

Chemistry 1A

Fall 2017

Name _____ Student ID _____

Exam 2

You will have 120 minutes to complete this exam.

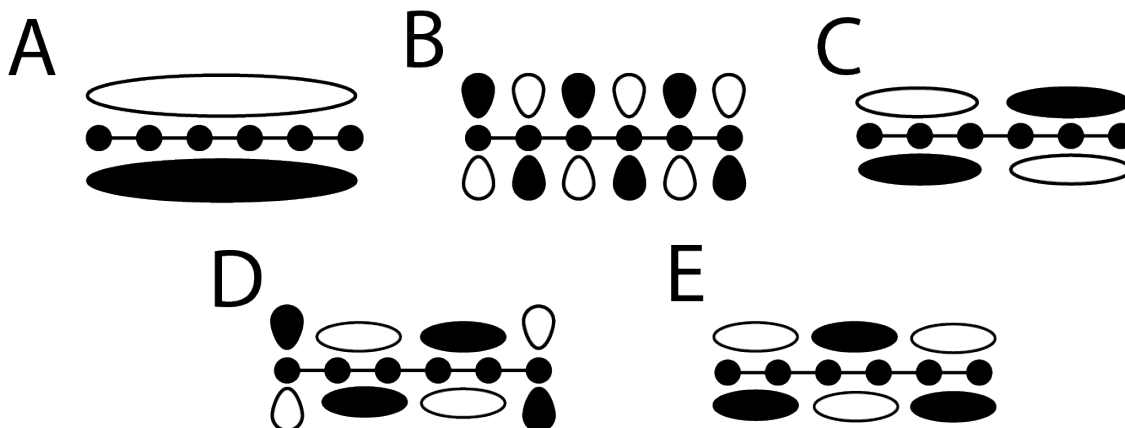
Please fill in the bubble that corresponds to the correct answer on the answer sheet. Only your answer sheet will be graded.

Each question has only 1 correct answer unless otherwise specified in the question. You are allowed to use the provided equation sheet and periodic table to help you answer the questions.

While all questions have been taken from the online database, specific details such as an element or number may have been changed and answers may have been switched around. Please read each question carefully.

Good luck!!

1) Which molecular orbital in 1,3,5-hexatriene has the highest energy?



2) What is the formal charge on the carbon atom in CO?

- A) -2 B) -1 C) 0 D) +1 E) +2

3) Which molecule does not have a net electric dipole moment?

- A) CHCl_3 B) H_2O C) NH_3 D) CH_2F_2 E) BH_3

4) A 54 g sample of aluminum reacts with 100.0 g of oxygen. Which is the formula of the oxide if, after the reaction is complete, the aluminum is consumed and 52.0 g of oxygen remain?

- A) Al_2O_3 B) AlO C) AlO_2 D) Al_6O_5 E) Al_3O_5

5) What is the oxidation number on sulfur in SO_4^{2-} ?

- A) -6 B) -4 C) 0 D) +4 E) +6

6) Which of the following, according to molecular orbital theory, has the strongest bond?

- A) F_2 B) F_2^{1-} C) O_2 D) O_2^{1-} E) N_2^{1-}

7) What is the bond order of He_2^+ ?

- A) -1/2 B) 0 C) 1/2 D) 1 E) 2

8) If you have 1 mole of C_{60} (buckminsterfullerene) and you separate it into individual carbon atoms, how many moles of carbon atoms do you have?

- A) 1 B) 6 C) 60 D) 360 E) 6.02×10^{23}

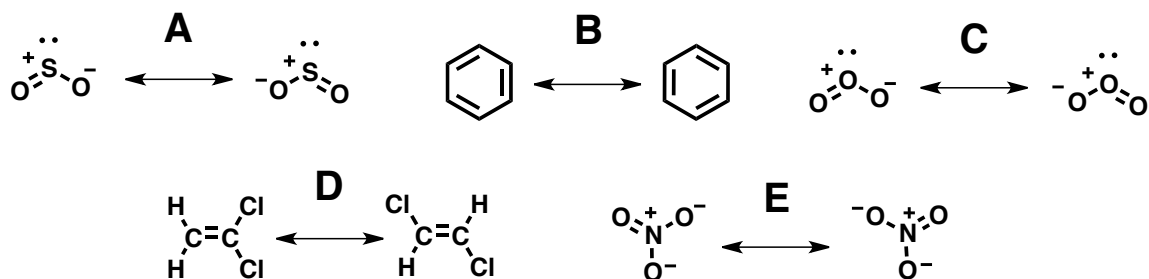
9) Which is the most strongly paramagnetic?

