Cukry możemy podzielić na trzy grupy. Ze względu na:

- wielkość cząsteczek

monosacharydy
disacharydy
polisacharydy

- grupy funkcyjne

polihydroksyaldehydy (aldozy)
polihydroksyketony (ketozy)

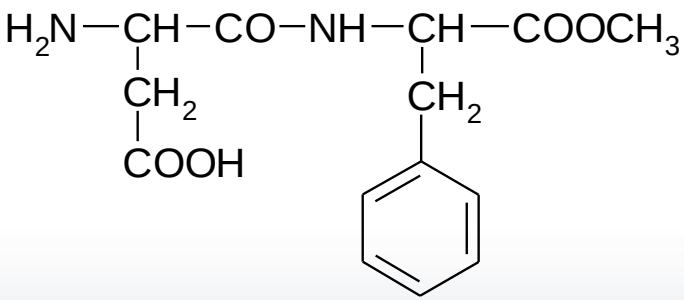
- liczbę atomów węgla (cukry proste)

triozy, tetrozy, pentozy, heksozy

Środki słodzące

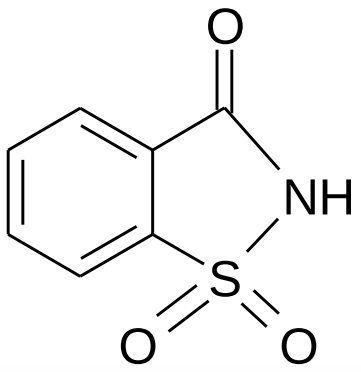
Aspartam

Aspartam: $C_{14}H_{18}N_2O_5$, (E 951),



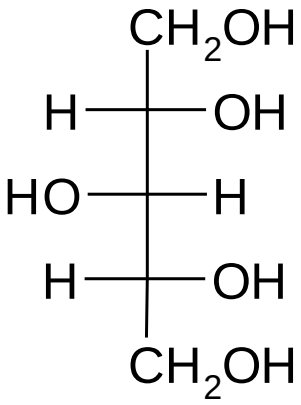
Sacharyna

Sacharyna: $C_7H_5NO_3S$. Jest ponad 300 razy słodsza od cukru. Jej mała tabletka jest równie słodka, co czubata łyżka cukru, pozbawiona jednak 20 kilokalorii.

