

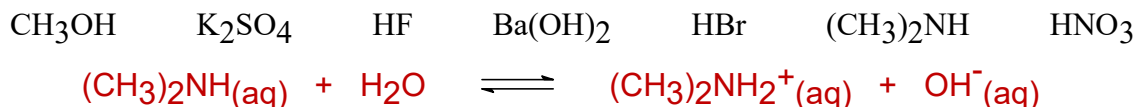
Chem 10113, Quiz 4

October 23, 2019

Answer Key

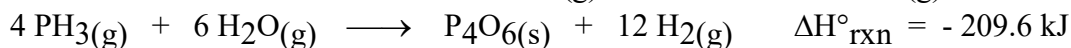
	IA (1)																VIIIA (18)	
1	1 H 1.0080	IIA (2)										III A (13)	IV A (14)	V A (15)	VIA (16)	VII A (17)	2 He 4.0026	
2	3 Li 6.9410	4 Be 9.0122										5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.179	
3	11 Na 22.990	12 Mg 24.305	IIIB (3)	IVB (4)	VB (5)	VIB (6)	VII B (7)	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. (4 points) Of the substances listed below, **HF** is a weak acid and **(CH₃)₂NH** is a weak base. (Write only one formula in each blank!) For the *weak base*, write a *balanced chemical equation* that shows how it reacts when mixed with water.



2. (6 points) **SHOW ALL WORK.** Given the following thermochemical data, determine the standard heat of formation (ΔH°_f) of P₄O₆(s) in kJ/mole.

Standard Heats of Formation (ΔH°_f): H₂O(g) = - 242 kJ/mole, PH₃(g) = 5.4 kJ/mole



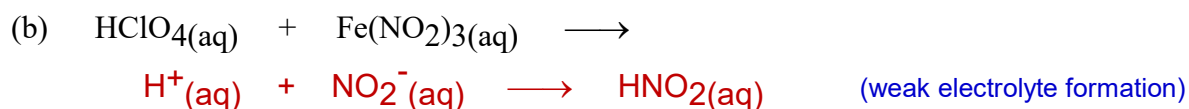
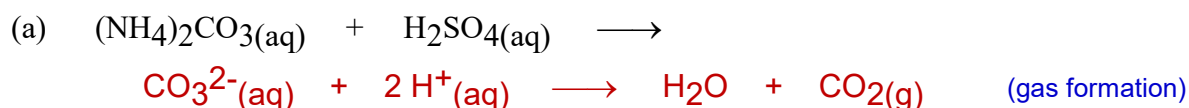
Apply Hess' Law (i.e., sum ΔH°_f products - sum ΔH°_f reactants).....

$$\Delta H^\circ_{\text{rxn}} = \Delta H^\circ_f(\text{P}_4\text{O}_6) + 12 \Delta H^\circ_f(\text{H}_2) - \{ 4 \Delta H^\circ_f(\text{PH}_3) + 6 \Delta H^\circ_f(\text{H}_2\text{O}) \}$$

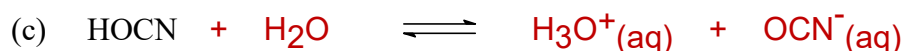
$$- 209.6 = \Delta H^\circ_f(\text{P}_4\text{O}_6) + 12 (0) - \{ 4 (5.4) + 6 (-242) \}$$

$$\Delta H^\circ_f(\text{P}_4\text{O}_6) = - 1640 \text{ kJ/mole}$$

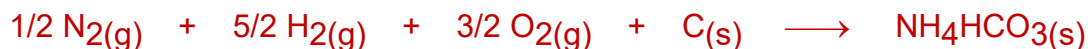
3. (4 points) For each of the following, clearly write the **balanced, net ionic equation**. (**Only the net ionic equation will be graded!**) Use subscripts [(s), (aq), etc.] to indicate the phase of each compound or ion. If no reaction occurs, write No Rx.



4. (3 points) Write a **balanced chemical equation** for the process that occurs when each of the following substances are mixed with water.



5. (2 points) The standard heat of formation (ΔH°_f) of $\text{NH}_4\text{HCO}_3(\text{s})$ is -849 kJ/mole. Write a **balanced chemical equation** for the reaction for which $\Delta H^\circ_{\text{rxn}}$ equals the same value.



6. (6 points) **SHOW ALL WORK.** In an insulated container, a solution of 50.0 g of 1-propanol ($\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$) in 75.0 g of water is initially at 23.5 °C. A piece of aluminum weighing 85.0 g is heated to 90.0 °C and then immersed in the ethanol/water solution. Assuming that no heat is lost to the surroundings, determine the final temperature of the mixture.

Specific Heats (in J/g·°C): 1-propanol = 2.40, Al = 0.903, H_2O = 4.184

$$\text{heat lost by Al} = \text{heat gained by 1-propanol} + \text{heat gained by H}_2\text{O}$$

$$(85 \text{ g})(0.903 \text{ J/g}\cdot^\circ\text{C})(90.0 \text{ }^\circ\text{C} - T_f) = (50 \text{ g})(2.40 \text{ J/g}\cdot^\circ\text{C})(T_f - 23.5 \text{ }^\circ\text{C})$$

$$+ (75 \text{ g})(4.184 \text{ J/g}\cdot^\circ\text{C})(T_f - 23.5 \text{ }^\circ\text{C})$$

$$6907.95 - 76.755 T_f = 120 T_f - 2820 + 313.8 T_f - 7374.3$$

$$T_f = 33.5 \text{ }^\circ\text{C}$$