CLASS________________ TEST________________ DATE________________

SCANTRON ITEM ANALYSIS- QUESTIONS 1-25 Number of wrong responses

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CLASS AVERAGE	ITEM 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

PASS 1

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PART 1

IMPORTANT
- USE NO. 2 PENCIL ONLY
- MAKE DARK MARKS
- ERASE COMPLETELY TO CHANGE
- EXAMPLE: A B ● D E

TO USE SUBJECTIVE SCORE FEATURE:
- Mark total possible subjective points
- Only one mark per line on key
- 163 points maximum

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NAME	Exam 2 2017		
SUBJECT		TEST NO.	
DATE		PERIOD	

TEST RECORD	
PART 1	
PART 2	
TOTAL	

SUBJECTIVE SCORE INSTRUCTOR USE ONLY

KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Key	A	D	C	D	E	A	D	C	B	B	C	C	B	D	B	E

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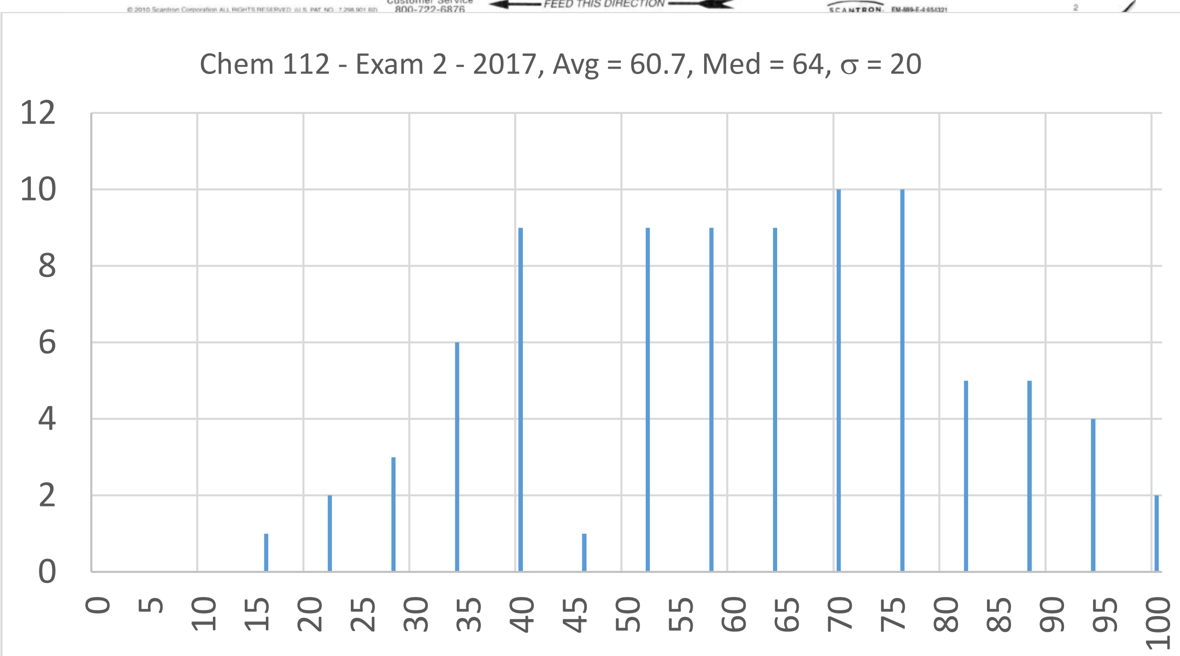


DO NOT OPEN THIS EXAM UNTIL YOU ARE INSTRUCTED TO DO SO

- Please print your name on the scantron
  - Last Name, First Name
  - That's all that's needed

- Sit in odd numbered seats.

- Books & Bags in the front of the room.

- No text entry calculators.

- Use the exams as scratch paper.

- Keep the exams when you are done.

- Turn in the scantrons.

100 total points. Questions 1-16 worth 6 points each. Question 17 worth 4 points.