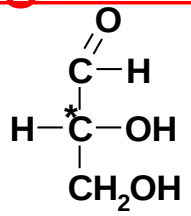


Ksylit

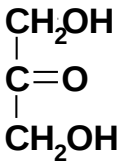
Ksylit: $C_5H_{12}O_5$,



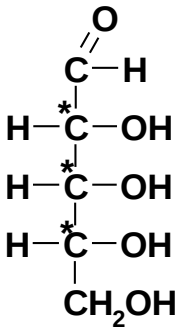
Węglowodany do zapamiętania



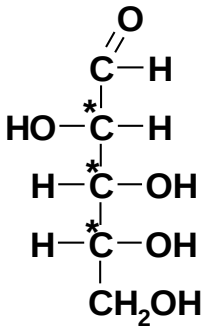
aldehyd D-(+)-glicerynowy



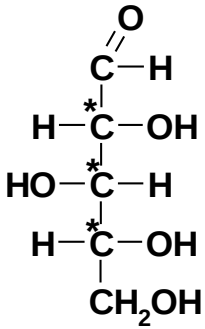
dihydroksyaceton



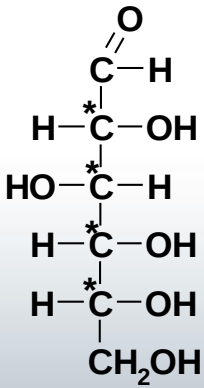
D-(-)-ryboza



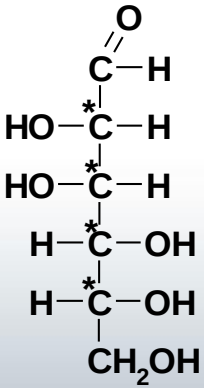
D-(-)-arabinoza



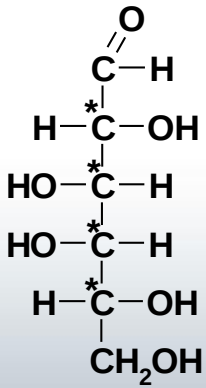
D-(+)-ksyloza



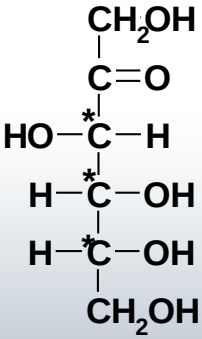
D-(+)-glukoza



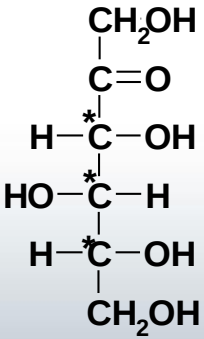
D-(+)-mannoza



D-(+)-galaktoza



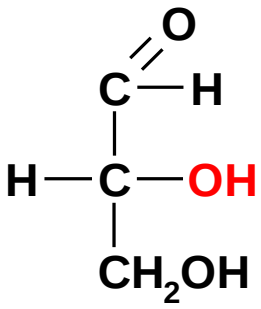
D-(-)-fruktoza



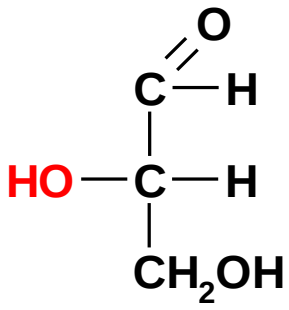
D-(+)-sorboza

IROMERIA WĘGLOWODANÓW

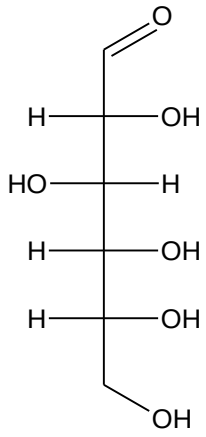
Izomery D i L



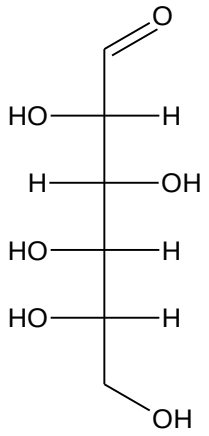
D



L

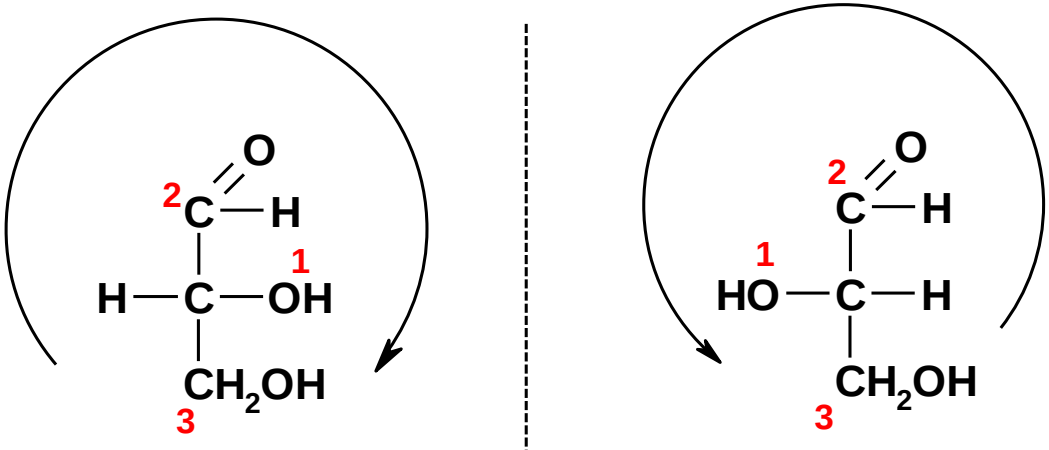


D-glukoza

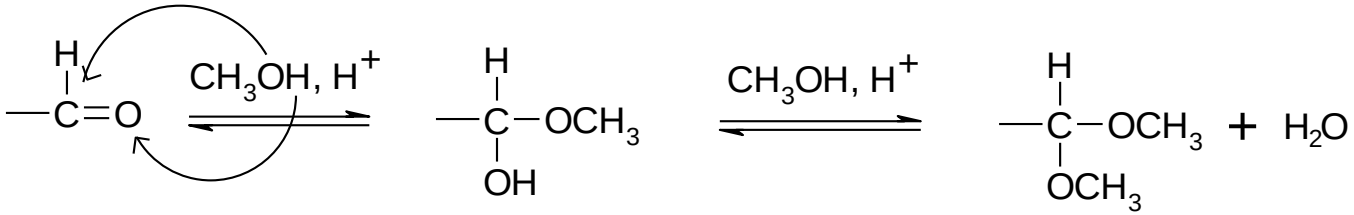


L-glukoza

Konfiguracja absolutna R i S

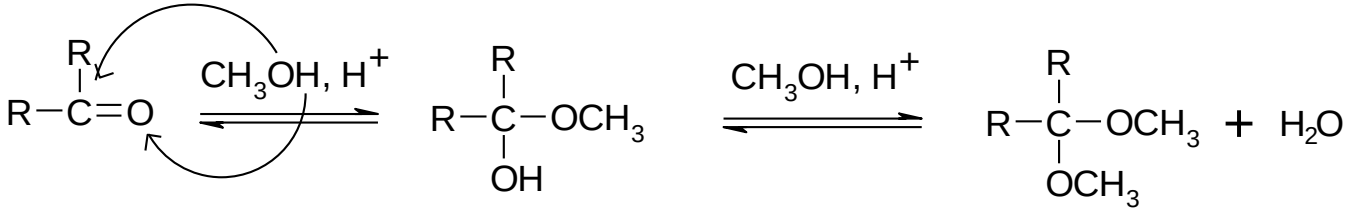


Aldehydy reagują w obecności bezwodnego HCl z alkoholami. W wyniku tej reakcji otrzymujemy nietrwałe **hemiacetale** (półacetale), które reagują szybko z następną cząsteczką alkoholu dając trwałe **acetale.**



hemiacetal
(alkohol, eter)

