Quiz 2 sample

H 2.1	*Pauling* Electronegativity					
Li 1.0	Be 1.5	B 2.0	C 2.5	N 3.0	O 3.5	F 4.0
Na 0.9	Mg 1.2	Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0
K 0.8	Ca 1.0	Ga 1.6	Ge 1.8	As 2.0	Se 2.4	Br 2.8
Rb 0.8	Sr 1.0	In 1.7	Sn 1.8	Sb 1.8	Te 2.1	I 2.5
Cs 0.7	Ba 0.9	Tl 1.8	Pb 1.9	Pb 1.9	Po 2.0	At 2.2

Useful units
Avogadro number $N_A = 6.022 \times 10^{23}$ mol^{-1}
Gas constant (SI) $R = 8.3145$ J mol^{-1} K^{-1}
Gas constant $R = 0.08206$ L atm mol^{-1} K^{-1}
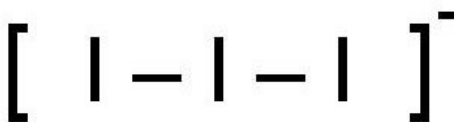1 atm = 101 325 Pa = 760 mm Hg
1 m^3 = 10^3 L

Q1   Consider the Lewis structure and the VSEPR-geometry of these molecules and decide which molecule has a linear structure.

a)   HCN
b) NH_4^+
c) CO_3^{2-}
d) SeF_2
e) H_2O

Q2   Complete the Lewis structure of the I_3^--ion and identify the appropriate hybridization of the central I-atom

a)   sp
b) sp^2
c) sp^3
d) dsp^3
e) d^2sp^3
f)   none of the above
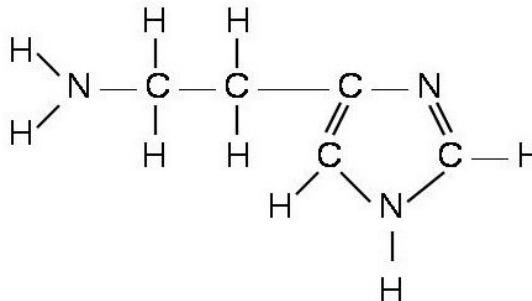
I_3^-ion:

$$\left[\ I-I-I\ \right]^-$$

Q3   For which of these molecules do you predict the smallest bond angle?

a) CH_4
b) NH_3
c) H_2S
d) CCl_4
e) SiF_4

Q4   As a response to allergens the body produces histamine. Complete the Lewis structure. How many sp^3 hybridized carbon atoms do you identify in this molecule?

a)   2
b)   3
c)   4
d)   5
e)   none

Histamine:

Q5 How many σ-bonds do you identify in the Histamine molecule?

a) 2
b) 15
c) 17
d) 19
e) 22

Q6 Which of the following gas atoms or molecules has the largest root mean square velocity u_{rms} in a sample of our atmosphere at STP?

a) Ar
b) CO_2
c) O_2
d) CH_4
e) they have all the same u_{rms}

Q7 Argon effuses into a vacuum with a rate of 20mL/min. An unknown gas under the same conditions effuses with a rate of 30.7mL /min. Which one of the following gases could it be?

a) Ne
b) He
c) NH_3
d) UF_6
e) H_2

Q8 Calculate the average kinetic energy of Methane (CH_4) in J/mol at t =25° C, P=1 atm

a) 3717 J/mol
b) 311 J/mol
c) 2477 J/mol
d) 22.4 J/mol
e) 36.68 J/mol

Q9 What is the density in g/L of Helium (He) in a stratospheric weather balloon at an altitude of ca 15,000 m; t = - 43 °C, and P = 66,000 Pa

a) 0.138 g/L
b) 14.01 g/L
c) 138 g/L
d) 0.000117 g/L
e) Additional information is needed

Q10 What is the pressure in the closed container when you read a Δh of 125 mm on the open u-tube manometer filled with mercury at an atmospheric pressure of 101325 Pa?

a) 117990 Pa
b) 84659 Pa
c) 16665 Pa
d) 125 torr
e) 760 torr
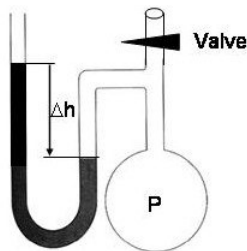
Q11 The *a* value in the van der Waals equation for Xe is _____ than Ne. The *b* value of Ne is _____ than Ar. Fill in the blanks using the words, respectively:

a) larger, larger
b) larger, smaller
c) smaller, larger
d) smaller, smaller
e) cannot be answered based on the information given

Q12 Which one of the following statements *can be deduced* from the molecular distribution of speed graphs shown below, corresponding to 3 different gases having different molar masses M; the y-axis corresponds to the fraction of molecules with a particular speed:

Molecular Speed u m/s
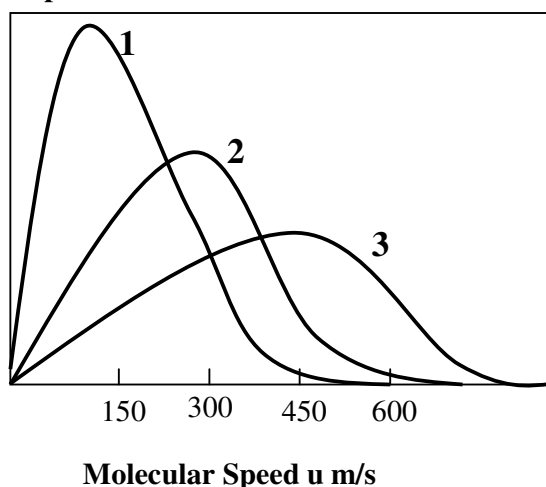
a) The average kinetic energy per mole of gas must be different for the three gases.
b) $M_1 < M_2 < M_3$ (M is the molar mass).
c) The temperature of Gas 3 must be higher than the temperature of Gas 1, otherwise its distribution function cannot be broader as shown.
d) The molecules of Gas 2 move at a speed of 300 m/s and collide with each other, as a result the molecules undergo only a change in direction. The pressure exerted on the wall is a function of the frequency of collisions and the speed at which the particles are moving.
e) All are false

Q13 Consider CO_2 and Ne under the following conditions:

Flask A, CO_2 (g)	Flask B, Ne (g)
2 moles	3 moles
740 K	370 K
0.50 atm	0.80 atm

Which of the following statements is *true*?
a) The volume CO_2 occupies is twice the volume occupied by Ne.
b) The force exerted when a CO_2 molecule collides with the walls is smaller than the force exerted when a Ne molecule collides with the walls.
c) The average kinetic of a Ne molecule is twice the average kinetic energy of CO_2 molecule.
d) The u_{rms} for the CO_2 molecules is smaller than the u_{rms} for the Ne molecules.
e) All are false

Q14 The valve between a 10-L tank containing a gas at 1 atm and a 3-L tank containing a gas at 0.5 atm is opened. Nothing else is changed in the environment. The two gases do not react. Calculate the final pressure in the tank:
a) 0.88 atm
b) 1.5 atm
c) 2.45 atm
d) 0.75 atm
e) Not enough information is given to solve for the final pressure.

Q15 The hybridization of I in ICl_4^- is:
a) sp
b) sp^2
c) sp^3
d) dsp^2
e) d^2sp^3

Q16 Which of the following molecules (C: central atom) contains the shortest C-O bond:
a) CH_3OH
b) CH_2O
c) CO
d) CO_2
e) CH_3CH_2OH

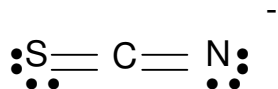**Q 17 Which of the following molecules has a resultant dipole moment $\mu \neq 0$?**
a) $CHCl_3$
b) BF_3
c) TeF_4
d) a and c
e) all of the above

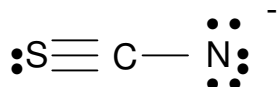**Q18 Which of the following is expected to be the best resonance structure of SCN⁻**

a)

$$:\ddot{S} - C \equiv N:$$ ⁻

b)

$$:\ddot{S} = C = \ddot{N}:$$ ⁻

c)

$$:S \equiv C - \ddot{N}:$$ ⁻

d)

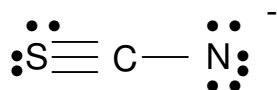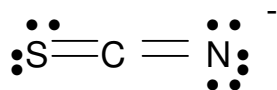$$:S \equiv C - \ddot{N}:$$ ⁻

e)
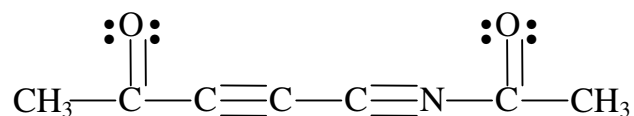
$$:\ddot{S} = C = \ddot{N}:$$ ⁻
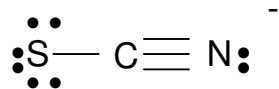
19 Which of the following electron arrangement and molecular geometries around the central atom (1st atom is the central atom) correctly correspond to the molecule in question:

a) CO_2, electron arrangement: trigonal planar; geometry: bent
b) ClF_3, electron arrangement: octahedral; geometry: T-shaped
c) $XeCl_4$, electron arrangement: trigonal bipyramid; geometry: see-saw
d) XeF_2, electron arrangement: trigonal bipyramid; geometry: linear
e) b and c are correct

Q20 How many atoms are in the same plane for the following molecule?

$$CH_3 - \overset{\overset{\displaystyle :O:}{\|}}{C} - C \equiv C - C \equiv N - \overset{\overset{\displaystyle :O:}{\|}}{C} - CH_3$$

a) 4
b) 5
c) 8
d) 9
e) 10

Periodic table:

Periodic Table Of The Elements