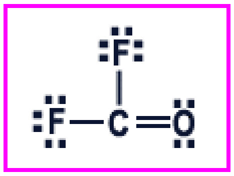
Question 1
5 Points

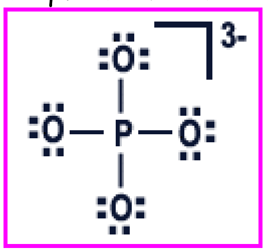
Draw a Lewis structure for F_2***CO*** in which the central ***C*** atom obeys the octet rule, and answer the questions based on your drawing.



1. The **number** of **lone pairs** on the central ***C*** atom: 0
2. The central ***C*** atom forms 2 **single bonds**.

Question 2
5 Points

Draw a Lewis structure for PO_4^{3-} in which the central **P** atom obeys the octet rule, and answer the questions based on your drawing.

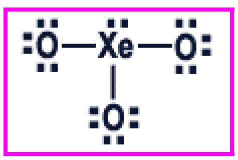


1. The **number** of **lone pairs** on this **structure** is: 12
2. The central **P** atom forms 0 **double bonds**.

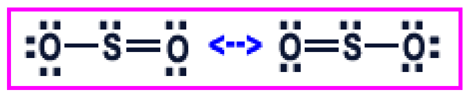
Question 3
9 Points

Draw Lewis Structures for **xenon trioxide** and **sulfur dioxide.**
(Include any resonance structures if applicable)

XeO_3

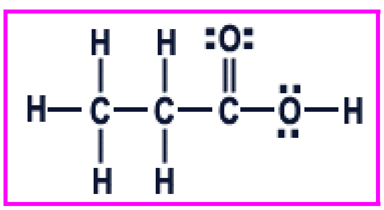


SO_2



Question 4
8 Points

Draw a Lewis diagram for ***CH_3CH_2COOH***. Use your diagram to answer the following questions. **Count double bonds as 2 bonds.**



a. The number of ***C-H*** bonds = 5
b. The number of ***O-H*** bonds = 1
c. The number of ***C-C*** bonds = 2
d. The number of ***C-O*** bonds = 3
e. Total number of **unshared pairs** = 4

Question 5
8 Points

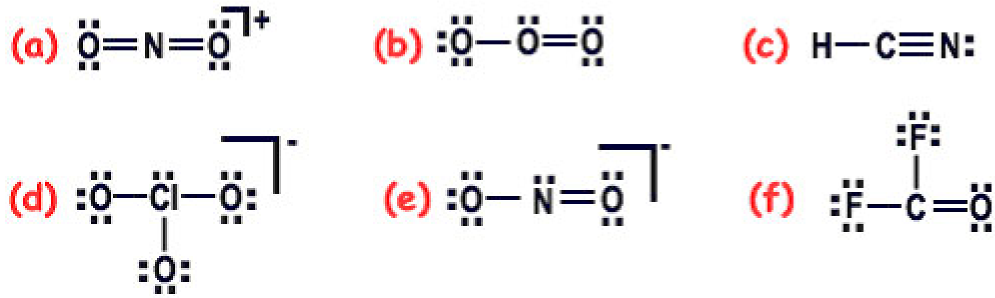
What is the name of the compound with the formula:

1. **PCl_5** Phosphorous pentachloride
2. **O_2F_2** Dioxygen difluoride

What is the formula for:

3. Tetraphosphorus decaoxide P_4O_{10}
4. Carbon tetrabromide CBr_4

Question 6
14 Points



The following questions relate to the Lewis Structures depicted above

a. The **molecule(s)** whose **electron pair geometry** is **linear**: a, c

b. The **bond angle** about the **Cl** atom in **d**: 109

c. The **molecular geometry** of **d**: Trigonal pyramid

d. The **molecular geometry** of **e**: Bent/Angular (120)

e. **Number** of molecules with a **bent molecular geometry**: 2

f. The **three molecules** with the ~ **same bond angle**: b, e, f

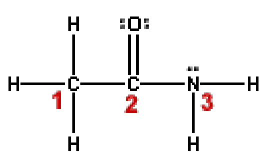
g. **Of these*** the **one** with a **bond angle closest** to 120^0: f
[*Answers for 6f]

Question 7
6 Points

The molecules $\mathbf{CH_4}$, $\mathbf{CHCl_3}$, $\mathbf{CH_2Cl_2}$, $\mathbf{CHCl_3}$ and $\mathbf{CCl_4}$ all have the same **molecular geometry** – **tetrahedron** – which if any of these molecules are nonpolar?

