Updated July 12/06 **CHAPTER 6 ANSWERS** **plus the few from Ch.9**

NUMERICAL ANSWERS TO ASSIGNED TUTORIAL PROBLEM SETS FOR CHEM206
FROM KOTZ & TREICHEL'S CHEMISTRY & CHEMICAL REACTIVITY, **6th Ed.**

NOTE: the answers from Ch.6 have been verified.

Ch.	Q#	Answer	Units	SFs	Comments
6	4	399	Cal	3 SF	
6	8	136	J/(mol K)	3 SF	
6	10	674	J	3 SF	
6	14	37.4	°C	3 SF	
6	18	0.27	J/(g·°C)	2 SF	
6	20	3.30×10^{2}	kJ	3 SF	
6	26	-3.0	kJ	2 SF	
6	28	-82.9	kJ	3 SF	
6	32	-68	kJ	2 SF	
6	36	-96	kJ/mol	2 SF	
6	40	-2800	kJ/mol	2 SF	
6	44a	-43.6	kJ	3 SF	
6	44b	diagram			
6	46	-3.20×10^{2}	kJ/mol	3 SF	
6	52a	5.0×10^{-1}	kJ	2 SF	
6	52b	18	kJ	2 SF	
6	52c	-6.47	kJ	3 SF	
6	52d	-4.13	kJ	3 SF	
6	58	103.6	kJ	4 SF	
6	62	a,b,c = exothermic; d = endothermic			
6	64	a,c,d are state functions			
6	66	Standard state is the most stable form of a substance in the physical state that exists at a pressure of 1 bar and at a specified temperature (*e.g.,* 298K for the data in the Appendix of the textbook). At 298K: H_2O(liquid), NaCl(solid), Hg(liquid), CH_4(gas).			

Ch.	Q#	Answer	Units	SFs	Comments
6	76	Assume tea has density 1.00g/mL, specific heat capacity 4.184 J/gK…& $q_{tea} = -q_{ice\_melted}$			
		126	g ice melts	3SF	
		9	g ice remains	1SF due to subtraction SF rules	
6	78	Assume cola has density 1.00g/mL, specific heat capacity 4.184 J/gK…& $q_{cola} = -q_{ice\_melted}$			
		$-1.1\text{x}10^4$	J	2SF	must be released by cola to cool cola to 0°C
		$1.5\text{x}10^4$	J	2SF	required to melt 1 ice cube…so, not all of cube will melt.
		32	g ice	2SF	will melt, leaving 13g of ice remaining.
6	80	-27	kJ/mol	2SF	
6	82	-140	kJ/mol	2SF	
6	88	Using H_2O(l) -- could use H_2O(g) data instead --> different answers			
6	88	-50.325	kJ/g	5SF	propane
6	88	-49.482	kJ/g	5SF	butane
6	88	-47.810	kJ/g	5SF	gasoline
6	88	-29.684	kJ/g	5SF	ethanol
6	92a	$-4.7\text{x}10^4$	J	2SF	= heat that body must lose to warm up soda But note: this heat is produced by the body… Body is expending energy to heat up the soda.
	92b	10.	Cal	2SF	body expends 11 Cal, but gains 1 Cal from low-cal soda.
	92c	230	Cal	2SF	body gains 240 Cal from regular soda…
6	96a	diagram: put $4CO_2$(g) & $4H_2O$(g) at the bottom of the E scale...& the isomers at appropriate higher levels			
	96b	146.1	kJ/mol	4SF	cis-2-butene, using Hess's law
		142.8	kJ/mol	4SF	trans-2-butene…
		155.3	kJ/mol	4SF	1-butene
	96c	diagram: put 4C(s) & $4H_2$(g) at the bottom of the E scale...& the isomers at appropriate higher levels			
	96d	-3.3	kJ/mol	2SF	for converting cis-2-butene to trans-2-butene.
6	108a	add up the equations as written to give net rxn: $H_2O(g) \rightarrow H_2(g) + \frac{1}{2} O_2(g)$			
	108b	$1.119\text{x}10^5$	g H_2(g)	4SF	
	108c	Step1: 217.4 kJ; Step2: -96.9 kJ; Step3: 30.6 kJ; Step4: 90.83 kJ; only Step2 is likely product-favoured			
	108d	The three endothermic steps likely limit the practical feasibility of this method. Important: in Ch.19 we will learn a much more reliable way to estimate product-favourability.			

9	56	Per mole phosgene produced: *based on bond dissociation energies (BDEs)* Bonds broken (energy required): 1 C≡O (1046 kJ/mol) + 1 Cl-Cl (242 kJ/mol) = 1288 kJ Bonds formed (energy released): 1 C=O (-745 kJ/mol) + 2 C-Cl (-339 kJ/mol) = -1423 kJ Difference = ΔH^o_{rxn} = -135 kJ ….shortcut: ΔH^o_{rxn} = sum(BDE bonds broken) – sum(BDE bonds formed)
9	58	$\Delta H^o_{rxn} = (2\text{ mol})(BDE_{OO\_in\_ozone}) - (2\text{ mol})(BDE_{O=O}) \Rightarrow BDE_{OO\_in\_ozone}$ = 301 kJ/mol ozone. This value is intermediate between O-O (bond order 1) and O=O (bond order 2), which is expected since from ozone's Lewis structure we see the bond order is 1.5.