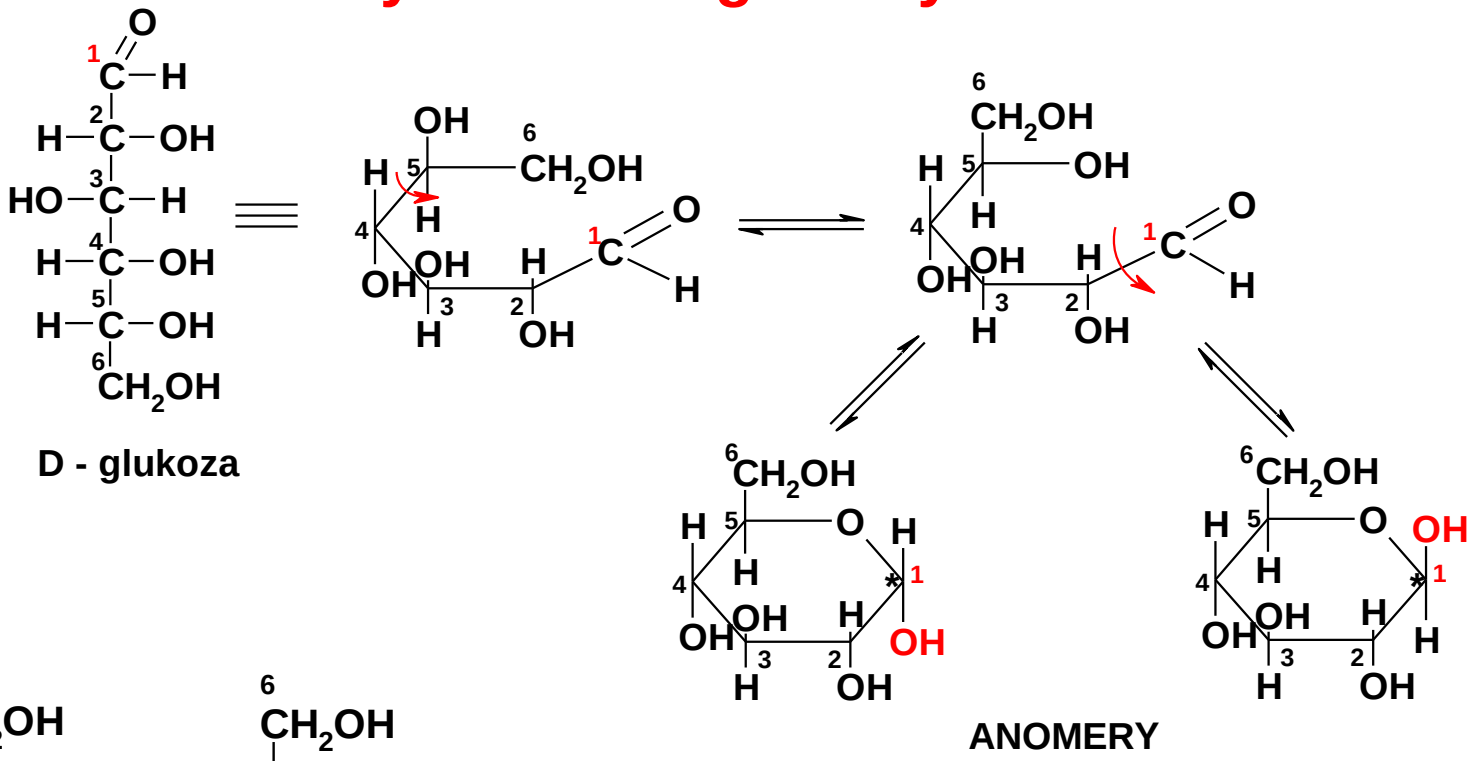
acetal
(eter)



