

Practice Exam # 3B

Printed Name: _____

Signature: _____

CHEMISTRY 1410

THIRD EXAM

100 POINTS

Each multiple choice question is worth 3 points. Read each question very carefully. The four numerical questions on the exam are worth 10 points each. Be sure to show your work on the numerical problems as partial credit will be based upon the work shown. **NOTE: TO RECEIVE PARTIAL CREDIT FOR ANY NUMERICAL PROBLEM, THE WORK SHOWN MUST BE CONSISTENT WITH THE ANSWER GIVEN!!**

MULTIPLE CHOICE: (60 Points) Each of following twenty multiple choice questions is worth 3 points. Circle the correct response.

QUESTION 1: Which of the following is a statement of Boyle's law?

- (a) At a fixed temperature and amount of gas, the volume is directly proportional to the pressure.
- (b) At a fixed temperature and amount of gas, the volume of a gas is inversely proportional to the pressure.
- (c) At a fixed pressure and amount of gas, the volume is inversely proportional to the absolute temperature.
- (d) At a fixed pressure and amount of gas, the volume is directly proportional to the absolute temperature.
- (e) Reacting gases combine and form products in simple proportions by volumes.

QUESTION 2: Which of the following is a statement of Avogadro's law.

- (a) At a fixed temperature and pressure, the volume of a gas is directly proportional to the number of molecules.
- (b) Reacting gases combine and form products in simple proportions by volumes.

(c) $V_{\text{total}} = V_{\text{gas 1}} + V_{\text{gas 2}} + V_{\text{gas 3}} + \dots$

(d) $P_{\text{total}} = P_{\text{gas 1}} + P_{\text{gas 2}} + P_{\text{gas 3}} + \dots$

(e) $(P + n^2 a/V^2)(V - n b) = n_{\text{gas}} RT$

QUESTION 3: At room temperature, HCl and NH₃ are both gases. Which of the following numerical values describes the relative velocity, which is defined as the ratio of the velocity of NH₃ gas divided by the velocity of HCl gas?

(a) 1.0, because all gases have the same velocity at the same temperature.

(b) 0.467

(c) 2.142

(d) 0.683

(e) 1.463

QUESTION 4: Which of the following sets of quantum numbers is NOT permitted.

(a) $n = 3, l = 2, m_l = 0$ and $s = 1/2$

(b) $n = 3, l = 3, m_l = -2$ and $s = 1/2$

(c) $n = 3, l = 1, m_l = 0$ and $s = -1/2$

(d) $n = 3, l = 2, m_l = -1$ and $s = -1/2$

(e) $n = 2, l = 1, m_l = -1$ and $s = 1/2$

QUESTION 5: Prince Louis-Victor de Broglie is remembered for

- (a) his assertion that wave-like properties were associated with all particles.
- (b) his statement that it is not possible to know precisely the position and momentum of an electron.
- (c) his discovery of the f-orbital.
- (d) his discovery of the neutron.
- (e) his proposal that neutron poor nuclei can undergo nuclear decay through either electron capture or beta emission.

QUESTION 6: The Pauli exclusion principle states that

- (a) charge on an electron is -1 and the mass of an electron is virtually zero.
- (b) is not possible to know precisely the position and momentum of an electron.
- (c) no two electrons in an atom can have the same four quantum numbers.
- (d) the atom is composed of subatomic particles, which are called protons, neutrons and electrons.
- (e) atoms can absorb only discrete wavelengths of light.

QUESTION 7: Which of the following sets of quantum numbers does **NOT** correspond to an electron in a d orbital.

- (a) $n = 3, l = 2, m_l = 0$ and $s = 1/2$
- (b) $n = 3, l = 2, m_l = -2$ and $s = 1/2$
- (c) $n = 4, l = 2, m_l = 0$ and $s = -1/2$
- (d) $n = 3, l = 2, m_l = -1$ and $s = -1/2$
- (e) $n = 4, l = 3, m_l = -1$ and $s = 1/2$

QUESTION 8: Schrodinger is remembered for

- (a) his statement that it is impossible to know the exactly the location and energy of the electron simultaneously.
- (b) his solution of the wave equation to obtain the various quantum numbers and shapes of the atomic orbitals.
- (c) his discovery of the proton.
- (d) his statement that no two electrons in an atom can have the same four quantum numbers.
- (e) his scattering experiments which lead to the discovery of the nucleus.

