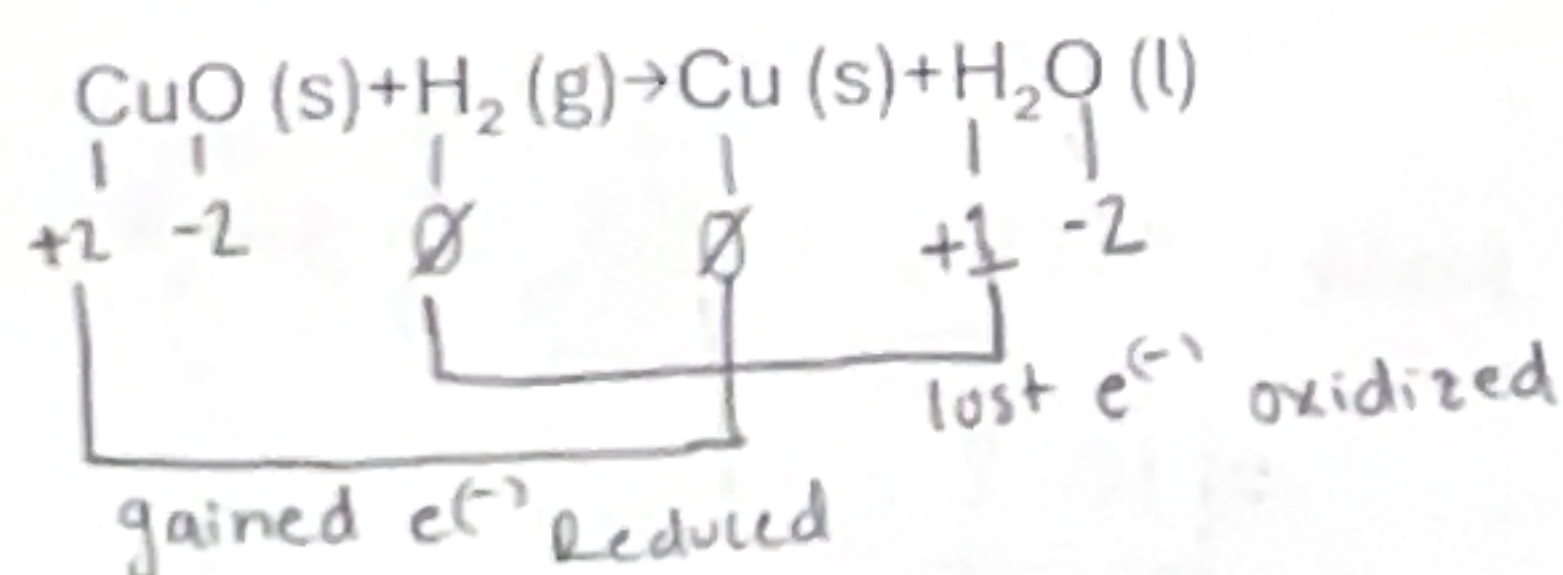
Write the molecular, complete ionic, and net ionic equations for the reaction that occurs when aqueous solutions of barium nitrate (Ba(NO₃)₂) and sodium sulfate (Na₂SO₄) are mixed.



Determine the oxidation number:



Determine what compound is reduced and oxidized.



Loss of Electrons says
Gain of Electrons

Oxidation Reduction

OIL RIG

Based on the activity series, which one of the reactions below will occur?

- A) $\text{Zn (s)} + \text{MnI}_2 \text{ (aq)} \rightarrow \text{ZnI}_2 \text{ (aq)} + \text{Mn (s)}$
- B) $\text{SnCl}_2 \text{ (aq)} + \text{Cu (s)} \rightarrow \text{Sn (s)} + \text{CuCl}_2 \text{ (aq)}$
- C) $2\text{AgNO}_3 \text{ (aq)} + \text{Pb (s)} \rightarrow 2\text{Ag (s)} + \text{Pb(NO}_3)_2 \text{ (aq)}$
- D) $3\text{Hg (l)} + 2\text{Cr(NO}_3)_3 \text{ (aq)} \rightarrow 3\text{Hg(NO}_3)_2 + 2\text{Cr (s)}$
- E) $3\text{FeBr}_2 \text{ (aq)} + 2\text{Au (s)} \rightarrow 3\text{Fe (s)} + 2\text{AuBr}_3 \text{ (aq)}$

When aqueous solutions of NaCl and AgNO₃ are mixed, will a precipitate form?



Yes; because Cl^- when paired with Ag^+ is not soluble.

What volume of a 12.0 M NaOH stock solution is required to prepare 250.0 mL of a 2.50 M NaOH solution?

Dilution equation

$$M_1 V_1 = M_2 V_2$$

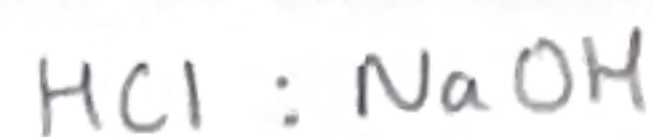
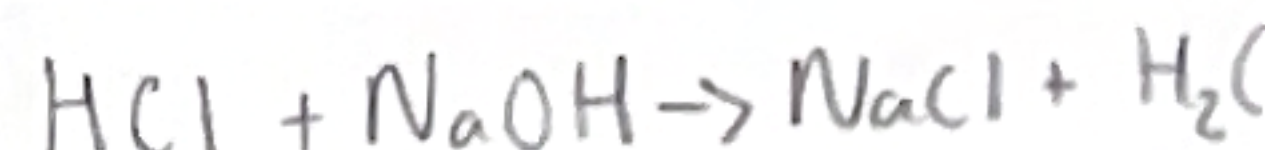
$$V_1 = \frac{M_2 V_2}{M_1} = \frac{(2.50 \text{ M})(0.25 \text{ L})}{12.0 \text{ M}}$$

$$= 0.0521 \text{ L} \rightarrow 52.1 \text{ mL}$$

If it takes 15.0 mL of 1.5 M HCl to neutralize 50.0 mL of NaOH solution, what is the molar concentration of NaOH?