- A) Cl_2 B) S_2 C) O_2^+ D) N_2^+ E) H_2

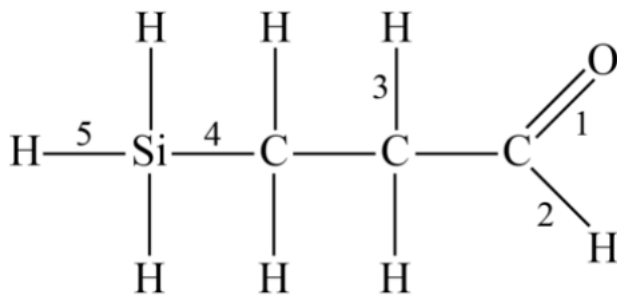
10) What is the approximate net energy change in producing Na^+ and Cl^- from Na and Cl atoms (in kJ/mol)?

- A) 323 B) 147 C) 0 D) -147 E) -323

11) Which of the following is not a pair of resonance structures?

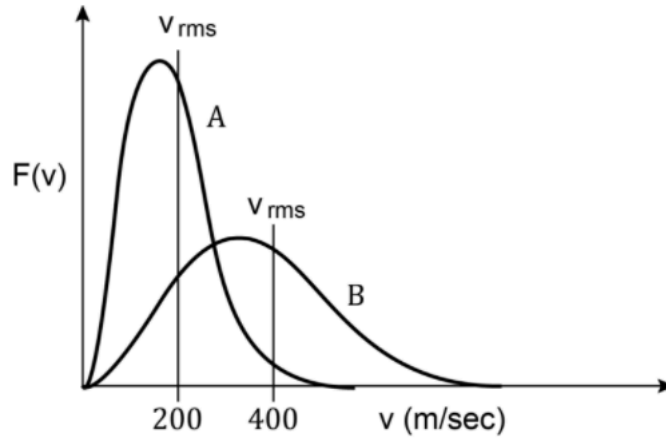


12) Which of the numbered bonds in the picture below has the largest dipole moment?



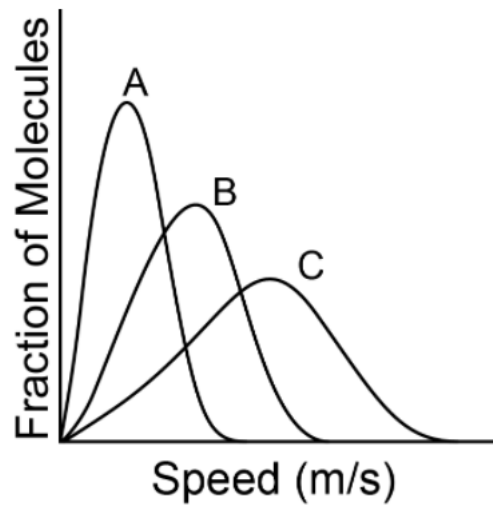
- A) 1 B) 2 C) 3 D) 4 E) 5

13) Curves A and B in the figure below depict the speed distributions for two different types of molecules. Distribution A corresponds to O_2 at a temperature 50K. Distribution B corresponds to CH_4 molecules but at what temperature?



- A) 25K B) 50K C) 100K D) 200K E) 400K

14) Which of the following statements about the figure shown below must be false?



- A) A is at a lower temperature than C
 B) C is the heaviest molecule if all the plots are at the same temperature.
 C) If all of the plots are of the same molecule, B is at a higher temperature than A.
 D) C is lighter than B.
 E) All of the statements are true.

15) One mole of which ideal gas sample has the greatest kinetic energy?

A) Ar at 300° C B) He at 400° C C) He 200° C

D) H₂ at 350° C E) H₂ at 100° C

16) What is the molecular mass of a compound (in g/mol) if 0.500 g of the gas occupies 0.100 L at 100 °C and 1.00 atm of pressure?

A) 65.1 B) 87.3 C) 120.1

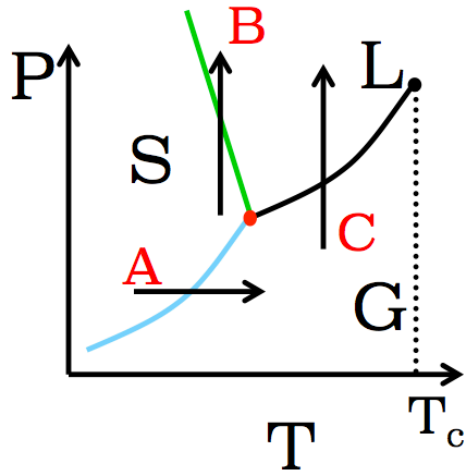
D) 152.9 E) 175.5

17) The absolute 0 of temperature is what?

