Chemistry 123
Final Exam

Spring 2008
June 11, 2008

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.

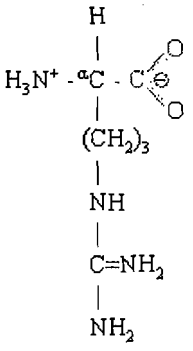
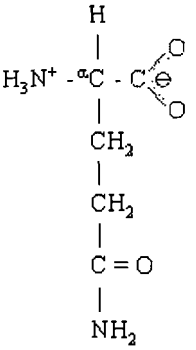
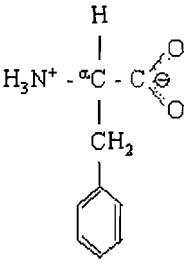
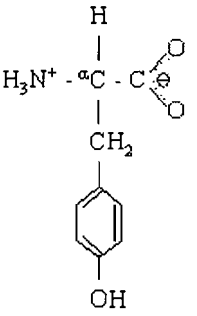
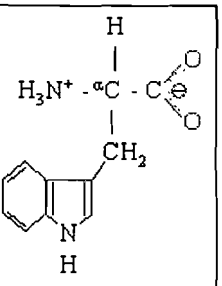
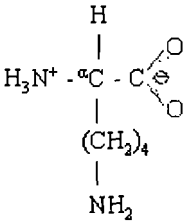
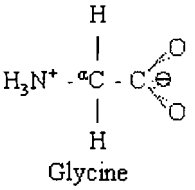
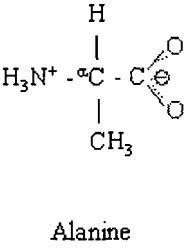
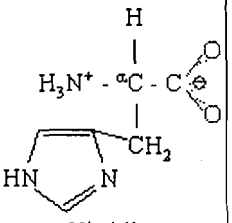
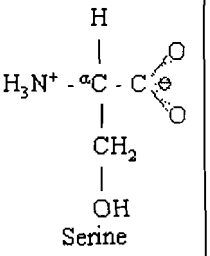
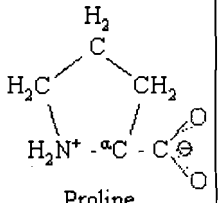
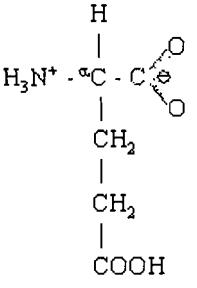
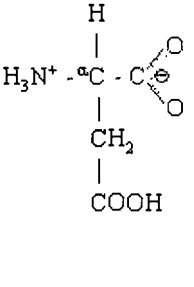
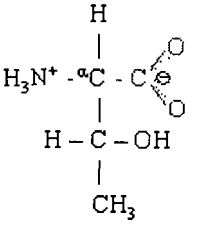
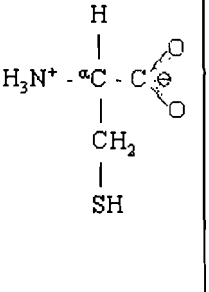
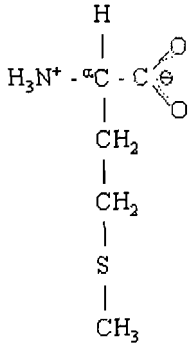
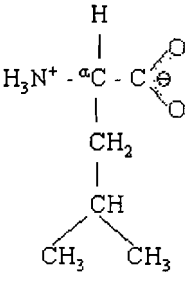
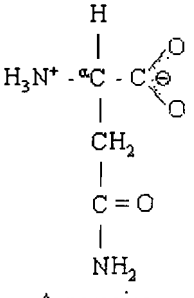
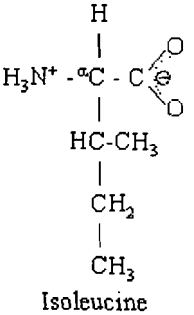
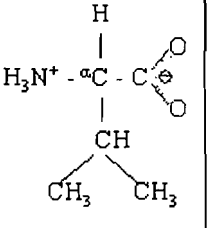
Fill in the front page of the Scantron answer sheet with your last name, first name, middle initial, and student identification number. **Leave the test form number and class section number blank.**

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.