$$\text{HCl } 15.0 \text{ mL} \rightarrow \frac{0.0150 \text{ L} \times 1.5 \text{ mol/L}}{1 \text{ L}} = 0.0225 \text{ mol}$$

$$\text{NaOH } 50.0 \text{ mL} \rightarrow 0.0500 \text{ L}$$



$$M = \frac{\text{mol}}{\text{L}} = \frac{0.0225 \text{ mol NaOH}}{0.0500 \text{ L}} = \boxed{0.450 \text{ M NaOH}}$$

A 500 mL sodium chloride solution has a chloride ion concentration of 0.350 M. What is the mass (g) of sodium chloride (NaCl) in the solution?

$$500 \text{ mL} \rightarrow 0.500 \text{ L}$$

$$\text{Cl}^- = 0.350 \text{ M}$$

$$\text{moles NaCl} = 0.350 \times 0.500 \text{ L} = 0.175 \text{ mol}$$

$$\text{mass NaCl} = 0.175 \text{ mol} \times 58.45 \text{ g/mol} = \boxed{10.2 \text{ g NaCl}}$$

Ch.5 Thermochemistry

Determine whether it's an endothermic or exothermic reaction:

Boiling water	Freezing water	Melting chocolate	Combustion
Endothermic	Exothermic	Endothermic	Exothermic

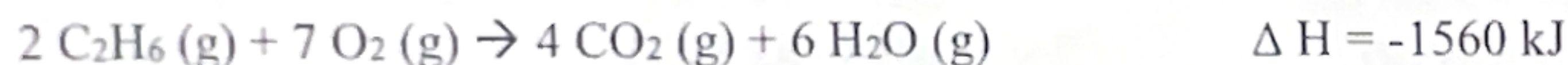
1000 J of heat is added to the system, and 450 J of work is done on the system. Calculate the change in internal energy of the system

$$\begin{aligned}\Delta E &= Q + W \\ &= (\text{heat}) + (\text{work}) \\ &= +1000 \text{ J} + 450 \\ &= +1450 \text{ J}\end{aligned}$$

Q: ⁽⁺⁾ absorbed heat ⁽⁻⁾ released heat

W: system had work done on it system did work.

Given the thermochemical reaction:



How much heat is released when 5.00 g of C_2H_6 (ethane) reacts?

$$\text{Molar mass } \text{C}_2\text{H}_6 = (2 \times 12) + (6 \times 1.008) = 30.07 \text{ g/mol}$$

$$\frac{5.00 \text{ g}}{30.07 \text{ g/mol}} = 0.166 \text{ mol} \quad \left| \quad \frac{-1560 \text{ kJ}}{2 \text{ mol } \text{C}_2\text{H}_6} \right| = \boxed{-129.48 \text{ kJ}}$$

50.0 g of metal at 30.0°C has 450 joules of heat added to it. The metal's specific heat capacity is $0.200 \text{ J/g}^\circ\text{C}$. What is the final temperature?

$$Q = mC\Delta T$$

$$q = 450 \text{ J}$$

$$m = 50.0 \text{ g}$$

$$C = 0.200 \text{ J/g}^\circ\text{C}$$

$$T_{\text{initial}} = 30.0^\circ\text{C}$$

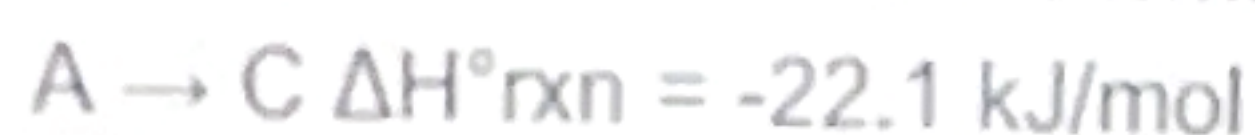
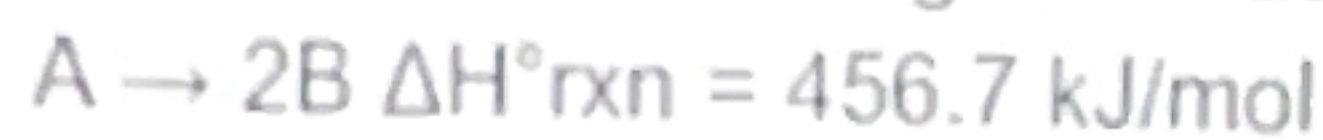
$$\Delta T = \frac{q}{m \cdot C}$$

$$= \frac{450 \text{ J}}{(50.0 \text{ g})(0.200 \text{ J/g}^\circ\text{C})}$$

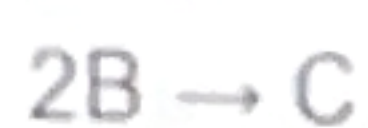
$$= 45.0^\circ\text{C}$$

$$T_{\text{final}} = 30.0^\circ\text{C} + 45.0^\circ\text{C} = \boxed{75.0^\circ\text{C}}$$

