Chemistry 123
Final Exam

Spring 2006
June 15, 2006

Oregon State University
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DO NOT OPEN THIS EXAM UNTIL INSTRUCTED. CALCULATORS ARE NOT TO BE SHARED.

Instructions: You should have with you several number two pencils, an eraser, your 3" x 5" note card, a calculator, and your University ID Card. If you have notes with you, place them in a sealed backpack and place the backpack OUT OF SIGHT or place the notes directly on the table at the front of the room.

Fill in the front page of the Scantron answer sheet with your last name, first name, middle initial, and student identification number. **Leave the test form number and class section number blank.**

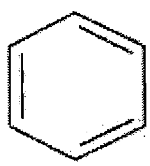
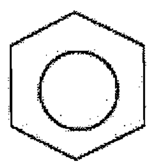
This exam consists of 36 multiple-choice questions. Each question has four points associated with it; except Question 36 which has five points associated with it. Select the best multiple-choice answer by filling in the corresponding circle on the rear page of the answer sheet. If you have any questions before the exam, please ask. If you have any questions during the exam, please ask the proctor. Open and start this exam when instructed. When finished, place your Scantron form in the appropriate stack. You may keep the exam packet, so please show your work and mark the answers you selected on it.

1 H Hydrogen 1.0079																	2 He Helium 4.0026
3 Li Lithium 6.941	4 Be Beryllium 9.01218											5 B Boron 10.81	6 C Carbon 12.011	7 N Nitrogen 14.0067	8 O Oxygen 15.9994	9 F Fluorine 18.9984	10 Ne Neon 20.179
11 Na Sodium 22.98977	12 Mg Magnesium 24.305											13 Al Aluminum 26.9815	14 Si Silicon 28.0855	15 P Phosphorus 30.97376	16 S Sulfur 32.06	17 Cl Chlorine 35.453	18 Ar Argon 39.948
19 K Potassium 39.0983	20 Ca Calcium 40.08	21 Sc Scandium 44.9559	22 Ti Titanium 47.88	23 V Vanadium 50.9415	24 Cr Chromium 51.996	25 Mn Manganese 54.9380	26 Fe Iron 55.847	27 Co Cobalt 58.9332	28 Ni Nickel 58.70	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.72	32 Ge Germanium 72.59	33 As Arsenic 74.9216	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.9059	40 Zr Zirconium 91.22	41 Nb Niobium 92.9064	42 Mo Molybdenum 95.94	43 Tc Technetium 98.906	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.9055	46 Pd Palladium 106.4	47 Ag Silver 107.868	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.69	51 Sb Antimony 121.75	52 Te Tellurium 127.60	53 I Iodine 126.9045	54 Xe Xenon 131.30
55 Cs Cesium 132.9054	56 Ba Barium 137.33	57–71 *Rare earths	72 Hf Hafnium 178.49	73 Ta Tantalum 180.9479	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.2	77 Ir Iridium 192.22	78 Pt Platinum 195.09	79 Au Gold 196.9665	80 Hg Mercury 200.59	81 Tl Thallium 204.37	82 Pb Lead 207.2	83 Bi Bismuth 208.9804	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
87 Fr Francium (223)	88 Ra Radium 226.0254	89–103 †Actinides	104 Rf Rutherfordium (261)	105 Ha Hahnium (262)	106 Sg Seaborgium (263)	107 Ns Neilsbohrium (262)	108 Hs Hassium (265)	109 Mt Meitnerium (266)	110 ‡ (269)	111 ‡			114				

57 La Lanthanium 138.9055	58 Ce Cerium 140.12	59 Pr Praseodymium 140.9077	60 Nd Neodymium 144.24	61 Pm Promethium 145	62 Sm Samarium 150.4	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.9254	66 Dy Dysprosium 162.50	67 Ho Holmium 164.9304	68 Er Erbium 167.26	69 Tm Thulium 168.9342	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
89 Ac Actinium 227.0278	90 Th Thorium 232.0381	91 Pa Protactinium 231.0359	92 U Uranium 238.029	93 Np Neptunium 237.0482	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (254)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium 259	103 Lr Lawrencium 262