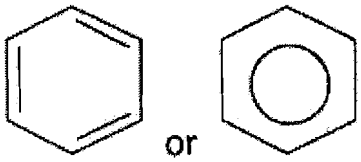
IA								VII				IIIA	IVA	VA	VIA	VIIA	VIIIA
1 H Hydrogen 1.0079																	2 He Helium 4.0026
3 Li Lithium 6.941	4 Be Beryllium 9.01218											5 B Boron 10.81	6 C Carbon 12.011	7 N Nitrogen 14.0067	8 O Oxygen 15.9994	9 F Fluorine 18.9984	10 Ne Neon 20.179
11 Na Sodium 22.98977	12 Mg Magnesium 24.305	IIIB	IVB	VB	VIB	VIIB				1B	IIB	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				→ Stable region?

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

 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)

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_{sp} [PbF_2, lead fluoride] = 3.6×10^{-8}

$K_a[C_6H_5COOH\ (aq)] = 6.30 \times 10^{-5}$
$K_b[NH_3\ (aq)] = 1.80 \times 10^{-5}$
$K_a[C_6H_8O_6\ (aq)] = 8.00 \times 10^{-5}$
$R = 8.314$ J/mol·K
$F = 96{,}485$ Coulombs/mole e^-
$N_A = 6.02 \times 10^{23}$
K_{sp} [MgF_2, mag fluoride] = 3.7×10^{-8}

1. A student prepares a solution of 0.0800 M nitric acid, HNO_3 (aq). The pH is:

(A) 1.10
(B) 0.0800
(C) 0.900
(D) 0.00120
(E) 1.20

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

Strong Acid $\quad 0.0800\,M$

$pH = -\log[H^+] = -\log(0.0800) = 1.10$

2. A student prepares a solution of 0.670 M benzoic acid, C_6H_5COOH (aq). The $[OH^-]$ is:

(A) 0.250 M
(B) 1.250 M
(C) 0.899 M
(D) 1.54×10^{-12} M
(E) 0.00650 M

$C_6H_5COOH(aq) \rightleftharpoons C_6H_5COO^-(aq) + H^+(aq)$

$K_a = 6.30 \times 10^{-5} = \frac{[C_6H_5COO^-][H^+]}{[C_6H_5COOH]} = \frac{x^2}{0.670 - x}$ → out

$6.30 \times 10^{-5} = \frac{x^2}{0.670}$

$x = [H^+] = 0.00650\,M$

$[H^+][OH^-] = 1 \times 10^{-14} \qquad [OH^-] = 1.54 \times 10^{-12}\,M$

3. A student titrates 0.5222 grams of KHP (potassium hydrogen phthalate; MW=204.2 g/mol) to the equivalence point with 24.08 mL of NaOH (aq). The concentration of the NaOH solution is:

(A) 0.09722 M
(B) 0.1722 M
(C) 0.1062 M
(D) 1.722×10^{-4} M
(E) 9.416 M

$moles_{KHP} = moles_{NaOH}$

$\frac{g_{KHP}}{MWT_{KHP}} = M_{NaOH} V_{NaOH}$

$\frac{0.5222\,g}{204.2\,g/mol} = (M_{NaOH})(0.02408\,L)$

$M_{NaOH} = 0.1062\,M$

→ Most acidic

4. Which buffer system has the **LOWEST** pH?

(A) 0.50 M C_6H_5COOH (aq) and 0.50 M C_6H_5COONa (aq)
(B) 1.00 M C_6H_5COOH (aq) and 0.50 M C_6H_5COONa (aq) More acid than base
(C) 0.50 M C_6H_5COOH (aq) and 1.00 M C_6H_5COONa (aq)

5. The pH of 0.250 M ammonium nitrate, NH_4NO_3 (aq), is:

(A) 7
(B) Less than 7 ← acid, spectator
(C) Greater than 7

$NH_4^+ \rightleftharpoons NH_3 + H^+$

$K_a =$ 1.8×10^{-5} 1.4×10^{-3} 6.3×10^{-5}

6. Consider CH_3COOH, $CH_2ClCOOH$, and C_6H_5COOH. The **weakest** acid is:

(A) CH_3COOH ↑ Lowest Ka
(B) $CH_2ClCOOH$
(C) C_6H_5COOH

7. 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.

