## Name\_\_\_\_\_

1)

2)

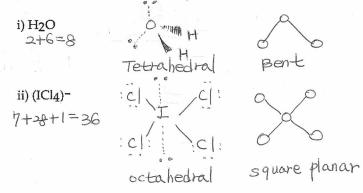
3) 1. 9 atm.

MC\_Chem1A\_Sp12\_LecExam3

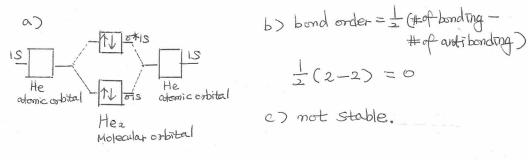
Please read the questions very carefully to understand what is being asked. If you do not understand anything, please ask your instructor. Use the reverse side of your question paper as scratch. No outside paper is allowed. You can use the periodic table and constant data provided. Total points = 39 + (16\*3=)48 = 87

SHORT ANSWER. Please write the set-up equation and insert the raw data with units in the equation before doing your calculations. Write the word or phrase that best completes each statement or answers the question.

1) Draw (a) the electron pair geometry (2 pts. each) and (b) the molecular geometry (2 pts. each) next to each of the molecules below:



2) (a) Draw the molecular orbital diagram (MO) of He<sub>2</sub> molecule (2 pts.) and (b) calculate its bond order (2 pts.) (c) Predict if the molecule is stable or not (1 pts.)?



3) A ball has a volume of 120.3 cm<sup>3</sup> and it contains 0.25 g of N<sub>2</sub> gas. Calculate the pressure inside the ball at 31°C (6 pts.)

$$pV = nRT \quad n: \ 0.25g \ N_{2} \times \frac{Imole}{28g \ N_{2}} = 0.008q mole$$

$$p = \frac{nRT}{V} \quad R: \ 0.082| \frac{dm_{1}L}{mol \cdot K}$$

$$T: \ 31 + 273.15 = 304.15K$$

$$V: 120.3 \ mL \times \frac{L}{1000 \ mL} = 0.1203L$$

$$p = \frac{0.008q \ mole \cdot 0.082| \frac{dm_{1}L}{mol \cdot K} \cdot 304.15K}{0.1203L} = 1.847 \ dm_{1}M$$

4) An inflated baloon has a volume of 60 L at Jettim pressure and at 22°C. Calculate its  
volume when it ascends to an altitude where the pressure is 0.45 atm and the  
temperature is -21°C (6 pts.)  

$$\frac{P_{N}}{T_{L}} = \frac{P_{N}V_{0}}{T_{L}} \qquad P_{1} : 1.0 \text{ d} \text{-m} \qquad P_{2} : 0.45 \text{ atm}$$

$$\frac{P_{N}}{T_{1}} = \frac{P_{N}V_{0}}{T_{L}} \qquad P_{1} : 1.0 \text{ d} \text{-m} \qquad P_{2} : 0.45 \text{ atm}$$

$$\frac{P_{N}}{T_{1}} = \frac{P_{N}V_{0}}{T_{L}} \qquad P_{1} : 1.0 \text{ d} \text{-m} \qquad P_{2} : 0.45 \text{ atm}$$

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$$\frac{P_{N}}{T_{1}} = \frac{P_{N}V_{0}}{T_{2}} \qquad P_{1} : 1.0 \text{ d} \text{-m} \qquad P_{2} : 0.45 \text{ atm}$$

$$\frac{P_{N}}{T_{1}} = \frac{P_{N}V_{0}}{T_{2}} \qquad P_{1} : 295.15 \text{ K} \qquad T_{2} : 252.15 \text{ K}$$

$$\frac{100 \text{ Atm}}{T_{2}} = \frac{132.82 \text{ V}_{2}}{105 \text{ d}} = 1.52.82 \text{ V}_{2} = 1.512.9 \text{ f}$$

$$\frac{100 \text{ d}}{V_{2}} = 11.39 \text{ L}$$

$$= 11 \text{ L}$$

$$\frac{100 \text{ d}}{V_{2}} = 10.39 \text{ L}$$

$$= 11 \text{ L}$$

$$\frac{100 \text{ d}}{100 \text{ d}} = \frac{308.15 \text{ K}}{0.082.15 \text{ K}}$$

