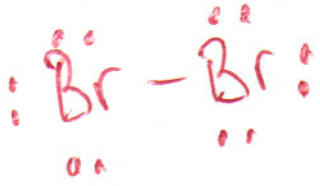
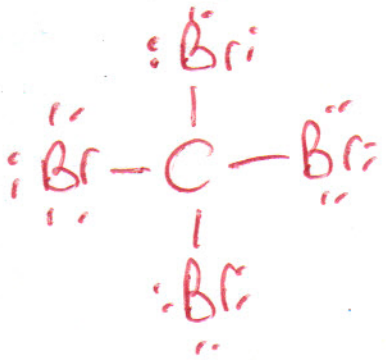
Name: Scott Beaver

[16 pt] **1. Print and complete the names/formulas in the table. Indicate as ionic (I) or covalent (C), and use the corresponding nomenclature.**

Name	Ionic/covalent	Formula
carbon dioxide	C	CO_2
potassium chloride	~~KCl~~ I	KCl
carbon nitride (C^{4-} N^{3-})	I	C_3N_4
carbon disulfide	C	CS_2
magnesium chloride	I	$MgCl_2$
sulfur hexafluoride	C	SF_6
dinitrogen pentoxide	C	N_2O_5
sulfur trioxide	C	SO_3 (g)

[8 pt.] **2. Draw Lewis structures for a) Br_2 and b) CBr_4.**



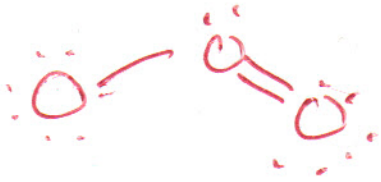


[10 pt.] **3. Consider ozone (O_3).**

a. Draw the skeleton structure with central atom O. O-O-O

b. How many total valence electrons? 3·6 = 18

c. Draw one correct Lewis structure.



d. How many lone pairs on the central atom? 1

e. How many atoms are bonded to the central atom? 2

f. How many electron charge clouds are around the central atom? 3

g. What is the molecular geometry (3D shape)? bent – 120°

h. Are the bonds polar (yes/no)? no

$\Delta EN\ (O-O) = 0$

i. Is ozone polar or non-polar? polar

polar – asymmetric

j. Are there any resonance structures? If so, draw one. yes

[12 pt.] 4. Balance the following reactions.

$2\ C_6H_{10} + 17\ O_2 \rightarrow 12\ CO_2 + 10\ H_2O$

$\underline{1}\ C_6H_{10}\ (g) + \underline{17/2}\ O_2\ (g) \rightarrow \underline{6}\ CO_2\ (g) + \underline{5}\ H_2O\ (g)$

1200 + 50

170

$\underline{1}\ C_6H_{12}\ (g) + \underline{9}\ O_2\ (g) \rightarrow \underline{6}\ CO_2\ (g) + \underline{6}\ H_2O\ (g)$

$2\ C_6H_{14} + 19\ O_2 \rightarrow 12\ CO_2 + 14\ H_2O$

$\underline{\quad}\ C_6H_{14}\ (g) + \underline{19/2}\ O_2\ (g) \rightarrow \underline{6}\ CO_2\ (g) + \underline{7}\ H_2O\ (g)$

1200 + 70

190

$\underline{\quad}\ H_2\ (g) + \underline{\quad}\ O_2\ (g) \rightarrow \underline{\quad}\ H_2O_2\ (s)$ (balanced)

[16 pt.] 5. Use the solubility guidelines to determine if any of the following are precipitation reactions. If so, complete the right side and balance the equation. If not, write "n.r." (no reaction).

a. __ $Ba(NO_3)_2$ (aq) + __ Na_2SO_4 (aq) → $BaSO_4$ (s) + $2NaNO_3$ (aq)

b. __ NaCl (aq) + __ $AgNO_3$ (aq) → $AgCl(s) + NaNO_3(aq)$

c. __ KBr (aq) + __ NH_4Cl (aq) → n.r.

d. 2 NaCl (aq) + __ $Pb(NO_3)_2$ (aq) → $PbCl_2$ (s) + $2NaNO_3$ (aq)

→ reduced, oxidation # ↓

[4 pt.] 6. Circle the **oxidizing agent** in the following redox reactions:

a. 2 Fe (s) + 3 Cl_2 (g) → 2 $FeCl_3$ (s)

(Cl_2: 0; $FeCl_3$: −1)

b. Cd^{2+} (aq) + Fe (s) → Cd (s) + Fe^{2+} (aq)

(Cd^{2+}: +2; Cd: 0)

[8 pt.] 7. Complete and balance the neutralization reactions. List all spectator ions for each reaction.

a. ___ HCl *(aq)* + __ KOH *(aq)* → $H_2O(l)$ + $KCl(aq)$

Spectator ions: K^+, Cl^-

b. ___ H_3PO_4 *(aq)* + 3 NaOH *(aq)* → $3H_2O(l)$ + $Na_3PO_4(aq)$

Spectator ions: Na^+, PO_4^{3-}

[8 pt.] 8. Give the oxidation number for nitrogen in the following:

a. N_2 (g) 0 (elemental form)

b. NO (g) +2

c. N_2O (g) +1

d. NH_3 (g) −3

$-3 + 1 \cdot 3 = +3$

Name: _____

[18 pt] 9. In the below (already balanced) equation, 0.265 g of cetane ($C_{16}H_{34}$) reacts with 0.631 g of oxygen.

$$2\ C_{16}H_{34} + 49\ O_2 \rightarrow 32\ CO_2 + 34\ H_2O$$

a. What is the **limiting reactant**?

b. What is the **theoretical yield for CO_2**?

$C_{16}H_{34}$: $\left(0.265\ g\ C_{16}H_{34}\right)\left(\frac{1\ mol\ C_{16}H_{34}}{226.432\ g\ C_{16}H_{34}}\right)\left(\frac{32\ mol\ CO_2}{2\ mol\ C_{16}H_{34}}\right)\left(\frac{44.01\ g\ CO_2}{mol\ CO_2}\right)$

$= 0.824\ g\ CO_2$

O_2: $\left(0.631\ g\ O_2\right)\left(\frac{1\ mol\ O_2}{32.00\ g\ O_2}\right)\left(\frac{32\ mol\ CO_2}{49\ mol\ O_2}\right)\left(\frac{44.01\ g\ CO_2}{mol\ CO_2}\right)$

$= \boxed{0.567\ g\ CO_2}$

Limiting reactant: O_2

CO_2 theoretical yield: $0.567\ g\ CO_2$

[+5 pt] Bonus: How many grams of **excess reactant** remain?

grams $C_{16}H_{34}$ consumed

$= \left(0.631\ g\ O_2\right)\left(\frac{1\ mol\ O_2}{32.00\ g\ O_2}\right)\left(\frac{2\ mol\ C_{16}H_{34}}{49\ mol\ O_2}\right)\left(\frac{226.432\ g\ C_{16}H_{34}}{mol\ C_{16}H_{34}}\right)$

$= 0.182\ g\ C_{16}H_{34}$ reacted

Excess = initial − reacted = $0.265\ g - 0.182\ g = \boxed{0.083\ g}$ $C_{16}H_{34}$ excess