Chemistry 1A Practice Midterm Exam 2
Professor Pines

Student Name: _____Student ID#_____

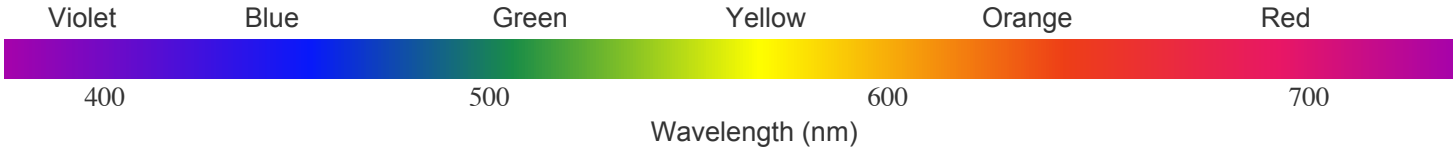
Potentially Useful Information

Ideal Gas: $PV = nRT$ $N_A = 6.0221 \times 10^{23}$ particles/mol Absolute T(K) = T(°C) + 273.15

$V_m = 22.414$ L mol^{-1} at SATP (1 atm, 298.15 K) R = 0.08206 L atm mol^{-1} K^{-1}

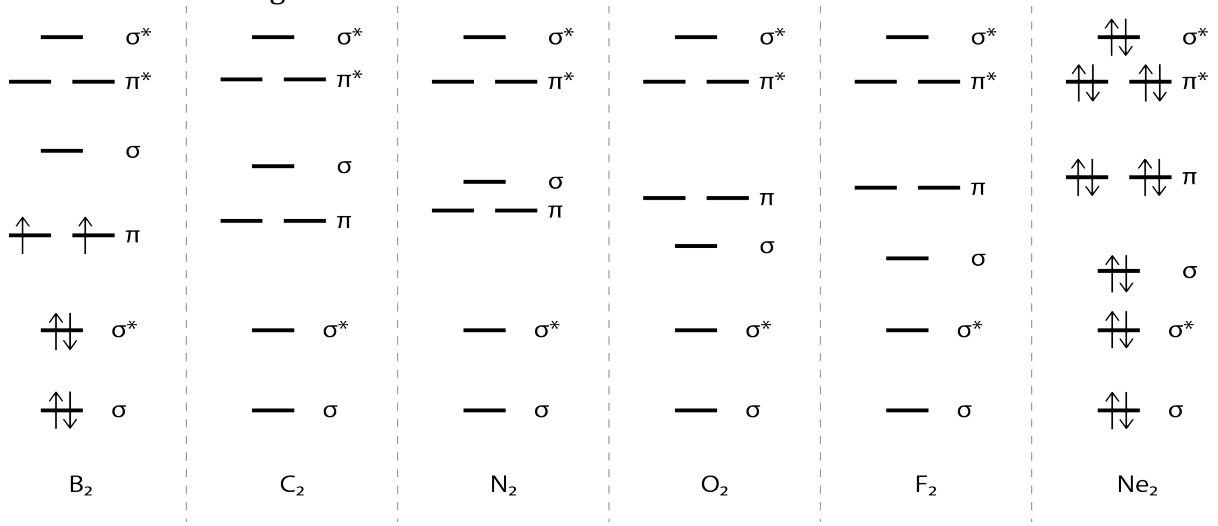
$$v_{rms} = \sqrt{\overline{v^2}} = \sqrt{\frac{3k_BT}{m}} = \sqrt{\frac{3RT}{M}}$$

Particle in a 1D box:
$E_n = \frac{h^2n^2}{8mL^2}$; $n = 1, 2, 3, \ldots$



$\lambda\nu = c$ $E_{photon} = h\nu$ $c = 2.9989 \times 10^8\ m\ s^{-1}$ $h = 6.62608 \times 10^{-34}\ J\ s$ $p = mv$ $E_k = \frac{mv^2}{2} = \frac{p^2}{2m}$

Molecular orbital diagrams:



	Na	K	Rb	Cl	Br	I
Ionization Energy (kJ/mol)	496	419	403	1251	1140	1008
Electron Affinity (kJ/mol)	53	48	47	349	325	295

Only scientific calculators may be used on this exam; graphing calculators (or any calculator with a "Solve" function the capability to store ASCII/text data, etc.) are strictly prohibited. The use of unauthorized materials will result in a grade of zero on the exam. At instructor discretion, students found cheating may also be reported to the UC Berkeley Center for Student Conduct.