Reduction Half-Reaction	E°, volt
Acidic Solution	
$F_2(g) + 2e^- \rightarrow 2F^-(aq)$	+2.866
$O_3(g) + 2H^+(aq) + 2e^- \rightarrow O_2(g) + H_2O(l)$	+2.075
$S_2O_8^{2-}(aq) + 2e^- \rightarrow 2SO_4^{2-}(aq)$	+2.01
$H_2O_2(aq) + 2H^+(aq) + 2e^- \rightarrow 2H_2O(l)$	+1.763
$MnO_4^-(aq) + 8H^+(aq) + 5e^- \rightarrow Mn^{2+}(aq) + 4H_2O(l)$	+1.51
$PbO_2(s) + 4H^+(aq) + 2e^- \rightarrow Pb^{2+}(aq) + 2H_2O(l)$	+1.455
$Cl_2(g) + 2e^- \rightarrow 2Cl^-(aq)$	+1.358
$Cr_2O_7^{2-}(aq) + 14H^+(aq) + 6e^- \rightarrow 2Cr^{3+}(aq) + 7H_2O(l)$	+1.33
$MnO_2(s) + 4H^+(aq) + 2e^- \rightarrow Mn^{2+}(aq) + 2H_2O(l)$	+1.23
$O_2(g) + 4H^+(aq) + 4e^- \rightarrow 2H_2O(l)$	+1.229
$2IO_3^-(aq) + 12H^+(aq) + 10e^- \rightarrow I_2(s) + 6H_2O(l)$	+1.20
$Br_2(l) + 2e^- \rightarrow 2Br^-(aq)$	+1.065
$NO_3^-(aq) + 4H^+(aq) + 3e^- \rightarrow NO(g) + 2H_2O(l)$	+0.956
$Ag^+(aq) + e^- \rightarrow Ag(s)$	+0.800
$Fe^{3+}(aq) + e^- \rightarrow Fe^{2+}(aq)$	+0.771
$O_2(g) + 2H^+(aq) + 2e^- \rightarrow H_2O_2(aq)$	+0.695
$I_2(s) + 2e^- \rightarrow 2I^-(aq)$	+0.535
$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$	+0.340
$SO_4^{2-}(aq) + 4H^+(aq) + 2e^- \rightarrow 2H_2O(l) + SO_2(g)$	+0.17
$Sn^{4+}(aq) + 2e^- \rightarrow Sn^{2+}(aq)$	+0.154
$S(s) + 2H^+(aq) + 2e^- \rightarrow H_2S(g)$	+0.14
$2H^+(aq) + 2e^- \rightarrow H_2(g)$	0
$Pb^{2+}(aq) + 2e^- \rightarrow Pb(s)$	-0.125
$Sn^{2+}(aq) + 2e^- \rightarrow Sn(s)$	-0.137
$Co^{2+}(aq) + 2e^- \rightarrow Co(s)$	-0.277
$Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$	-0.440
$Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$	-0.763
$Al^{3+}(aq) + 3e^- \rightarrow Al(s)$	-1.676
$Mg^{2+}(aq) + 2e^- \rightarrow Mg(s)$	-2.356
$Na^+(aq) + e^- \rightarrow Na(s)$	-2.713
$Ca^{2+}(aq) + 2e^- \rightarrow Ca(s)$	-2.84
$K^+(aq) + e^- \rightarrow K(s)$	-2.924
$Li^+(aq) + e^- \rightarrow Li(s)$	-3.040
Basic Solution	
$O_3(g) + H_2O(l) + 2e^- \rightarrow O_2(g) + 2OH^-(aq)$	+1.246
$OCl^-(g) + H_2O(l) + 2e^- \rightarrow Cl^-(aq) + 2OH^-(aq)$	+0.890
$O_2(g) + 2H_2O(l) + 4e^- \rightarrow 4OH^-(aq)$	+0.401
$2H_2O(l) + 2e^- \rightarrow H_2(g) + 2OH^-(aq)$	-0.828

Selected Functional Groups:

Name	Condensed Formula	Description
alkene	$R_2C{=}CR_2$	contains a C=C double bond
alkyne	RC≡CR	contains a C≡C triple bond
alcohol	ROH	contains O singly bonded to a C and a H
thiol (thiol alcohol)	RSH	contains S singly bonded to a C and a H
Disulfide	SS	contains S singly bonded to an S
ether	ROR	contains O singly bonded to two C
aldehyde	RCHO	contains C doubly bonded to O and singly to H
ketone	RCOR	contains C doubly bonded to O and singly to two C
hemiacetal	ROCOHR	contains C singly bonded to O of ether and of alcohol
carboxylic acid	RCOOH	contains C doubly bonded to O and singly to O of OH
ester	RCOOR	contains C doubly bonded to O and singly to O
amine	N	contains N bonded to C and/or H
amide	RCONR	contains C doubly bonded to O and singly to N
aromatic	 or 	contains a flat six-member ring

