

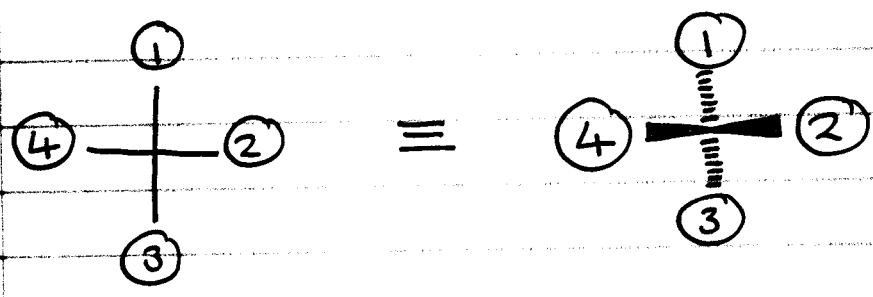
- ① FISCHER PROJECTIONS
- ② CIS/TRANS DIASTEREISOMERS
- ③ CONSEQUENCES OF CHIRALITY
- ④ ACIDS & BASES -INTRO

Read Ch 4

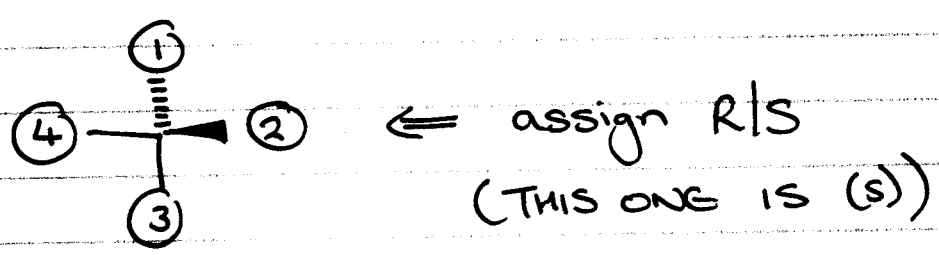
Problems 3.6-3.9, 3.24-3.36

MIDTERM  
LOW 9, HIGH 95  
MEAN = 67

### ① Determining R/S in Fischer Projections



Switch one wedge and one dash for STRAIGHT LINES



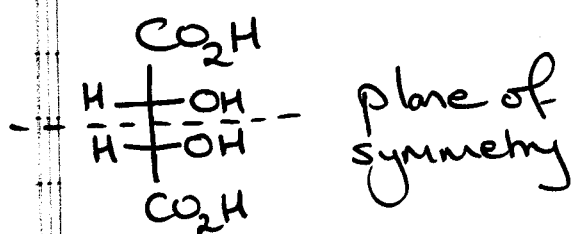
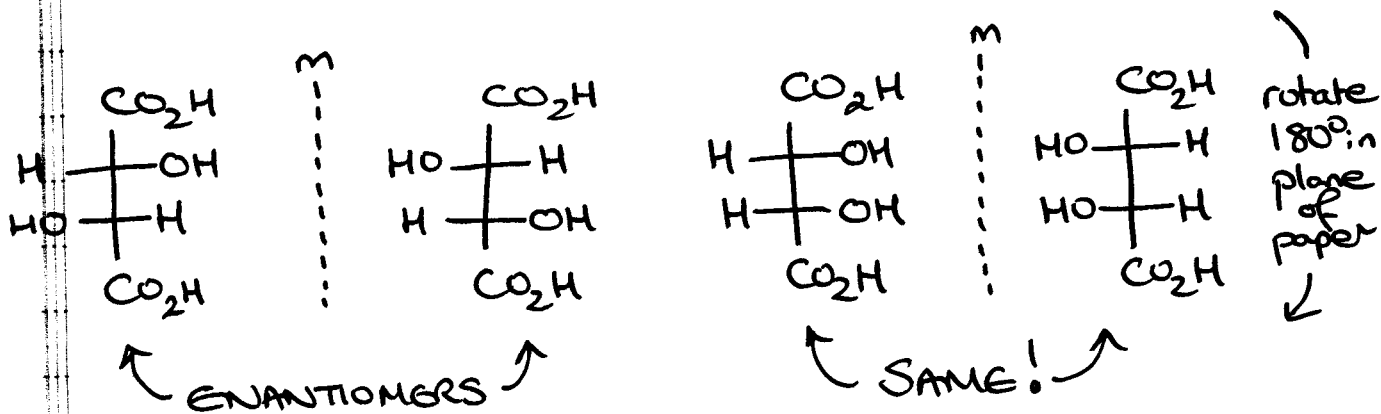
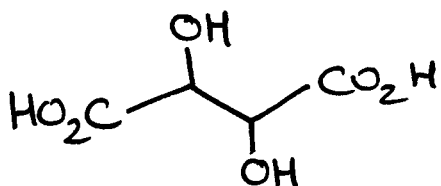
Go back and determine R/S for 2,3,4 trihydroxybutanal