hemiketal

ketal

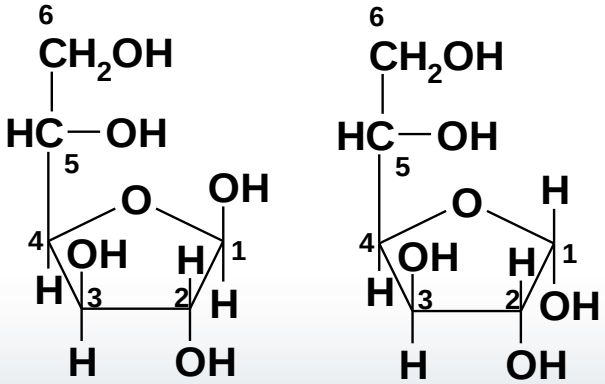
Przemiana oksocykliczna D-glukozy



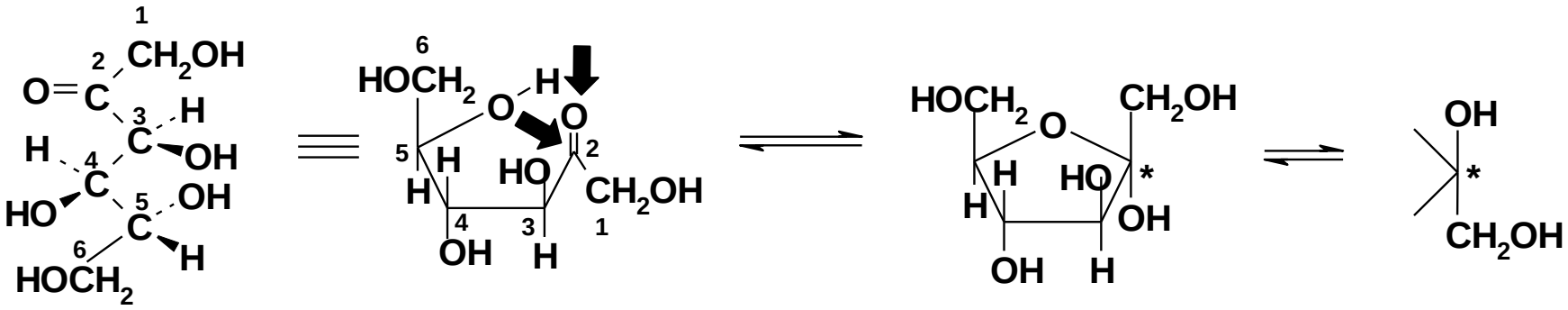
D - glukoza

ANOMERY

α –D-glukopiranoza β –D-glukopiranoza



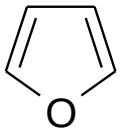
β-D-glukofuranoza α-D-glukofuranoza



forma lañcuchowa

uproszczony wzór formy cyklicznej

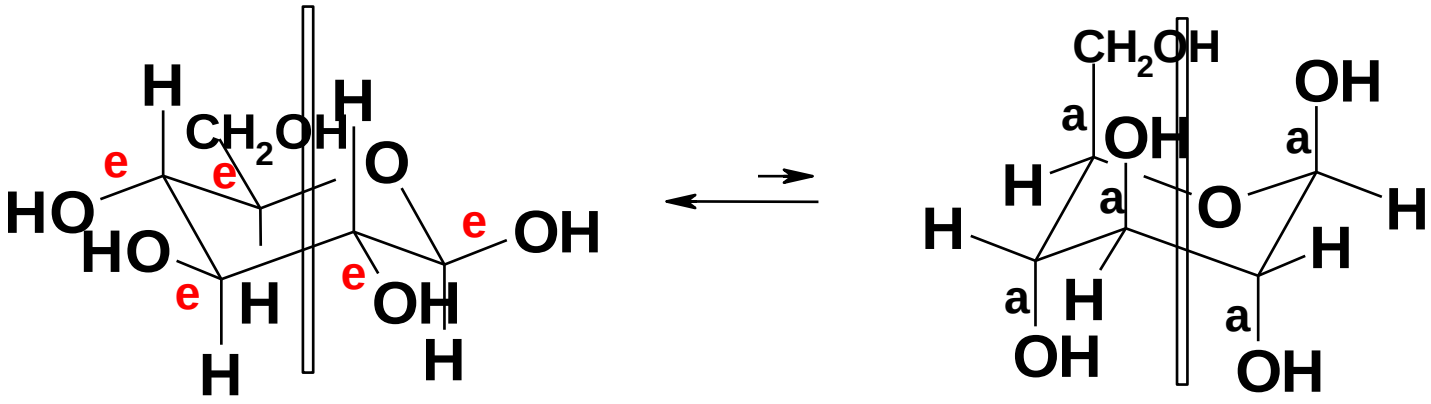
forma cykliczna-furanoza



furan

KONFORMACJA

β-D-(+)-glukopiranozy



I

II

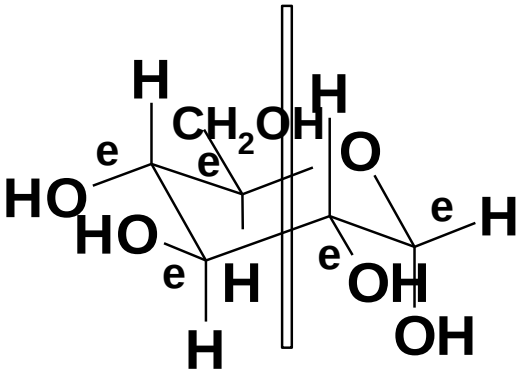
bardziej trwaly;
wszystkie objetosciowe
grupy sa ekwatorialne

mniej trwaly;
wszystkie objetosciowe
grupy sa aksjalne

α-D-glukopiranoza

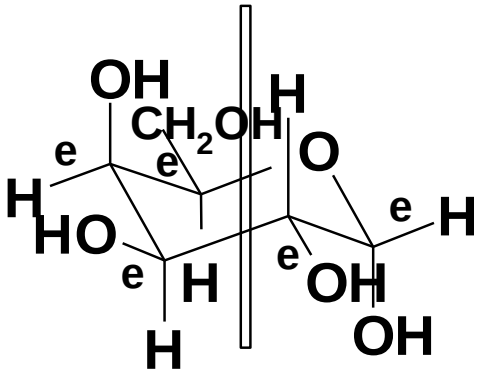
β-D-mannopiranoza

α-D-galaktopiranoza



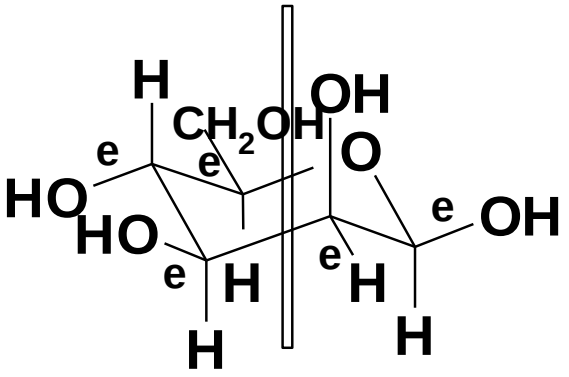
III

trwala konformacja



V

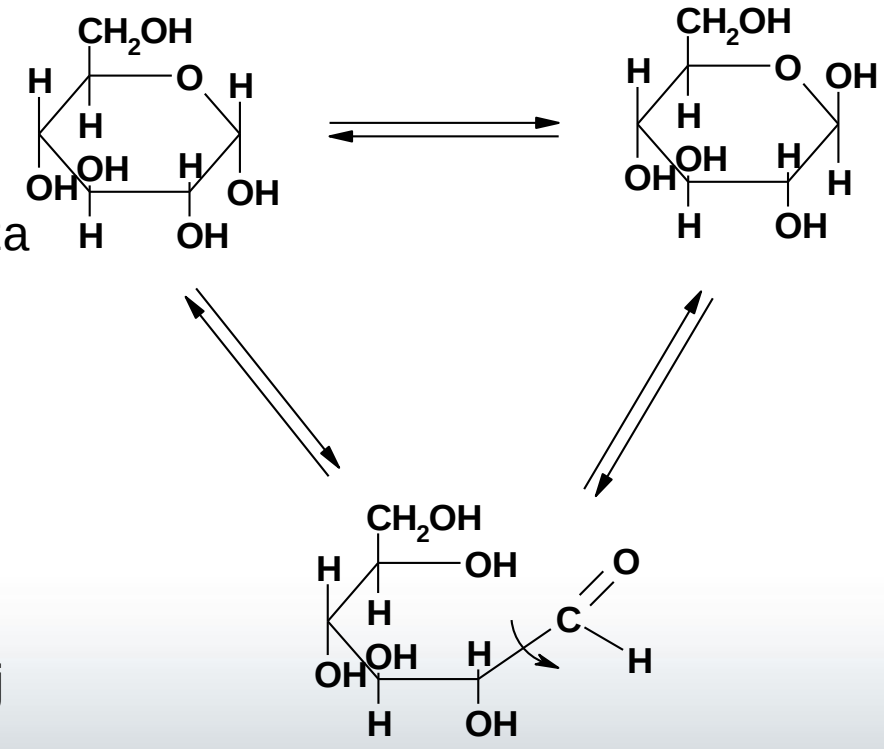
trwala konformacja



IV

trwala konformacja

ANOMERYZACJA I MUTAROTACJA



α – D – glukopiranoza
(~36%)