Possibly Useful Information:

$K_a[HCOOH\ (aq)] = 1.80 \times 10^{-4}$

$K_a[CH_2ClCOOH\ (aq)] = 1.40 \times 10^{-3}$

$K_a[CH_3COOH\ (aq)] = 1.80 \times 10^{-5}$

$K_a[C_9H_8O_4\ (aq)] = 3.0 \times 10^{-4}$

$K_a[NH_4^+\ (aq)] = 5.6 \times 10^{-10}$

1 Amp = 1 Coulomb/second

$K_a[C_6H_5COOH\ (aq)] = 6.30 \times 10^{-5}$

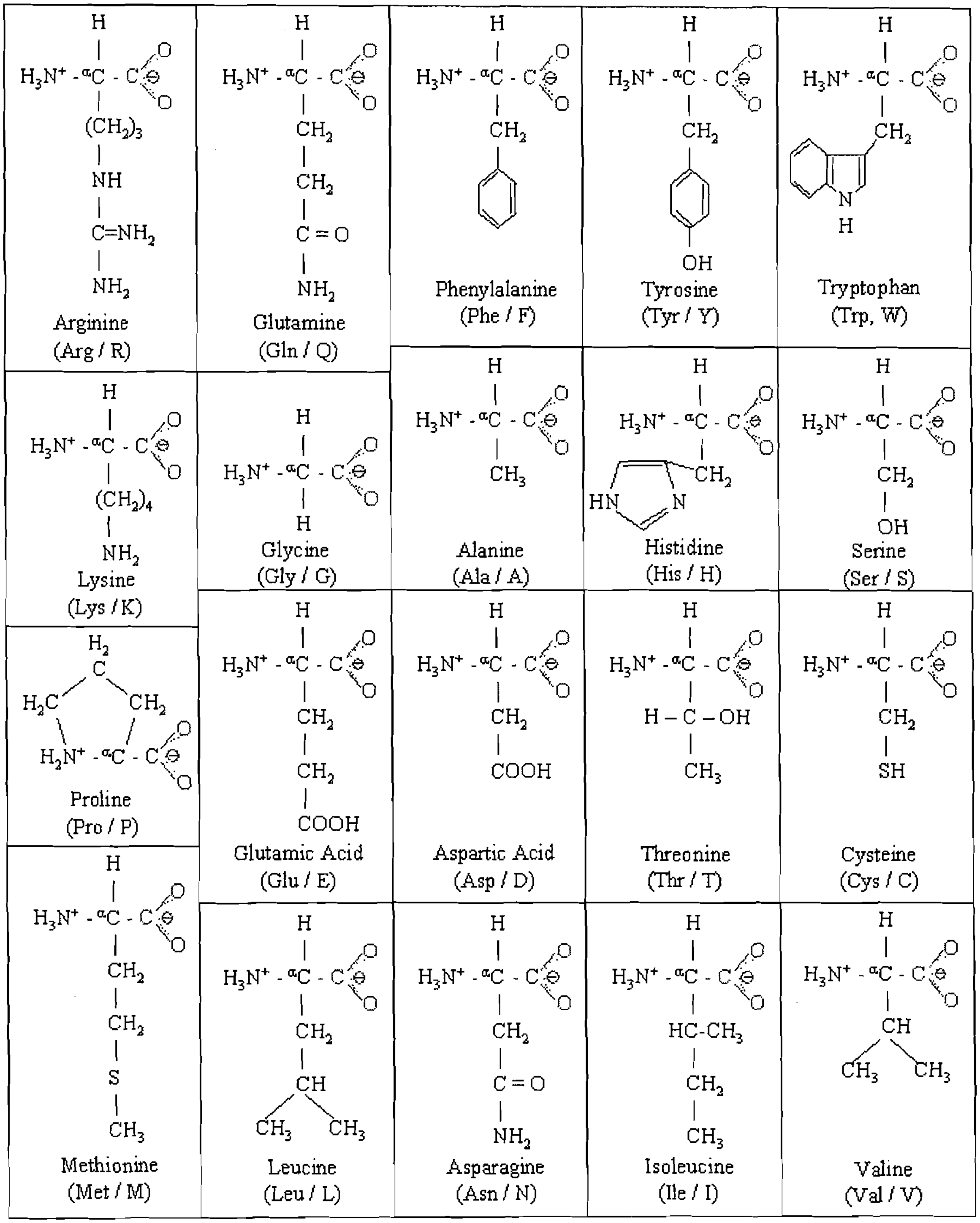
$K_b[NH_3\ (aq)] = 1.80 \times 10^{-5}$

$K_a[C_6H_8O_6\ (aq)] = 8.00 \times 10^{-5}$

$R = 8.314\ J/mol \cdot K$

$F = 96{,}485$ Coulombs/mole e^-

$N_A = 6.02 \times 10^{23}$


Arginine
(Arg / R)
Glutamine
(Gln / Q)
Phenylalanine
(Phe / F)
Tyrosine
(Tyr / Y)
Tryptophan
(Trp, W)
Lysine
(Lys / K)
Glycine
(Gly / G)
Alanine
(Ala / A)
Histidine
(His / H)
Serine
(Ser / S)
Proline
(Pro / P)
Glutamic Acid
(Glu / E)
Aspartic Acid
(Asp / D)
Threonine
(Thr / T)
Cysteine
(Cys / C)
Methionine
(Met / M)
Leucine
(Leu / L)
Asparagine
(Asn / N)
Isoleucine
(Ile / I)
Valine
(Val / V)

1. The pH of 0.250 M nitric acid, HNO_3 (aq), is:

(A) 0.250
(B) 1.250
(C) 0.602
(D) 12.75
(E) 13.40

$HNO_3(aq) \xrightarrow{100\%} H^+(aq) + NO_3^-(aq)$

↑ 0.250 M

$pH = -\log[H^+] = -\log(0.250) = 0.602$

2. The pH of 0.330 M chloroacetic acid, $CH_2ClCOOH$ (aq), is:

(A) 13.52
(B) 0.482
(C) 3.34
(D) 1.67
(E) 0.0215

$CH_2ClCOOH(aq) \rightleftharpoons CH_2ClCOO^-(aq) + H^+(aq)$

0.300 M − x   x   x

$K_a = 1.40 \times 10^{-3} = \frac{x^2}{0.330 - x}$ out $x^2 = 4.62 \times 10^{-4}$

Front of exam $x = 0.0215$

$x = [H^+] = 0.0215$

$pH = -\log[H^+] = -\log(0.0215) = 1.67$

3. The pH of a buffer system which is
0.225 M CH_3CH_2COOH (aq) and 0.225 M CH_3CH_2COONa (aq) is 4.88.

The pH of a buffer system which is
0.450 M CH_3CH_2COOH (aq) and 0.225 M CH_3CH_2COONa (aq) is:

(A) 4.88
(B) greater than 4.88
(C) less than 4.88

More acid — lower pH

4. A student titrates 1.000 gram of KHP (potassium hydrogen phthalate MW=204.2 g/mol) to the equivalence point with 45.75 mL of NaOH (aq). The concentration of the NaOH solution is:

(A) 0.09733 M
(B) 0.1018 M
(C) 0.1070 M
(D) 4.671 M
(E) 9.342 M

$moles_{NaOH} = moles_{KHP}$

$M_{NaOH} V_{NaOH} = \frac{mass_{KHP}}{Molar\ Mass_{KHP}}$

$(M_{NaOH})(0.04575\ L) = \frac{1.000\ g}{204.2\ g/mol}$

$M_{NaOH} = 0.1070\ M$

5. The pH of 1.00 M sodium acetate, CH_3COONa (aq), is:

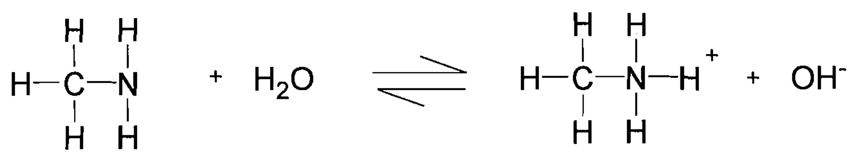
← Spectator Ion

↖ Base

(A) Greater than 7.00.
(B) Less than 7.00.
(C) 7.00.

