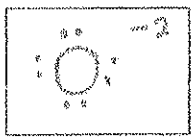
HOMEWORK ASSIGNMENT #1:ORGANIC CHEMISTRY I (30 pts)

Lewis Modeling: | Due Wed 7 September 2016

Your name: Answer

1a) Draw the most stable **Lewis dot** electronic configuration for O in CaO and **clearly indicate its charge** in your drawing:

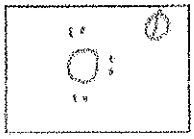


1b) Write down the equivalent, ***complete*** electronic configuration for the above species. (remember: complete configuration means starting with $1s^2 2s^2$...etc)

$O^{2-} = 1s^2 2s^2 2p^6$ (Ne)

1c) Does O as drawn above appear to obey the octet rule ? (YES) NO

2a) Draw the most stable Lewis dot electronic configuration for one of the O in O_2 and **clearly indicate its charge** in your drawing:



2b) Write down the equivalent, complete electronic configuration for the above species:

$1s^2 2s^2 2p^4$ (share e^- w/ other O)

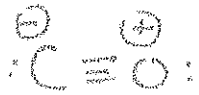
2c) Does O as drawn above appear to obey the octet rule ? YES (NO)

2d) Compare your answers in 1c and 2c. Explain why both O are stable in the two compounds despite the disparity you should have observed in your answers.

(1a) is reflective of ionic bonding ⇒ transfer of $2e^-$ from Ca → O. (2a) reflects covalent, shared Bonding

3. Draw the most stable Lewis structures that conform to the octet rule for the covalent and polar covalent compounds below. Make sure to indicate any formal charge present on each atom: (2 pts each)

a) O_2 

b) CO 

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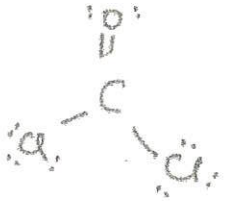
3. (continued)

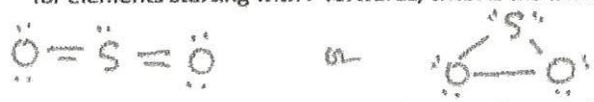
c) phosgene , $COCl_2$ note: C is central to O and both Cl (2 pts)



no formal charges on any atom

d) sulfur dioxide, SO_2 note: S is centrally bonded to both O (2 pts)

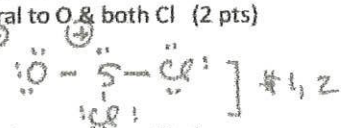
4. If SO_2 's bonding conforms to the rule that the octet rule can be broken to minimize formal charge for elements starting with P forwards, what is the best structure for SO_2 ? (1 pt)



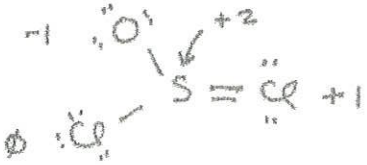
all atoms have Ø formal charge

4a) Given that thionyl chloride ($SOCl_2$) is entirely single-bonded, what are the expected formal charges on the individual atoms ?Assume S is central to O & both Cl (2 pts)

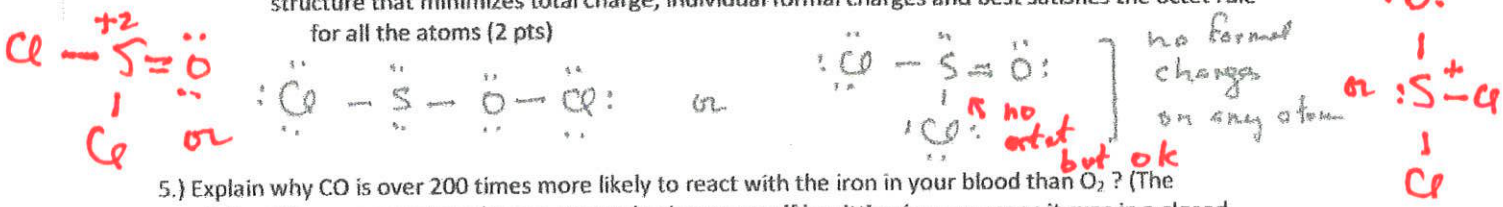
S 1+ O 1- Cl(#1) 0 Cl(#2) 0



4b) If the S is double-bonded to one of the Cl, ***draw*** the most stable Lewis structure with the formula $SOCl_2$ which obeys the octet rule . Indicate any formal charges on each atom. (Assume S is central to O and both Cl. The overall molecule can be either a cation or an anion, e.g. it can hold a net charge) (2 pts)



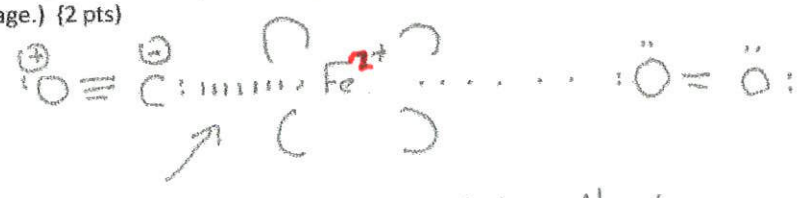
4c) If you don't make any assumptions about how $SOCl_2$ atoms are connected, draw a structure that minimizes total charge, individual formal charges and best satisfies the octet rule for all the atoms (2 pts)



no formal charges on any atom

but ok

5.) Explain why CO is over 200 times more likely to react with the iron in your blood than O_2 ? (The reactivity difference explains why you can asphyxiate yourself by sitting in your car as it runs in a closed garage.) (2 pts)



Strong ... electrostatic attraction which permanently binds ≡C:⊖ end to +3 Fe.

Weak; no formal charge so no real driving force to bond strongly

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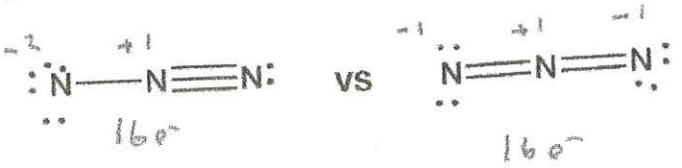
6. Decide whether the pairs below are the same or different chemical species and briefly explain **why** they are the same or different: (2 pts each/6 pts total)



16 e⁻ vs 16 e⁻

Same count of e⁻ ⇒ these are asymmetric resonances of N_3^-

16 e⁻ vs 14 e⁻

different e⁻ counts ⇒ different species even if elements are the same

16 e⁻ vs 20 e⁻

Alternatively — if you noted equivalence or non-equivalent of overall charge - That works too