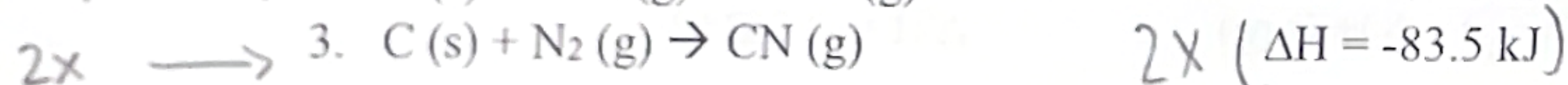
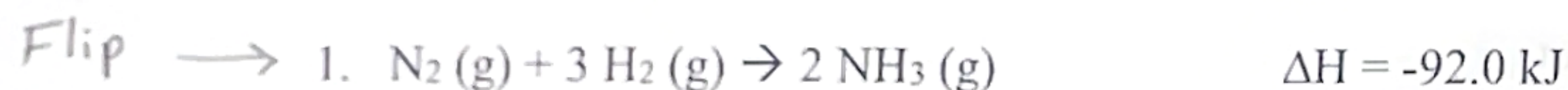
Flip $\rightarrow$ Consider the following two reactions:



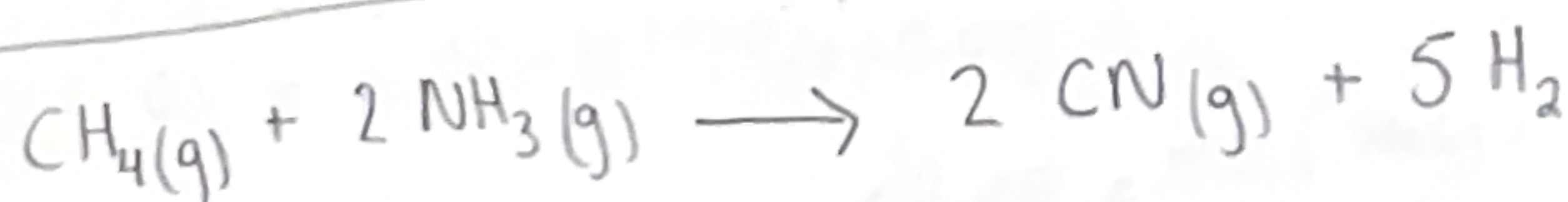
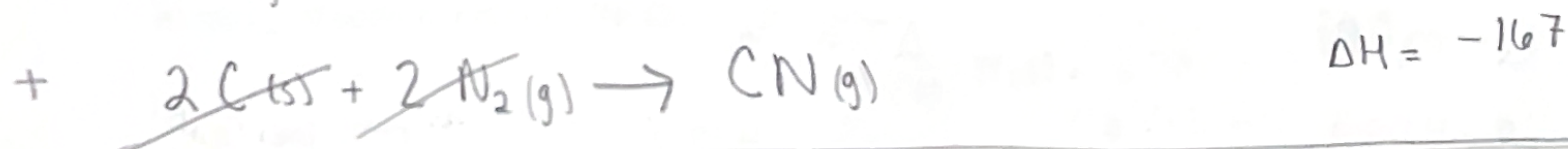
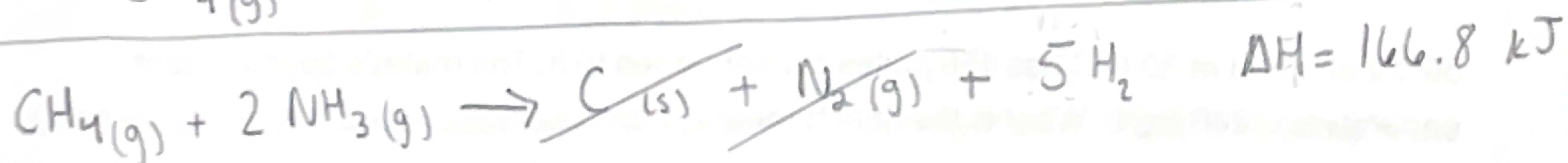
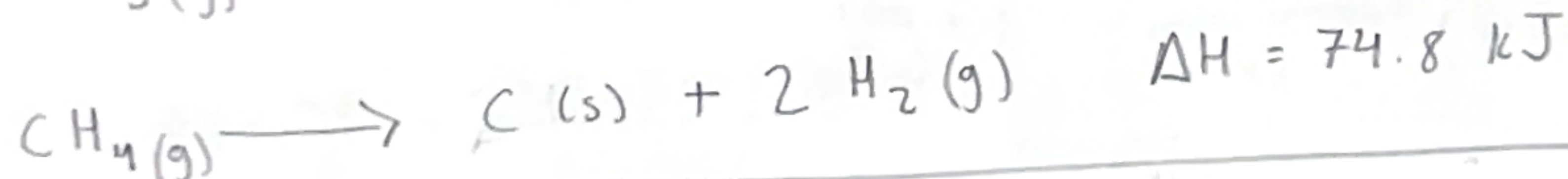
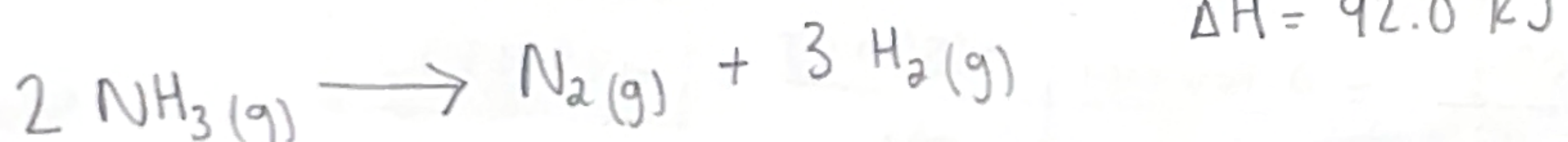
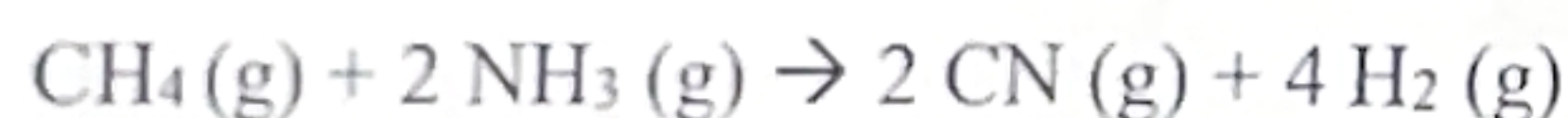
Determine the enthalpy change for the process:



Given the thermochemical reactions:

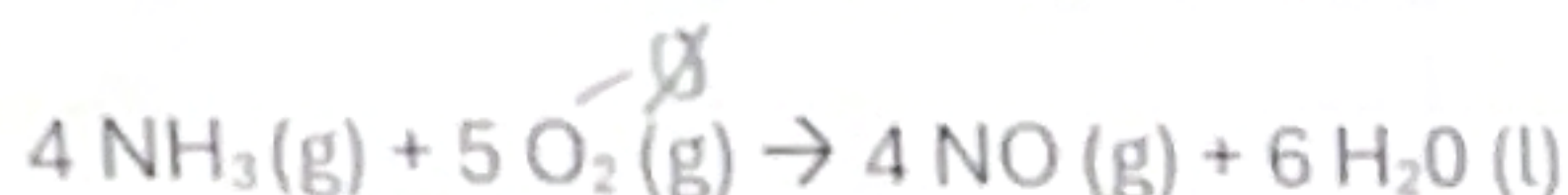


What is the change in enthalpy (ΔH) for the reaction:



$$\Delta H = -0.2 \text{ kJ}$$

Given the data in the table, $\Delta H^\circ_{\text{rxn}}$ for the reaction below is _____ kJ.



Substance	ΔH°_f (kJ/mol)
H ₂ O (l)	-286
NO (g)	90
HNO ₃ (aq)	-207
NH ₃ (g)	-46

$$\begin{aligned} \Delta H_{\text{rxn}} &= \sum \Delta H_{\text{products}} - \sum \Delta H_{\text{reactants}} \\ &= 6(-286) + 4(90) - 4(-46) \\ &= (-1716 + 360) - (-184) \\ &= -1356 + 184 \\ &= -1172 \end{aligned}$$

Ch.6 Electronic Structure of Atoms

What are the possible values for quantum numbers?

n = principal quantum numbers 1-7 energy levels

$l = 0 ; n-1 ; l \leq n-1$ shape of orbitals

$m_l = -l \text{ through } +l$ orientation of orbital $-l \leq m_l \leq +l$

$m_s = -\frac{1}{2} \text{ or } +\frac{1}{2}$ spin of electrons

If $n = 1$, then l can only be 0 (zero)

If $n = 3$ and $l = 2$, then m_l can be -2, -1, 0, 1, 2

What is the frequency (s^{-1}) of electromagnetic radiation that has a wavelength of 2.3 m?

Speed of light equation $\rightarrow c = \lambda \nu$

$$\nu = \frac{c}{\lambda} = \frac{3.00 \times 10^8 \text{ m/s}}{2.3 \text{ m}} = 1.3 \times 10^8 \text{ s}^{-1}$$

The wavelength of a photon that has an energy of $6.33 \times 10^{-18} \text{ J}$ is _____ m.

Photon energy equation $\rightarrow E = \frac{hc}{\lambda}$

$$\lambda = \frac{hc}{E} = \frac{(6.626 \times 10^{-34} \text{ J}\cdot\text{s})(3.00 \times 10^8 \text{ m/s})}{6.33 \times 10^{-18} \text{ J}}$$

$$\lambda = 3.14 \times 10^{-8} \text{ m}$$

E = energy of photon
 h = Planck's constant ($6.626 \times 10^{-34} \text{ J}\cdot\text{s}$)
 c = Speed of light ($3.00 \times 10^8 \text{ m/s}$)
 λ = Wavelength (m)

Value of l	0	1	2	3
Letter used	s	p	d	f

Write the electron configuration for the following elements:

Cation

Li: $1s^2$

Sc: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1$

Br: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$

Ga: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^1$

List the different wavelengths from longest to shortest:

Radio waves (longest)

Microwaves

Infrared Radiation

Visible light

Ultraviolet Radiation

X-rays

Gamma rays (shortest)

What is the Pauli exclusion principle?