$CH_3COO^-(aq) + H^+(aq) \rightleftharpoons CH_3COOH(aq)$

6. Methylamine (pictured below) has a lone pair of electrons on the nitrogen, can accept a proton, and is in equilibrium with methylammonium ion in water.



methylamine

methylammonium ion

Methylamine is:

(A) a strong acid
(B) a weak acid
(C) a strong base
(D) a weak base ← equilibrium, accepts a proton
(E) neither an acid or a base

7. Which of the following processes exhibits an increase in entropy of the system?

going to greater disorder

(A) $2\ NO_2\ (g) \rightarrow N_2O_4\ (g)$
(B) $NH_4NO_3\ (s) \rightarrow NH_4NO_3\ (aq)$ a solid dissolving
(C) $H_2O\ (g) \rightarrow H_2O\ (s)$
(D) $CH_3OH\ (g) \rightarrow CH_3OH\ (l)$
(E) $H_2O\ (l) \rightarrow H_2O\ (s)$

8. Which of the following statements is true?

(A) All endothermic processes which result in a system of greater disorder are spontaneous.
(B) All endothermic processes which result in a system of greater order are spontaneous.
(C) All exothermic processes which result in a system of greater disorder are spontaneous.
(D) All exothermic processes which result in a system of greater order are spontaneous.

$\Delta G = \Delta H - T\Delta S$

$(-) = (-) - (+)(+)$

$(-)$ Always if exothermic and greater disorder

spontaneous

9. $\Delta H = -144$ kJ and $\Delta S = -163$ J/K for a process. Determine the temperature in which the system is at equilibrium?

(A) 19.0 K
(B) 23.5 K
(C) 298 K
(D) 883 K
(E) 1900 K

$\Delta G = \Delta H - T\Delta S$

$0 = (-144\ kJ) - (T)(-0.163\ kJ/K)$

equilibrium

T = 883 K

10. The K_{sp} for PbI_2 is 7.14×10^{-9}. The solubility of PbI_2 is:

(A) 1.96×10^{-11} M
(B) 1.96×10^{-8} M
(C) 1.96×10^{-7} M
(D) 2.14×10^{-4} M
(E) 1.21×10^{-3} M

$PbI_2(s) \rightleftharpoons Pb^{2+}(aq) + 2I^-(aq)$

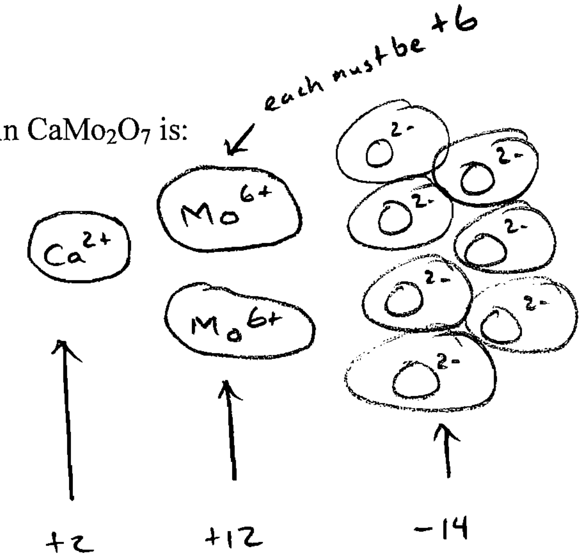
$K_{sp} = [Pb^{2+}][I^-]^2 = (x)(2x)^2 = 4x^3$

$7.14 \times 10^{-9} = 4x^3$

$x = \text{solubility} = 1.21 \times 10^{-3}$ M

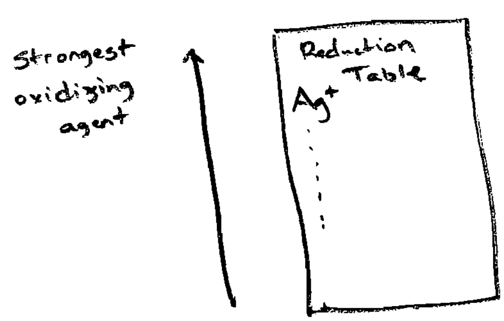
11. The oxidation number of each molybdenum in $CaMo_2O_7$ is:

(A) +2.
(B) +3.
(C) +4.
(D) +5.
(E) +6.



12. Consider Co^{2+} (aq), Pb^{2+} (aq), Cu^{2+} (aq), Ag^+ (aq), and Li^+ (aq). The strongest oxidizing agent is:

(A) Co^{2+} (aq).
(B) Pb^{2+} (aq).
(C) Cu^{2+} (aq).
(D) Ag^+ (aq).
(E) Li^+ (aq).



$Al^{3+} + 3e^- \rightarrow Al$

13. A student provides a current of 3.25 amps through an aqueous solution of $Al(NO_3)_3$ for 5.00 hours. The voltage is such that aluminum metal is deposited at the cathode. The mass of aluminum deposited is:

(A) 0.0909 g.
(B) 1.54 g.
(C) 2.73 g.
(D) 2.73 g.
(E) 5.45 g.