QUESTION 9: Heisenberg is remembered for

- (a) his assertion that wave-like properties were associated with all particles.
- (b) his statement that it is not possible to know precisely the position and momentum of an electron.

- (c) his discovery of the f-orbital.
- (d) his discovery of the neutron.
- (e) his proposal that neutron poor nuclei can undergo nuclear decay through either electron capture or beta emission.

QUESTION 10: One of the following statements pertaining to electronegativities is correct.

- (a) In general the electronegativity increases as one goes from left to right along a given row in the Periodic table, and also increases as one goes down a given column in the Periodic table.
- (b) In general the electronegativity increases as one goes from right to left along a given row in the Periodic table, and also increases as one goes down a given column in the Periodic table.
- (c) In general the electronegativity increases as one goes from left to right along a given row in the Periodic table, and also increases as one goes up a given column in the Periodic table.
- (d) In general the electronegativity increases as one goes from right to left along a given row in the Periodic table, and also increases as one goes up a given column in the Periodic table.
- (e) The electronegativity shows no periodic trends.

QUESTION 11: One of the following statements pertaining to ionization potentials is correct.

- (a) In general the ionization potential increases as one goes from left to right along a given row in the Periodic table, and also increases as one goes down a given column in the Periodic table.

- (b) In general the ionization potential increases as one goes from right to left along a given row in the Periodic table, and also increases as one goes down a given column in the Periodic table.
- (c) In general the ionization potential increases as one goes from left to right along a given row in the Periodic table, and also increases as one goes up a given column in the Periodic table.
- (d) In general the ionization potential increases as one goes from right to left along a given row in the Periodic table, and also increases as one goes up a given column in the Periodic table.
- (e) The ionization potential shows no periodic trends.

QUESTION 12: What is the volume occupied by one mole of an ideal gas at STP conditions?

- (a) 24.5 liters
- (b) 22.4 liters
- (c) 1 liter
- (d) 10 liters
- (e) correct answer is not given.

QUESTION 13: For an ideal gas, what would the sketch of Volume versus Kelvin Temperature look like at a constant pressure and number of moles?

- (a) The graph would be a hyperbola located in the first quadrant system as neither the volume nor absolute temperature can be negative.
- (b) The graph would be a parabola located in the first quadrant system as neither the volume nor absolute temperature can be negative.
- (c) Would be straight line of positive slope going through the origin.

- (d) Would be straight line of negative slope going through the origin.
- (e) Would be straight line of positive slope not going through the origin.

QUESTION 15: For an ideal gas, what would the sketch of Volume versus number of moles look like at a constant pressure and temperature?

- (a) The graph would be a hyperbola located in the first quadrant system as neither the volume nor number of moles can be negative.
- (b) The graph would be a parabola located in the first quadrant system as neither the volume nor number of moles can be negative.
- (c) Would be straight line of positive slope going through the origin.
- (d) Would be straight line of negative slope going through the origin.
- (e) Would be straight line of positive slope not going through the origin.

QUESTION 15: Which of the following electron configurations is not possible.

- (a) $1s^2 2s^2 2p^5 3s^1$
- (b) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$
- (c) $1s^2 2s^2$
- (d) $1s^2 2s^2 2p^5 3p^1$
- (e) $1s^2 2s^2 2p^6 3s^2 2d^1$

QUESTION 16: What are the possible numerical values of m_l for an f-orbital?

- (a) -1, 0, 1
- (b) -2, -1, 0, 1, 2

- (c) -3, -2, -1, 0, 1, 2, 3
- (d) Impossible to determine from the information given. One needs to also know the principal quantum number in order to answer the question.
- (e) Correct answer is not given.

QUESTION 17: Which of the following is the correct ground-state electron configuration for the Mn^{2+} cation.

- (a) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$
- (b) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^3$
- (c) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^7$
- (d) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$
- (e) The correct answer is not given.

QUESTION 18: What is the total number of electrons that can be accommodated in the atomic orbitals in the principal level $n = 4$.

- (a) 2 electrons
- (b) 6 electrons
- (c) 10 electrons
- (d) 14 electrons
- (e) 32 electrons

QUESTION 19: One of the following statements pertaining to atomic radius (atomic size) is correct.