— a molecule with  $n$  chiral centers can have a maximum of stereoisomers =  $2^n$

e.g. 2,3,4 trihydroxybutanal has 2 stereocenters

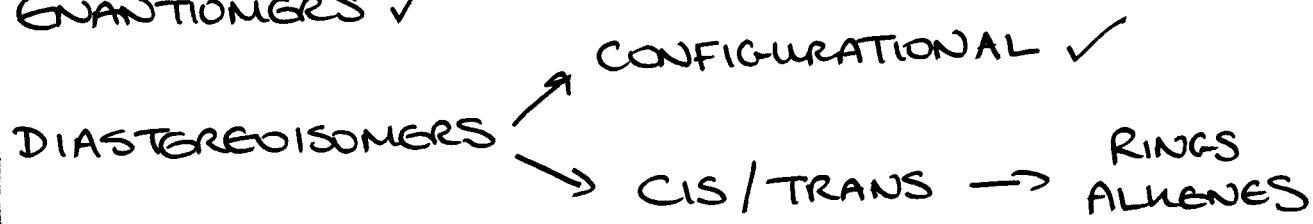
$$2^2 = 4$$

CONSIDER TARTARIC ACID

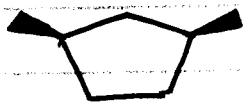


Compound w/ stereoisomers but is ACHIRAL  
=> MESO

ENANTIOMERS ✓



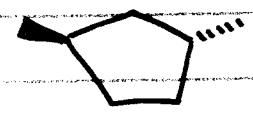
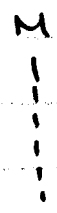
RINGS



cis  
(meso)



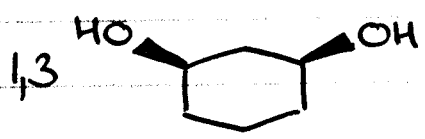
trans



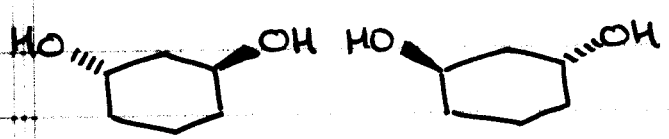
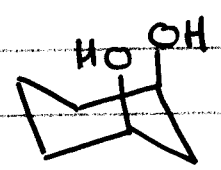
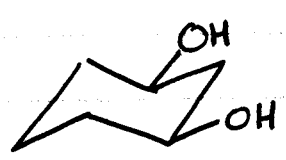
trans

ENANTIOMERS

consider CYCLOHEXANES



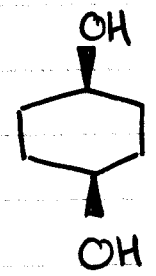
cis  
(meso)



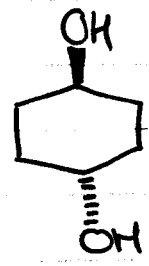
trans  
ENANTIOMERS

DRAW CHAIR FOR EACH, AND DO A RING FLIP FOR EACH ENANTIOMER (IN EACH CASE, CHAIRS ARE IDENTICAL)

1,4

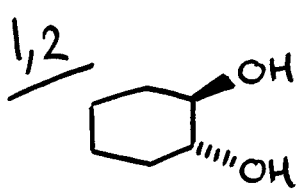


cis

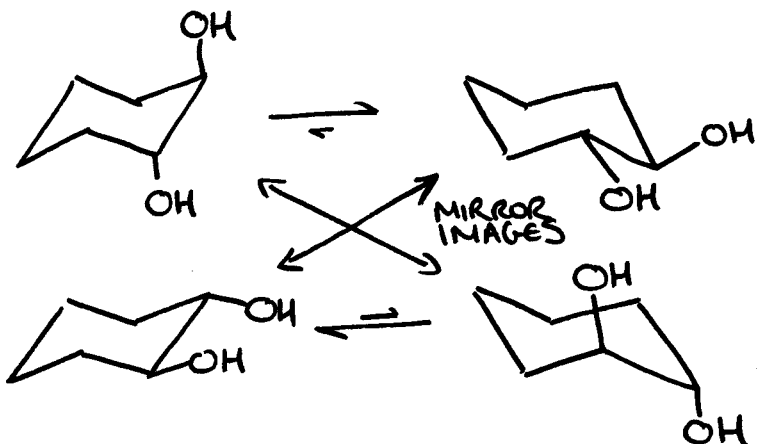
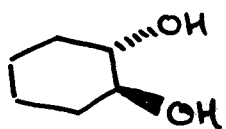


