A 15-mL sample of 0.1 M HA (a weak acid) is titrated with 0.3 M NaOH. Calculate the pH with 5 mL of NaOH added past the equivalence point.

This is a _____ problem.

1. weak acid in water
2. weak base in water
3. strong acid in water
4. strong base in water
5. buffer

A 15-mL sample of 0.1 M HA (a weak acid) is titrated with 0.3 M NaOH. Calculate the pH with 5 mL of NaOH added past the equivalence point.

This is a _____ problem.

10% 1. weak acid in water

15% 2. weak base in water
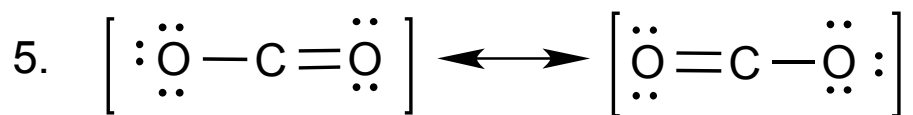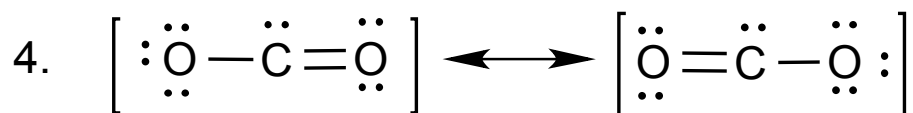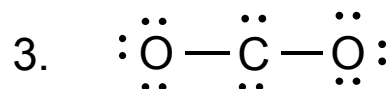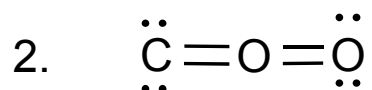
1%   3. strong acid in water

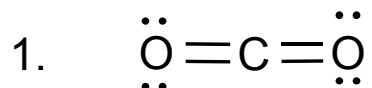63% 4. strong base in water

10% 5. buffer

Using the periodic table information below, pick the correct Lewis Structure(s) for CO_2

1. $\ddot{O}=C=\ddot{O}$

2. $\ddot{C}=O=\ddot{O}$

3. $:\ddot{O}-\ddot{C}-\ddot{O}:$

4. $\left[:\ddot{O}-\ddot{C}=\ddot{O}\right] \longleftrightarrow \left[\ddot{O}=\ddot{C}-\ddot{O}:\right]$

5. $\left[:\ddot{O}-C=\ddot{O}\right] \longleftrightarrow \left[\ddot{O}=C-\ddot{O}:\right]$

Group→1   2   3   4   5   6   7   8   9   10   11   12   13   14   15   16   17   18
↓Period

| 1 | 1 H | | | | | | | | | | | | | | | | | 2 He |

| 2 | 3 Li | 4 Be | | | | | | | | | | | 5 B | 6 C | 7 N | 8 O | 9 F | 10 Ne |

Using the periodic table information below, pick the correct Lewis Structure(s) for CO_2

✓ 1. $\ddot{O}=C=\ddot{O}$

2. $\ddot{C}=O=\ddot{O}$
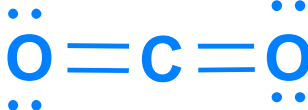
3. $:\ddot{O}-\ddot{C}-\ddot{O}:$

4. $\left[:\ddot{O}-\ddot{C}=\ddot{O}\right] \longleftrightarrow \left[\ddot{O}=\ddot{C}-\ddot{O}:\right]$

5. $\left[:\ddot{O}-C=\ddot{O}\right] \longleftrightarrow \left[\ddot{O}=C-\ddot{O}:\right]$

83%

2%

5%

6%

4%

1.   2.   3.   4.   5.