No 2 particles can occupy the same quantum state simultaneously

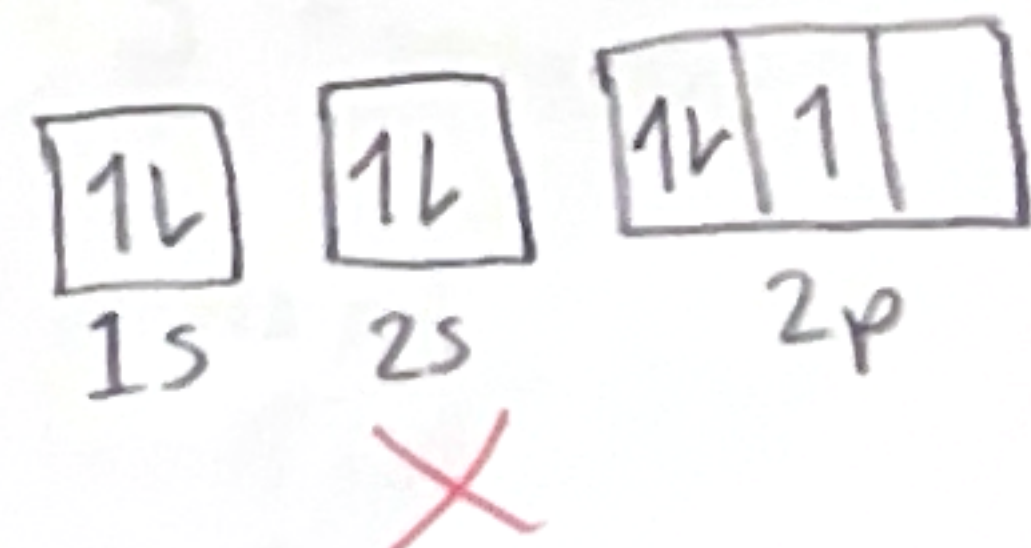
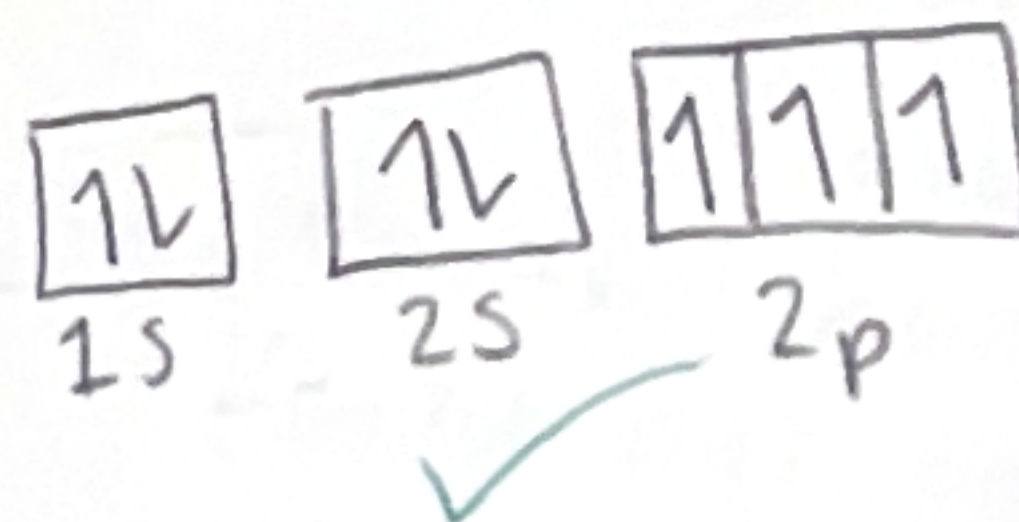
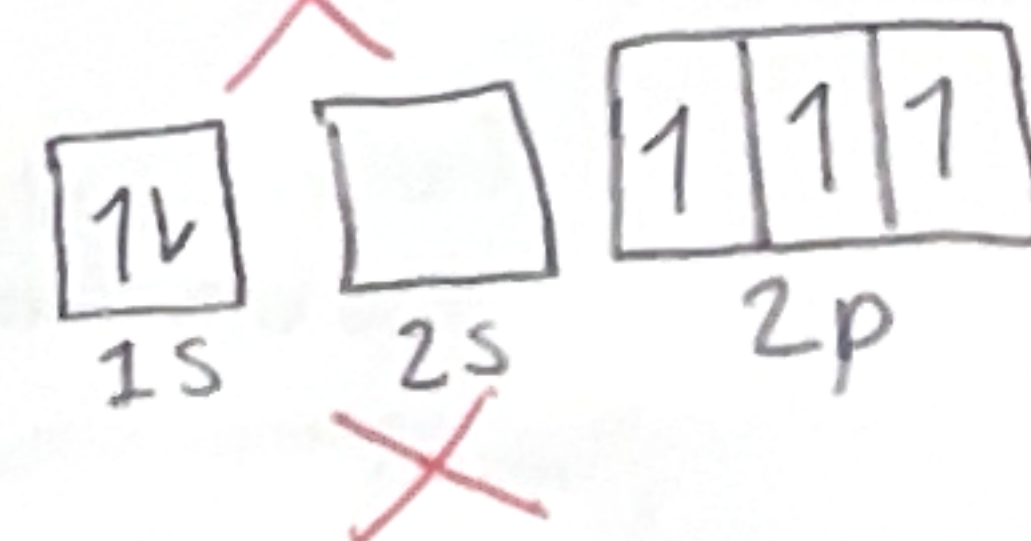
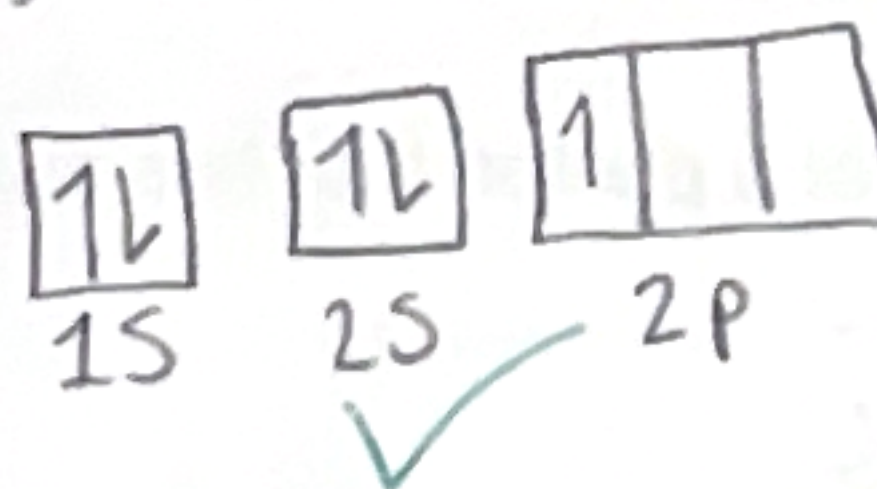
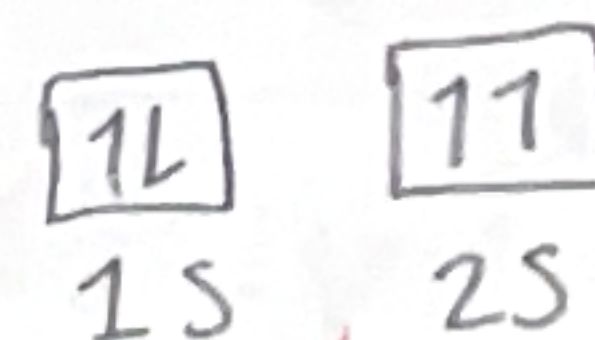
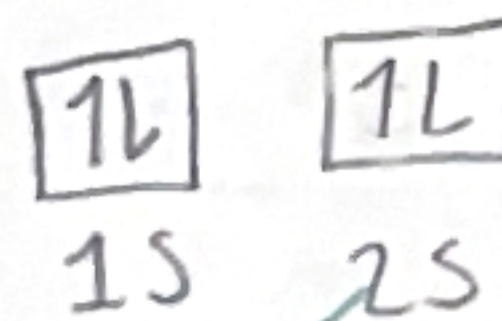
(can't have same four electronic quantum numbers)

