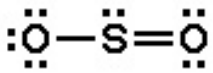
Chem 110 **Fall 2015** **Exam II** **Whelan**

SID | | | | | | | | | Last Key First Answer

Question 1 (3 Points)

To answer the questions, interpret the following Lewis diagram for SO_2



a) The number of **single** bond: 1

b) The number of **double** bond: 1

c) The number of **equivalent Lewis** structures: 2

Question 2 (8 Points)

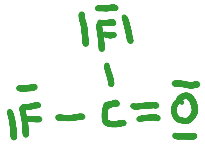
Draw a Lewis structure for each of the following where the central atom obeys the **octet rule**.

CN^-

C: 4
N: 5
−: 1
10

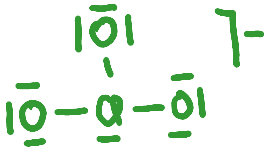
F_2CO

F: 2(7)
C: 4
O: 6
24



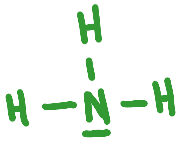
ClO_3^-

Cl: 7
O: 3(6)
−: 1
26



NH_3

N: 5
H: 3(1)
8



Question 3 (6 Points)

On the rough work paper provided – draw a Lewis structure for CO_2 in which the central C atom obeys the octet rule, and answer the questions on the right based on your drawing.

a) The number of **unshared pairs** (**lone pairs**) on the central C atom is: 0

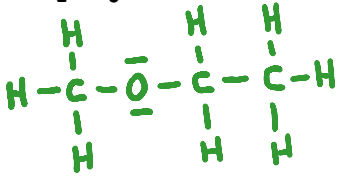
b) The central C atom forms 0 **single** bonds.

c) The central C atom forms 2 **double** bonds.

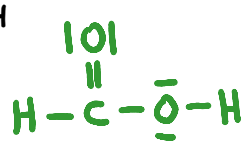
Question 4 (8 Points)

Draw a Lewis structure for each of the following **organic molecules**.

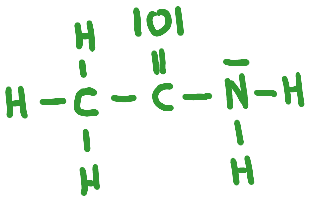
$CH_3OCH_2CH_3$



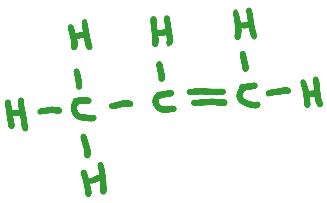
$HCOOH$



CH_3CONH_2

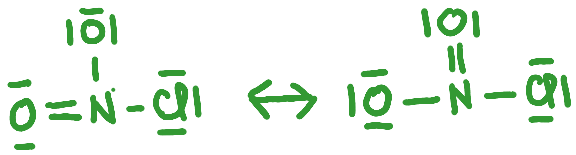


C_3H_6



Question 5 — 6 Points

NO_2Cl has resonance structures – draw them. **Cl = Chlorine**



Question 6 — 8 Points

What is the **name** of the compound with the formula:

a) **NF_3** Nitrogen trifluoride

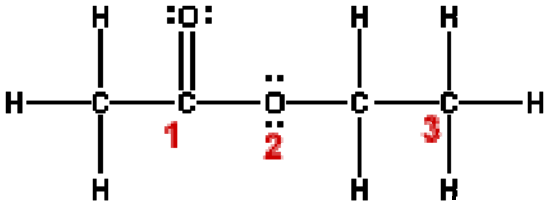
b) **P_4O_{10}** Tetraphosphorus dec

What is the **formula** for:

a) **sulfur hexafluoride** SF_6

b) **Nitrogen monoxide** NO

Question 7 — 6 Points



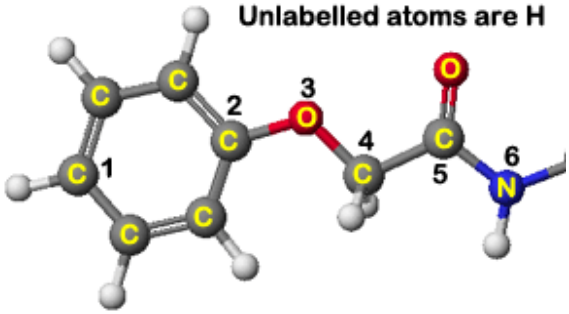
What is the bond angle about:

a) **1**: 120°

b) **2**: ~109°

c) **3**: ~109°

Question 8 — 6 Points



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

C2 120°

O3 ~109°

N6 ~109°

Question 9 — 4 Points

$HNO_2(aq) + OH^-(aq) \Leftrightarrow NO_2^-(aq) + H_2O(l)$ K = **4.50×10^{10}** at 298K.

