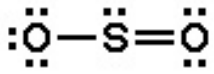
Chem 110 **Fall 2011** **Exam II** **Whelan**

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

Question 1 (8 Points)

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



a) The number of **lone pair** on central atom 1

b) The number of **single** bond 1

c) The number of **double** bond 1

d) 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^-

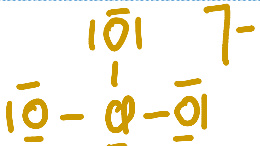
C: 4
N: 5
−: 1
10

F_2CO

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

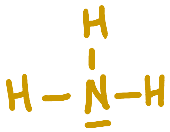
ClO_3^-

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

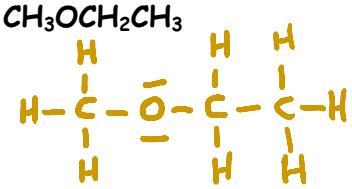
b) The central C atom forms 0 **single** bonds.

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

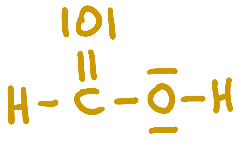
Question 4 (8 Points)

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

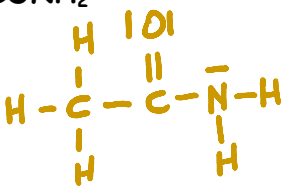
$CH_3OCH_2CH_3$



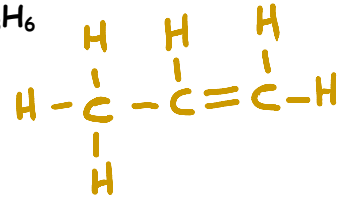
$HCOOH$



CH_3CONH_2



C_3H_6



Question 5 **6 Points**

NO_2Cl has resonance structures – draw them.

Question 6 **8 Points**

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

a) **NF_3** Nitrogen Trifluoride

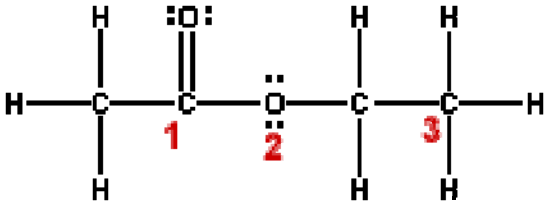
b) **P_4O_{10}** Tetraphosphorus decaoxide

What is the **formula** for:

a) **sulfur hexafluoride** SF_6

b) **Nitrogen monoxide** NO

Question 7 **6 Points**



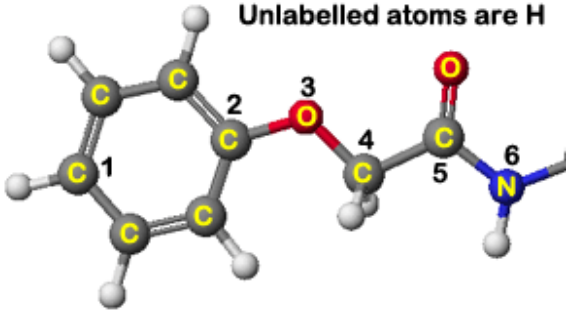
What is the bond angle about:

a) **1**: 120^0

b) **2**: $\sim 109^0$

c) **3**: $\sim 109^0$

Question 8 **6 Points**



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

C2 120^0

O3 $\sim 109^0$

N6 $\sim 109^0$

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

AX₂E₁ | AX₂E₁ | AX₂E₂

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

b) HCN(aq) + H_2O(l) ⇔ 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) ⇔ 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) ⇔ 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) ⇔ 2 NOCl(g) + 18.4 kcal

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

The reaction must:

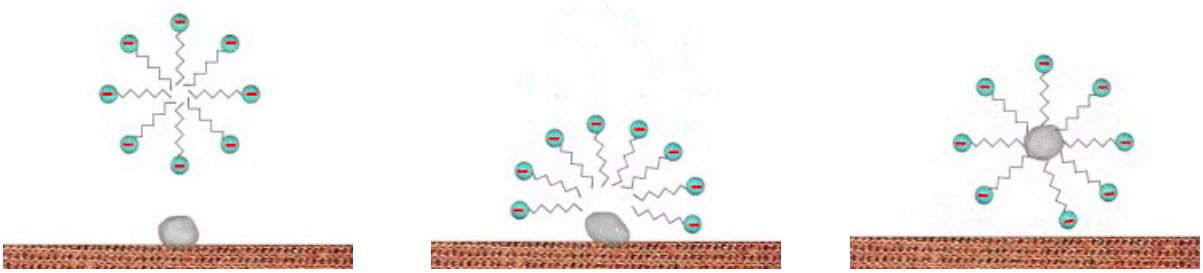
a) Run in the **forward** direction.
b) Run in the **reverse** direction.
c) Remain the **same**.

The concentration of **Cl_2** will:

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

Question 16
4 Points

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



a) Fabric softeners
b) Micelle actions
c) Membranes
d) The dissolution process
e) Detergents
f) EDTA use in salad dressings
g) Lead poisoning
h) Chelating therapy.

Exam II Score