$\Delta H = (-)$ $\Delta S = (+)$

8. Consider the combustion of propane: $C_3H_8\,(g) + 5\,O_2\,(g) \rightarrow 3\,CO_2\,(g) + 4\,H_2O\,(g)$

heat is given off $\Delta H = (-)$ — 6 moles gas → 7 moles gas — more disorder $\Delta S = (+)$

(A)	$\Delta H = (+)$	$\Delta S = (+)$	$\Delta G = (-)$
(B)	$\Delta H = (+)$	$\Delta S = (-)$	$\Delta G = (-)$
(C)	$\Delta H = (-)$	$\Delta S = (+)$	$\Delta G = (-)$
(D)	$\Delta H = (-)$	$\Delta S = (-)$	$\Delta G = (-)$

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

(A) $NH_4NO_3\,(aq) \rightarrow NH_4NO_3\,(s)$
(B) $CH_3CH_2OH\,(l) \rightarrow CH_3CH_2OH\,(s)$
(C) $N_2O_4\,(g) \rightarrow 2\,NO_2\,(g)$
(D) $H_2O\,(g) \rightarrow H_2O\,(s)$
(E) $CH_3OH\,(g) \rightarrow CH_3OH\,(l)$

more disorder

one mole gas → two moles gas

10. Consider the "cold pack" reaction. Which of the following statements is correct?

$NH_4NO_3\,(s) \rightarrow NH_4NO_3\,(aq)$ $\Delta S = (+)$ (more disorder) $\Delta H = +50.6$ kJ (endothermic) $\Delta H = (+)$

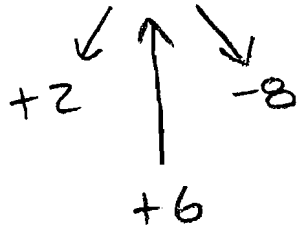
(A) The process is endothermic; entropy increases; and the process is spontaneous at high temperatures.
(B) The process is endothermic; entropy increases; and the process is spontaneous at low temperatures.
(C) The process is endothermic; entropy decreases; and the process is spontaneous at high temperatures.
(D) The process is exothermic; entropy decreases; and the process is spontaneous at low temperatures.
(E) The process is exothermic; entropy increases; and the process is spontaneous at all temperatures.

$\Delta G = \Delta H - T\Delta S$
$(+)\quad (+)$

$(-)$ at low T — if T is too low — $T\Delta S$ will be too small and ΔH wins

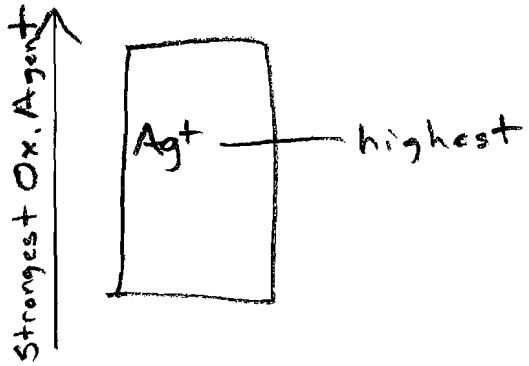
11. The oxidation number of chromium in Na_2CrO_4 is:

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



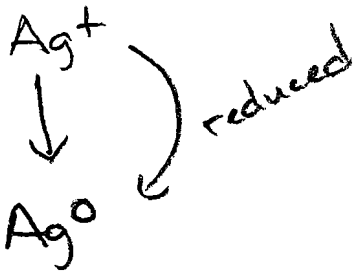
12. Consider Na^+ (aq), Pb^{2+} (aq), Zn^{2+} (aq), Ag^+ (aq), and Li^+ (aq). The strongest oxidizing agent is:

(A) Na^+ (aq)
(B) Pb^{2+} (aq)
(C) Zn^{2+} (aq)
(D) Ag^+ (aq)
(E) Li^+ (aq)