Group→1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
↓Period

1 | 1 H

2 | 3 Li | 4 Be | ... | 5 B | 6 C | 7 N | 8 O | 9 F | 10 Ne
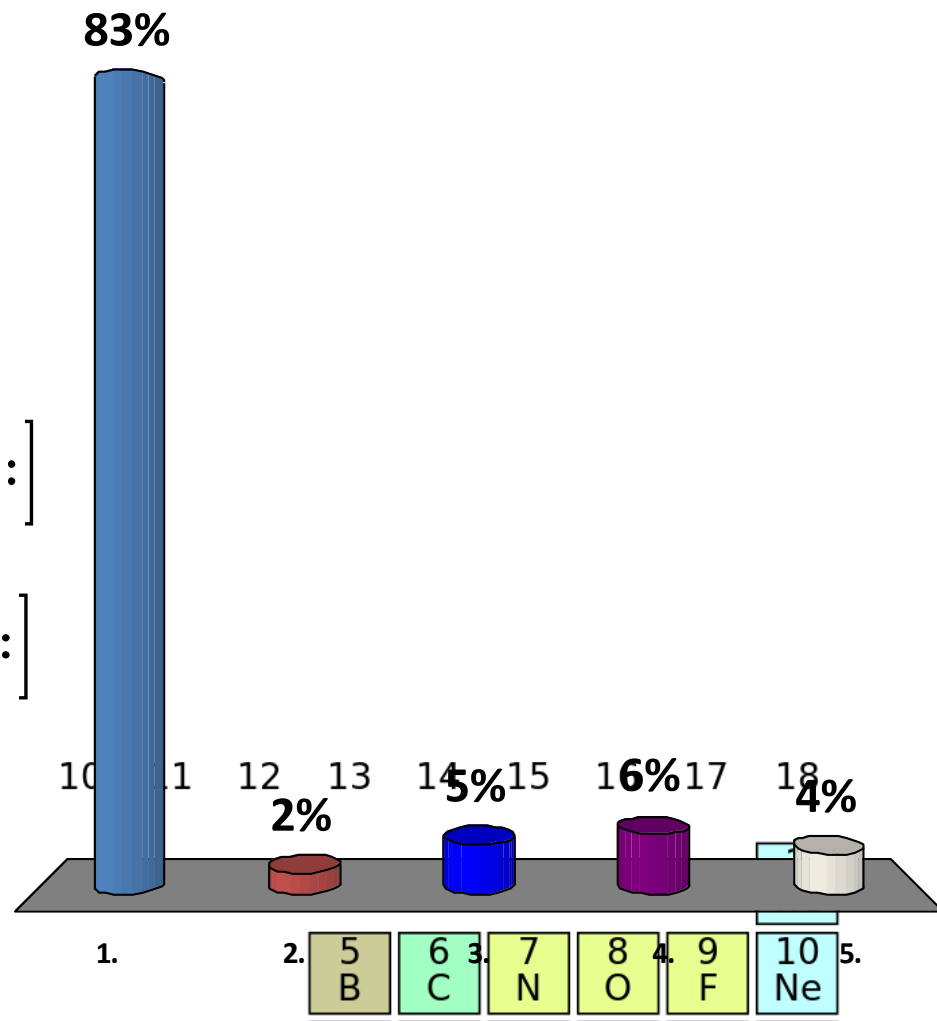
For CO_2 with the Lewis structure $\ddot{O}=C=\ddot{O}$ which of the following are true:

A. Geometry is AX_2 and linear
B. Geometry is AX_4 and bent

U. The hybridization of C and O are 2sp
V. The hybridization of C and O are $2sp^2$
W. The hybridization of C is 2sp and of O is $2sp^2$
X. The hybridization of C is 2sp and of O is none

1. A and U
2. A and V
3. A and W
4. A and X
5. B and U
6. B and V
7. B and W
8. B and X

For CO_2 with the Lewis structure $\ddot{O}=C=\ddot{O}$ which of the following are true:

A. Geometry is AX_2 and linear
B. Geometry is AX_4 and bent

U. The hybridization of C and O are 2sp
V. The hybridization of C and O are $2sp^2$
W. The hybridization of C is 2sp and of O is $2sp^2$
X. The hybridization of C is 2sp and of O is none

7%	1.	A and U
9%	2.	A and V
71%	3.	A and W
12%	4.	A and X
0%	5.	B and U
0%	6.	B and V
0%	7.	B and W
1%	8.	B and X

