Dr. Zellmer
Time: 7 PM Sun.
40 min

Chemistry 1250
Spring Semester 2022
Quiz VII

T, R
March 6, 2022

Name ________________________ Rec. TA/time ________________________

Show **ALL** your work or **EXPLAIN** to receive full credit.

1. (3 pts) Which hybrid orbitals lead to a **bent** shape with bond angles of about 105°?

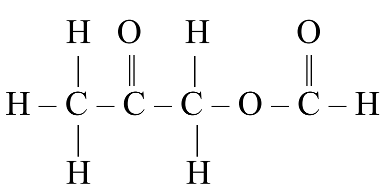
   a) sp b) sp^2 c) sp^3 d) sp^3d e) sp^3d^2

2. (3 pts) Describe what a sigma, σ, bond is and what a pi, π , bond is in terms of their electron density. Sketch what a pi bond between two atoms looks like (use two large dots to represent the nucleus of each atom).

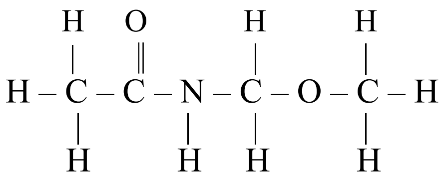
3. (3 pts) How many **sp** hybridized carbon atoms are contained in the following compound?

$$H - C \equiv C - CH_2 - C \equiv C - CH_2 - C \equiv C - CH = CH - CH_2 - CH = CH - CH_3$$

4. (7 pts) For the following molecule (draw in any lone-pair electrons not shown), what are the total number of σ and π bonds in the molecule? **Explain your answers.**



5. (6 pts) For the following molecule (draw in any lone-pair electrons not shown) answer the questions below. **Explain your answers.**



$CH_3\text{-}\overset{\overset{O}{\|}}{C}\text{-}NH\text{-}CH_2\text{-}O\text{-}CH_3$ (Condensed formula)

a) What are the hybridizations of all the central atoms left to right?

CH_3 carbon atom on the far left:

C = O carbon atom:

C – N – C nitrogen atom:

N – C – O carbon atom:

C – O – C oxygen atom:

CH_3 carbon atom on the far right:

b) What are the bond angles around all the central atoms from left to right?

H – **C** – C (1st C atom on the left)

C – **C** – N (2nd C atom from left)

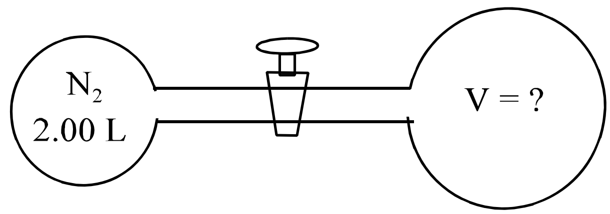
C – **N** – C (the N atom)

N – **C** – O (C atom between N and O atoms)

C – **O** – C (O atom between the two C atoms on the right)

O – **C** – H (C atom on the far right)

6. (5 pts) Two flasks are connected by a stopcock. Both flasks are held at the same temperature. The 2.00 L flask is filled with N_2 at a pressure of 1456 mm Hg. The flask with an unknown volume, V, was evacuated (contains no gas). The stopcock is opened and the N_2 fills both flasks. The resulting pressure after the N_2 fills both flasks is 416 mm Hg? What is the volume, V, of the flask on the right (in liters, L)?



7. (4 pts) Consider three one-liter flasks labeled A, B, and C filled with the gases NO, NO_2, and N_2O, respectively, each at STP. What can be said about the number of molecules of each gas? (atomic weights: N = 14.01, O = 16.00)

a) flask A b) flask B c) flask C d) none e) all are the same

8. (5 pts) What volume (L) of NO at 500°C and 0.5 atm will be produced in the following reaction if 10.0 L of oxygen reacts with excess NH_3 and the volume of NO is measured under the same conditions of temperature and pressure? (atomic weights: N = 14.01, H = 1.008, O = 16.00)

$$4\ NH_3(g) + 5\ O_2(g) \longrightarrow 4\ NO(g) + 6\ H_2O(g)$$

9. (6 pts) A 1.50 L container of Ar at 740.0 torr and 25.0 °C is connected to a 2.50 L container of O_2 at 765.0 torr and 25.0 °C. What is the **total pressure** (torr) after the gases have mixed if the temperature remains at 25.0 °C? (Atomic weights: O = 16.00, Ar = 39.95)