Nonpolar: CH_4 and CCl_4

Question 8
6 Points

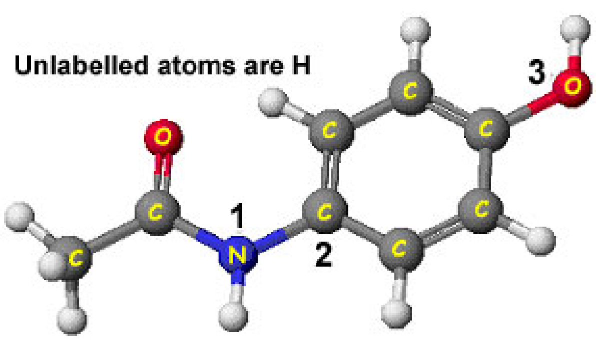


What is the bond angle about:

a. **C2**: 120

b. **N3**: 109

Question 9
9 Points



What is the **bond angle** about the **numbered** atoms?

1. 109
2. 120
3. 109

Question 10
6 Points

The order (**most soluble to least soluble**) of **solubility in water** for the following molecules is:

$NH_3 > CO_2 > O_2$

What would you anticipate the order to be (**most soluble to least soluble**) in carbon tetrachloride, $\mathbf{CCl_4}$ $O_2 > CO_2 > NH_3$

In one sentence, justify your choice.

Water is polar, while CCl_4 is nonpolar, expect solubility to reverse.

Question 11
6 Points

Write the **equilibrium constant expression**, K_c, for the following reactions:

a) $2\ H_2(g) + S_2(g) \Leftrightarrow 2\ H_2S(g)$ K_c = **$[H_2S]^2/[H_2]^2[S_2]$**

b) $2\ SO_3(s) \Leftrightarrow 2\ SO_2(g) + O_2(g)$ K_c = **$[SO_2]^2[O_2]$**

c) $NO_2^-(aq) + H_2O(l) \Leftrightarrow HNO_2(aq) + OH^-(aq)$ K_c = **$[HNO_2][OH^-]/[NO_2^-]$**

Question 12
3 Points

$HNO_2(aq) + HS^-(aq) \Leftrightarrow NO_2^-(aq) + H_2S(aq)$ $K = \mathbf{4.50 \times 10^3}$ at 298K.

Assuming that you start with equal concentrations of **HNO_2** and **HS^-**, and that no **NO_2^-** or **H_2S** is initially present, which of the following best describes the equilibrium system?

- ❑ Appreciable quantities of all species are present at equilibrium.
- ❑ The forward reaction is favored at equilibrium.
- ❑ The reverse reaction is favored at equilibrium.

Question 13
9 Points

Consider the following system at equilibrium at 298 K:

$$2\ NO(g) + Br_2(g) \Leftrightarrow 2\ NOBr(g)$$

When some **$Br_2(g)$** is **removed** from the equilibrium system at constant temperature:

The **reaction** must:

- ❑ Run in the forward direction.
- ❑ Run in the reverse direction.
- ❑ Remain the same.

The **equilibrium constant** K will:

- ❑ Remain the same.
- ❑ Increase.
- ❑ Decrease.

The concentration of **NO** will:

- ❑ Remain the same.
- ❑ Increase.
- ❑ Decrease.

Question 14
6 Points

Consider the following system at equilibrium at 698 K:

$$2\ HI(g) + 2.49\ kcal \Leftrightarrow H_2(g) + I_2(g)$$

If the **temperature** on the equilibrium system is suddenly decreased:

The concentration of **I_2** will:

- ❑ Remain the same.
- ❑ Increase.
- ❑ Decrease.

The **equilibrium constant** K will:

- ❑ Remain the same.
- ❑ Increase.
- ❑ Decrease.

Exam II Score