Constants	R = 8.314 J/K-mol R = 0.0821 l-atm/K-mol	1 mole = 6.022 x 10^{23}	Faraday = 96,500 coulombs
Chem 111 Equations q = m Cs (ΔT)	**Gas Equations** $u = \sqrt{\frac{3RT}{M}}$	$(P+(n^2a/V^2))(V-nb)=nRT$	PV = nRT
Pythagorean Theorem:	$a^2 + b^2 = c^2$	**Volume of a cube:**	$V = l^3$
Henry's Law	$S = k_HP$		
Clausius-Clapeyron Equation	$\ln P = \frac{-\Delta H_{vap}}{RT} + b$	$\ln \frac{P_2}{P_1} = \frac{\Delta H_{vap}}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$	
Colligative Properties	π = MRT	$P_A = P_A^0X_A$ $\Delta P = P_A^0X_B$	
	$\Delta T_b = K_bc_m$	$\Delta T_f = K_fc_m$	
Chemical Kinetics $\ln[A]_t = -kt + \ln[A]_0$	$\frac{1}{[A]_t} = kt + \frac{1}{[A]_0}$	**Arrhenius Equation** $k = A\left(e^{-\frac{Ea}{RT}}\right)$	$\ln \frac{k_2}{k_1} = \frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)\backslash$
Chemical Equilibrium	aA + bB = cC + dD	$K_C = \frac{[C]^c[D]^d}{[A]^a[B]^b}$	$K_p = K_c(RT)^{\Delta n}$
pH pH = - log [H^+]	antilog(x) = 10^x pX = - log X	$K_aK_b = K_w$	Henderson-Hasselbach Eqn $pH = pK_a + \log\frac{[base]}{[acid]}$
Quadratic formula	$ax^2 + bx + c = 0$	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	
Chemical Thermodynamics	$\Delta U = q + w$	$w = -P\Delta V$	$\Delta G = \Delta H - T\Delta S$
	$\Delta G = \Delta G^0 + RT \ln Q$	$\Delta G^0 = -RT \ln K$	$\Delta G^0 = -nFE_{cell}$
Electrochemistry	$E^0_{cell} = E^0_{cathode} - E^0_{anode}$	Nersnt Equation $E_{cell} = E^0_{cell} - \frac{RT}{nF}\ln Q$	At 298K $E_{cell} = E^0_{cell} - \frac{0.0592}{n}\log Q$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 **H** 1.008																	2 **He** 4.0026
3 **Li** 6.94	4 **Be** 9.0122											5 **B** 10.81	6 **C** 12.011	7 **N** 14.007	8 **O** 15.999	9 **F** 18.998	10 **Ne** 20.180
11 **Na** 22.990	12 **Mg** 24.305											13 **Al** 26.982	14 **Si** 28.085	15 **P** 30.974	16 **S** 32.06	17 **Cl** 35.45	18 **Ar** 39.948
19 **K** 39.098	20 **Ca** 40.078	21 **Sc** 44.956	22 **Ti** 47.867	23 **V** 50.942	24 **Cr** 51.996	25 **Mn** 54.938	26 **Fe** 55.845	27 **Co** 58.933	28 **Ni** 58.693	29 **Cu** 63.546	30 **Zn** 65.38	31 **Ga** 69.723	32 **Ge** 72.630	33 **As** 74.922	34 **Se** 78.97	35 **Br** 79.904	36 **Kr** 83.798
37 **Rb** 85.468	38 **Sr** 87.62	39 **Y** 88.906	40 **Zr** 91.224	41 **Nb** 92.906	42 **Mo** 95.95	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** 127.60	53 **I** 126.90	54 **Xe** 131.29
55 **Cs** 132.91	56 **Ba** 137.33	57-71 *	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.84	75 **Re** 186.21	76 **Os** 190.23	77 **Ir** 192.22	78 **Pt** 195.08	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.38	82 **Pb** 207.2	83 **Bi** 208.98	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89-103 #	104 **Rf** (265)	105 **Db** (268)	106 **Sg** (271)	107 **Bh** (270)	108 **Hs** (277)	109 **Mt** (276)	110 **Ds** (281)	111 **Rg** (280)	112 **Cn** (285)	113 **Nh** (286)	114 **Fl** (289)	115 **Mc** (289)	116 **Lv** (293)	117 **Ts** (294)	118 **Og** (294)

