Chem 1121
Spring 2012
Exam 5A

Name:_____

Multiple Choice. Select the best answer, and record your response on a scantron sheet.

Q1. [4 pts] Which of the following equations is Avogadro's law?
a) $p \propto V$ b) $V \propto T$ c) $V \propto n$ d) $p \propto 1/V$ e) $p \propto 1/T$

Q2. [4 pts] The partial pressure of a substance above its liquid is known as:
a) vapor pressure b) barometric pressure c) ideal pressure
d) boiling point e) osmotic pressure

Q3. [4 pts] A reaction that absorbs heat is called:
a) dynamic b) catalyzed c) explosive d) endothermic e) non-ideal

Q4. [4 pts] A reaction with a high activation energy will be:
a) fast b) slow c) exothermic

Q5. [4 pts] What can you say about a reaction at equilibrium:
a) the molecules are no longer reacting
b) the activation energy has been reduced to zero
c) the rate of the forward reaction is zero
d) the rate of the forward reaction equals the rate of the reverse reaction
e) Le Chatelier's principle no longer applies

Q6. [4 pts] What is the Arrhenius definition of a base:
a) proton donor b) proton acceptor c) releases H^+ in solution
d) releases OH^- in solution e) turns litmus blue

Q7. [4 pts] Which of the following molecules is probably a triprotic acid?
a) HC_2H_2O b) H_2SO_4 c) H_3PO_4 d) HCO_2H e) H_2CO_3

Q8. [4 pts] An aqueous solution at 25 ºC with $[H^+] = 1.0 \times 10^{-8}$ M is:
a) acidic b) neutral c) basic d) a buffer e) not enough information

Q9. [4 pts] What is the pOH of a solution if $[H^+] = 1.0 \times 10^{-6}$
a) 5.00 b) 6.00 c) 7.00 d) 8.00 e) 9.00

Q10. [4 pts] Which radioactive particle is strongly repelled by a negatively charged plate?
a) alpha b) beta c) gamma d) delta e) epsilon

Q11. [4 pts] Cobalt-60 ($^{60}_{27}\mathrm{Co}$)undergoes beta decay. What is the identity of the daughter atom formed?
a) $^{60}_{29}\mathrm{Cu}$ b) $^{64}_{29}\mathrm{Cu}$ c) $^{56}_{25}\mathrm{Mn}$ d) $^{61}_{27}\mathrm{Co}$ e) $^{60}_{28}\mathrm{Ni}$

Q12. [4 pts] Hydrogen-3 has a half life of approximately ten years. What percent of a sample of hydrogen-3 will remain after twenty years?

a) 100 % b) 50 % c) 25 % d) 10 % e) 0 %

Show all work to receive credit. You must use the factor-label (conversion-factor) method for all conversions. Be sure to show all units and write your answers using the correct number of significant figures or decimal places.

Q13. [10 pts] What volume will 23.4 g of $NH_3(g)$ occupy at a pressure of 1.20 atm and a temperature of –5 ºC?

Q14. [10 pts] Consider the following reaction at equilibrium:

$$2CH_4(g) + 2NO(g) \rightleftharpoons 2CO(g) + 2NH_3(g) + H_2(g) + \text{heat}$$

Which direction (left, right, or no change) will the equilibrium shift when:

a) The amount of NO(g) is decreased: _____

b) The pressure is increased: _____

c) The amount of $H_2(g)$ is decreased: _____

d) The temperature is increased: _____

e) The amount of CO(g) is increased: _____

Q15. [10 pts] Calculate the pH of the following solutions:

Be sure to show ALL work! Answers that do not show work will not receive any credit. ☹

a) 0.25 M $HNO_3(aq)$

b) 0.35 M $Mg(OH)_2(aq)$

c) 0.25 M $HC_2H_3O_2(aq)$, a weak acid that undergoes 3.0 % dissociation.

