

CHEM UN2045 – TPS 2

Circle the Date: Feb 20th 2024 / Feb 22nd 2024

*Instructions: You have 10 min to work on the questions individually. This will be followed by another 10 minutes where you may discuss with a partner the questions, change answers if needed, and submit one copy of your copies together. You may only use pen or pencil, and paper. **Clarity in your 3-D drawings is required – ambiguous or unclear drawings will be given no credit.** It is strongly suggested that you work your answers out on scratch paper and then transfer them to the test packet.*

Names (please print):

Honor pledge: We have neither given nor received aid on this examination.

Signatures: _____

1. (10 pts): _____

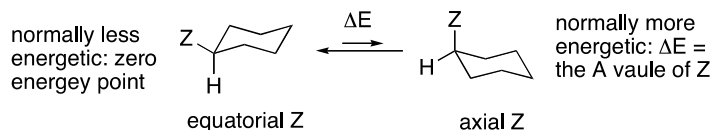
2. (10 pts): _____

3. (10 pts): _____

TOTAL (30 pts): _____

Periodic Table of the Elements																		18 VIII 8A																							
1 IA 1A																	2 He Helium 4.003																								
3 Li Lithium 6.941	4 Be Beryllium 9.012															13 B Boron 10.811	14 C Carbon 12.011	15 N Nitrogen 14.007	16 O Oxygen 15.999	17 F Fluorine 18.998	18 Ne Neon 20.180																				
11 Na Sodium 22.990	12 Mg Magnesium 24.305															19 K Potassium 39.098	20 Ca Calcium 40.078															27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.631	33 As Arsenic 74.922	34 Se Selenium 78.971	35 Br Bromine 79.904	36 Kr Krypton 84.798
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.867	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.631	33 As Arsenic 74.922	34 Se Selenium 78.971	35 Br Bromine 79.904	36 Kr Krypton 84.798																								
37 Rb Rubidium 84.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.95	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.905	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.414	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.904	54 Xe Xenon 131.294																								
55 Cs Cesium 132.905	56 Ba Barium 137.328	57-71														72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.084	79 Au Gold 196.967	80 Hg Mercury 200.592	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium (209)	85 At Astatine 208.980	86 Rn Radon 222.018											
87 Fr Francium 223.021	88 Ra Radium 226.025	89-103														104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (266)	107 Bh Bohrium (264)	108 Hs Hassium (265)	109 Mt Meitnerium (268)	110 Ds Darmstadtium (271)	111 Rg Roentgenium (272)	112 Cn Copernicium (277)	113 Nh Nihonium (284)	114 Fl Flerovium (289)	115 Uup Ununpentium (294)	116 Lv Livermorium (293)	117 Uus Ununseptium (294)	118 Uuo Ununoctium (294)											
Lanthanide Series																		57 La Lanthanum 138.905	58 Ce Cerium 140.116	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.243	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.500	67 Ho Holmium 164.930	68 Er Erbium 167.259	69 Tm Thulium 168.934	70 Yb Ytterbium 173.055	71 Lu Lutetium 174.967									
Actinide Series																		89 Ac Actinium 227.028	90 Th Thorium 232.038	91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.083	99 Es Einsteinium 252.083	100 Fm Fermium 257.105	101 Md Mendelevium 258.105	102 No Nobelium 259.105	103 Lr Lawrencium 262.105									

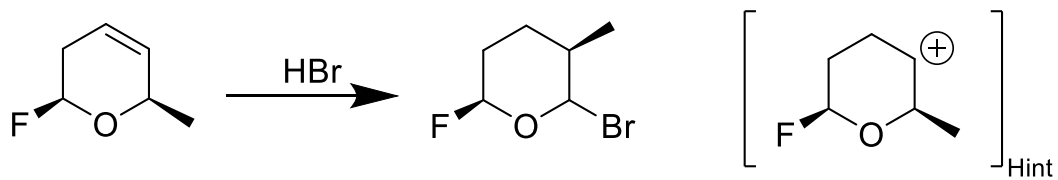
Conformational Free Energy Difference (ΔG , kcal/mol) for Common Substituents X in Cyclohexanes