For CO_2 with the Lewis structure $\overset{\cdot\cdot}{\underset{\cdot\cdot}{O}}=C=\overset{\cdot\cdot}{\underset{\cdot\cdot}{O}}$ and the information that the χ of C is 2.55 and χ of O is 3.44, which of the following is true:

1. CO_2 is a polar molecule: electronegativity difference of C and O is > 0.4

2. CO_2 is a nonpolar molecule: electronegativity difference of C and O is > 0.4

3. CO_2 is a nonpolar molecule. It has polar bonds but no net dipole.

4. CO_2 is a polar molecule because it has polar bonds and is linear.

For CO_2 with the Lewis structure Ö=C=Ö and the information that the χ of C is 2.55 and χ of O is 3.44, which of the following is true:

1. CO_2 is a polar molecule: electronegativity difference of C and O is > 0.4

2. CO_2 is a nonpolar molecule: electronegativity difference of C and O is > 0.4

3. CO_2 is a nonpolar molecule. It has polar bonds but no net dipole.

4. CO_2 is a polar molecule because it has polar bonds and is linear.

89%

5%   5%

0%

1.   2.   3.   4.

$CO_2 \longrightarrow CH_3^+$

CoA

$CO_2 \longrightarrow CO$

$H_3C-\overset{\overset{\displaystyle O}{\|}}{C}-CoA \longrightarrow$ biofuels
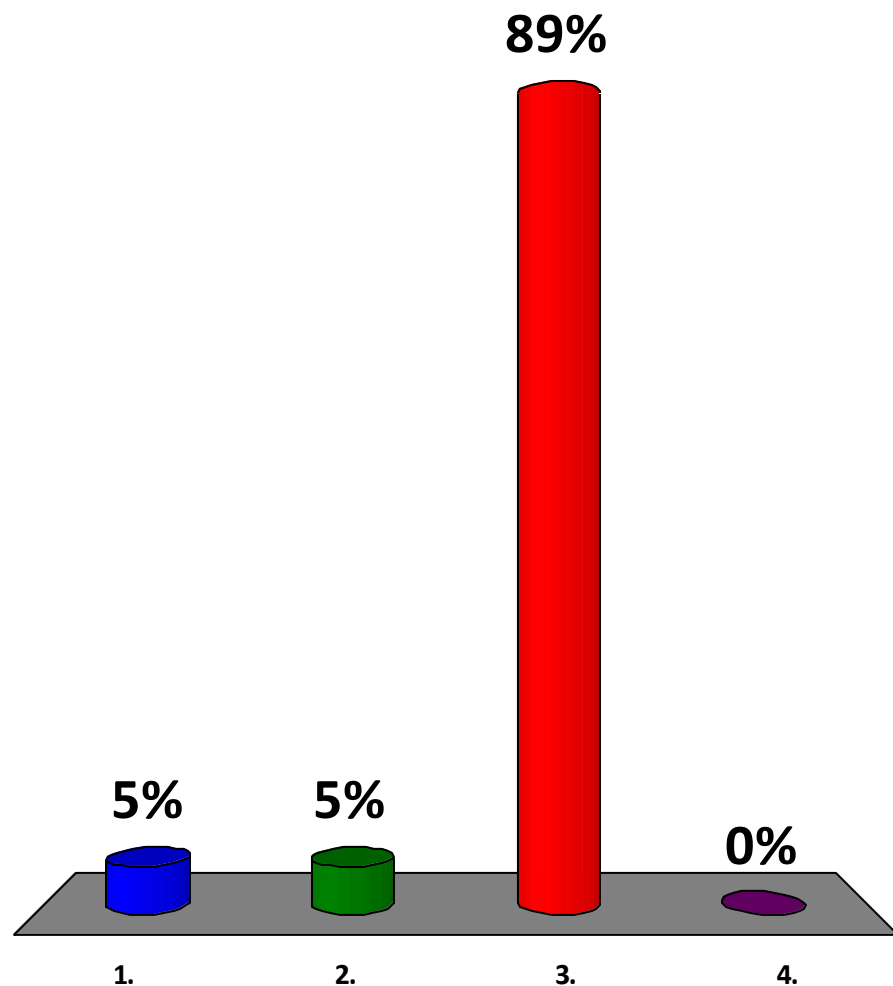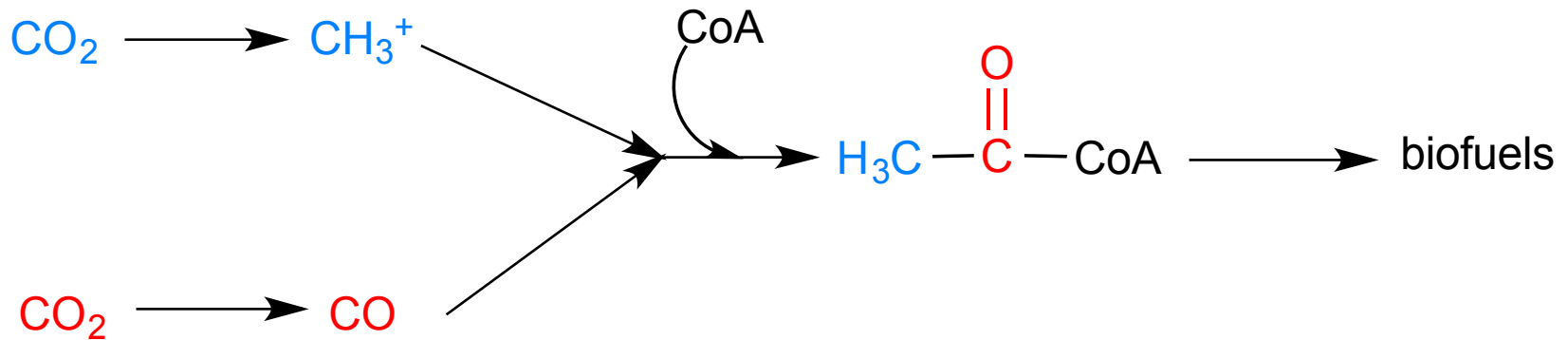
What redox process is happening to carbon of the CO_2?