$5.00\,h \left(\frac{3600\,s}{1\,h}\right)\left(\frac{3.25\,C}{s}\right)\left(\frac{1\,mol\,e^-}{96{,}485\,C}\right)\left(\frac{1\,mol\,Al}{3\,mol\,e^-}\right)\left(\frac{26.98\,g\,Al}{1\,mol\,Al}\right) =$

amps

5.45 g Al

oxidized (lost e-)

14. Consider the reaction Zn (s) + Cu^{2+} (aq) → Zn^{2+} (aq) + Cu (s). Which of the following statements is **true**?

reduced (gained)

(A) Zn (s) is reduced, it is gaining electrons.
(B) Cu^{2+} (aq) is reduced, it is gaining electrons.
(C) Zn (s) is reduced, it is losing electrons.
(D) Cu^{2+} (aq) is reduced, it is losing electrons.

15. The calculated cell potential (voltage) for the 2 Li (s) + Cu^{2+} (aq) → 2 Li^+ (aq) + Cu (s) is:

(A) + 0.340 V
(B) + 2.700 V
(C) + 3.040 V
(D) + 3.380 V
(E) + 5.906 V

	E° (V)
$Cu^{2+} + 2e^- \rightarrow Cu^0$	+0.340
$Li^+ + 1e^- \rightarrow Li^0$	-3.040

difference is +3.380V

Do not multiply Li x 2 for voltage

16. Consider fuel cells. Which of the following is **false**?

(A) A hydrogen fuel cell produces energy.
(B) The hydrogen fuel cell demonstrated in class produced water.
(C) The hydrogen fuel cell demonstrated in class contains platinum to facilitate the process.
(D) The fuel cell consists of tiny chambers that allow hydrogen gas to explode.
(E) The hydrogen fuel cell demonstrated in class input hydrogen and oxygen gases.

17. When the reaction Fe (s) + $Cr_2O_7^{2-}$ (aq) → Cr^{2+} (aq) + Fe^{3+} (aq) is correctly balanced in acid,

(A) 3 protons (H^+) are consumed.
(B) 7 protons (H^+) are consumed.
(C) 8 protons (H^+) are consumed.
(D) 12 protons (H^+) are consumed.
(E) 42 protons (H^+) are consumed.

$8\times\{Fe^0 \rightarrow Fe^{3+} + 3e^-\}$

$3\times\{8e^- + 14H^+ + Cr_2O_7^{2-} \rightarrow 2Cr^{2+} + 7H_2O\}$

+12 +4

$8Fe^0 + 24e^- + 42H^+ + 3Cr_2O_7^{2-} \rightarrow 8Fe^{3+} + 24e^- + 6Cr^{2+} + 21H_2O$

18. When a beta particle is emitted,

(A) An electron is converted to a helium nucleus.
(B) A gamma ray is released.
(C) Two gamma rays are released.
(D) ~~A proton is converted to a neutron.~~
(E) A neutron is converted to a proton.

$n \rightarrow p + e^-$ (β)

19. Am-243 decays to produce a beta particle and ____________________.

(A) Cm-243
(B) ~~Am-242~~
(C) Am-245
(D) Np-243
(E) Np-241

$^{243}_{95}Am \rightarrow {}^{0}_{-1}\beta + {}^{243}_{96}Cm$

20. Ra-226 decays to produce an alpha particle and ____________________.

(A) Rn-222
(B) ~~Rn-226~~
(C) Fr-226
(D) Fr-222
(E) Po-222

$^{226}_{88}Ra \rightarrow {}^{4}_{2}\alpha + {}^{222}_{86}Rn$

21. A student obtains a sample of Sr-90 ($t_{1/2}$ = 28.5 years) containing 50,000 atoms. How long will it take for the sample to decay to 1880 atoms of Sr-90?

(A) 135 years
(B) ~~151 years~~
(C) 162 years
(D) 302 years
(E) 1880 years

① Calc k: $\ln\frac{1}{2} = -k(28.5\,y)$, $k = 0.0243\,y^{-1}$

② Calc t: $\ln\left(\frac{1880\text{ atoms}}{50{,}000\text{ atoms}}\right) = -(0.0243\,y^{-1})(t)$

$t = 135\,y$

22. A radioactive decay series that begins with ^{232}Th ends with formation of the stable nuclide ^{208}Bi. How many alpha particle emissions and how many beta particle emissions are involved in the sequence of radioactive decays?