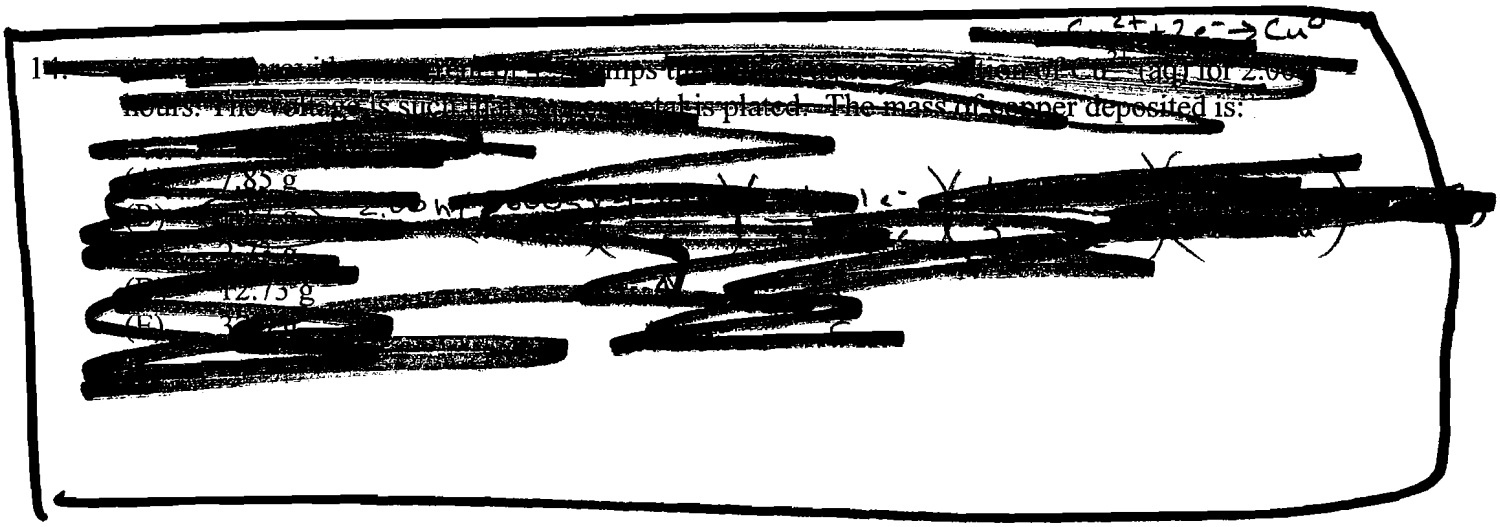
13. Consider the reaction $3\ Ag^+$ (aq) + Al (s) → Al^{3+} (aq) + 3 Ag (s). The species being reduced is:

(A) Ag^+ (aq)
(B) Al (s).
(C) Al^{3+} (aq).
(D) Ag (s).



14. [illegible] mps t[illegible] on of Cu^{2+} (aq) for 2.00 hours. The voltage is such that [illegible] is plated. The mass of copper deposited is:

(A) 1.85 g
(B) [illegible]
(C) 12.75 g
(D) [illegible]
(E) [illegible]



14. Consider a "General Chemistry Battery" in which one beaker contains aqueous aluminum sulfate [$Al_2(SO_4)_3$] and an aluminum metal electrode and the other beaker contains aqueous zinc sulfate [$ZnSO_4$] and a zinc metal electrode. Which of the following statements is **false**?

(A) Zn^{2+} (aq) is reduced. ✓ $Zn^{2+} + 2e^- \rightarrow Zn^0$
(B) The concentration of Zn^{2+} (aq) increases as the process proceeds. $Zn^{2+} + 2e^- \rightarrow Zn^0$ ← reactant – goes away
(C) The mass of the zinc electrode will increase as the process proceeds.
(D) Electrons flow from the aluminum beaker to the zinc beaker. ✓
(E) A salt bridge is needed to allow the flow of ions. ✓

$Zn^{2+} + 2e^- \Rightarrow Zn^0$
$Al^{3+} + 3e^- \Rightarrow Al^0$
(Zn^{2+} wins)

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

(A) +2.219 V
(B) +2.493 V
(C) +2.356 V
(D) +0.137 V
(E) +1.100 V

$Sn^{2+} + 2e^- \rightarrow Sn^0$ -0.137 V
$Mg^{2+} + 2e^- \rightarrow Mg^0$ -2.356 V
} difference

$(-0.137V) - (-2.356V) = 2.219$ V

16. When the reaction Cr (s) + $B_2O_5^{2-}$ (aq) → B^{2+} (aq) + Cr^{3+} (aq) is correctly balanced in acid,

(A) 3 protons (H^+) are consumed
(B) 10 protons (H^+) are consumed
(C) 20 protons (H^+) are consumed
(D) 30 protons (H^+) are consumed
(E) 42 protons (H^+) are consumed

$[Cr^0 \rightarrow Cr^{3+} + 3e^-] \times 4$

$[4e^- + 10H^+ + B_2O_5^{2-} \rightarrow 2B^{2+} + 5H_2O] \times 3$

8+ 4+

$4Cr^0 + 12e^- + 30H^+ + 3B_2O_5^{2-} \rightarrow 4Cr^{3+} + 12e^- + 6B^{2+} + 15H_2O$

