

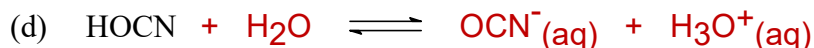
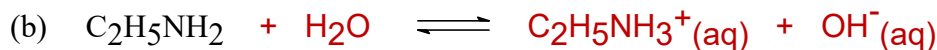
Chem 10113, Quiz 4

October 10, 2018

Answer Key

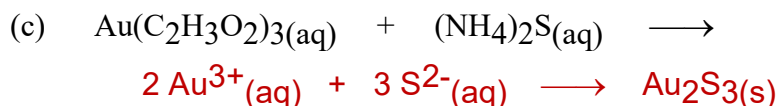
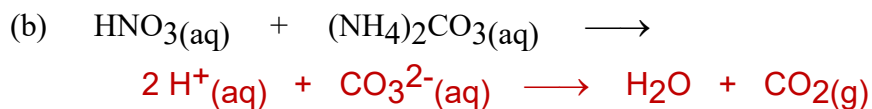
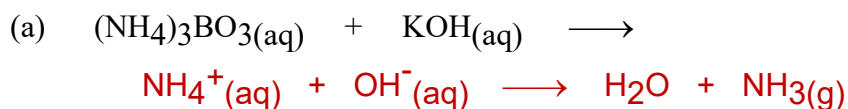
	IA (1)																VIIIA (18)	
1	1 H 1.0080	IIA (2)										III A (13)	IV A (14)	V A (15)	VIA (16)	VII A (17)	2 He 4.0026	
2	3 Li 6.9410	4 Be 9.0122										5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.179	
3	11 Na 22.990	12 Mg 24.305	IIIB (3)	IVB (4)	VB (5)	VIB (6)	VII B (7)	VIII B (8)	VIII B (9)	VIII B (10)	IB (11)	IIB (12)	13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.066	17 Cl 35.453	18 Ar 39.948
4	19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.880	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.847	27 Co 58.933	28 Ni 58.690	29 Cu 63.546	30 Zn 65.380	31 Ga 69.723	32 Ge 72.610	33 As 74.922	34 Se 78.960	35 Br 79.904	36 Kr 83.800
5	37 Rb 85.468	38 Sr 87.620	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.940	43 Tc 98.907	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 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.29
6	55 Cs 132.91	56 Ba 137.33	57 La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.20	77 Ir 192.22	78 Pt 195.09	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.20	83 Bi 208.98	84 Po 208.98	85 At 209.99	86 Rn 222.02
7	87 Fr 223.02	88 Ra 226.03	89 Ac 227.03	104 Unq 261.11	105 Unp 262.11	106 Unh 263.12	107 Uns 262.12											

1. (5 points) Write a **balanced chemical equation** for the process that occurs when each of the following substances are mixed with water. (*Note*: Use equilibrium arrows where appropriate.)



2. (2 points) In $\text{Fe}_2(\text{Cr}_2\text{O}_7)_3$, the oxidation states are: Fe = **+3** and Cr = **+6**

3. (6 points) For each of the following, clearly write the **balanced, net ionic equation**. (*Only the net ionic equation will be graded!*) Use subscripts [(s), (aq), etc.] to indicate the phase of each compound or ion. If no reaction occurs, write No Rx.



4. (7 points) **SHOW ALL WORK.** Dimethylsulfoxide (DMSO) is a liquid organosulfur compound, $(\text{CH}_3)_2\text{SO}$ (molar mass = 78.13), that is used in veterinary medicine as a liniment for horses but can be harmful to humans. DMSO has a density of 1.10 g/mL and it is completely miscible with water. In a simple lab experiment, 27.0 g of ice (i.e., solid H_2O) at 0.0°C was added to 0.300 L of DMSO at 27.5°C in a well-insulated container. After stirring for some time, all of the ice had melted and the final temperature of the water-DMSO mixture was 11.6°C . Determine the *molar heat capacity* of DMSO in $\text{J}/\text{mole}\cdot^\circ\text{C}$. (*Note:* The heat of fusion of H_2O is $6.00\text{ kJ}/\text{mole}$.)

$$\text{heat lost by DMSO} = \text{heat required to melt the ice} + \text{heat gained by H}_2\text{O}$$

$$\text{heat to melt ice} = (27.0\text{ g}) (1\text{ mole} / 18.0\text{ g}) (6,000\text{ J}/\text{mole}) = 9,000\text{ J}$$

$$\text{mass of DMSO} = (300\text{ mL}) (1.10\text{ g}/\text{ml}) = 330\text{ g}$$

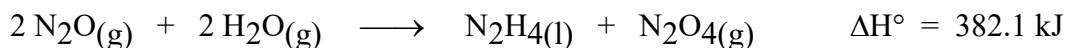
$$\text{let SpH} = \text{specific heat of DMSO}$$

$$(\text{SpH})(330\text{ g})(27.5^\circ\text{C} - 11.6^\circ\text{C}) = 9,000\text{ J} + (4.184\text{ J}/\text{g}\cdot^\circ\text{C})(27.0\text{ g})(11.6^\circ\text{C} - 0^\circ\text{C})$$

$$\text{SpH} = 1.97\text{ J}/\text{g}\cdot^\circ\text{C}$$

$$\text{molar heat capacity} = (1.97\text{ J}/\text{g}\cdot^\circ\text{C}) (78.13\text{ g}/\text{mole}) = 154\text{ J}/\text{mole}\cdot^\circ\text{C}$$

5. (6 points) **SHOW ALL WORK.** Given the thermochemical equation,



and the following standard heats of formation (ΔH°_f),

compound	$\text{H}_2\text{O}(\text{g})$	$\text{N}_2\text{O}(\text{g})$	$\text{N}_2\text{O}_4(\text{g})$
ΔH°_f (kJ/mole)	-241.8	81.6	11.1

determine the standard heat of formation (ΔH°_f) of $\text{N}_2\text{H}_4(\text{l})$ in kJ/mole.

$$\Delta\text{H}^\circ_{\text{rxn}} = \sum \Delta\text{H}^\circ_f (\text{products}) - \sum \Delta\text{H}^\circ_f (\text{reactants})$$

$$382.1\text{ kJ} = [(1\text{ mole}) \Delta\text{H}^\circ_f (\text{N}_2\text{H}_4) + (1\text{ mole}) (11.1\text{ kJ}/\text{mole})]$$

$$- [(2\text{ mole}) (81.6\text{ kJ}/\text{mole}) + (2\text{ mole}) (-241.8\text{ kJ}/\text{mole})]$$

$$\Delta\text{H}^\circ_f (\text{N}_2\text{H}_4) = 50.6\text{ kJ}/\text{mole}$$