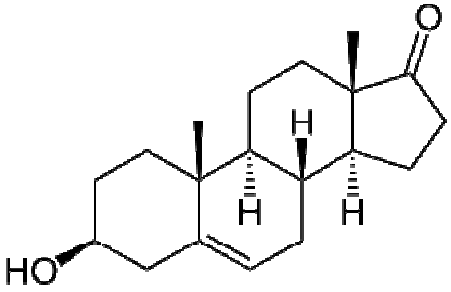
Name _____

CHEM 230 SEMESTER 01-2015 HOMEWORK 4

Print out this homework on letter sized paper. Answer the questions carefully (not on this sheet) and then submit your answers on Monday morning at the start of class. Note that if there is clear evidence of copying, the whole exercise may attract a zero mark, and the matter may be reported to the authorities.

The following questions concern optically active organic compounds.



1) Identify all the chiral centres in the above structure of dehydroepiandrosterone (DHEA) by circling the relevant carbon atoms. (3)

2) What is meant by the term *optically active*? (2)

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3) What is meant by the term *racemic mixture*? (2)

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4) What essential feature makes a compound optically active? (2)

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5) Optically active compounds come in pairs of isomers. What term is used to designate these pairs of optical isomers? (1)

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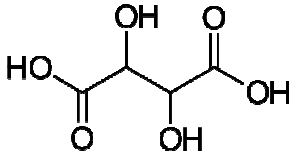
6) The formula C_5H_{10} describes several different isomers, two of which are a pair of optical isomers. Give the stereochemical formula of each member of the pair and name them. Include the stereochemical designation (R or S) in the names. (Hint: they contain a ring.) (4)

7) Tartaric acid (2,3-dihydroxybutanedioic acid):  has two chiral centres and three stereoisomers, designated as (2R, 3R)-tartaric acid, (2S, 3S)-tartaric acid and (2R, 3S)-tartaric acid.

a) How are (2R, 3R)-tartaric acid and (2S, 3S)-tartaric acid related to one another? (1)

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b) How are (2R, 3R)-tartaric acid and (2R, 3S)-tartaric acid related to one another? (1)

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c) The names (2S, 3R)-tartaric acid and (2R, 3S)-tartaric acid describe mirror images which are identical, a *meso* compound. What feature distinguishes such compounds? (1)

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d) What is the specific rotation, $[\alpha]_D^{20}$, of (2S, 3R)-tartaric acid? (1)

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e) What is the specific rotation, $[\alpha]_D^{20}$, of racemic tartaric acid? (1)

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f) What is the specific rotation $[\alpha]_D^{20}$, of (2R, 3R)-tartaric acid, given that the value for (2S, 3S)-tartaric acid is -12.4°ml g^{-1} dm^{-1}? (1)

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8) a) Calculate the optical purity of a sample of 2-bromobutane that shows a value of $[\alpha]_D^{20}$ = 12.4°ml g^{-1} dm^{-1}, given that $[\alpha]_D^{20}$ for (2S)-2-bromobutane is 23.1°ml g^{-1} dm^{-1}. (2)

b) Calculate the proportion of (2R)-2-bromobutane in the mixture. (2)