(A) 7 alpha and 6 beta decays.
(B) 7 alpha and 5 beta decays.
(C) 7 alpha and 4 beta decays.
(D) 6 alpha and 2 beta decays.
(E) 6 alpha and 5 beta decays.

23. Considering the carbon cycle and radiocarbon dating, which of the following statements is **false**?

(A) The carbon-14 concentration in fossils is less than the carbon-14 concentration in you.
(B) Carbon-14 in living organisms does not undergo decay.
(C) Carbon-14 can be used to date specimens previously in the carbon cycle.
(D) Carbon-14 is generated in the upper atmosphere.

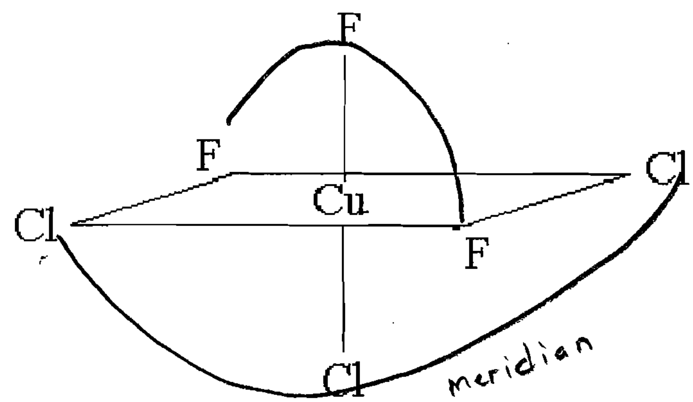
24. Which of the following is **NOT** a Lewis base is the presence of a transition metal ion?

(A) OH^-
(B) F^-
(C) H_2O
(D) NH_3
(E) CH_4

25. The coordination number for Co^{3+} in $[CoCl_4F_2]^{3-}$ is:

(A) 4
(B) 1
(C) 2
(D) 3
(E) 6

26. The complex:



(A) is cis-$[CuCl_3F_3]^{4-}$.
(B) is trans-$[CuCl_3F_3]^{4-}$.
(C) ~~is fac-$[CuCl_3F_3]^{4-}$.~~
(D) is mer-$[CuCl_3F_3]^{4-}$.
(E) is world-cup-fever-$[CuCl_3F_3]^{4-}$.

27. How many **unpaired** electrons are present in $[Mn(CN)_6]^{4-}$?
[Mn is the Mn^{2+} ion; CN is the CN^- ion; and the Mn^{2+} is **low spin**].

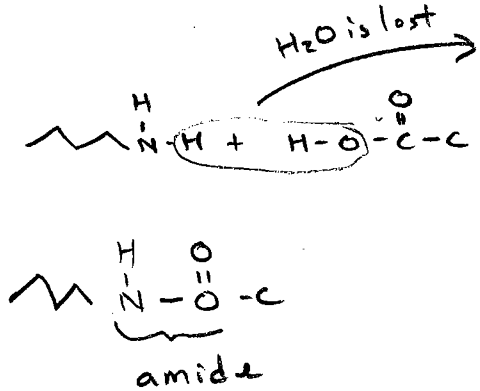
(A) 0
(B) 1
(C) 2
(D) 3
(E) 5

28. A compound having the chemical formula $C_{250}H_{500}$ is:

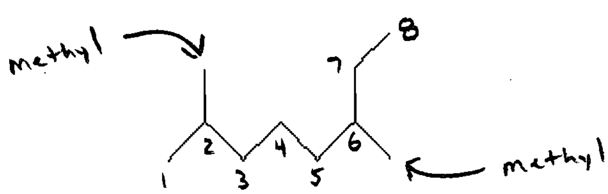
(A) an alkane
(B) an alkene
(C) an alkyne
(D) an aldehyde
(E) an alcohol

29. When an amine and a carboxylic acid react in a condensation reaction (such as two amino acids reacting):

(A) an ester is formed.
(B) an alkane is formed.
(C) an alkene is formed.
(D) an amide is formed.
(E) an alcohol is formed.