* Lanthanide series	57 **La** 138.91	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** 173.05	71 **Lu** 174.97
# Actinide series	89 **Ac** (227)	90 **Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	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** (262)

1) The presence of a non-volatile solute will do which of the following to the boiling point of a solvent? [1]

a) increase BP
b) decrease BP
c) may increase or decrease BP
d) does not effect BP

2) At the melting point of a solid which of the following statements is true about its vapor pressure? [2]

a) the VP of the liquid is 1 atm
b) the VP of the solid is 1 atm
c) the VP of the liquid is less than the solid's VP
d) the VP of the liquid is equal to the solid's VP
e) the VP of gas is greater than 1 atm

3) A 2.50 molal solution of glycerine (MW = 92.11) in water has a density of 1.23 g/mL. Calculate the mass percentage of glycerine in this solution. [3]

a) 15.8%
b) 16.8%
c) 18.7%
d) 20.0 %
e) 21.1%

4) The solubility of CO_2 in water at 20 ^{0}C is 8.67 x 10^{-3} M when the partial pressure of CO_2 is 0.50 atm. What is the solubility of CO_2 when the partial pressure above the solution is 5.2 atm? [4]

a) 0.00012 M
b) 0.00083 M
c) 0.044 M
d) 0.090 M
e) 0.0121 M

5) Given the data in the table below, determine the rate law for the following reaction. [5]

$2Hg^{2+}(aq) + C_2O_4^{2-}(aq) \rightarrow 2CO_2^{2-}(aq) + Hg_2^{2+}(aq)$

$[Hg^{2+}]$	$[C_2O_4^{2-}]$	Initial rate (M/s)
0.10	0.10	1.2 x 10^{-7}
0.10	0.20	4.8 x 10^{-7}
0.20	0.20	9.6 x 10^{-7}

a) rate = k $[Hg^{2+}][C_2O_4^{2-}]$
b) rate = k $[Hg^{2+}]^2[C2O4^{2-}]$
c) rate = k $[Hg^{2+}][C_2O_4^{2-}]^3$
d) rate = k $[Hg^{2+}]^{3/2}[C_2O_4^{2-}]$
e) rate = k $[Hg^{2+}][C_2O_4^{2-}]^2$

6) The following reaction mechanism would indicate which of the following rate law? [6]

$NO + O_2 = NO_3$ fast equilibrium
$NO_3 + NO \rightarrow 2NO_2$ slow

a) rate = k $[NO]^2[O_2]$
b) rate = k $[NO][O_2]$
c) rate = k $[NO]^{1/2}[O_2]$
d) rate = k $[NO]^2$
e) rate = k $[O_2]$

7) A first order reaction expected to be a linear relationship if the following is plotted. [7]

a) 1/[A]t vs. t
b) [A]t vs. t
c) $1/[A]t^2$ vs. t
d) ln[A]t vs. t
e) 1/[A]t vs. 1/t

8) The half-life of a second order reaction is [8]

a) ln(k)
b) ln2/k
c) $1/[A]_0k$
d) 1/k
e) $[A]_0k$

9) Calculate the freezing point of a solution that is made by mixing equal volumes of antifreeze (ethylene glycol, $C_2H_6O_2$) and water. [9]