$[\alpha]_D^{20} = 112,2^O$

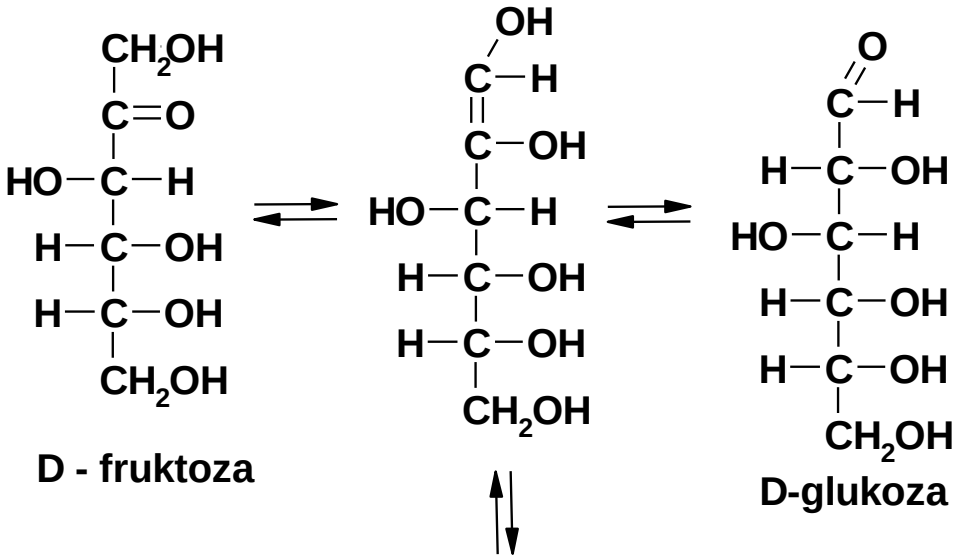
β – D – glukopiranoza
(~64%)

$[\alpha]_D^{20} = 18,7^O$

formy łańcuchowej
(0,02%)

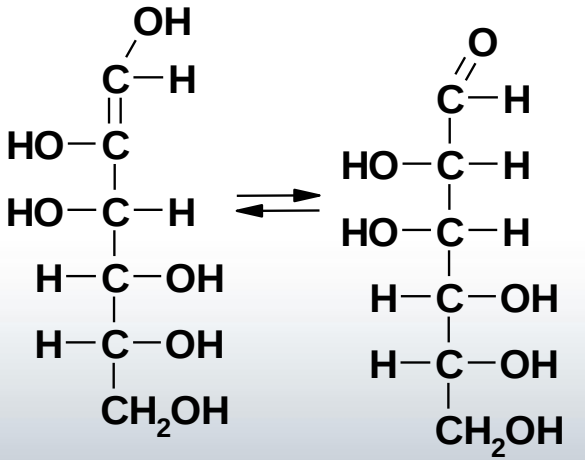
TAUTOMERYZACJA

forma enolowa (endiolowa)



D - fruktoza

D-glukoza



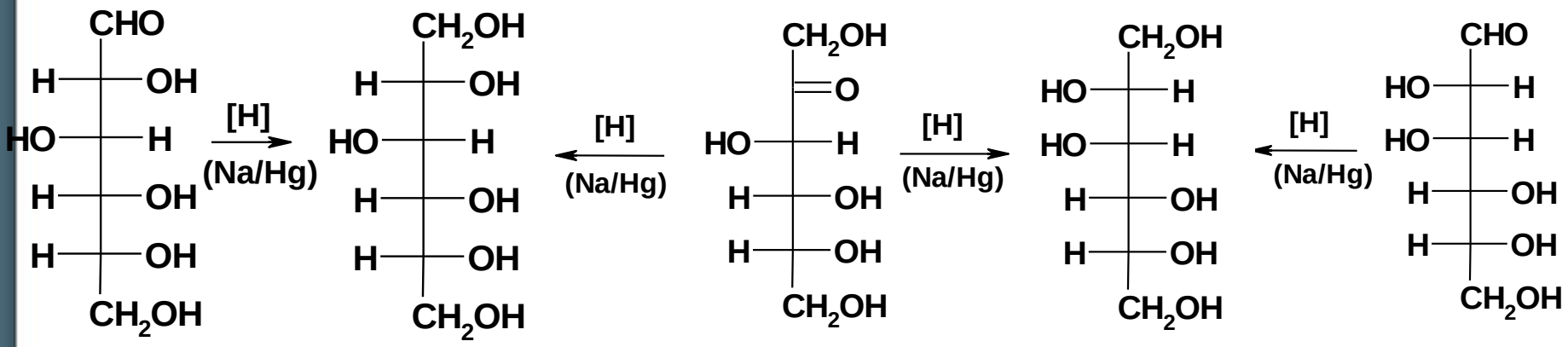
forma enolowa (endiolowa)