What is the Aufbau principle?

Electrons occupies orbital in order from lowest energy to highest

What is Hund's Rule?

Electrons will first occupy separate orbital with parallel spins before doubling up in one orbital



Ch. 7: Periodic Properties of the Elements.

Ch. 8: Chemical Bonding

Ch. 9: Molecular Geometry & Bonding Theories

	Element: Ammonia $\text{NH}_3 : 5 + 1(3) = 8$ $\frac{-6}{2}$
Lewis Dot Structure	
Formal Charge F.C = Valence e^- - (bonds + lone pairs) count dots	$\text{N} : 5 - (3 + 2) = 0$ $\text{H}_1 : 1 - (1 + 0) = 0$ $\text{H}_2 : 1 - (1 + 0) = 0$ $\text{H}_3 : 1 - (1 + 0) = 0$
# electron domains	4
Electron domain geometry	Tetrahedral
Molecular geometry	Trigonal Pyramidal
Bond Angle	107°
Hybridization	sp^3
Polar or Nonpolar Molecule	Polar Molecule
Polar or Nonpolar bonds	Polar Bonds $\begin{matrix} \text{H} = 2.1 \\ \text{N} \approx 3.0 \\ \hline .9 \end{matrix}$
# of Sigma and pi bonds	3 σ 0 π

Ch. 10: Gases

A balloon with a volume of $5.0 \times 10^3 \text{ L}$ is filled with air at a pressure of 1.0 atm and a temperature of 20°C . If the balloon is taken to a higher altitude where the pressure is 0.50 atm and the temperature is -5°C , what will be the new volume of the balloon?

$$P_1 = 1.0 \text{ atm}$$

$$P_2 = 0.50 \text{ atm}$$

$$V_1 = 5.0 \times 10^3 \text{ L}$$

$$V_2 = ?$$

$$T_1 = 20^\circ\text{C} + 273.15$$

$$T_2 = -5^\circ\text{C} + 273.15$$

$$\text{Combined Gas Law} = \frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\frac{(1.0 \text{ atm})(5.0 \times 10^3 \text{ L})}{293.15 \text{ K}} = \frac{(0.50 \text{ atm}) V_2}{268.15 \text{ K}}$$

$$\frac{17.056 \cdot 268.15 \text{ K}}{0.50 \text{ atm}} = V_2 = 9,135.02 \text{ L} \approx \boxed{9,100 \text{ L}}$$

A sample of 8.00 g of oxygen gas (O_2) is placed in a 1.5 L container. If the gas exerts a pressure of 2.00 atm, what is the temperature of the oxygen gas in Kelvin?

$$n = \frac{\text{mass}}{\text{molar mass}} = \frac{8.00 \text{ g } \text{O}_2}{32.00 \text{ g/mol}} = 0.25 \text{ mol}$$

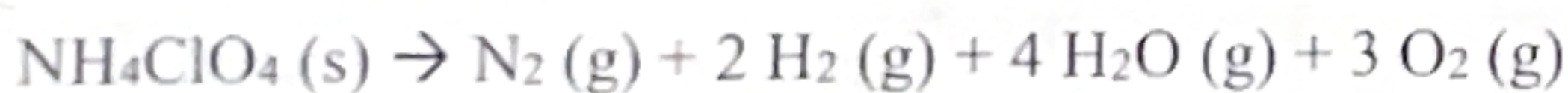
$$PV = nRT$$

$$T = \frac{PV}{nR} = \frac{(2.00 \text{ atm})(1.5 \text{ L})}{(0.25 \text{ mol})(0.0821 \frac{\text{atm} \cdot \text{L}}{\text{mol} \cdot \text{K}})}$$

$$= 146.23$$

$$= \boxed{150 \text{ K}}$$

Ammonium perchlorate (NH_4ClO_4) is used as a propellant in rocket engines. It decomposes according to the following reaction:



If 50.0 L of oxygen gas (O_2) is required at 30.0°C and 1.00 atm pressure, what mass of ammonium perchlorate (NH_4ClO_4) must decompose to provide this amount of oxygen gas?

$$P = 1.00 \text{ atm}$$

$$T = 30.0^\circ\text{C} + 273.15 \rightarrow 303.15 \text{ K}$$

$$V = 50.0 \text{ L}$$

$$R = 0.0821 \frac{\text{atm} \cdot \text{L}}{\text{mol} \cdot \text{K}}$$

$$PV = nRT$$

$$n = \frac{PV}{RT} = \frac{(1.00 \text{ atm})(50.0 \text{ L})}{(0.0821 \frac{\text{atm} \cdot \text{L}}{\text{mol} \cdot \text{K}})(303.15 \text{ K})}$$

$$= 2.01 \text{ mol } \text{O}_2$$

$$(\text{moles}) \cdot (\text{molar mass})$$

$$2.01 \text{ mol } \text{O}_2 \cdot \frac{1 \text{ mol } \text{NH}_4\text{ClO}_4}{3 \text{ mol } \text{O}_2} = 0.67 \text{ mol } \text{NH}_4\text{ClO}_4 \cdot 117.492 \text{ g/mol}$$

$$= \boxed{78.8 \text{ g } \text{NH}_4\text{ClO}_4}$$

A sample of oxygen gas (O_2) is contained in a 3.00 L container at a temperature of 250 K and a pressure of 1.50 atm. Calculate the density of the oxygen gas.

