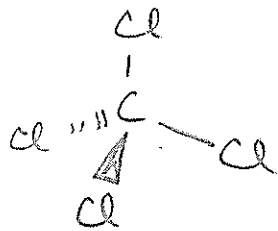


CHEM 4616: Homework #9

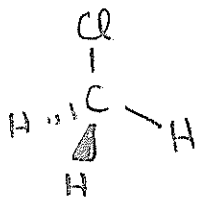
Corresponds to the quiz to be given in class on Thursday, April 10th, 2008

Chang, Chapter 18: Problems 1-6, 9, 11, 12, 17, 18

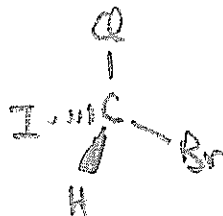
18.1



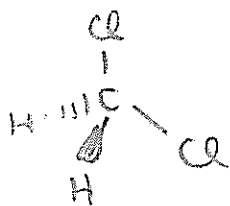
$4C_3, 3C_2, 3\sigma_4, 6\sigma$



$C_3, 3\sigma$



none



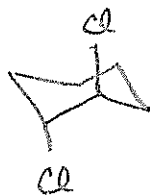
$C_2, 2\sigma$

18.2



C_6 and $6C_2$

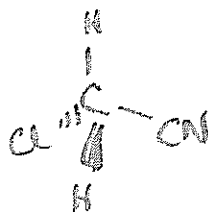
18.3



dissymmetric

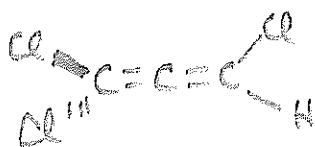


asymmetric



asymmetric

18.4



Has a C_2 axis and no other elements.

\therefore It is chiral.

18.5

$$\alpha = 0.34^\circ$$

$$l = 10 \text{ cm} = 1 \text{ dm}$$

$$[\alpha]_D^{299} = \frac{\alpha}{lc}$$

$$c = 9.6 \text{ g}/100 \text{ mL} = 0.096 \text{ g/mL}$$

$$= \frac{0.34^\circ}{(1 \text{ dm})(0.096 \text{ g/mL})} = \boxed{3.5^\circ/[\text{dm}(\text{g/mL})]} \leftarrow \text{specific rotation}$$

$$[\Phi]_\lambda^T = \frac{[\alpha]_\lambda^T M}{100} = \boxed{12 \text{ deg}/[\text{dm}(\text{mol/mL})]} \leftarrow \text{molar rotation}$$

Sucrose is $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ with a molar mass of 342 g/mol .

18.6

$$\alpha = \frac{180}{\lambda} (n_L - n_R) l = 2.41^\circ$$

$$\rightarrow (n_L - n_R) = \frac{\alpha \lambda}{180 l} = \frac{(2.41^\circ)(589 \text{ nm})}{180 (1.0 \text{ dm})} = \boxed{7.9 \times 10^{-8}}$$

18.9 Vary the pathlength and/or the concentration.

18.11 The chiral compound could have reacted with the newly added achiral compound.

18.12

$$d(\alpha\text{-glucose}) = +112.2^\circ$$

$$d(\beta\text{-glucose}) = +18.7^\circ$$

A mixture of the two falls in between at 56.8°

$$56.8^\circ = x(112.2^\circ) + (1-x)(18.7^\circ) \quad (x = \text{mole fraction of } \alpha\text{-glucose})$$

$$(93.5^\circ)x = 38.1^\circ$$

$$x = 0.407$$

40.7% α -glucose and 59.3% β -glucose

18.17

$$\alpha = (-3.8^\circ)$$

$$[\alpha]_D^{25} = -16.6^\circ = \frac{\alpha}{lc} \rightarrow c = \frac{\alpha}{l[\alpha]_D^{25}} = \frac{(-3.8^\circ)}{(1.0 \text{ dm})(-16.6^\circ)} = \boxed{0.23 \text{ g/mL}}$$

18.18 The molecule has a long-wavelength $\pi \rightarrow \pi^*$ transition.