D-mannoza

REAKCJE CHEMICZNE

MONOSACHARYDÓW

1.Redukcja monosacharydów



D-glukoza D-glucitol D-fruktoza D-mannitol D-mannoza

2. Utlenianie monosacharydów.

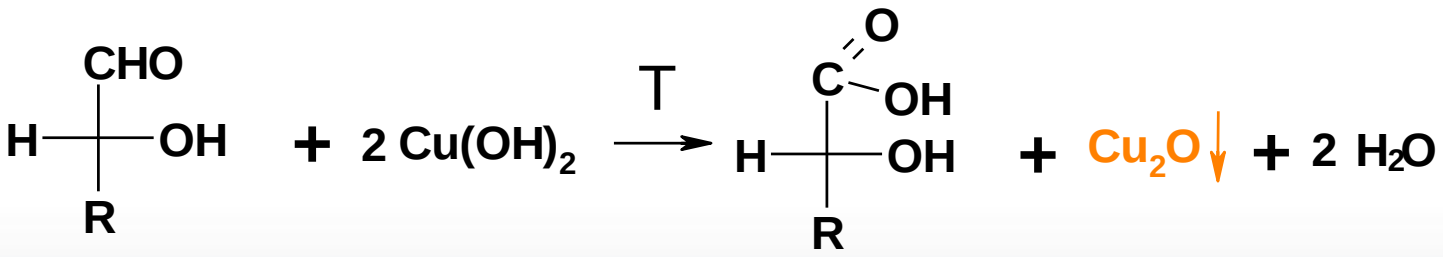
a) utlenianie w środowisku zasadowym odczynnikami:

Fehlinga, Benedicta, Trommera, Tollensa, kwasem pikrynowym

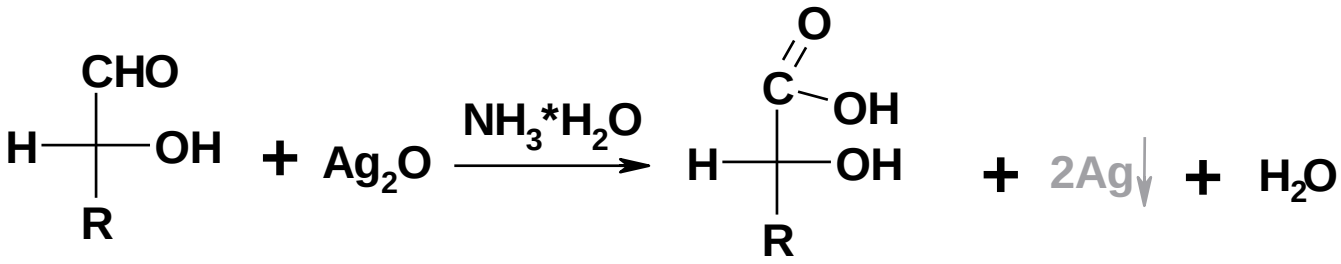
otrzymujemy kwasy aldonowe

Trommer

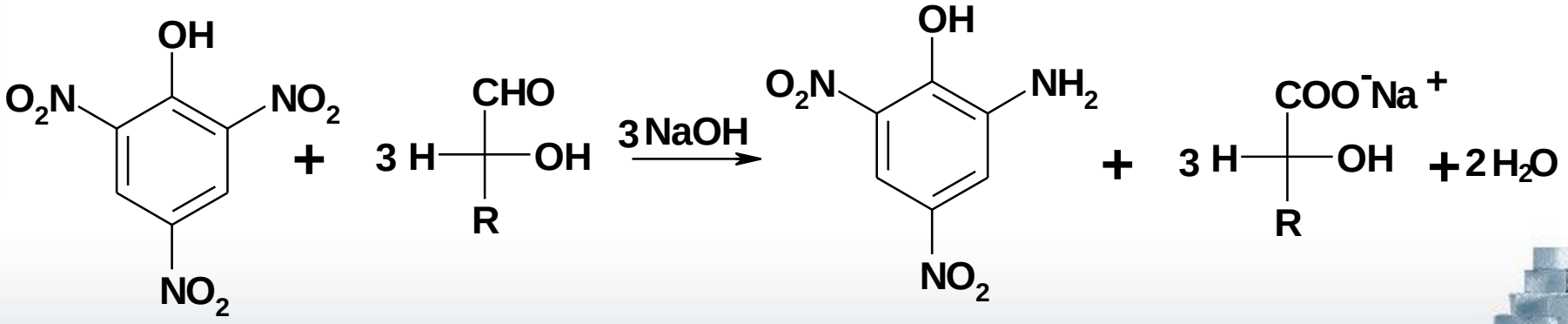
$$CuSO_4 + 2\,NaOH \longrightarrow Cu(OH)_2 + Na_2SO_4$$