$$PV = nRT$$

$$n = \frac{PV}{RT} = \frac{(1.50)(3.00)}{(0.0821)(250)} = 0.219 \text{ mol}$$

$$D = \frac{m}{V}$$

$$= \frac{7.01 \text{ g}}{3.00 \text{ L}} = \boxed{2.34 \text{ g/L}}$$

$$\text{molar mass } O_2 = 32.00 \text{ g/mol}$$

$$\text{mass } O_2 = (0.219 \text{ mol})(32.00 \text{ g/mol}) = 7.01 \text{ g}$$

A container with a total pressure of 5.00 atm contains two gases, oxygen (O_2) and nitrogen (N_2). If the mole fraction of oxygen is 0.40, calculate the partial pressures of oxygen and nitrogen in the container.

$$\text{Law of Partial Pressures} = P_{\text{gas}} = X_{\text{gas}} \cdot P_{\text{total}}$$

$$X_{N_2} = 1 - X_{O_2} = 1 - 0.40 = 0.60$$

$$P_{O_2} = 5.00 \text{ atm} \cdot 0.40 = 2.00 \text{ atm } O_2$$

$$P_{N_2} = 5.00 \text{ atm} \cdot 0.60 = 3.00 \text{ atm } N_2$$

Calculate the mole fraction of sodium chloride (NaCl) in a solution prepared by dissolving 50.0 g of NaCl in 200.0 g of water

$$\text{Molar mass} = (1 \times 22.99) + (1 \times 35.45) = 58.44 \text{ g/mol}$$

$$\text{moles NaCl} = \frac{50.0 \text{ g}}{58.44 \text{ g/mol}} = 0.854 \text{ mol}$$

$$\text{molar mass } H_2O = (2 \times 1.008) + (1 \times 16.00) = 18.016 \text{ g/mol}$$

$$\text{moles } H_2O = \frac{200.0 \text{ g}}{18.016 \text{ g/mol}} = 11.1 \text{ mol}$$

$$\frac{\text{Part}}{\text{Whole}} = \frac{0.854 \text{ mol NaCl}}{0.854 + 11.1} = \frac{0.854}{11.954} = 0.0713 \text{ mole fraction of NaCl}$$

A gas sample has a pressure of 760.0 torr. Convert this pressure to kilopascals (kPa)

$$1 \text{ atm} = 101.325 \text{ kPa} = 760 \text{ torr}$$

$$\frac{760 \text{ torr}}{760 \text{ torr}} \times 101.325 \text{ kPa} = 101.325 \text{ kPa}$$

Ch.11 Liquid and intermolecular forces

Discuss the types of intermolecular forces and how they affect the properties of materials.

London Dispersion
(All molecules)
* non-polar molecules
lowest boiling point

Dipole - Dipole
(Polar molecules)
• Partial δ^- and δ^+
medium boiling point

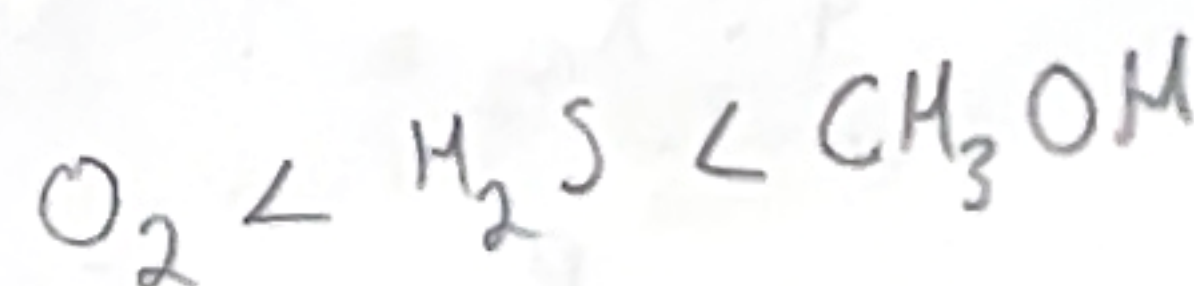
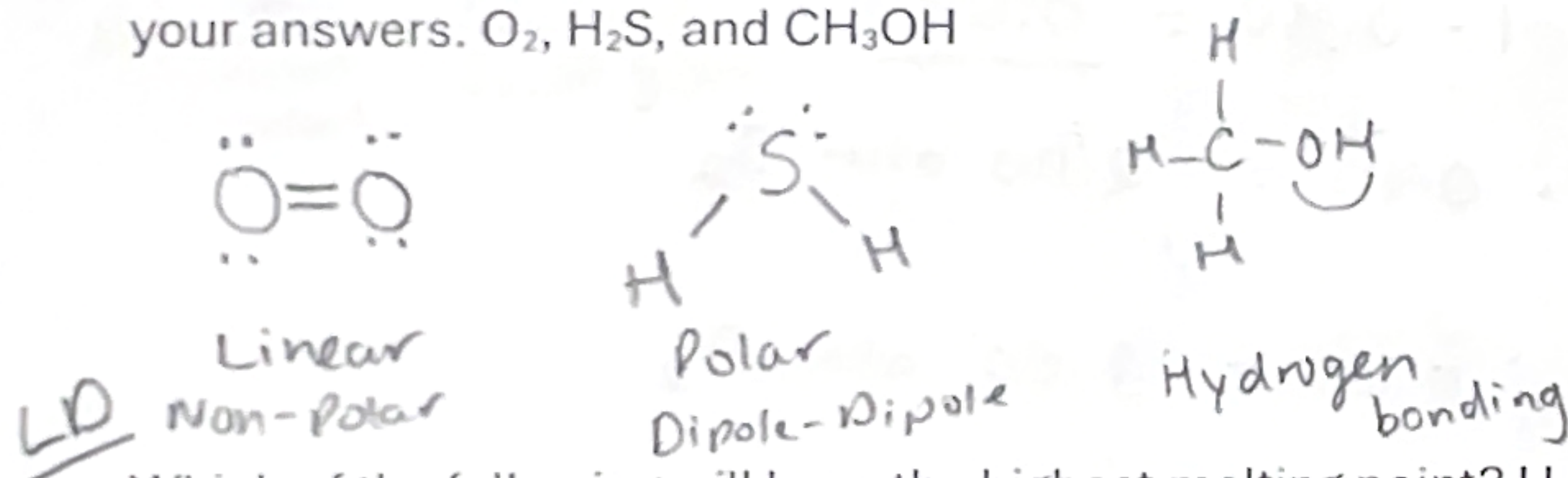
Hydrogen Bonding
(Polar molecules)
• H paired with F, O, N
Highest boiling point

