

Quiz 2 sample

| Pauling Electronegativity | | | | | | |
|---------------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| H 2.1 | | | | | | |
| 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

$$N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$$

Gas constant (SI)

$$R = 8.3145 \text{ J mol}^{-1} \text{ K}^{-1}$$

Gas constant

$$R = 0.08206 \text{ L atm mol}^{-1} \text{ K}^{-1}$$

1 atm = 101 325 Pa = 760 mm Hg

1 m³ = 10³ L

...Together At Work



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:



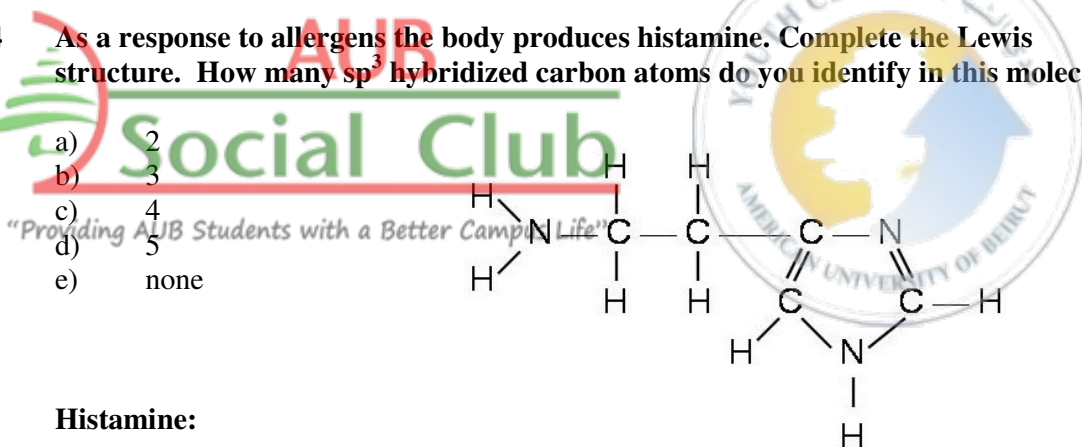
...Together At Work

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?

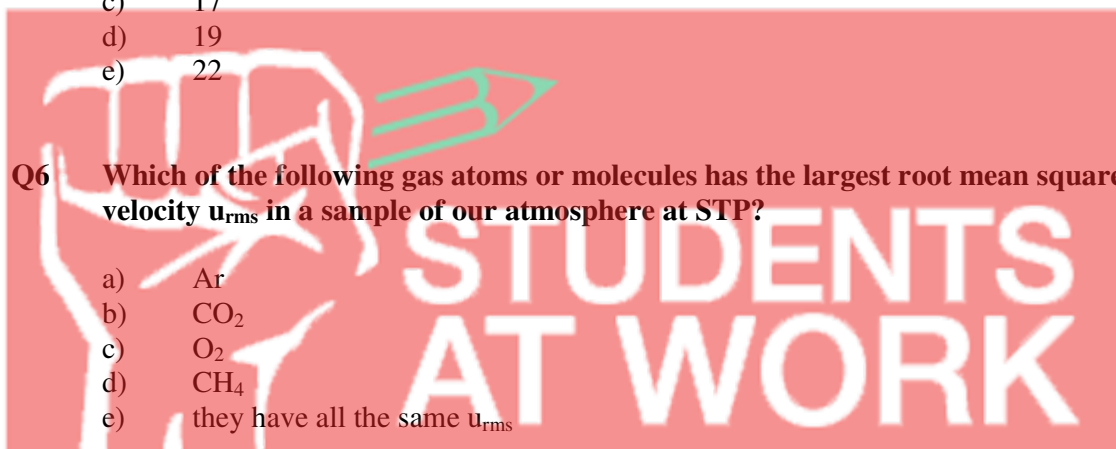
- a) Ne
- b) He
- c) NH_3
- d) UF_6
- e) H_2

Q8 Calculate the average kinetic energy of Methane (CH_4) in J/mol at $t = 25^\circ \text{C}$, $P = 1 \text{ atm}$