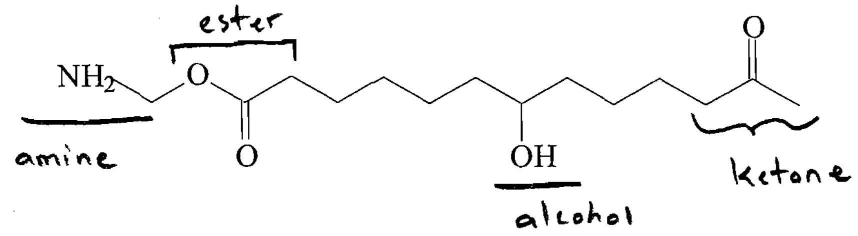


30. The systematic name of:



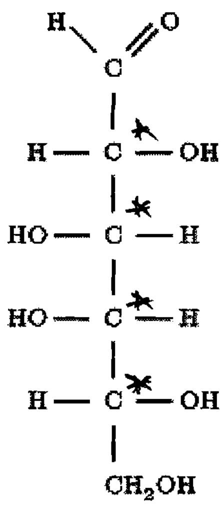
(A) is 5-isopropyl-2-ethylpentane
(B) is 2,6-dimethyloctane
(C) is 6-ethyl-2-methylheptane
(D) is 3-ethyl-6-dimethyloctane
(E) is 2-ethyl-6-methylheptane

31. Identify the functional groups in the following molecule:



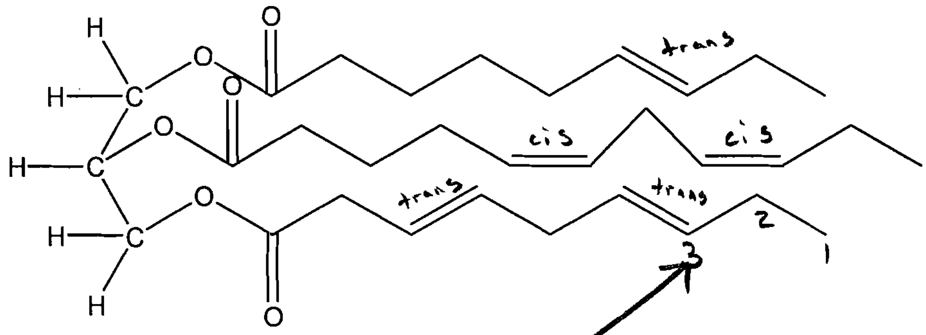
(A) aldehyde, alcohol, ester, amine
(B) aldehyde, alcohol, ether, amine
(C) carboxylic acid, amine, ether, alcohol
(D) ketone, alcohol, ester, amine
(E) ester, carboxylic acid, alcohol, amine

32. The following is the structure of galactose. Which of the following statements is **false:**



(A) The structure shows D- galactose
(B) Galactose is an aldohexose
(C) Galactose has 5 chiral carbons Only 4
(D) It can form [redacted] a ring structure
(E) It is a carbohydrate

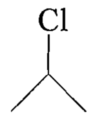
33. Consider the fat molecule below. Which of the following is **false**?

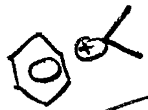


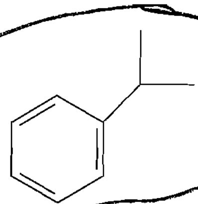
(A) It is an omega-3 fat
(B) It is unsaturated
(C) It contains cis bonds
(D) It contains trans bonds
(E) It could not occur naturally because the top carbon chain only has one double bond

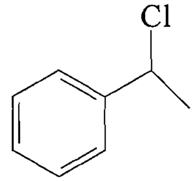
34. An isomer of 2-butanol is:

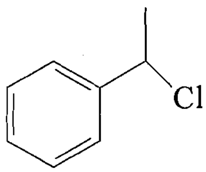
(A) 1-butanol
(B) 2-butane
(C) 2-methylbutane
(D) 1-methylbutane
(E) 2-methylpropane

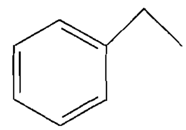
35. The organic product of benzene and  in the presence of $AlCl_3$ is:



(A) 

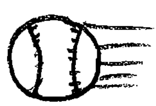
(C) 

(B) 

(D) 

36. OSU Softball went to the College World Series a couple of weeks ago. OSU Baseball is currently at the College World Series and begins play against Miami on Saturday afternoon. The eight teams vying for the championship are Clemson, Georgia Tech, Cal State Fullerton, North Carolina, Rice, Georgia, Oregon State, and Miami. Who do you predict to win?

(A) Oregon State
(B) Oregon State
(C) Oregon State
(D) Oregon State
(E) Oregon State



[Any response will receive full credit; even no response.]

Questions 1 through 35 have four points attached (140 total). Any response to Question 36 will receive full credit (5 Points); even no response. The point total for this exam is 145 points. See the grade sheet or CH 123 web syllabus for grade computation details. Final exam keys, scores, and course grades will be posted on the CH 123 website as they become available. Have a great life. Go out there and do some really cool stuff :)