Ethylene Glycol: density = 1.12 g/cm^3, MW = 62 g/mol
Water: density = 1.00 g/cm^3
K_f (H_2O) = 1.86 ^{0}C/m

a) -10.6 ^{0}C
b) -33.7 ^{0}C
c) -14.5 ^{0}C
d) -2.1 ^{0}C
e) -42.5 ^{0}C

10) Diamond crystalizes in a cubic lattice with an edge length of 357 pm. If there are a total of 8 carbon atoms in the unit cell, what is the density of diamond? [10]

a) 12.9 g/cm^3
b) 3.54 g/cm^3
c) 8.26 g/cm^3
d) 2.26 g/cm^3
e) 6.20 g/cm^3

11) Which type of bonding does Ca form upon solidification? [11]

a) covalent network
b) ionic
c) metallic
d) molecular
e) ion-dipole

12] Which of the following compounds will be most soluble in ethanol (CH_3CH_2OH)? [12]

a) trimethylamine ($N(CH_3)_3$)
b) acetone (CH_3COCH_3)
c) ethylene glycol ($HOCH_2CH_2OH$)
d) hexane ($CH_3CH_2CH_2CH_2CH_2CH_3$)
e) chloroform ($CHCl_3$)

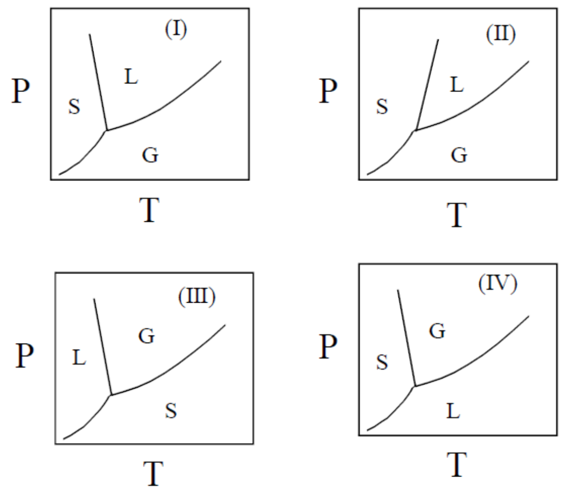
13] Which of the following statements is **true**? [13]

a) In general, the solubility of a solid in water decreases with increasing temperature.
b) In general, the solubility of a gas in water decreases with increasing temperature.
c) The solubility of a gas in water usually increases with decreasing pressure.
d) The solubility of an ionic solid in water decreases with increasing temperature.
e) None of the above statements are true.

14] Which of the following concentration units are temperature dependent? [14]

a) mole fraction
b) molality
c) mass percent
d) molarity
e) none of the above.

15] Which of the following diagrams would best describe the phase diagram of carbon dioxide? [15]



a) IV
b) II
c) I
d) III

16] A change in temperature from 10 °C to 20 °C is found to double the rate of a given chemical reaction. How did this change affect the reacting molecules? [16]

a) It doubled their average velocity.
b) It doubled their average energy.
c) It doubled the number of collisions per second.
d) It doubled the pressure inside the reaction vessel.
e) It doubled the proportion of molecules possessing at least the minimum energy required for the reaction.

17] My recitation meets at

a) 12:30 pm on Thursdays
b) blank
c) blank
d) 2:30 pm on Thursdays

Answers

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[1] a)

[2] d

[3] c) for 1 kg of solution: 2.50 mol/kg x 92.11g/mol gly. = 230.3 g gly.
Mass% = [230.3g/230.3+1000g] x 100 = 18.7%

[4] d) S = kP k = 8.67e-3M/0.50 atm = 1.734e-2 M/atm S = 1.734e-2(5.2 atm) = 0.090 atm

[5] e)

[6] a)
[7] d)
[8] c)
[9] b) assume 1 L of water and 1 L E.G.

	H_2O	EG
vol	1 L	1 L
mass	1000 g	1120 g
mol	55.5 mol	18.1 mol

molality EG = 18.1 mol/kg water $\Delta T = -k_f\underline{m} = -1.86\ ^0C/\underline{m}\ 18.1\ \underline{m} = -33.7\ ^0C$

[10] b
[11] c

[12] c
[13] b
[14] d
[15] b
[16] e