trans

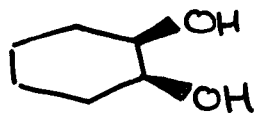
BOTH ACHIRAL



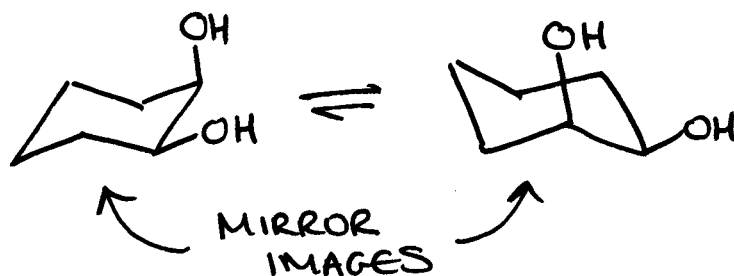
trans



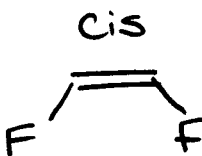
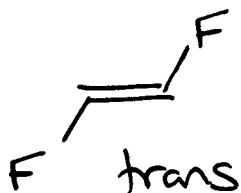
cis



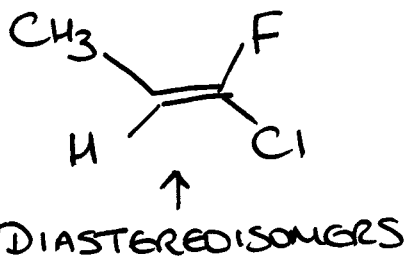
meso



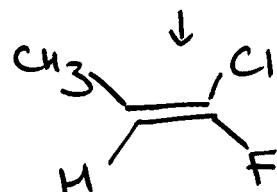
ALKENES



DIASTEREISOMERS



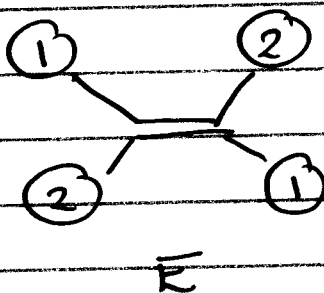
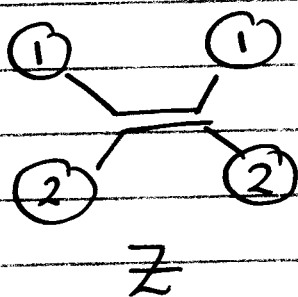
cis/trans? (E)



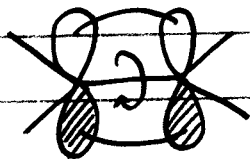
? (Z)

5

Use same priority rules as for R/S on each C of the double bond



WHY NO ROTATION ABOUT DOUBLE BONDS?



Rotation would remove overlap (break  $\pi$  BOND) and this doesn't happen under normal conditions

### ③ CONSEQUENCES OF CHIRALITY

Properties of stereoisomers

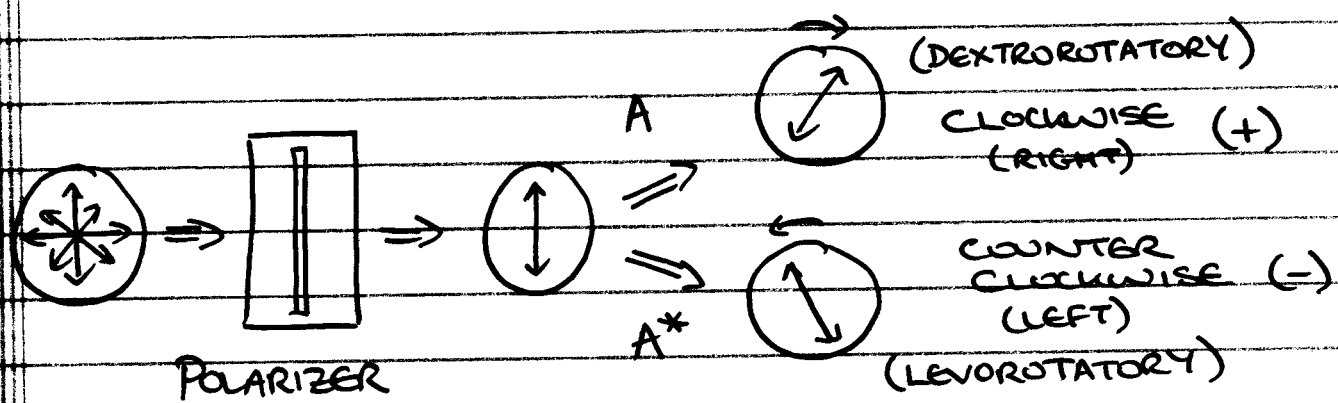
ENANTIOMERS — Identical PHYSICAL & CHEMICAL PROPERTIES (in an ACHIRAL environment)

eg. mp, bp, solubility in water etc

DIASTEROISOMERS — different...