Assuming you start with equal concentrations of **HNO_2** and **OH^-**, and no **NO_2^-** is initially present, **circle** those of the following that **best** describes the **equilibrium system**?

a) The **forward** reaction is favored at equilibrium.

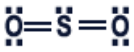
b) **Appreciable** quantities of **all species** are present at equilibrium.

c) The **reverse** reaction is favored at equilibrium.

d) Very little **OH^-** will be present at equilibrium.

e) The **concentration** of **NO_2^-** will be approximately equal to the **HNO_2** **concentration** at equilibrium.

Question 10 (8 Points)



A

B

C

The following questions relate to the Lewis Structures depicted above

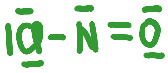
a) The **molecule** with the **smallest** bond angle: C

b) The **molecular geometry** of **B**: Angular / Bent (120°)

c) The **Electron Pair Geometry** of **C**: Tetrahedron

d) The **molecule(s)** that is(are) expected to be **polar**: A, B & C

Question 11 (6 Points)



The **electron-pair geometry** around the **N** atom in **NOCl**? Trigonal planar - There is/are 1 **lone pair(s)** around the central atom, so the **molecular geometry** of the **NOCl** molecule is predicted to be Angular / Bent (120°).

Question 12 (4 Points)

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

a) $2\ NOBr(g) \Leftrightarrow 2\ NO(g) + Br_2(g)$ K = $\frac{[NO]^2[Br_2]}{[NOBr]^2}$

b) $HCN(aq) + H_2O(l) \Leftrightarrow H_3O^+(aq) + CN^-(aq)$ K = $\frac{[H_3O^+][CN^-]}{[HCN]}$

Question 13 (6 Points)

Consider the following system at equilibrium at 698 K:

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

When some **$I_2(g)$** is **removed** from the equilibrium system at constant temperature:

The reaction must:

a) Run in the **forward** direction.

b) Run in the **reverse** direction.

c) Remain the **same**.

The concentration of **H_2** will:

a) **Increase**

b) Remain the **same**

c) **Decrease**

Question 14 (6 Points)

Consider the following system at equilibrium at 298 K:

$H_3O^+(aq) + NO_2^-(aq) \Leftrightarrow HNO_2(aq) + H_2O(l)$

When some **OH^-** is **added** to the equilibrium system at constant temperature:

The reaction must:

a) Run in the **forward** direction.

b) Run in the **reverse** direction.

c) Remain the **same**.

The concentration of **HNO_2** will:

a) **Increase**

b) Remain the **same**

c) **Decrease**

Question 15
6 Points

Consider the following system at equilibrium at 573 K:

$$2\ NO(g) + Cl_2(g) \Leftrightarrow 2\ NOCl(g) + 18.4\ kcal$$

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

The reaction must:

a) Run in the **forward** direction.
b) Run in the **reverse** direction.
c) Remain the **same**.

The concentration of Cl_2 will:

a) **Increase**
b) Remain the **same**
c) **Decrease**

Question 16
6 Points

Consider the following system at equilibrium at 675K:

$$N_2(g) + 3\ H_2(g) \Leftrightarrow 2\ NH_3(g)$$

If the **volume** of the equilibrium system is suddenly **increased**:

The reaction must:

d) Run in the **forward** direction.
e) Run in the **reverse** direction.
f) Remain the **same**.

The concentration of NH_3 will:

d) **Increase**
e) Remain the **same**
f) **Decrease**

Question 17
3 Points

In our discussion on the **consequences of molecular polarity**, the depiction below was used to discuss:

a) Fabric softeners
b) Membranes
c) Detergents
d) Like dissolves like
e) Lead poisoning

Exam II Score