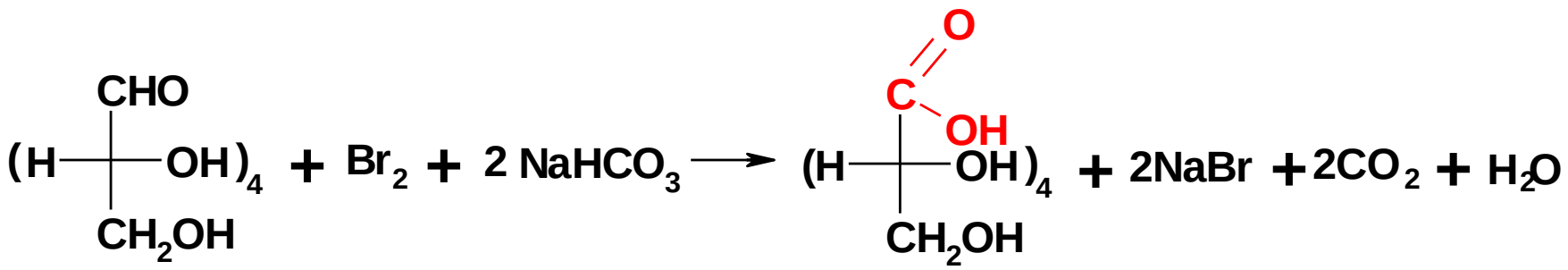
Tollens



Kwas pikrynowy



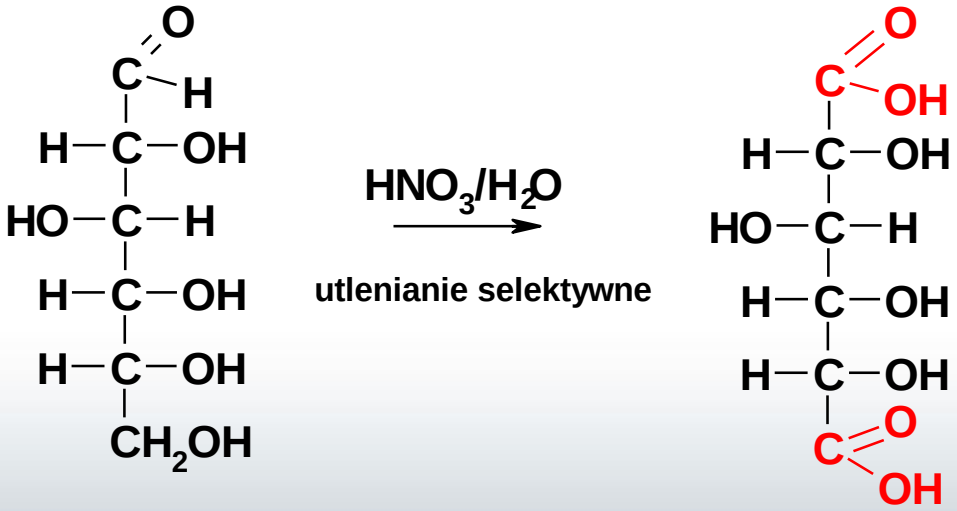
b) utlenianie wodą bromową aldoz (ketozy nie reagują)



glukoza

kwas glukonowy

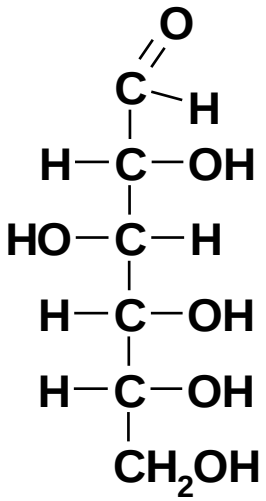
c) utlenianie gorącym kwasem azotowym aldoz- otrzymujemy kwasy aldarowe



D-glukoza

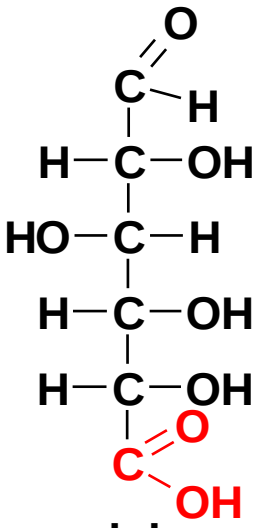
kwas D- glukarowy (cukrowy)

d) biologiczne utlenianie aldoheksoz- otrzymujemy kwasy uronowe.