1. Both carbons are being reduced from +4 to +2
2. The blue C is being reduced from +4 to -2 and the red C is being reduced from +4 to +2
3. Both carbons are being oxidized from +4 to +2
4. No redox change is happening.

$CO_2 \longrightarrow CH_3^+$

CoA

$H_3C - \overset{\overset{\displaystyle O}{\|}}{C} - CoA \longrightarrow$ biofuels

$CO_2 \longrightarrow CO$
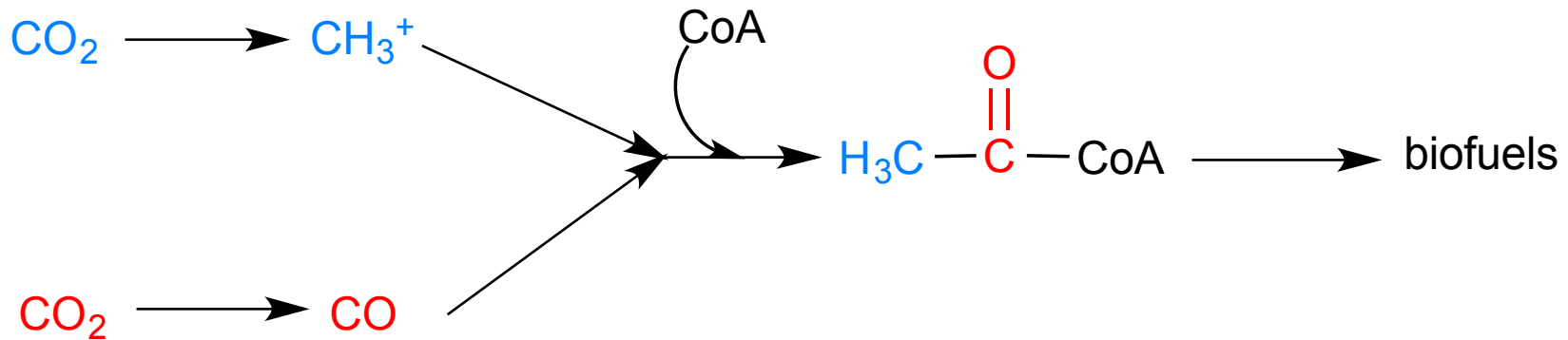
What redox process is happening to carbon of the CO_2?