# OPTICAL ACTIVITY

- rotation of plane polarized light



Specific Rotation  $[\alpha]_{\lambda}^T = \frac{\text{Obs rotation } (^{\circ})}{\text{Length (dm)} \times \text{conc (g/mL)}}$

T = temperature  
 $\lambda$  = wavelength of light

Racemic mixture  $\rightarrow$  specific rotation = 0 ( $\pm$ )

NO RELATIONSHIP b/w R/S and +/-

## ENANTIOMERIC EXCESS (ee)

$$ee = \frac{[R] - [S]}{[R] + [S]} \times 100$$

$$= \%R - \%S$$

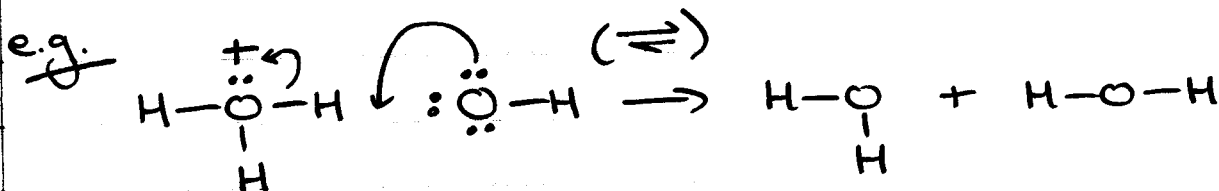
e.g. if a sample is 90% R and 10% S

the ee = 90 - 10 = 80%

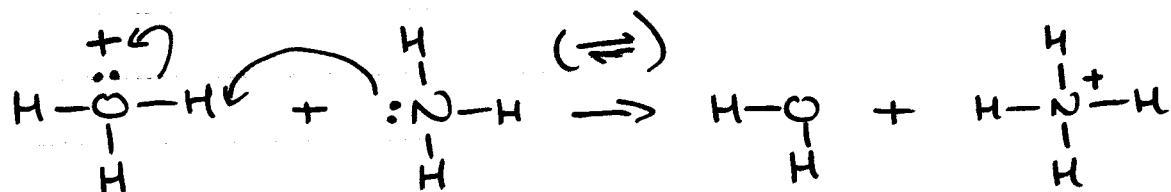
Read Sections 3.8 and 3.9  
chirality in the natural world  
(DNA, PROTEINS, ENZYMES, DRUGS)

Chapter 4 ACIDS/BASES

BRONSTED LOWRY ⇒ ACID H<sup>+</sup> DONOR  
BASE H<sup>+</sup> ACCEPTOR



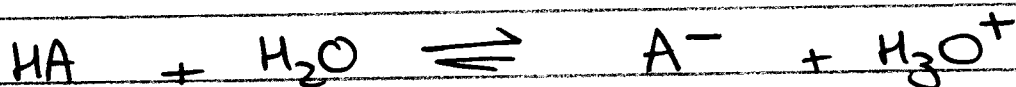
ACID (H<sup>+</sup> DONOR) hydronium ion  
BASE (H<sup>+</sup> ACCEPTOR) hydroxide ion



ACID                      BASE                      CONJUGATE BASE                      CONJUGATE ACID

## ACID DISSOCIATION CONSTANTS

- Quantify acid strength



$$K_{\text{eq}} = \frac{[\text{H}_3\text{O}^+][\text{A}^-]}{[\text{HA}][\text{H}_2\text{O}]}$$

← charges very little (huge xs)

$$K_{\text{a}} = K_{\text{eq}}[\text{H}_2\text{O}] = \frac{[\text{H}_3\text{O}^+][\text{A}^-]}{[\text{HA}]}$$

e.g. for acetic acid CC(=O)O

$$K_{\text{a}} = 1.74 \times 10^{-5}$$

most organic acids have  $K_{\text{a}}$  values with -ve exponents, so we often compare  $\text{p}K_{\text{a}}$  values

$$\text{p}K_{\text{a}} = -\log_{10} K_{\text{a}}$$

$$\text{p}K_{\text{a}}(\text{CH}_3\text{CO}_2\text{H}) = 4.76$$

LARGER  $\text{p}K_{\text{a}}$  VALUE  $\rightarrow$  WEAKER ACID

STRONG ACID  $\equiv$  WEAK CONJUGATE BASE / WEAK ACID  $\equiv$  STRONG CONJUGATE BASE

Scan this table or Page 141