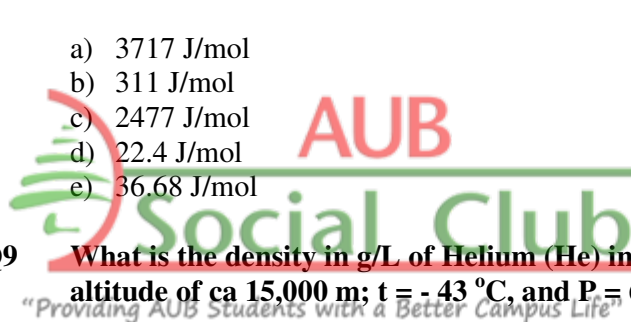
- a) 3717 J/mol
- b) 311 J/mol
- c) 2477 J/mol
- d) 22.4 J/mol
- e) 36.68 J/mol

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

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

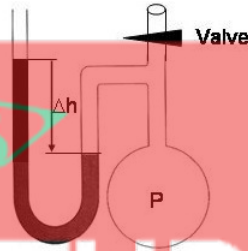


... Together At Work



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?

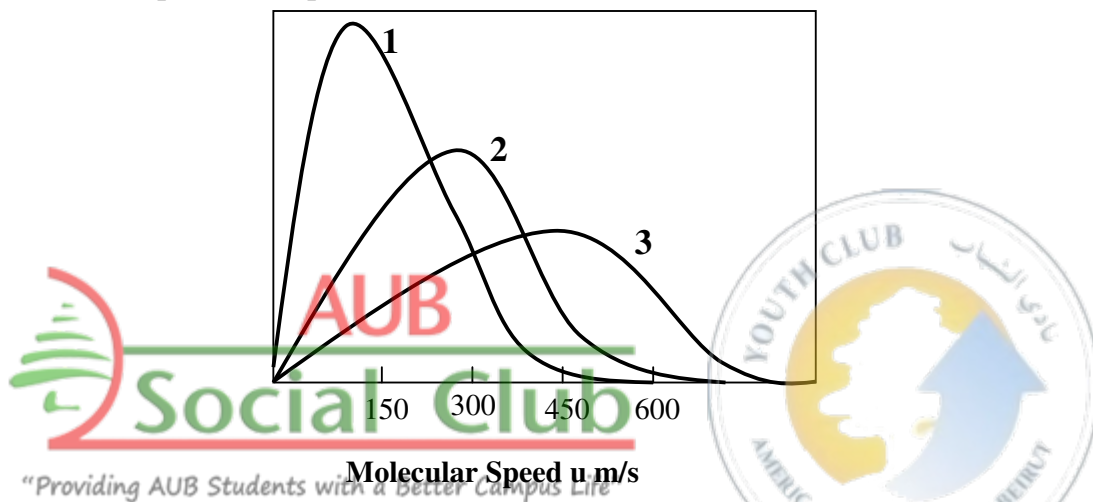
- a) 117990 Pa
- b) 84659 Pa
- c) 16665 Pa
- d) 125 torr
- e) 760 torr



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:



- 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 CO₂ and Ne under the following conditions:

Flask A, CO₂ (g)

2 moles

740 K

0.50 atm

Flask B, Ne (g)

3 moles

370 K

0.80 atm

Which of the following statements is true?

- a) The volume CO₂ occupies is twice the volume occupied by Ne.
- b) The force exerted when a CO₂ 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 CO₂ molecule.
- d) The u_{rms} for the CO₂ 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 ICl₄⁻ is:

- a) sp
- b) sp²
- c) sp³
- d) dsp²
- e) d²sp³

Q16 Which of the following molecules (C: central atom) contains the shortest C-O bond:

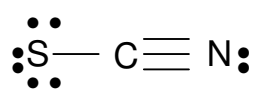
- a) CH₃OH
- b) CH₂O
- c) CO
- d) CO₂
- e) CH₃CH₂OH

Q17 Which of the following molecules has a resultant dipole moment $\mu \neq 0$?