17. Pu-245 decays to produce a beta particle and _____.

(A) Co-60
(B) U-241
(C) U-238
(D) Am-245
(E) Pu-246

$^{245}_{94}Pu \rightarrow {}^{0}_{-1}\beta + {}^{245}_{95}Am$

18. A student ( ) obtains a 10.0 gram sample of ^{131}I ($t_{1/2}$ = 8.0 days). How long will it take so that only 3.0 grams of ^{131}I remain?

(A) 13.9 days
(B) 14.7 days
(C) 2.40 days
(D) 1.52 days
(E) 15.2 days

① Calc k $\quad \ln 2 = -k t_{1/2}$

$-0.6931 = (-k)(8.0\,d) \quad k = 0.0866\,\frac{1}{d}$

② Calc t $\quad \ln\left[\frac{A}{A_0}\right] = -kt$

$\ln\left[\frac{3.0\,g}{10.0\,g}\right] = -(0.0866\,\frac{1}{d})(t)$

$t = 13.9\,d$

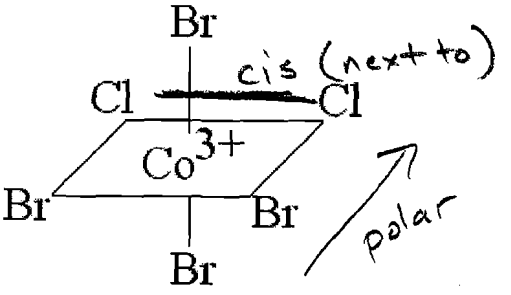
19. A radioactive decay series that begins with ^{257}Fm ends with formation of the stable nuclide ^{209}Bi. How many alpha particle emissions and how many beta particle emissions are involved in the sequence of radioactive decays?

(A) 48 alpha and 24 beta decays.
(B) 24 alpha and 48 beta decays.
(C) 24 alpha and 7 beta decays.
(D) 12 alpha and 41 beta decays.
(E) 12 alpha and 7 beta decays.

48

$^{257}_{100}Fm \rightarrow \underline{12}\ {}^{4}_{2}\alpha + \underline{7}\ {}^{0}_{-1}\beta + {}^{209}_{83}Bi$

20. The complex:

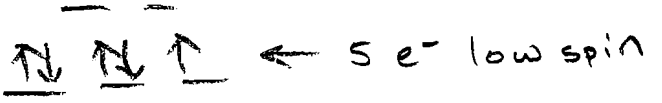


(A) is the cis- isomer and it is polar
(B) is the trans- isomer and it is polar
(C) is the mer- isomer and it is polar
(D) is the fac- isomer and it is polar
(E) is the fac- isomer and it is non-polar

21. How many **unpaired** electrons are present in $[Fe(NO_2)_6]^{3-}$?
[Fe is the Fe^{3+} ion; NO_2 is the NO_2^- ion; and the Fe^{3+} is **low spin**].

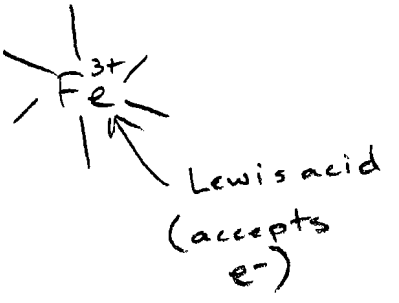
(A) 0
(B) 1
(C) 2
(D) 3
(E) 5

Fe^{3+} ⇒ Group 8 − 3 = 5 d^5



22. Consider $[Fe(CN)_6]^{3-}$. Which of the following is **false**?

(A) $[Fe(CN)_6]^{3-}$ is an octahedral complex ✓
(B) The iron ion has a coordination number of three — six
(C) All bond angles in the complex are 90° ✓
(D) Fe^{3+} is a Lewis acid ✓
(E) $[Fe(CN)_6]^{3-}$ is nonpolar ✓