Of the following, _____ is characteristic of gases.

A) Highly compressible B) Large distances between molecules

C) They expand spontaneously D)The form homogeneous mixtures

D) All of the above.

Which of the following molecules or ions is bent?

ICl_2^-	CO_2	SO_2	C_2H_2	HCN

In which of the molecules or ions below does nitrogen (N) have the highest oxidation state

CN^-	NO_2	NO_3^-	NH_3	N_2

The formal charge on the carbon atom in CO_2 is

-2	-1	0	1	2

What is the O-C-O bond angle (in degrees) in CO_3^{-2}?

180	120	109	105	90

How many reasonable structural isomers can be generated with the molecular formula C_3H_8O?

2	3	4	5	6

How would you describe the shape of SO_4^{-2}

Linear	Trigonal planar	Tetrahedral	T-shaped	Bent

What is the best description of the sigma bond in CN^{1-}?

2p on carbon combined with 2p on nitrogen.	2s on carbon combined with 2s on nitrogen.	sp^3 on carbon combined with sp^3 on nitrogen.	sp^2 on carbon combined with sp^2 on nitrogen.	sp on carbon combined with sp on nitrogen.

What is the formal charge on carbon in HCN?

-3 -1 0 1 2

Which molecular shape has the largest bond angle?

Tetahedral	Square planar	Trigonal Pyramidal	Trigonal planar	Octahedral

Which molecular shape has a dipole moment if all the terminal atoms are identical?

Tetahedral	Square planar	Trigonal Pyramidal	Trigonal planar	Octahedral

Which of the following bonds gets weaker when the species shown is ionized?

F_2 F_2^{1-} O_2^{1-} O_2 N_2^{1-}

Which change(s) in a sample of ideal gas would have the same effect as increasing the velocity of the particles?

Increase in temperature.	Increase in volume.	Decrease in pressure	Increase in the number of moles of gas.	None of these.

Hydrogen gas taken from a nuclear experiment contains $^3H_2$ and $^2H_2$. One mole of gas weighs 5.00 g and has a pressure of 1 atm inside a fixed volume. What is the partial pressure of $^3H_2$?

0.1 atm 0.25 atm 0.5 atm 0.75 atm 1 atm

Which has the greatest electron affinity?

S^+ Cl^+ Ar^+ K^+ Ca^+

The average speed of helium atoms (mass 6.64e-27 kg) in a sample at very low temperatures is 75 m/s. What is the momentum (kg m s^{-1}) of the average helium atom under these conditions?

5.00E-25 7.40E-22 4.00E-20 4.80E-25 5.40E-19

Which has the largest atomic radius?

Br	Sn	Sb	Te	I

What is the oxidation number of S in SO_3?

-2	-1	0	1	2

In which of the following molecules is the carbon-carbon bond likely to be the strongest?

H_3CCH_3	H_2CCH_2	CH3CH2F	HCCH	H_2CO

What is the bond order of He_2^+?

0	1/2	1	3/2	2

Which species has a dipole moment?

CH_4	CCl_4	BF_3	$CHCl_3$	NH_4^+

Which species contains the smallest bond angle?

CO_3^{-2}	SO_4^{-2}	ClO_2^-	OH_4^{+2}	O_3

What is the steric number and electron pair configuration about iodine in IF_3?

2, linear	3, trigonal planar	4, tetrahedral	5, trigonal bipyramid	6, octahedral

Which statement describes the C-O bond in H_2CO?

It involves p orbitals on C and O.	It contains a sigma bond.	It contains a pi bond.	C and O are sp^2 hybridized.	All are true