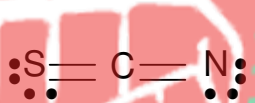
- a) CHCl₃
- b) BF₃
- c) TeF₄
- d) a and c
- e) all of the above

Q18 Which of the following is expected to be the best resonance structure of SCN^-

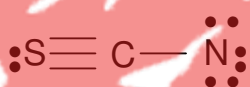
a)



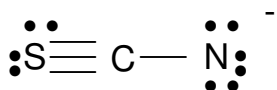
b)



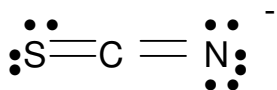
c)



d)



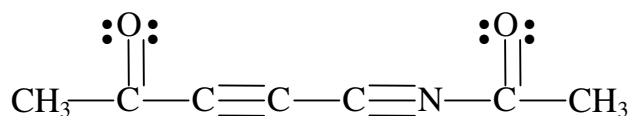
e)



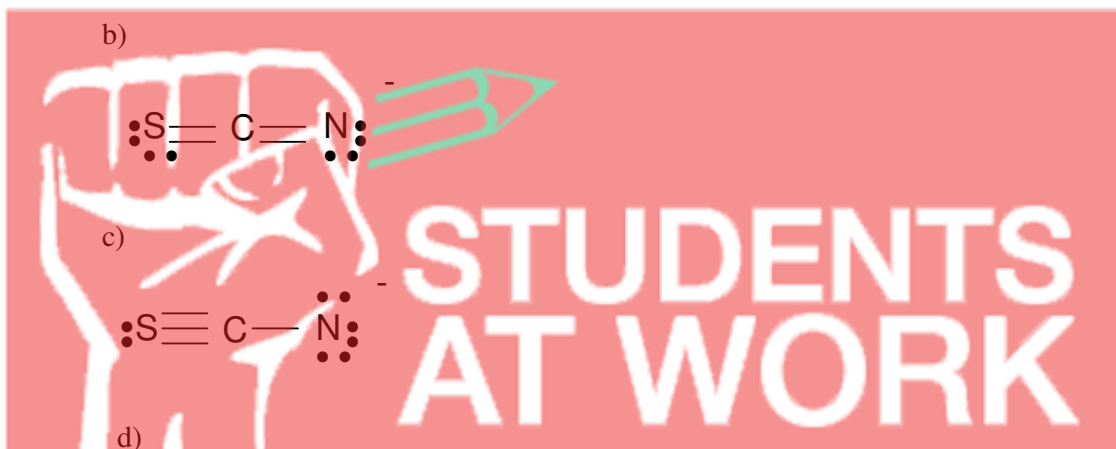
19 Which of the following electron arrangement and molecular geometries around the central atom (1st atom is the central atom) correctly correspond to the molecule in question:

- 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

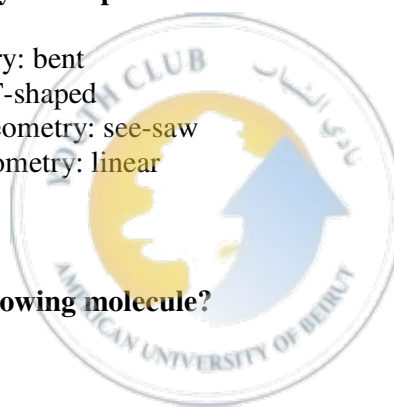
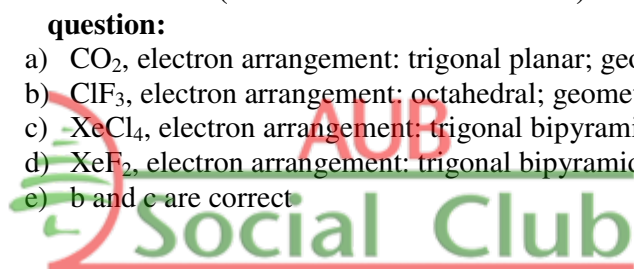
Q20 How many atoms are in the same plane for the following molecule?