23. The formula of an alkene with 30 carbon atoms is:

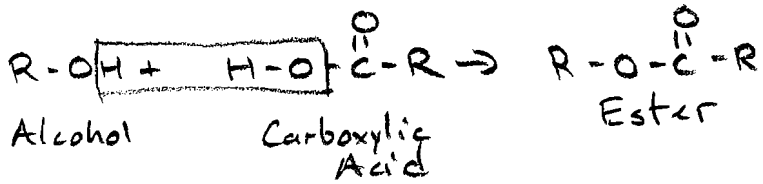
(A) is $C_{30}H_{32}$
(B) is $C_{30}H_{60}$
(C) ~~is $C_{30}H_{62}$~~
(D) is $C_{30}H_{58}$
(E) is $C_{30}H_{30}$

C_nH_{2n}

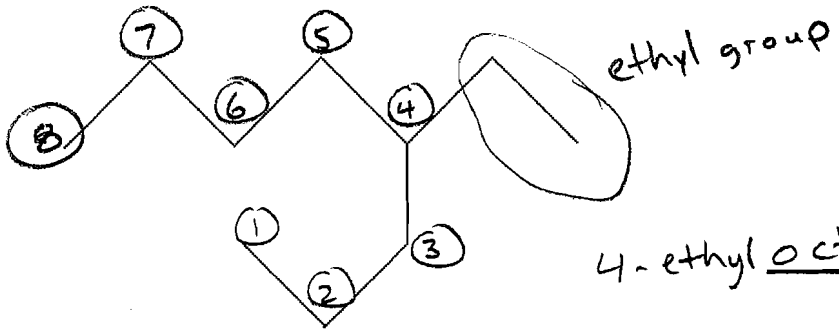
$C_{30}H_{60}$

24. When an alcohol and a carboxylic acid react in a condensation reaction:

(A) an ester is formed
(B) an alkane is formed
(C) a ketone is formed
(D) an amide is formed
(E) an aldehyde is formed

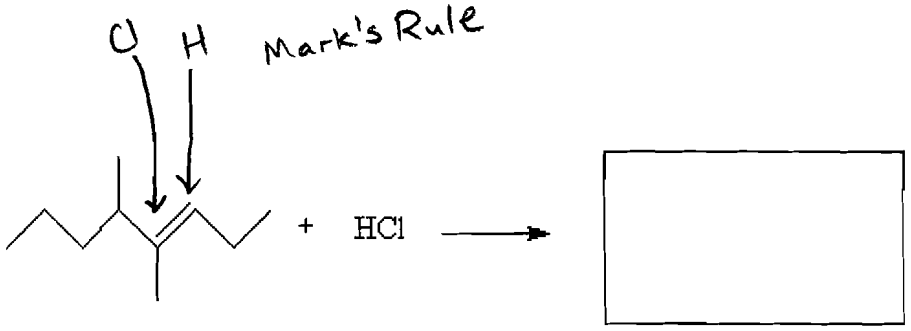


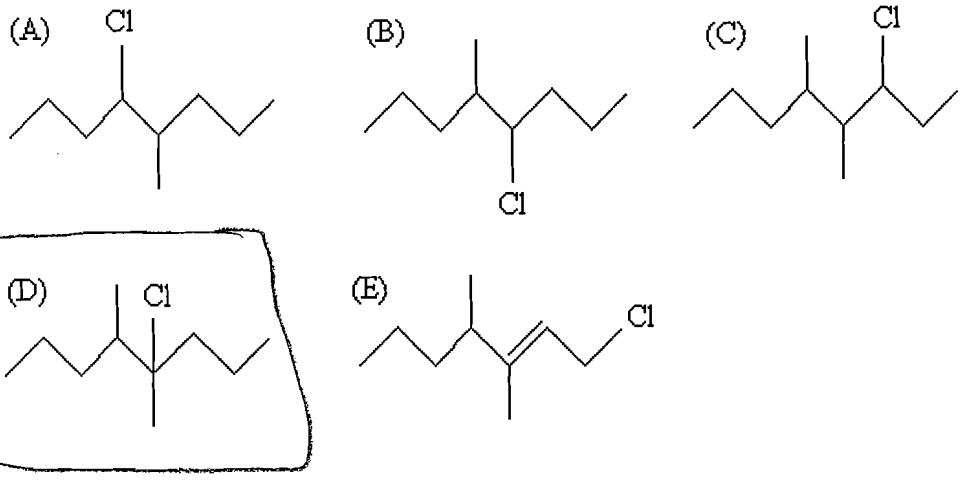
25. What is the name of the following structure?