$$\frac{100 \text{ d}}{P_{N}} = \frac{463 \text{ AO}_{0}}{0.082.10 \text{ d}} = 308.15 \text{ K}}$$

$$\frac{100 \text{ d}}{P_{N}} = \frac{1.88 \text{ d}/\text{L}}{0.082.10 \text{ d}} = \frac{1.89 \text{ d}/\text{L}}{0.082.15 \text{ K}}$$

$$\frac{1.88 \text{ d}/\text{L}}{0.082.10 \text{ d}} = 1.08 \text{ d}/\text{L}$$

$$\frac{1.88 \text{ d}/\text{L}}{0.082.10 \text{ d}} = \frac{1.900 \text{ d}}{1.800 \text{ d}} = 1.000 \text{ d} \text{$$

P.

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MULTIPLE CHOICE. On scantron, answer by filling the bubbles of the same number as the question number. Choose the one alternative that best completes the statement or answers the question. (3 poins each)

A) the principal quantum number of the valence orbitals increases         B) effective nuclear charge decreases down a group         C) effective nuclear charge increases down a group         B) both effective nuclear charge increases down a group         B) both effective nuclear charge increases down a group         B) both effective nuclear charge increases down a group         B) both effective nuclear charge of an atom is primarily affected by	7) The atomic rad	ius of main-group e	lements generally i	increases down a g	group because	7)
B) effective nuclear charge decreases down a group C) effective nuclear charge increases down a group D) effective nuclear charge increases down a group and the principal quantum number of the valence orbitals increases 8) The effective nuclear charge of an atom is primarily affected by, (8), A) nuclear charge B) orbital radial probability C) outer electrons D) inner electrons D) inner electrons E) electrondistribution 9) Which of the following has the largest second ionization energy? A) Si (B) Mg (C) Na (D) P (E) Al 10) The ion with the smallest diameter is, (9) A) I <sup>-</sup> (B) O <sup>2-</sup> (C) CI <sup>-</sup> (D) F <sup>-</sup> (E) Br <sup>-</sup> 11) Which equation correctly represents the electron affinity of calcium? (a) Ca (g) + Ca <sup>+</sup> (g) + e <sup>-</sup> B) Ca (g) + Ca <sup>-</sup> (g) (a <sup>++</sup> C) Ca (g) + Ca <sup>-</sup> (g) + e <sup>-</sup> E) Ca <sup>+</sup> (g) + e <sup>-</sup> Ca (g) (a <sup>++</sup> C) Ca <sup>-</sup> (g) + Ca <sup>-</sup> (g) (a <sup>++</sup> E) Ca <sup>+</sup> (g) + e <sup>-</sup> Ca (g) (a <sup>++</sup> C) Ca <sup>-</sup> (g) + Ca <sup>-</sup> (g) (a <sup>++</sup> E) Ca <sup>+</sup> (g) + e <sup>-</sup> Ca (g) (a <sup>++</sup> C) Ca <sup>-</sup> (g) + Ca <sup>-</sup> (g) (a <sup>++</sup> E) Ca <sup>+</sup> (g) + e <sup>-</sup> Ca (g) (a <sup>++</sup> C) Ca <sup>-</sup> (g) + Ca <sup>-</sup> (g) (a <sup>++</sup> C) Ca <sup>+</sup> (g) + e <sup>-</sup> Ca (g) (a <sup>++</sup> C) Ca <sup>+</sup> (g) + e <sup>-</sup> Ca (g) (a <sup>++</sup> C) Ca <sup>+</sup> (g) + e <sup>-</sup> Ca (g) (a <sup>++</sup> C) Ca <sup>+</sup> (g) + e <sup>-</sup> Ca (g) (a <sup>++</sup> C) Ca <sup>+</sup> (g) + e <sup>-</sup> Ca <sup>+</sup> (g) (a <sup>++</sup> C) Ca <sup>+</sup> (g) + e <sup>-</sup> Ca <sup>+</sup> (g) (a <sup>++</sup> ) (a <sup>++</sup> ) (a <sup>++</sup> ) (a <sup>++</sup> ) (a <sup>++++++++++++++++++++++++++++++++++++</sup>	A) the princip	oal quantum numbe	r of the valence orb	itals increases		
C) effective nuclear charge increases down a group D) effective nuclear charge aigzags down a group and the principal quantum number of the valence orbitals increases 8) The effective nuclear charge of an atom is primarily affected by (a) nuclear charge B) orbital radial probability C) outer electrons D) inner electrons E) electrondistribution 9) Which of the following has the largest second ionization energy? A) Si (B) Mg (C) Na (D) P (E) Al 10) The ion with the smallest diameter is (b) F <sup>-</sup> (c) Cl <sup>-</sup> (c)					-₩	