* Heavier molecules $\rightarrow$ higher B.P
(when comparing similar types of molecules)

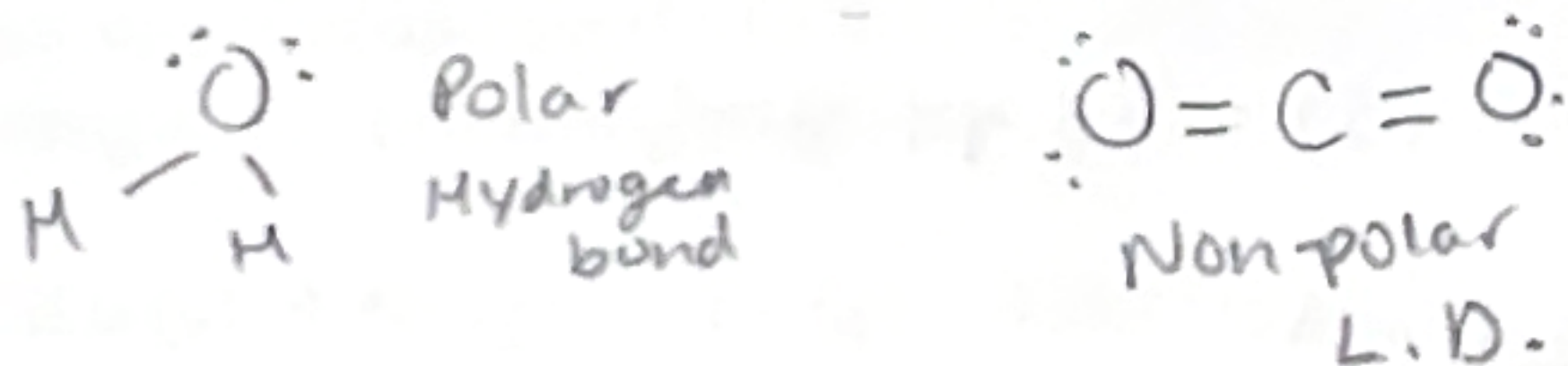
* less branching $\rightarrow$ higher B.P
(molecules pack together closely, creates)
Stronger intermolecular forces

Rank the following compounds from weakest to strongest intermolecular forces. Justify your answers. O_2 , H_2S , and CH_3OH

H-1
O-2
N-3
C-4



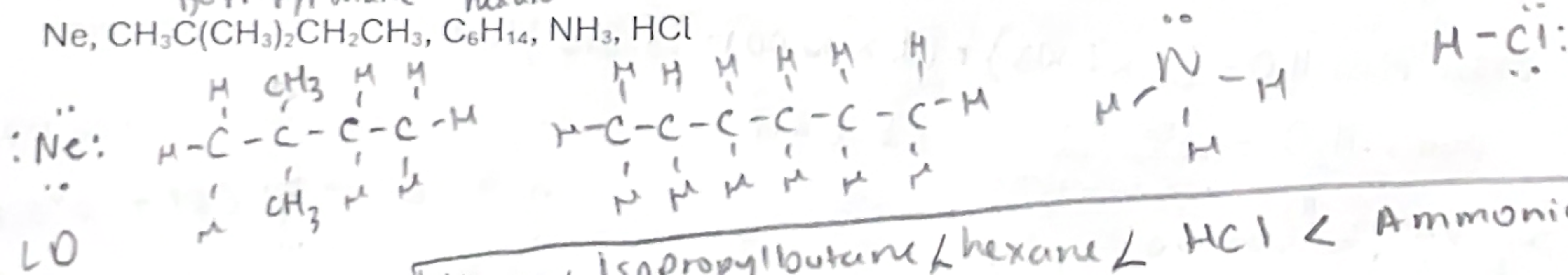
Which of the following will have the highest melting point? H_2O or CO_2



H_2O will have higher melting point

Rank the following in order of increasing boiling point:

Ne, $CH_3C(CH_3)_2CH_2CH_3$ (isopropyl butane), C_6H_{14} (hexane), NH_3 , HCl



Neon < Isopropylbutane < hexane < HCl < Ammonia

Which compound is most likely to dissolve best in water? Hexane or Sodium chloride

Polar solvent
 Non-polar
 London dispersion
 Ionic compound $Na^+ Cl^-$
 Ion-dipole interactions

$NaCl$ most likely to dissolve in H_2O b/c it dissociates into its ions & interacts w/ polar water mols.