Chemistry 105a,

Fall, 2004
Exam #2
Oct 7, 2004

Dr. Robert Bau

First letter of last name	PLEASE PRINT YOUR NAME IN BLOCK LETTERS Name: Last 4 digits of S.I.D.: T.A.'s Name:

Lab: (M aft./M eve./Tu morn./Tu aft./W aft./Th morn./F aft./none)
(please circle lab section above)

Question	Maximum points	Score	Grader
1	10		
2	24		
3	10		
4	10		
5	14		
6	16		
7	16		
Total	100		

ANSWER KEY

I	II											III	IV	V	VI	VII	VIII
1 H 1.00797																	2 He 4.00260
3 Li 6.941	4 Be 9.01218											5 B 10.811	6 C 12.0111	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.179
11 Na 22.9897	12 Mg 24.305											13 Al 26.9815	14 Si 28.086	15 P 30.9737	16 S 32.064	17 Cl 35.453	18 Ar 39.948
19 K 39.0983	20 Ca 40.08	21 Sc 44.9559	22 Ti 47.90	23 V 50.941	24 Cr 51.996	25 Mn 54.9380	26 Fe 55.847	27 Co 58.9332	28 Ni 58.69	29 Cu 63.546	30 Zn 65.377	31 Ga 69.72	32 Ge 72.59	33 As 74.9216	34 Se 78.96	35 Br 79.904	36 Kr 83.80
37 Rb 85.467	38 Sr 87.62	39 Y 88.9059	40 Zr 91.22	41 Nb 92.9064	42 Mo 95.94	43 Tc 98.9062	44 Ru 101.07	45 Rh 102.905	46 Pd 106.4	47 Ag 107.868	48 Cd 112.40	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.904	54 Xe 131.30
55 Cs 132.905	56 Ba 137.34	57 La 138.905	72 Hf 178.49	73 Ta 180.948	74 W 183.85	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.09	79 Au 196.966	80 Hg 200.59	81 Tl 204.38	82 Pb 207.19	83 Bi 208.980	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.025	89 Ac 227.027	104	105	106	107	108	109									

Lanthanides	58 Ce 140.12	59 Pr 140.907	60 Nd 144.24	61 Pm	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.925	66 Dy 162.50	67 Ho 164.930	68 Er 167.26	69 Tm 168.934	70 Yb 173.04	71 Lu 174.97
Actinides	90 Th 232.038	91 Pa 231.035	92 U 238.029	93 Np 237.048	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 Lw

I have observed all the rules of academic integrity while taking this exam

_____
signature

Question 1 (10 pts) CIRCLE CORRECT ANSWERS

(a) For the reaction $Ba(NO_3)_2\,(aq) + K_2SO_4\,(aq) \rightarrow BaSO_4\,(s) + 2\,KNO_3\,(aq)$, the spectator ions are:

(i) $Ba^+(aq)$ and $NO_3^-(aq)$
(ii) $Ba^+(aq)$ and $SO_4^-(aq)$
(iii) $K^+(aq)$ and $SO_4^-(aq)$
→ (iv) $K^+(aq)$ and $NO_3^-(aq)$
(v) $Ba^{2+}(aq)$ and $NO_3^-(aq)$
(vi) $Ba^{2+}(aq)$ and $SO_4^{2-}(aq)$
(vii) $K^+(aq)$ and $SO_4^{2-}(aq)$
(viii) $K^{2+}(aq)$ and $NO_3^-(aq)$
(ix) none of the above

(b) For the reaction in part (a), the net ionic equation is:

(i) $Ba^+\,(aq) + SO_4^-\,(aq) \rightarrow BaSO_4\,(s)$
→ (ii) $Ba^{2+}\,(aq) + SO_4^{2-}\,(aq) \rightarrow BaSO_4\,(s)$
(iii) $K^+\,(aq) + NO_3^-\,(aq) \rightarrow KNO_3\,(aq)$
(iv) $Ba(NO_3)_2\,(aq) + K_2SO_4\,(aq) \rightarrow BaSO_4\,(s) + 2K^+(aq) + 2NO_3^-(aq)$
(v) $Ba^+\,(aq) + 2NO_3^-\,(aq) + 2K^+\,(aq) + SO_4^-\,(aq) \rightarrow BaSO_4\,(s) + 2\,KNO_3\,(aq)$
(vi) $Ba^{2+}\,(aq) + 2NO_3^-\,(aq) + 2K^+\,(aq) + SO_4^{2-}\,(aq) \rightarrow BaSO_4\,(s) + 2\,KNO_3\,(aq)$
(vii) none of the above

(c) For the reaction $Al(OH)_3\,(s) + 3\,HNO_3\,(aq) \rightarrow Al(NO_3)_3\,(aq) + 3\,H_2O\,(l)$, the spectator ions are:

(i) $H^+(aq)$ and $OH^-(aq)$
(ii) $Al^+\,(aq) + NO_3^-\,(aq)$
(iii) $Al^{3+}\,(aq) + NO_3^-\,(aq)$
(iv) $H^+(aq)$ only
(v) $OH^-(aq)$ only
(vi) $Al^+\,(aq)$ only
(vii) $Al^{3+}\,(aq)$ only
← (viii) $NO_3^-\,(aq)$ only
(ix) none of the above