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9) Which of the following has the largest second ionization energy? A) Si (B) Mg (C) Na (D) P (E) Al (0) The ion with the smallest diameter is A) $\Gamma^-$ (B) $O^{2-}$ (C) $C\Gamma^-$ (D) $F^-$ (E) $Br^-$ (1) Which equation correctly represents the electron affinity of calcium? (A) Ca (g) $\rightarrow$ Ca <sup>+</sup> (g) + e <sup>-</sup> (B) Ca (g) $\rightarrow$ Ca <sup>+</sup> (g) + e <sup>-</sup> (C) Ca (g) $\rightarrow$ Ca <sup>-</sup> (g) (Ca <sup>+</sup> (g) + e <sup>-</sup> (C) Ca (g) $\rightarrow$ Ca <sup>-</sup> (g) (Ca <sup>+</sup> (g) + e <sup>-</sup> (C) Ca <sup>+</sup> (g) + e <sup>-</sup> $\rightarrow$ Ca (g) (12) Transition metals within a period differ mainly in the number of electrons. (A) P (B) S (C) f (D) d (C) Ca <sup>+</sup> (C) (C) Ca <sup>+</sup> (C						
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A) I <sup>-</sup> B) O <sup>2-</sup> C) Cl <sup>-</sup> D) F <sup>-</sup> E) Br <sup>-</sup> (1) Which equation correctly represents the electron affinity of calcium? (11) (A) Ca (g) $\rightarrow$ Ca <sup>+</sup> (g) + e <sup>-</sup> B) Ca (g) $\rightarrow$ Ca <sup>-</sup> (g) + e <sup>-</sup> C (a) Ca (g) $\rightarrow$ Ca <sup>-</sup> (g) + e <sup>-</sup> D) Ca <sup>-</sup> (g) $\rightarrow$ Ca (g) + e <sup>-</sup> E) Ca <sup>+</sup> (g) + e <sup>-</sup> $\rightarrow$ Ca (g) (12) Transition metals within a period differ mainly in the number of electrons. (12) A) p B) s C) f (D) d E) all of the above (A) Ca <sup>+</sup> $\checkmark$ B) Br <sup>-</sup> $\vee$ C) Rb <sup>+</sup> $\checkmark$ D) Xe $\checkmark$	A) Si	(B) Mg	C) Na	D) P	E) Al	
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$(A) Ca (g) \rightarrow Ca^{+} (g) + e^{-}$ $B) Ca (g) + e^{-} \rightarrow Ca^{-} (g)$ $C) Ca (g) \rightarrow Ca^{-} (g) + e^{-}$ $D) Ca^{-} (g) \rightarrow Ca (g) + e^{-}$ $E) Ca^{+} (g) + e^{-} \rightarrow Ca (g)$ $(12) Transition metals within a period differ mainly in the number of electrons. (12) A) p B) s C) f (D) d E) all of the above (13) Which of the following does not have eight valence electrons? (13) (A) Ca^{+} \times B) Br- \vee C) Rb+ \vee D) Xe \vee$	11) 1471-1			the of an latera ?		11)
B) $Ca (g) + e^{-} \rightarrow Ca^{-} (g)$ C) $Ca (g) \rightarrow Ca^{-} (g) + e^{-}$ D) $Ca^{-} (g) \rightarrow Ca (g) + e^{-}$ E) $Ca^{+} (g) + e^{-} \rightarrow Ca (g)$ 12) Transition metals within a period differ mainly in the number of electrons. 12) A) p B) s C) f (D) d E) all of the above 13) Which of the following does <u>not</u> have eight valence electrons? 13) (A) $Ca^{+} \checkmark$ B) $Br^{-} \lor$ C) $Rb^{+} \lor$ D) $Xe \lor$						11)
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C) Ca (g) $\rightarrow$ Ca (g) + e <sup>-</sup> D) Ca <sup>-</sup> (g) $\rightarrow$ Ca (g) + e <sup>-</sup> E) Ca <sup>+</sup> (g) + e <sup>-</sup> $\rightarrow$ Ca (g) 12) Transition metals within a period differ mainly in the number of electrons. 12) A) p B) s C) f (D) d E) all of the above 13) Which of the following does <u>not</u> have eight valence electrons? 13) (A) Ca <sup>+</sup> $\checkmark$ B) Br <sup>-</sup> $\vee$ C) Rb <sup>+</sup> $\vee$ D) Xe $\vee$	B) Ca (g) + e	$e^- \rightarrow Ca^-(g)$	21			
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<ul> <li>D) d</li> <li>E) all of the above</li> <li>13) Which of the following does <u>not</u> have eight valence electrons?</li> <li>13)</li> <li>(A) Ca+ ×</li> <li>B) Br<sup>-</sup> ∨</li> <li>C) Rb<sup>+</sup> ∨</li> <li>D) Xe ∨</li> </ul>						
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(A) Ca <sup>+</sup> × B) Br <sup>-</sup> $\vee$ C) Rb <sup>+</sup> $\vee$ D) Xe $\vee$	E) all of the a	above				
B) Br <sup>-</sup> $\vee$ C) Rb <sup>+</sup> $\vee$ D) Xe $\vee$	13) Which of the fo	ollowing does not ha	ave eight valence el	ectrons?		13) A
B) Br <sup>-</sup> $\vee$ C) Rb <sup>+</sup> $\vee$ D) Xe $\vee$	AVCa+ X					
C) Rb <sup>+</sup> $\lor$ D) Xe $\lor$	0					
D) Xe 🗸						
E) All of the above have eight valence electrons.	,					
	E) All of the	above have eight va	dence electrons.			