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



...Together At Work



Periodic table:

Periodic Table Of The Elements

| | | | | | | | | | | | | | | | | | |
|-----------------------|---------------------|-----------------------|----------------------|-----------------------|----------------------|-----------------------|---------------------|-----------------------|---------------------|-----------------------|---------------------|-----------------------|---------------------|-----------------------|--------------------|----------------------|--------------------|
| 1 H 1.00794 | 2 He 4.002602 | | | | | | | | | | | 18 Ar 39.948 | | | | | |
| 3 Li 6.941 | 4 Be 9.0122 | 5 B 10.811 | 6 C 12.0107 | 7 N 14.0064 | 8 O 15.9994 | 9 F 18.9984 | 10 Ne 20.1797 | 11 Na 22.98977 | 12 Mg 24.305 | 13 Al 26.981538 | 14 Si 28.0855 | 15 P 30.973761 | 16 S 32.065 | 17 Cl 35.4527 | 18 Ar 39.948 | | |
| 19 K 39.0983 | 20 Ca 40.078 | 21 Sc 44.955910 | 22 Ti 47.867 | 23 V 50.9415 | 24 Cr 51.9961 | 25 Mn 54.938049 | 26 Fe 55.845 | 27 Co 58.933200 | 28 Ni 58.6934 | 29 Cu 63.546 | 30 Zn 65.39 | 31 Ga 69.723 | 32 Ge 72.61 | 33 As 74.92160 | 34 Se 78.96 | 35 Br 79.904 | 36 Kr 83.80 |
| 37 Rb 85.4678 | 38 Sr 87.62 | 39 Y 88.90585 | 40 Zr 91.224 | 41 Nb 92.90638 | 42 Mo 95.94 | 43 Tc 98.9062 | 44 Ru 101.07 | 45 Rh 102.90550 | 46 Pd 106.42 | 47 Ag 107.8682 | 48 Cd 112.411 | 49 In 114.818 | 50 Sn 118.710 | 51 Sb 121.760 | 52 Te 127.60 | 53 I 126.90447 | 54 Xe 131.29 |
| 55 Cs 132.90545 | 56 Ba 137.327 | 57 La 138.9055 | 58 Ce 140.116 | 59 Pr 140.90768 | 60 Nd 144.242 | 61 Pm 144.9128 | 62 Sm 150.36 | 63 Eu 151.964 | 64 Gd 157.25 | 65 Tb 158.92534 | 66 Dy 162.50 | 67 Ho 164.93032 | 68 Er 167.26 | 69 Tm 168.93421 | 70 Yb 173.04 | 71 Lu 174.967 | 72 Hf 178.49 |
| 87 Fr 223 | 88 Ra 226 | 89 Ac 227 | 90 Th 232.0381 | 91 Pa 231.03688 | 92 U 238.02891 | 93 Np 237.0482 | 94 Pu 244 | 95 Am 243 | 96 Cm 247 | 97 Bk 247 | 98 Cf 251 | 99 Es 252 | 100 Fm 257 | 101 Md 261 | 102 No 259 | 103 Lr 262 | 104 Rf 261 |

Atomic Number: 22

Boiling point (K): 3762

Melting point (K): 1943

Density at 300 K (g/cm³): 4.5

Group: 4

Oxidation states: +4, +3

Atomic mass is accurate to ±1 in last decimal place unless otherwise indicated.

Examples: Ti = 47.867 ± 0.001, Fe = 55.845 ± 0.002

(Atomic masses from Pure Appl. Chem. 1996, 68, 2339)

Commercial lithium compounds are available in the form of metallic lithium in the range 6.94 - 7.00. [H. P. O., T. B. Copan, Q. Z. Wang and Y. H. Wang, Anal. Chem. 1987, 69, 4076.]

| | | | | | |
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| | | | | | | | |
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| 96 Cm 247 | 97 Bk 247 | 98 Cf 251 | 99 Es 252 | 100 Fm 257 | 101 Md 261 | 102 No 259 | 103 Lr 262 |