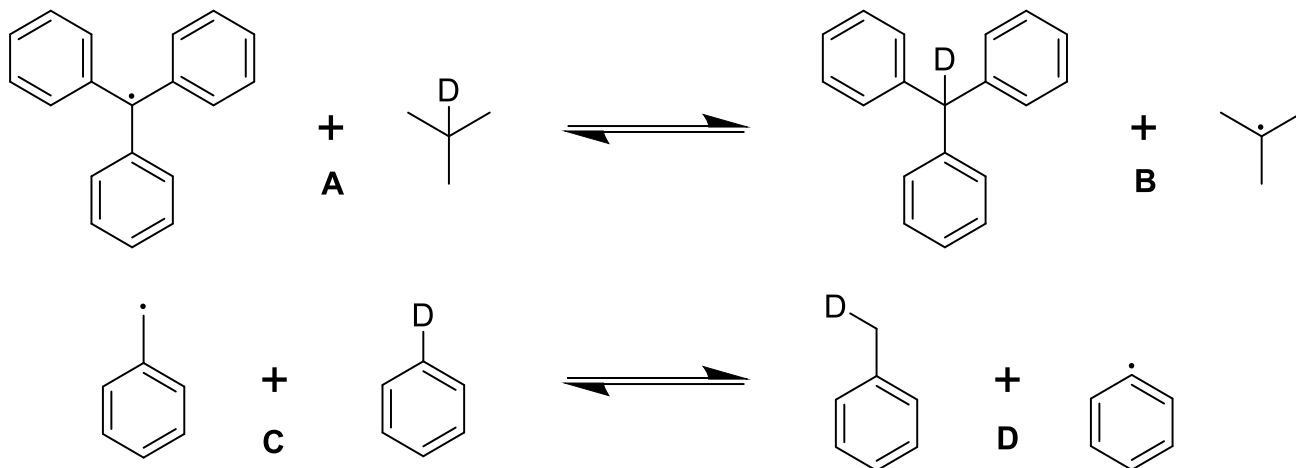
X	A-value kcal/mol	X	A-value kcal/mol	X	A-value kcal/mol
F	0.24	SMe	1.0	CH ₃	1.8
Cl	0.4	SPh	1.2	CH ₂ CH ₃	2.0
Br	0.2-0.7	S(O)Me	1.2	i-C ₃ H ₇	2.2
I	0.4	S(O) ₂ Me	2.5	c-C ₆ H ₁₁	2.2
OH	0.6 (0.9*)	NH ₂	1.2 (1.8*)	t-C ₄ H ₉	> 4.5
OMe	0.7	NH ₃ ⁽⁺⁾	1.9	ethynyl	0.2
OEt	0.9	NHMe	1.0	C ₆ H ₅	3.0
OAc	0.7	NMe ₂	2.1	COOH	1.2
OTs	0.7	NMe ₃ ⁽⁺⁾	2.4	COO ⁽⁻⁾	2.2
OTMS	0.7	NO ₂	1.0	COOMe	1.1
SH	1.2	N ₃	0.5	CN	0.2

* In H-bonding solvents

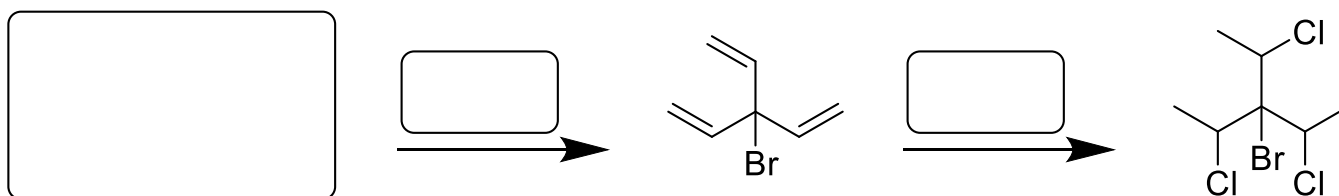
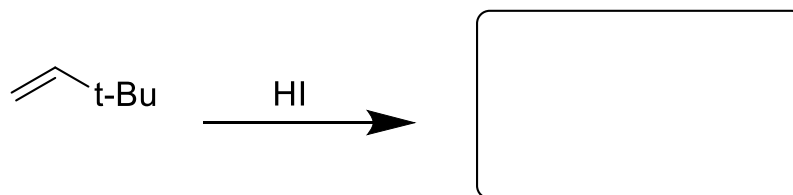
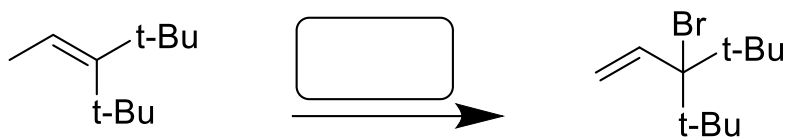
(1) Inspect the following reaction. Propose a suitable mechanism for the reaction below. A key intermediate is shown in brackets. (10 pts)



(2) The reactions below are known as disproportionation reactions. Circle the sides of the equilibria that are favored. Once you have done this, compare the two equilibria. Which of the two equilibria below is stronger and why? (10 pts)



(3) Complete the following reactions by filling out the boxes with the reactant, reagent, or product.
(10 pts)



BLANK. Indicate if needed.