(d) When $Pb(NO_3)_2(aq)$ and KI(aq) are mixed, the net ionic equation is

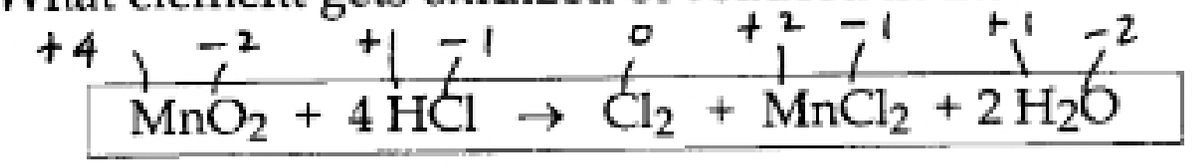
(i) $Pb^+(aq) + I^-(aq) \rightarrow PbI(s)$
→ (ii) $Pb^{2+}(aq) + 2\,I^-(aq) \rightarrow PbI_2(s)$
(iii) $Pb^{2+}(aq) + I^{2-}(aq) \rightarrow PbI(s)$
(iv) $K^+(aq) + NO_3^-(aq) \rightarrow KNO_3(s)$
(v) $K^+(aq) + NO_3^-(aq) \rightarrow KNO_3(aq)$
(vi) none of the above

(e) When $Na_2SO_4\,(aq)$ and $K_3PO_4\,(aq)$ are mixed, the net ionic equation is

(i) $Na^+\,(aq) + PO_4^-\,(aq) \rightarrow NaPO_4\,(s)$
(ii) $Na^+\,(aq) + PO_4^{3-}\,(aq) \rightarrow Na_3PO_4\,(s)$
(iii) $K^+\,(aq) + SO_4^-\,(aq) \rightarrow KSO_4\,(s)$
(iv) $K^+\,(aq) + SO_4^{2-}\,(aq) \rightarrow K_2SO_4\,(s)$
→ (v) none of the above (NO REACTION)

Question #2 (24 pts)

(a) (8 pts) What element gets oxidized or reduced in the following reaction? (Fill in the blanks or circle correct answers)



element		ox. number		ox. number
Cl	is oxidized from	−1	to	0
Mn	is reduced from	+4	to	+2

The oxidizing agent is (Mn / O / H / Cl / (MnO2) / HCl / Cl_2 / $MnCl_2$ / H_2O)

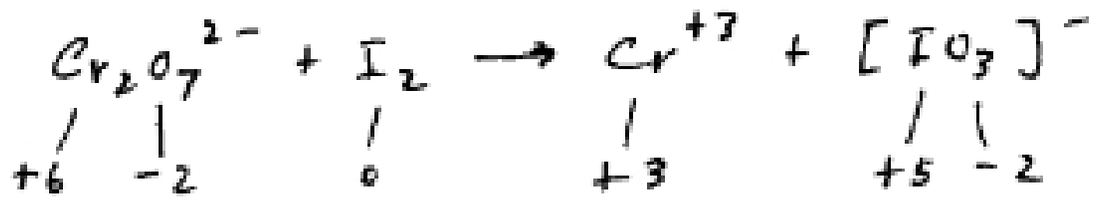
The reducing agent is (Mn / O / H / Cl / MnO_2 / (HCl) / Cl_2 / $MnCl_2$ / H_2O)

(b) Balance the following oxidation-reduction equation:

$$[Cr_2O_7]^{2-} + I_2 \rightarrow Cr^{+3} + [IO_3]^-$$

(16 pts)

Note: you can do this question **either** in acidic or basic conditions (just choose one).



ox: $I(0) \rightarrow I(+5) + 5e^-$ ×3

red: $Cr(+6) + 3e^- \rightarrow Cr(+3)$

3(ox): $3I(0) \rightarrow 3I(+5) + 15e^-$ ×5

5(red): $5Cr(+6) + 15e^- \rightarrow 5Cr(+3)$

add: $5Cr(+6) + 3I(0) \rightarrow 5Cr(+3) + 3I(+5)$

substitute: $\frac{5}{2} Cr_2O_7^{2-} + \frac{3}{2} I_2 \rightarrow 5Cr^{+3} + 3IO_3^-$ ×2

remove fractions: $5 Cr_2O_7^{2-} + 3I_2 \rightarrow 10Cr^{3+} + 6IO_3^-$ (main equation)

If in acid:

add H^+ to balance charges: $5 Cr_2O_7^{2-} + 3I_2 + 34H^+ \rightarrow 10Cr^{3+} + 6IO_3^-$

add H_2O's to balance H's: $5 Cr_2O_7^{2-} + 3I_2 + 34H^+ \rightarrow 10Cr^{3+} + 6IO_3^- + 17H_2O$ (Answer)

If in base:

add OH^- to balance charges: $5 Cr_2O_7^{2-} + 3I_2 \rightarrow 10Cr^{3+} + 6IO_3^- + 34OH^-$

add H_2O's to balance H's: $5 Cr_2O_7^{2-} + 3I_2 + 17H_2O \rightarrow 10Cr^{3+} + 6IO_3^- + 34OH^-$