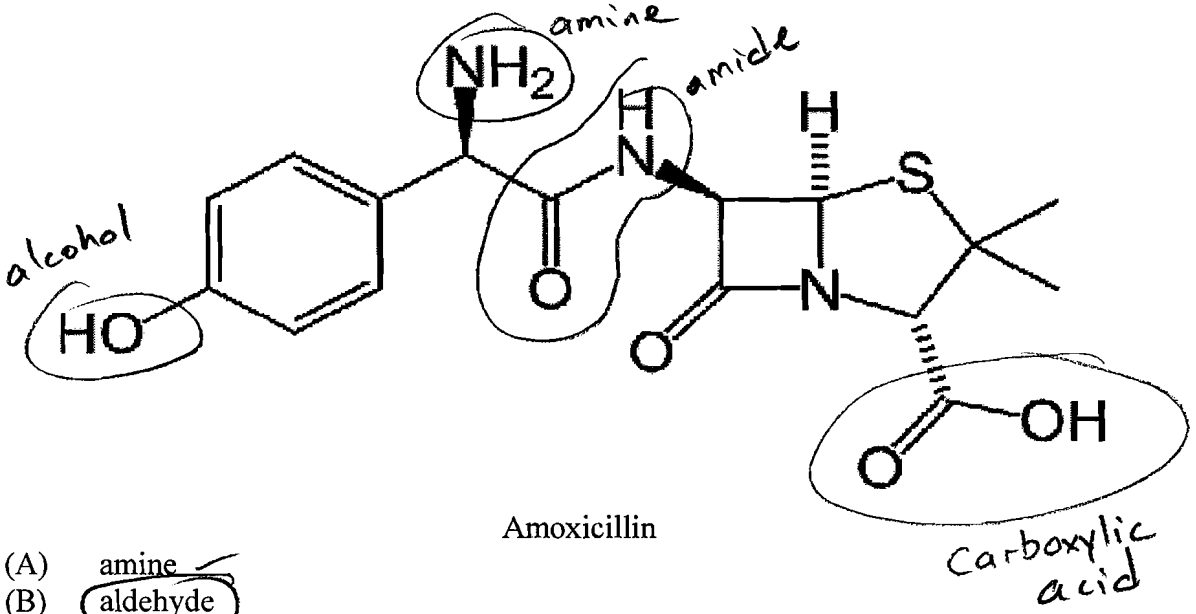
(A) 3-propylheptane
(B) 5-propylheptane
(C) 4-propylheptane
(D) 4-ethyloctane
(E) 4-ethylheptane

26. Complete the following addition reaction:





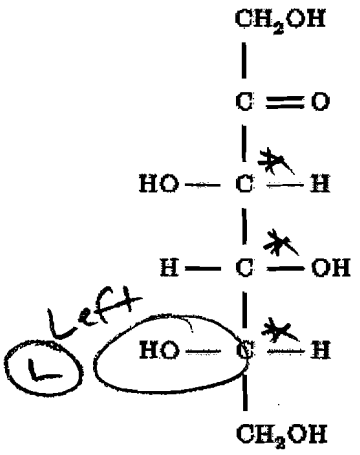
27. Which of the following functional groups is **not** present in Amoxicillin?



Amoxicillin

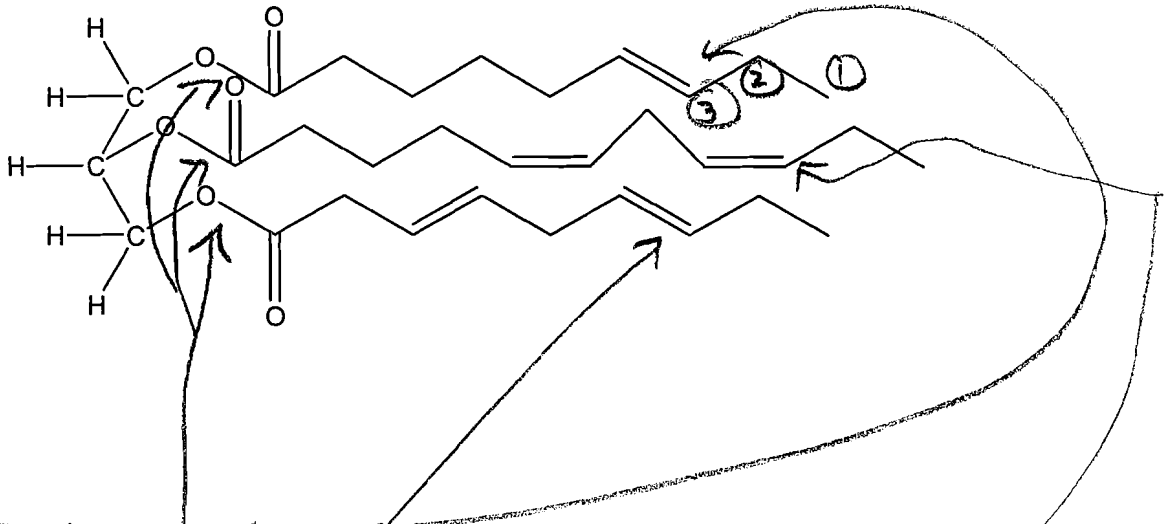
(A) amine
(B) aldehyde
(C) carboxylic acid
(D) amide
(E) alcohol