11%
1. Both carbons are being reduced from +4 to +2

83% ✔
2. The blue C is being reduced from +4 to -2 and the red C is being reduced from +4 to +2

4%
3. Both carbons are being oxidized from +4 to +2

1%
4. No redox change is happening.

At physiological pH (7.4), how much folic acid is protonated?

pK_a for folic acid is 4.8.

1. More folic acid is protonated than deprotonated.

2. More folic acid is deprotonated than protonated.

3. The amounts of deprotonated and protonated are about equal.

4. Not enough information is provided.

At physiological pH (7.4), how much folic acid is protonated?

pK$_a$ for folic acid is 4.8.

22% ✓ 1. More folic acid is protonated than deprotonated.

75% 2. More folic acid is deprotonated than protonated.

2% 3. The amounts of deprotonated and protonated are about equal.

1% 4. Not enough information is provided.

Tie-breaker Question 1

25.0 mL of 0.10 M HCOOH with 0.15 M NaOH
(K_a = 1.77 x 10^{-4} for HCOOH)
pH = -log [0.004$\underline{2}$1] = 2.375 (to how many sig figs?)
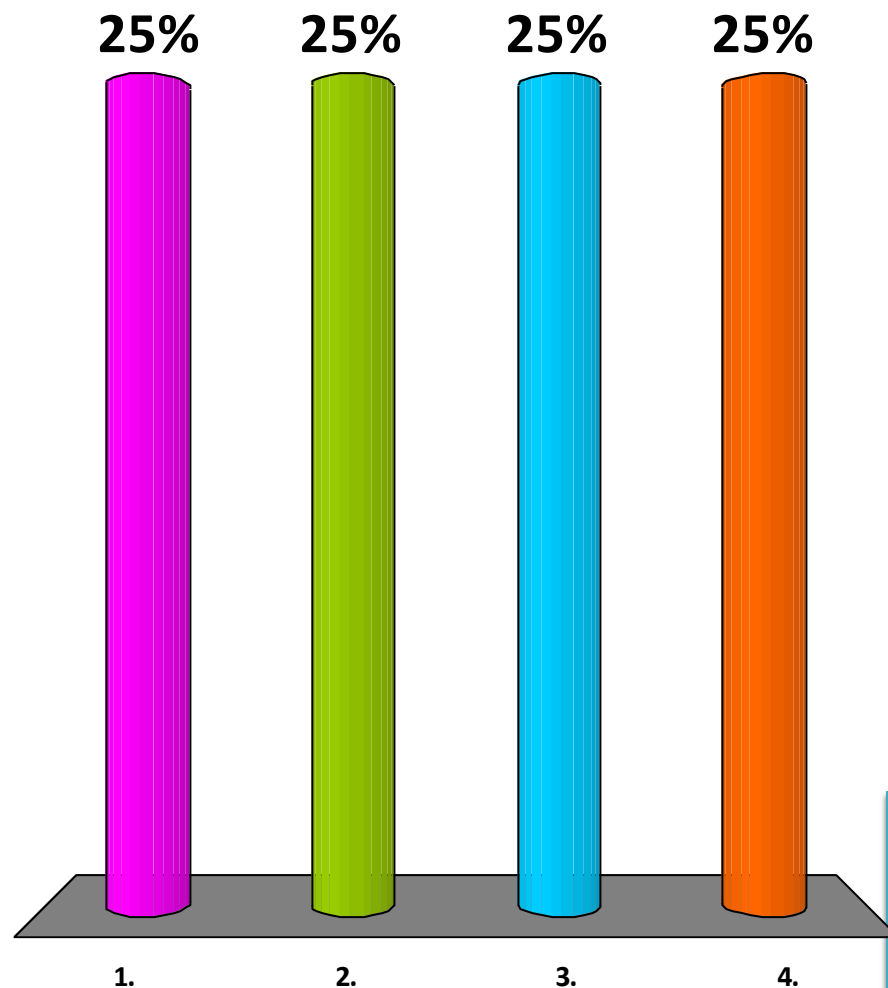
1. 2.4
2. 2.38
3. 2.
4. 2.375