10. (3 pts) Which of the following is the ordering of **average kinetic energies** of 1 mole each of the following gases; H_2S at 900 K, Ne at 750 K and O_2 at 400 K? (Assuming ideal gas behavior.) (atomic weights: H = 1.008, O = 16.00, Ne = 20.18, S = 32.07)

a) $O_2 < Ne < H_2S$

b) $Ne < H_2S < O_2$

c) $H_2S < O_2 < Ne$

d) $O_2 < H_2S < Ne$

e) $Ne = O_2 = H_2S$

USEFUL INFORMATION

R = 0.08206 L-atm/mol-K = 8.3145 J/mol-K

Avogadro's number = 6.02×10^{23} particles/mole

1 Å = 1×10^{-10} m = 1×10^{-8} cm

molar volume at STP = 22.41L

	IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIIIB			IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1	1.008 **H** 1																	4.003 **He** 2
2	6.941 **Li** 3	9.012 **Be** 4											10.811 **B** 5	12.011 **C** 6	14.007 **N** 7	15.999 **O** 8	18.998 **F** 9	20.179 **Ne** 10
3	22.990 **Na** 11	24.305 **Mg** 12											26.98 **Al** 13	28.09 **Si** 14	30.974 **P** 15	32.06 **S** 16	35.453 **Cl** 17	39.948 **Ar** 18
4	39.098 **K** 19	40.08 **Ca** 20	44.96 **Sc** 21	47.88 **Ti** 22	50.94 **V** 23	52.00 **Cr** 24	54.94 **Mn** 25	55.85 **Fe** 26	58.93 **Co** 27	58.69 **Ni** 28	63.546 **Cu** 29	65.38 **Zn** 30	69.72 **Ga** 31	72.59 **Ge** 32	74.92 **As** 33	78.96 **Se** 34	79.904 **Br** 35	83.80 **Kr** 36
5	85.47 **Rb** 37	87.62 **Sr** 38	88.91 **Y** 39	91.22 **Zr** 40	92.91 **Nb** 41	95.94 **Mo** 42	98 **Tc** 43	101.07 **Ru** 44	102.91 **Rh** 45	106.42 **Pd** 46	107.87 **Ag** 47	112.41 **Cd** 48	114.82 **In** 49	118.69 **Sn** 50	121.75 **Sb** 51	127.60 **Te** 52	126.90 **I** 53	131.39 **Xe** 54
6	132.91 **Cs** 55	137.33 **Ba** 56	138.91 **La** 57	178.39 **Hf** 72	180.95 **Ta** 73	183.85 **W** 74	186.21 **Re** 75	190.23 **Os** 76	192.22 **Ir** 77	195.08 **Pt** 78	196.97 **Au** 79	200.59 **Hg** 80	204.38 **Tl** 81	207.2 **Pb** 82	208.98 **Bi** 83	209 **Po** 84	210 **At** 85	222 **Rn** 86
7	223 **Fr** 87	226.03 **Ra** 88	227.03 **Ac** 89	261 **Rf** 104	262 **Ha** 105	263 **Sg** 106	262 **Ns** 107	265 **Hs** 108	266 **Mt** 109	269 110	272 111	277 112						

Lanthanide Series	140.12 **Ce** 58	140.91 **Pr** 59	144.24 **Nd** 60	145 **Pm** 61	150.36 **Sm** 62	151.96 **Eu** 63	157.25 **Gd** 64	158.93 **Tb** 65	162.50 **Dy** 66	164.93 **Ho** 67	167.26 **Er** 68	168.93 **Tm** 69	173.04 **Yb** 70	173.04 **Lu** 71
Actinide Series	232.04 **Th** 90	231.04 **Pa** 91	238.03 **U** 92	237.05 **Np** 93	**Pu** 94	**Am** 95	**Cm** 96	**Bk** 97	**Cf** 98	**Es** 99	**Fm** 100	**Md** 101	**No** 102	**Lr** 103

A PERIODIC CHART OF THE ELEMENTS
(Based on ^{12}C)