A) 0.0 K B) 273 K C) -273 K

D) 0.0° C E) 0.0° F

18) Which corresponds to the sublimation of dry ice at 1 atm?

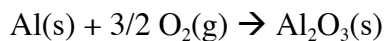


A) A B) B C) C

19) What is the change in the internal energy (ΔU) in Joules of a system that releases 1000 J of heat and does 225 J of work on the surroundings?

- A) 155×10^{-10} B) -1225 C) -775
D) 775 E) 1225

20) The value of ΔH° for the following reaction is -1676 kJ.



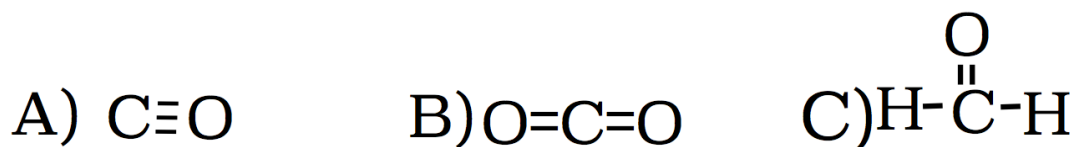
What is ΔH in kJ for the formation of 75.0 g of $\text{Al}_2\text{O}_3(\text{s})$? (Choose the closest answer)

- A) -2.51×10^5 B) -12600 C) -2513
D) -1256 E) 3351

21) Which of the following has a non-zero ΔH_f° ?

- A) $\text{O}_2(\text{l})$ B) C (graphite) C) $\text{N}_2(\text{g})$
D) $\text{F}_2(\text{g})$ E) $\text{Cl}_2(\text{g})$

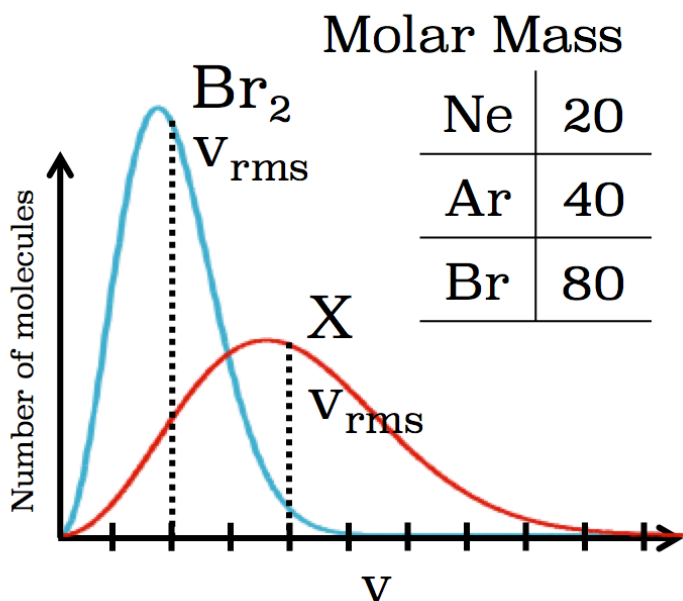
22) Which of the following molecules possesses no electric dipole moment?



23) What is the hybridization of the C orbitals in C_6H_6 (benzene)?

- A) sp B) sp^2 C) sp^3

24) Shown is the Maxwell Boltzmann distribution at ~ 300 K for Br_2 and X. What is X?

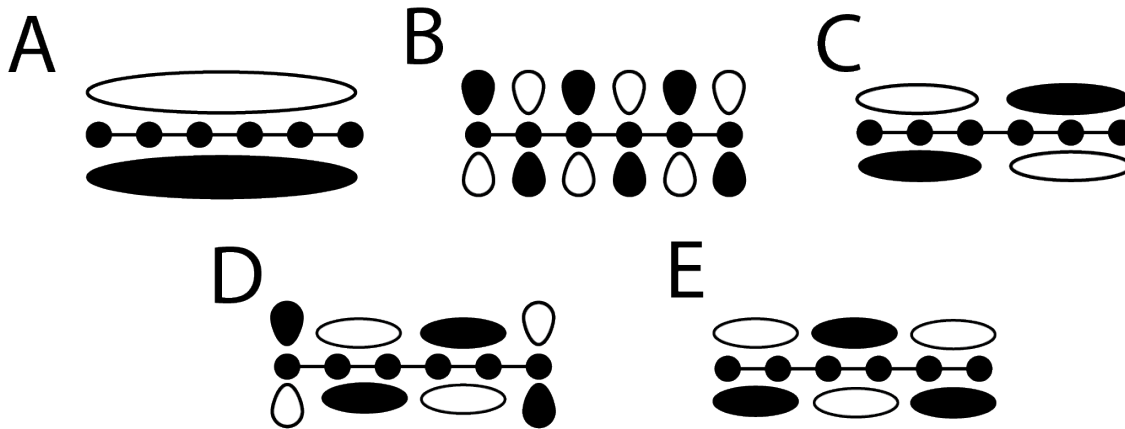


A) Ne

B) Ar

C) Br

25) Which molecular orbital is the LUMO for 1,3,5-hexatriene?



