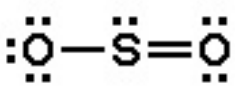
Chem 110 **Fall 2013** **Exam II** **Whelan**

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(s): 1

c) The number of **double** bond(s): 1

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

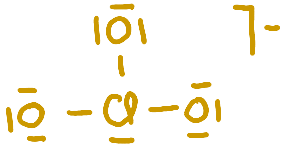
Question 2 (8 Points)

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

O_2

Carbon dioxide

ClO_3^-



F_2CO

Question 3 (6 Points)

On the rough work paper provided – draw **a Lewis structure** for NO_2^- in which the central **N** 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 N atom is: 1

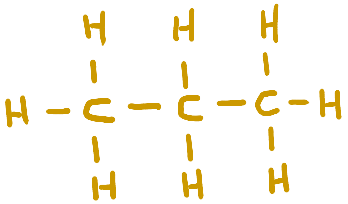
b) The central N atom forms 1 **single** bonds.

c) The central N atom forms 1 **double** bonds.

Question 4 (8 Points)

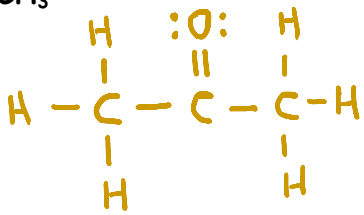
Draw a **Lewis structure** for each of the following **organic molecules**.

C_3H_8

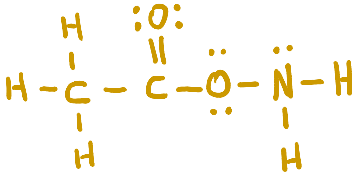


HCOOH

CH_3COCH_3



CH_3COONH_2



Question 5 (6 Points)

O_3 has **resonance structures** – draw them.

Question 6 (8 Points)

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

a) N_2O Dinitrogen monoxide

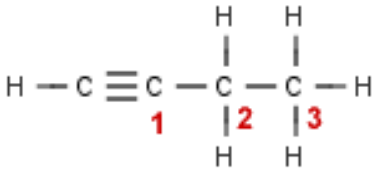
b) BBr_3 Boron tribromide

What is the **formula** for:

a) **Phosphorus pentachloride** PCl_5

b) **Sulfur hexafluoride** SF_6

Question 7 (6 Points)



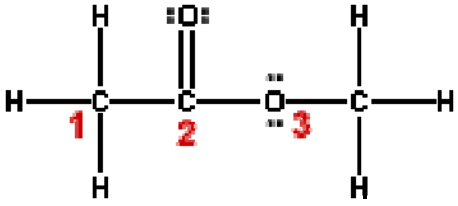
What is the **electron pair geometry** about:

a) **Atom 1**: LINEAR

b) **Atom 2**: TETRAHEDRON

c) **Atom 3**: TETRAHEDRON

Question 8 (6 Points)



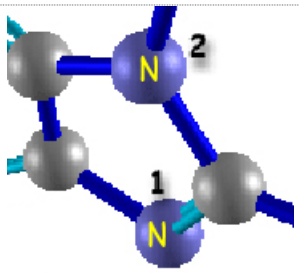
What is the **predicted bond angle** about:

a) **Atom 1**: ~109°

b) **Atom 2**: 120°

c) **Atom 3**: ~109°

Question 9 (4 Points)



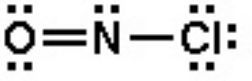
What is the **predicted bond angle** about the following atoms?

a) **Nitrogen 1** 120°

b) **Nitrogen 2** ~109°

Question 10 (6 Points)

The **Lewis Dot Structure** for **NOCl** is depicted on the right.



a) The **electron pair geometry** around **N** is: TRIGONAL PLANAR

b) The **molecular geometry** around **N** is: ANGULAR / BENT (120°)

Question 11
8 Points

The **electron-pair geometry** around the **S** atom in **SBr_2**? TETRAHEDRON.

There is/are 2 **lone pair(s)** around the central atom, so the **molecular geometry** of the **SBr_2** molecule is predicted to be ANGULAR/BENT (~109°).

SBr_2 is POLAR. **(Polar/Nonpolar)**

Question 12
2 Points

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

Solubility of Some Common Substances

Compound	Solubility in H_2O g/100mL	
O_2	$4.5x10^{-3}$	18°C
N_2	$2.0x10^{-3}$	18°C
NH_3	89.5	0°C
CO_2	0.179	18°C
HCl	72.1	20°C

a) Membranes
b) Micelle action
c) Fabric softeners
d) Like dissolves like
e) Detergents

Question 13
4 Points

$ClO^-(aq) + H_2O(l) \Leftrightarrow HClO(aq) + OH^-(aq)$ K = **$2.86x10^{-7}$** at 298K.

Assuming you start with **ClO^-** and no **HClO** or **OH^-**, **circle** those of the following that **best** describes the **equilibrium system**?

a) The **reverse** reaction is favored at equilibrium.
b) **Appreciable** quantities of **all species** are present at equilibrium.
c) The **forward** reaction is favored at equilibrium.
d) **Very little HClO** will be present at equilibrium.

Question 14
6 Points

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

a) $2\ NOCl(s) \Leftrightarrow 2\ NO(g) + Cl_2(g)$ K = $[NO]^2[Cl_2]$

b) $HF(aq) + H_2O(l) \Leftrightarrow H_3O^+(aq) + F^-(aq)$ K = $[H_3O^+][F^-]/[HF]$

Question 15
4 Points

Consider the following system at equilibrium at 698K:

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

When some **$I_2(g)$** 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 **H_2** will:

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

Question 16
6 Points

Dinitrogen tetraoxide and **nitrogen dioxide** are two gases that exist in equilibrium at a range of temperatures. **NO_2** is a **reddish brown** gas while **N_2O_4** is **colorless**.

If we represent the equilibrium as: $N_2O_4(g) \Leftrightarrow 2NO_2(g)$

Consider the following experimental observations:

- At **High Temperature** the **red color is very strong**.
- At **Low Temperature** the gas has **very little color**.

We can conclude from these observations:

a) That the reaction is:

☐ Exothermic ☐ Endothermic ☐ Neutral

b) When the **temperature** is **decreased** the **equilibrium constant**, K

☐ Increases ☐ Decreases ☐ Remains the same.

c) When the **temperature** is **decreased** the **equilibrium concentration** of NO_2

☐ Increases ☐ Decreases ☐ Remains the same.

Question 17
4 Points

Consider the following system at equilibrium at 350 K:

$2\ CH_2Cl_2(g) \Leftrightarrow CH_4(g) + CCl_4(g)$

If the volume of the equilibrium system is suddenly increased at constant temperature::

The reaction must:

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

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

c) Remain the **same**.

The number of moles of **CCl_4** will:

a) **Increase**

b) Remain the **same**

c) **Decrease**

Exam II Score