

Name \_\_\_\_\_

Period \_\_\_\_\_

Pre-AP Chemistry, Grade 10

Test 3

Answer Sheet:

I. Multiple Choice

1. ES

2. T

3. S

4. B

5. D

6. E

7. A

8. B

9. B

10. E

11. C

12. B

13. E

14. A

15. F

16. C

17. A

18. B

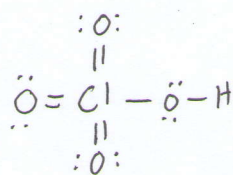
19. B

20. A

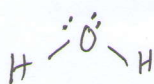
II. Free Response

1. a)  $H_3O^+$

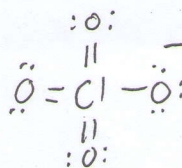
b) (A)



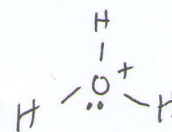
(B)



(C)



(D)



c) Bond Length (Circle One)

Cl = O

140.8 pm

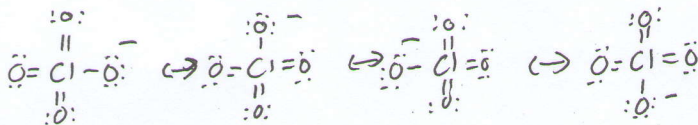
163.5 pm

Cl - O

140.8 pm

163.5 pm

d) (i)



Because of resonance, all Cl-O bonds are identical in  $\text{ClO}_4^-$ , so they all have the same bond length.

(ii) Since each oxygen atom resonates between a double (Cl=O) and single (Cl-O) bond, the oxygen-chlorine bond in  $\text{ClO}_4^-$  should be longer than a double bond but shorter than a single bond. Since each oxygen is in a Cl=O bond for 3/4 of the resonance structures and a Cl-O bond for 1/4 of the resonance structures, the Cl-O bond length is closer to a double bond length than a single bond length.

e) Partial Charge ( $\delta+$  or  $\delta-$ )

$\delta-$

O

Bond

H

Atom

Partial Charge ( $\delta+$  or  $\delta-$ )

$\delta+$

Atom  
(H, Cl, O)

(- or =)

Atom  
(H, Cl, O)

f) O in water most attracted to H in  $\text{HClO}_4$  (Circle One):

H

Cl

O

Explanation - The oxygen in  $\text{H}_2\text{O}$  is partially negatively charged, so it is attracted to the partially positively charged hydrogen in  $\text{HClO}_4$ .

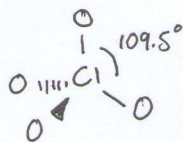


g) Bigger bond angles (circle one):

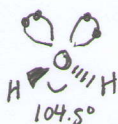
$\text{ClO}_4^-$

$\text{H}_2\text{O}$

Explanation -



vs



Both  $\text{ClO}_4^-$  and  $\text{H}_2\text{O}$  have four electron groups around the central atom. However, two of the electron groups around the oxygen in water are lone pairs, which repel the electrons in bonds more than do other electrons in bonds. So, the bond angle in  $\text{H}_2\text{O}$  is smaller.

Extra Credit

h)