10

Tie-breaker Question 1

25.0 mL of 0.10 M HCOOH with 0.15 M NaOH
(K_a = 1.77 x 10^{-4} for HCOOH)
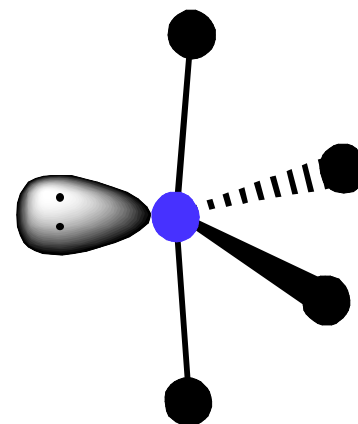pH = -log [0.004$\underline{2}$1] = 2.375 (to how many sig figs?)

25%　**25%**　**25%**　**25%**

1. 2.4
2. 2.38
3. 2.
4. 2.375

1.　2.　3.　4.

10

Tiebreaker question 2:

Which is true for this structure? Select the most complete true answer.

1. Formula type is AX4.
2. Formula type is AX4E.
3. SN is 4.
4. SN is 5.
5. Geometry is pyramidal.
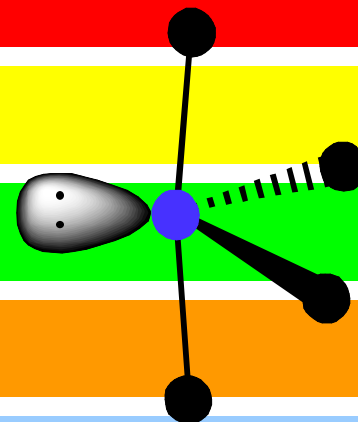6. Geometry is see-saw.
7. 1, 3, and 5 are all true.
8. 2, 4, and 6 are all true.
9. 2, 3, and 6 are all true.

10

Tiebreaker question 2:

Which is true for this structure? Select the most complete true answer.

11%	1. Formula type is AX4.
11%	2. Formula type is AX4E.
11%	3. SN is 4.
11%	4. SN is 5.
11%	5. Geometry is pyramidal.
11%	6. Geometry is see-saw.
11%	7. 1, 3, and 5 are all true.
11%	✓ 8. 2, 4, and 6 are all true.
11%	9. 2, 3, and 6 are all true.

10

Indicate which of the following statements about catalysts are true.

A) In an equilibrium process, a catalyst increases the rate of the forward reaction, but leaves the rate of the reverse reaction unchanged.

B) A catalyst is not consumed in the course of a reaction.

C) A catalyst must be carefully chosen to shift the equilibrium toward products.

1. Only statement A is true.
2. Only statement B is true.
3. Only statement C is true.
4. A and B are true.
5. B and C are true.
6. A and C are true.
7. All of the statements are true.
8. None of the statements are true.

10

Indicate which of the following statements about catalysts are true.

A) In an equilibrium process, a catalyst increases the rate of the forward reaction, but leaves the rate of the reverse reaction unchanged.

B) A catalyst is not consumed in the course of a reaction.

C) A catalyst must be carefully chosen to shift the equilibrium toward products.

1.06E-02 1. Only statement A is true.

62% ✓ 2. Only statement B is true.

1.60E-02 3. Only statement C is true.

7% 4. A and B are true.

16% 5. B and C are true.

1.60E-02 6. A and C are true.

8.51E-02 7. All of the statements are true.

2.13E-02 8. None of the statements are true.

10

5.111 Principles of Chemical Science
Fall 2014