26) Which of the following molecules would you expect to condense at the lowest temperature?

A) Ar

B) H_3CCH_3

C) H_3CCHCl_2

D) $\text{H}_3\text{CCH}_2\text{OH}$

E) They all condense at the same temperature

27) What is the bond order for the O-O bonds in the molecule ozone (O_3)?

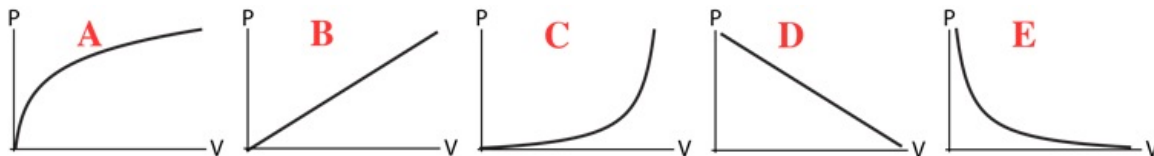
- A) 0.5 B) 1.0 C) 1.5 D) 2.0 E) 2.5

28) For the following molecule what is the length of the longest conjugated pi system if each bond represents $L = 1$?

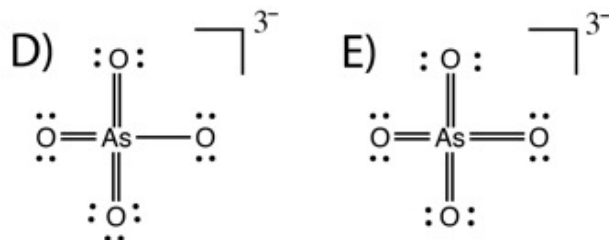
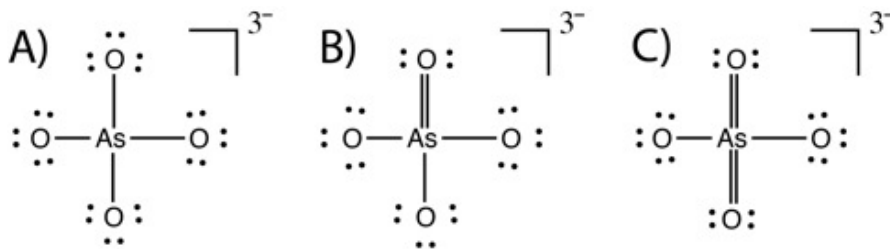


- A) 1 B) 3 C) 5 D) 6 E) 12

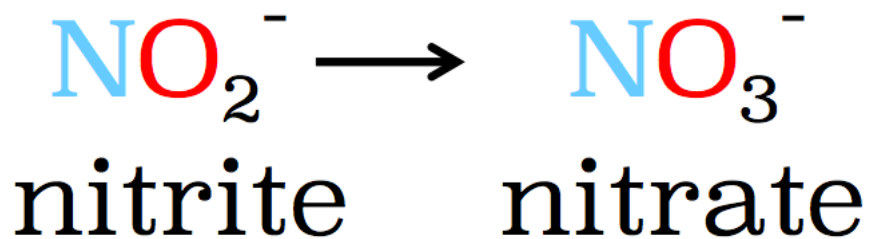
29) For an ideal gas what is the correct graph for pressure versus volume?



30) What is the best Lewis structure for AsO_4^{3-} ?



31) How does the NO bond order change in the following process?



- A) Increases B) Decreases C) Stays the same

32) If treated like an ideal gas, the pressure exerted by 1 mole of CO_2 in a 22.4 L vessel at 0°C is 1 atm. What is the pressure exerted by one mole of CO_2 (a real gas) in a 22.4 L vessel at 0°C ? (For CO_2 , $a=3.59 \text{ atm}\cdot\text{L}^2/\text{mol}^2$ and $b=0.053 \text{ L/mol}$)

- A) 1.07 B) 0.1016 C) 1.0 D) 0.993 E) 0.007

33) What is the shape of SF_6 ?

- A) trigonal bipyramidal B) see-saw C) t-shaped
D) tetrahedral E) octahedral

34) What is the shape of NH_3 ?

- A) trigonal pyramidal B) bent C) T-shaped
D) tetrahedral E) trigonal planar