	-					
	14) In which of the molecules below is the carbon-carbon distance the shortest?	14) 👱				
	A) H <sub>3</sub> C-CH <sub>3</sub>					
	B) $H_2C=C=CH_2$					
	C) H <sub>3</sub> C-CH <sub>2</sub> -CH <sub>3</sub>					
	D) $H_2C=CH_2$					
	(E)/H-C≡C-H					
	4+3+4+2+7= 20					
	15) There are valence electrons in the Lewis structure of CH3CH2Cl.	15) D				
	A) 10 B) 14 C) 18 D) 20 E) 12					
	16) To convert from one resonance structure to another,	16) C				
	A) electrons and atoms can both be moved	12 12				
	B) only atoms can be moved					
	C) only electrons can be moved					
	D) neither electrons nor atoms can be moved					
	E) electrons must be added					
		T				
	17) Of the bonds C-N, C=N, and C=N, the C-N bond is	17)				
	A) intermediate in both strength and length					
	B) strongest/longest					
	C) weakest/shortest					
	D)weakest/longest					
	E) strongest/shortest					
		10) C				
	18) Of the possible bonds between carbon atoms (single, double, and triple),	18)				
	A) a single bond is stronger than a double bond $\times$ B) a triple bond is longer than a single bond $\times$					
	(C) a double bond is longer than a triple bond					
	D) a single bond is stronger than a triple bond $\times$					
	E) a double bond is stronger than a triple bond $\times$					
	19) Gaseous mixtures	19) D				
	A) can only contain isolated atoms					
	B) are all heterogeneous					
	C) can only contain molecules					
	D) are all homogeneous					
	E) must contain both isolated atoms and molecules					
		20) A				
	20) The molar volume of a gas at STP is L.         (A) 22.4       B) 0.08206       C) 62.36       D) 1.00       E) 14.7	20) _/				
	(A) 22.4         B) 0.08206         C) 62.36         D) 1.00         E) 14.7					
TRI	JE/FALSE. On scantron, choose "A" for a true answer and "B" for wrong answer. (3 pts each)					
	21) Possible shapes of AB3 molecules are linear, trigonal planar, and T-shaped.					
		21) <u>F</u> F 22) <u>F</u>				
	22) If the temperature is lowered from 60°C to 30°C, the volume of a fixed amount of gas will be	22) _ + +				
	one half the original volume. $\bigvee \propto \neg$	а <sup>- П</sup>				

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