Q16. [10 pts] Write the balanced nuclear equation for the alpha-decay of Polonium-210.
(Polonium is element number 84, Po)

Q17. [5 pts] Carbonic acid, H_2CO_3 is a weak diprotic acid. What does diprotic mean? Write out chemical equations that show the dissociation reactions of carbonic acid in water.

Q18. [7 pts] What does a buffer do? How is it made?

BONUS Question:

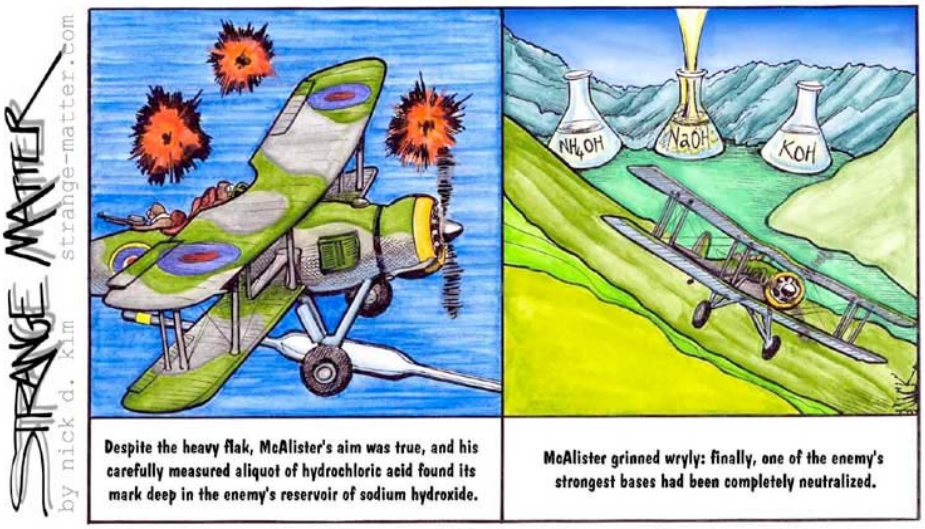
Explain why liquids boil at a lower temperature when atmospheric pressure is reduced?

Useful Information

1 atm = 760 mmHg = 760 torr = 101,325 Pa $P_1V_1=P_2V_2$ $\frac{V_1}{T_1}=\frac{V_2}{T_2}$ $\frac{P_1}{T_1}=\frac{P_2}{T_2}$ $T(\text{K}) = t(^\circ\text{C}) + 273$

$pV = nRT$ $R = 0.08206\ \text{L}\cdot\text{atm/mol}\cdot\text{K}$ $T(\text{K}) = t(^\circ\text{C}) + 273$

$\text{pH} = -\log_{10}[\text{H}^+]$ $[\text{H}^+] = 10^{-\text{pH}}$ $K_w = 1.0 \times 10^{-14} = [\text{H}^+][\text{OH}^-]$ (25°C)



Periodic Table

1 IA												13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1 **H** 1.01	2 IIA																2 **He** 4.00
3 **Li** 6.94	4 **Be** 9.01											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
11 **Na** 22.99	12 **Mg** 24.31	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9 VIIIB	10	11 IB	12 IIB	13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.07	17 **Cl** 35.45	18 **Ar** 39.95
19 **K** 39.1	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.88	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.69	29 **Cu** 63.55	30 **Zn** 65.39	31 **Ga** 69.72	32 **Ge** 72.61	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
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** 118.71	51 **Sb** 121.76	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.29
55 **Cs** 132.9	56 **Ba** 137.3	57 **La*** 138.9	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.9	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89 **Ac^** (227)	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (263)	107 **Bh** (264)	108 **Hs** (265)	109 **Mt** (268)	110 **Ds** (271)	111 **Rg** (272)							

*	58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0
^	90 **Th** 232.0	91 **Pa** (231)	92 **U** 238.0	93 **Np** (237)	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)