- (a) In general the atomic radius increases as one goes from left to right along a given row in the Periodic table, and also increases as one goes down a given column in the Periodic table.
- (b) In general the atomic radius increases as one goes from right to left along a given row in the Periodic table, and also increases as one goes down a given column in the Periodic table.
- (c) In general the atomic radius increases as one goes from left to right along a given row in the Periodic table, and also increases as one goes up a given column in the Periodic table.
- (d) In general the atomic radius increases as one goes from right to left along a given row in the Periodic table, and also increases as one goes up a given column in the Periodic table.
- (e) The atomic radius shows no periodic trends.

QUESTION 20: Which of the following is a correct statement of Dalton's law of partial pressures?

- (a) At a fixed temperature and pressure, the volume of a gas is directly proportional to the number of molecules.
- (b) Reacting gases combine and form products in simple proportions by volumes.
- (c) $V_{\text{total}} = V_{\text{gas 1}} + V_{\text{gas 2}} + V_{\text{gas 3}} + \dots$
- (d) $P_{\text{total}} = P_{\text{gas 1}} + P_{\text{gas 2}} + P_{\text{gas 3}} + \dots$
- (e) $(P + n^2 a/V^2)(V - n b) = n_{\text{gas}} RT$

NUMERICAL AND NON-MULTIPLE CHOICE QUESTIONS:

Each numerical and non-multiple choice question is worth 10 points.

QUESTION 21: Give the ground state electron configurations for the following elements:

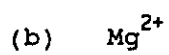
(a) Au

(b) Cr

(c) As

(d) Re

QUESTION 22: Give the ground state electron configurations for the following ions:



QUESTION 23: Phosgene is a highly toxic gas made up of carbon, oxygen and chlorine atoms. Its density at 1.05 atm and 25 °C is 4.24 grams/Liter. What is the molar mass of phosgene?

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QUESTION 24: A certain laser gas uses a gas mixture made up of 9.00 grams of HCl, 2.00 grams of H₂ and 165.0 grams of Ne. What pressure is exerted by the mixture in a 50.0 Liter tank at 100 °C?

IA	1	H	1.01																	2	He	4.00																																
	IIA																			VIIA																																		
	3	Li	6.94	4	Be	9.01																	9	F	19.00	10	Ne	20.18																										
	11	Na	23.00	12	Mg	24.31																	17	Cl	35.45	18	Ar	39.95																										
	19	K	39.10	20	Ca	40.08	IIIB		IVB		VB		VIB		VIIB		VIII		IIB		IIIA		IVA		VA		VIA		VIIA																									
	37	Rb	85.47	38	Sr	87.62	39	Y	88.91	40	Zr	91.22	41	Nb	92.91	42	Mo	95.94	43	Tc	(98)	44	Ru	101.07	45	Rh	102.91	46	Pd	106.42	47	Ag	107.87	48	Cd	112.41	49	In	114.82	50	Sn	118.69	51	Sb	121.75	52	Te	127.60	53	I	126.90	54	Xe	131.29
	55	Cs	132.91	56	Ba	137.33	57	La	138.91	72	Hf	178.49	73	Ta	180.94	74	W	183.85	75	Re	186.21	76	Os	190.20	77	Ir	192.22	78	Pt	195.08	79	Au	196.97	80	Hg	200.59	81	Tl	204.38	82	Pb	207.20	83	Bi	208.98	84	Po	(209)	85	At	(210)	86	Rn	(222)
	87	Fr	(223)	88	Ra	226.03	89	Ac	227.03	104	Uupf	(261)	105	Uupf	(262)	106	Uubf	(263)																																				

* Lanthanides

58	Ce	140.12	59	Pr	140.91	60	Nd	144.24	61	Pm	(145)	62	Sm	150.36	63	Eu	151.96	64	Gd	157.25	65	Tb	158.93	66	Dy	162.50	67	Ho	164.93	68	Er	167.26	69	Tm	168.93	70	Yb	173.04	71	Lu	174.97
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† Actinides

90	Th	232.04	91	Pa	231.04	92	U	238.03	93	Np	237.05	94	Pu	(244)	95	Am	(243)	96	Cm	(247)	97	Bk	(247)	98	Cf	(251)	99	Es	(252)	100	Fm	(257)	101	Md	(258)	102	No	(259)	103	Lr	(260)
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