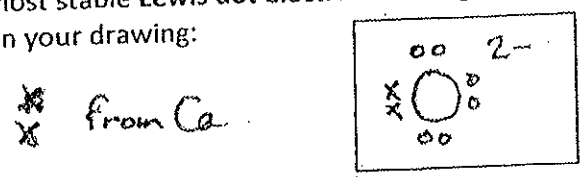
HOMEWORK ASSIGNMENT #1:ORGANIC CHEMISTRY I (30 pts)

Lewis Modeling: D

Your name: Answers 1 pt

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



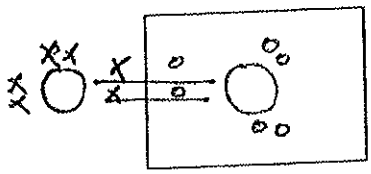
1b) Write down the equivalent, ***complete*** electronic configuration for the above species. (remember: complete configuration means starting with $1s^2 2s^2$...etc)

$1s^2 2s^2 2p^6$ (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 <u>clearly indicate its charge</u> in your drawing:

Take 'snapshot' of O in O_2



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

$1s^2 2s^2 2p^4$

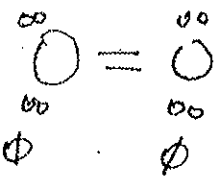
2c) Does O as drawn above appear to obey the octet rule ? (YES) NO

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.

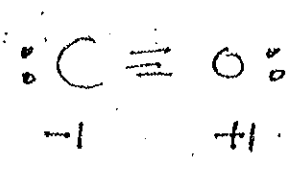
O in (1a) has taken 2e⁻ from Ca to form octet + ionic bond.
O in (2a) shares e⁻ with other O to form octet + covalent bonds

3. Draw the most stable Lewis structures 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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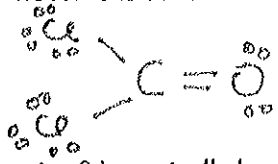
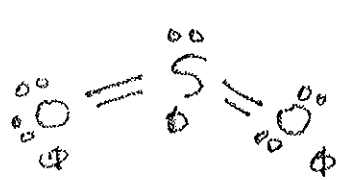
3. (continued)

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

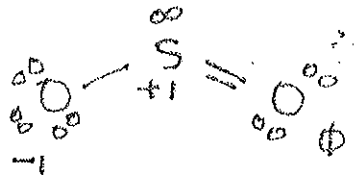


all 4 atoms have Φ Formal charge

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

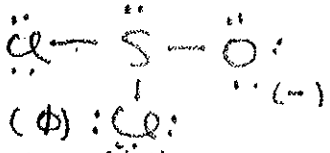


or

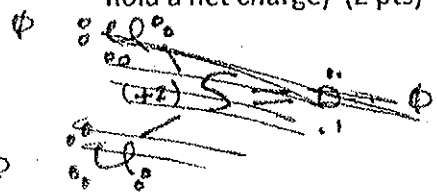


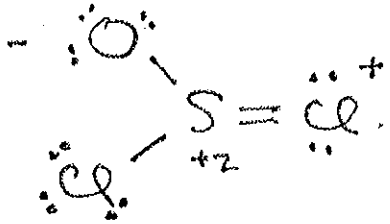
4a) Given that thionyl chloride ($SOCl_2$) is entirely single-bonded, what are the expected formal charges on the individual atoms ? Assume S is central to O (+1) both Cl (2 pts total)

S +1 O −1 Cl(#1) Φ Cl(#2) Φ

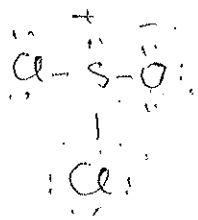


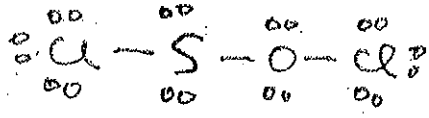
4b) If the S is double-bonded to one of the Cl, ***draw*** the most stable Lewis structure with the formula $SOCl_2$ which obeys the octet rule . Indicate any formal charges on each atom. (Assume S is central to O and both Cl. The overall molecule can be either a cation or an anion, e.g. it can hold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





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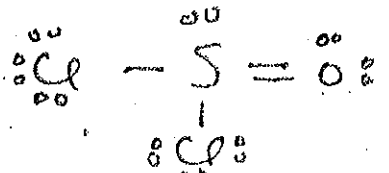
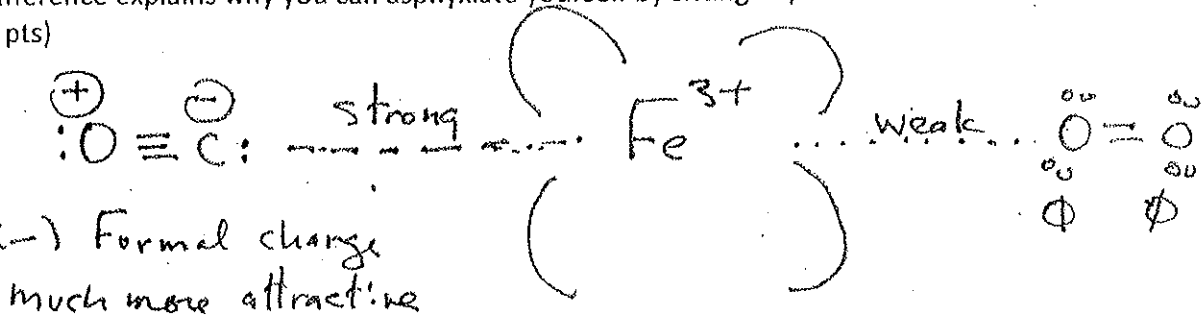


Extended Lewis

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)



(−) Formal charge much more attractive to +3 Fe than Φ Formal charge O in O_2 Heme

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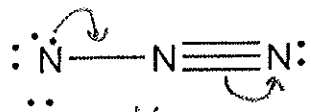
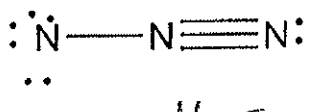
6. Decide whether the pairs below are the same or different chemical species and briefly explain ***why*** they are the same or different: (2 pts each/6 pts total)



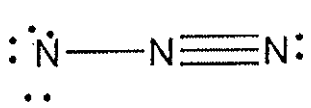
16 e⁻ vs 16 e⁻

Same



16 e⁻ vs 14 e⁻

different



16 e⁻ vs 20 e⁻

different