28. Identify the number of chiral carbons and whether sorbose (shown below) is L- or D-.



(A) 3 chiral carbons and L-
(B) 3 chiral carbons and D-
(C) 4 chiral carbons and L-
(D) 4 chiral carbons and D-
(E) 5 chiral carbons and D-

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



(A) Contains an omega-3
(B) It is saturated
(C) It contains cis bonds
(D) It contains trans bonds
(E) It contains ester groups

30. Which of the following is false?

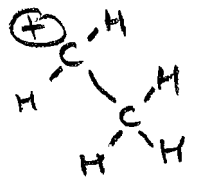
(A) In our Aromatic Electrophilic Substitution reaction, the roll of $AlCl_3$ as a catalyst is to remove Cl^-

(B) In our Aromatic Electrophilic Substitution reaction, a carbocation is not formed

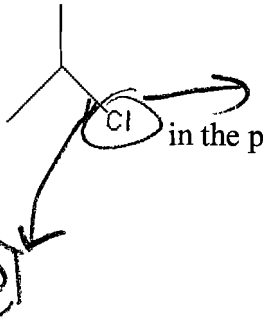
(C) $C_6H_{12}O_6$ is an acceptable chemical formula of a carbohydrate

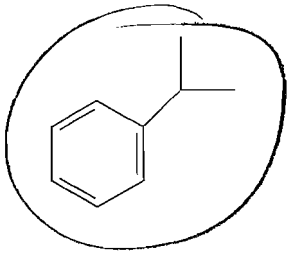
(D) An L-aldohexose is a carbohydrate

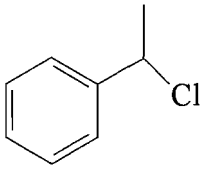
A carbocation is formed

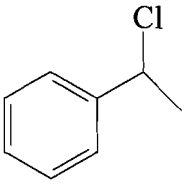


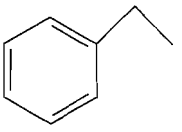
and another in the ring

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

(A) 

(B) 

(C) 

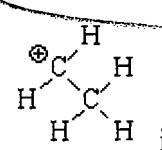
(D) 

32. Which of the following is false?

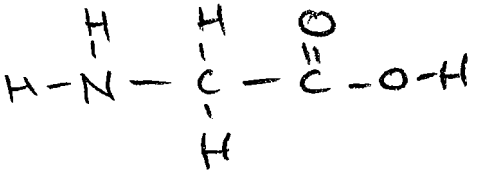
(A) Proteins are made of amino acids linked together Yes

(B) Proteins contain amide links Yes

(C) Amino acids contain an amine group and a nitric acid group
carboxylic acid

(D)  is a carbocation ✓

(E) 19 of the 20 standard amino acids contain a chiral carbon (glycine does not contain a chiral carbon) ✓



33. Well, well, well... CH 123 is over. Now it's time to:

(A) Sleep / Party / Sleep / Party / Sleep / Party / Sleep / Party / Sleep / Party / Sleep / Party
(B) Get a head start on those... never mind, no more OWLs!
(C) Be charming and get some dates
(D) Two words: Doritos and Blackberry
(E) Take my other six final exams!

[Any response will receive full credit; even no response.]
Questions 1 through 32 have four points attached (128 total). Any response to Question 33 will receive full credit (2 Points total); even no response. The point total for this exam is 130 points. See the grade sheet for grade computation details. Final exam keys, scores, and course grades will be posted on the CH 123 website as they become available.