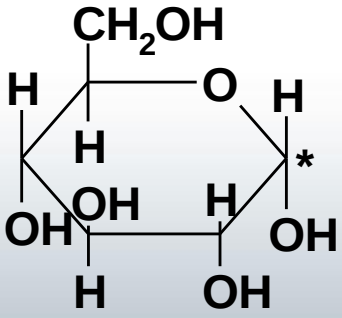
glukoza

enzymy

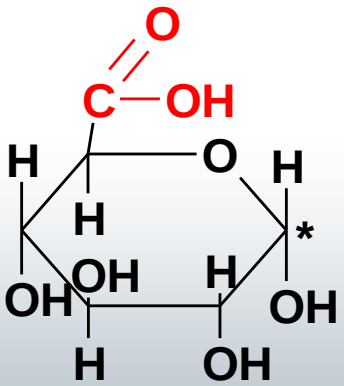


kwas glukouronowy

lub kwas glukuronowy

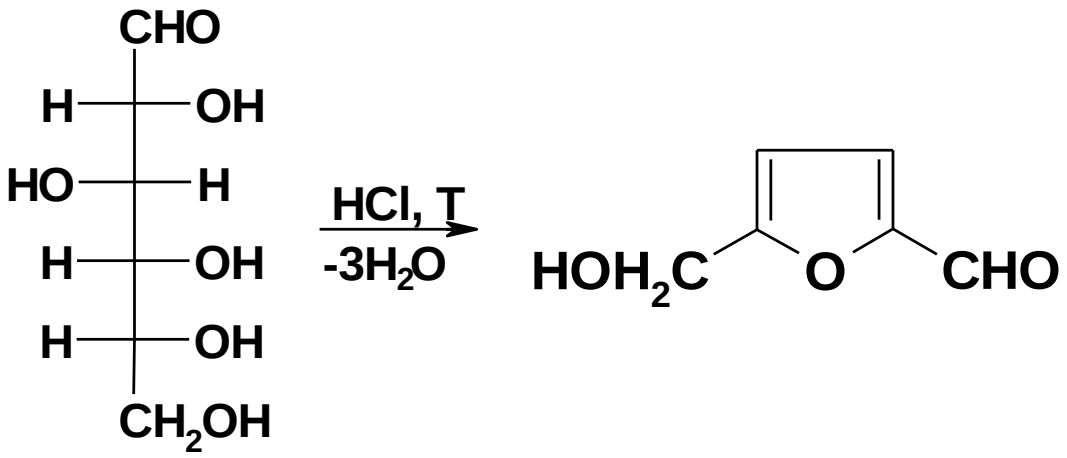


enzymy



5. Dehydratacja monosacharydów w środowisku silnie kwaśnym

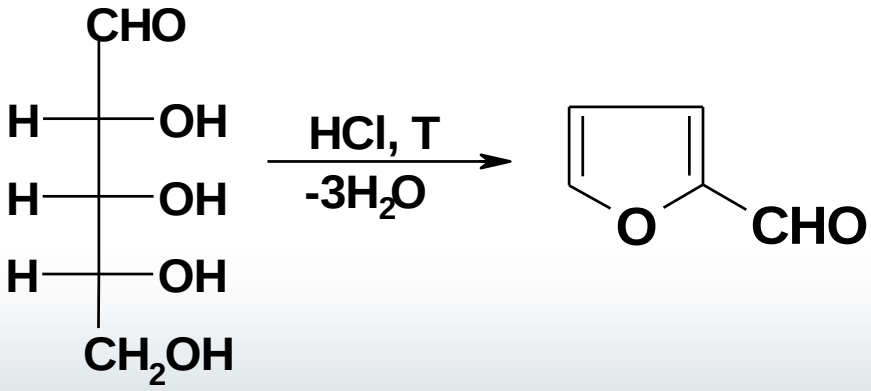
heksozy



D-glukoza

5-hydroksymetylofurfural

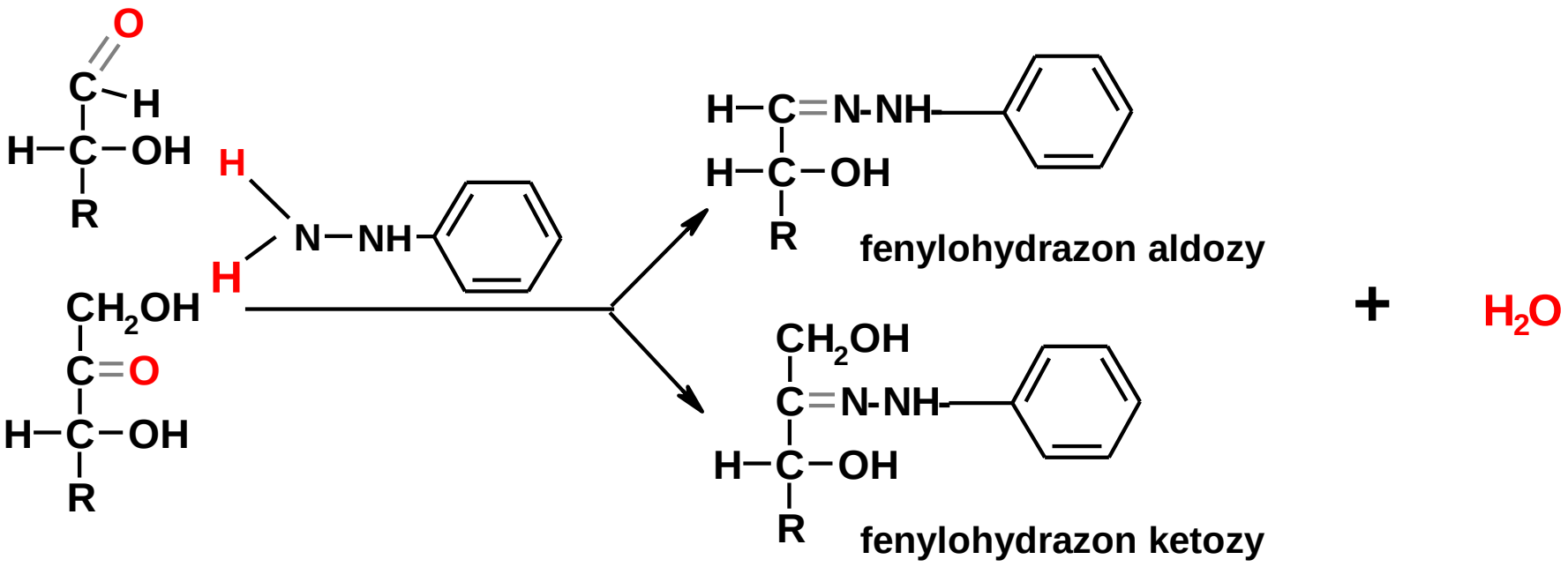
pentozy



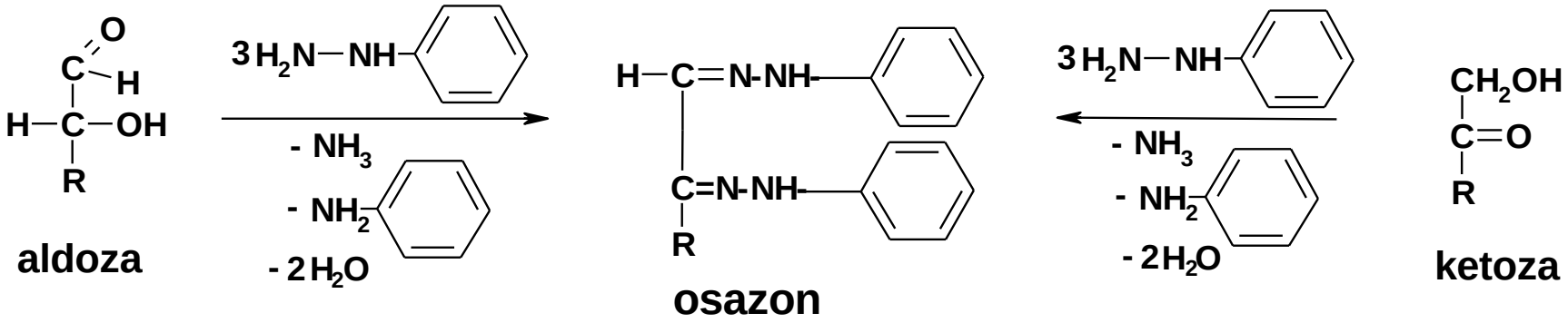
D-ryboza

furfural

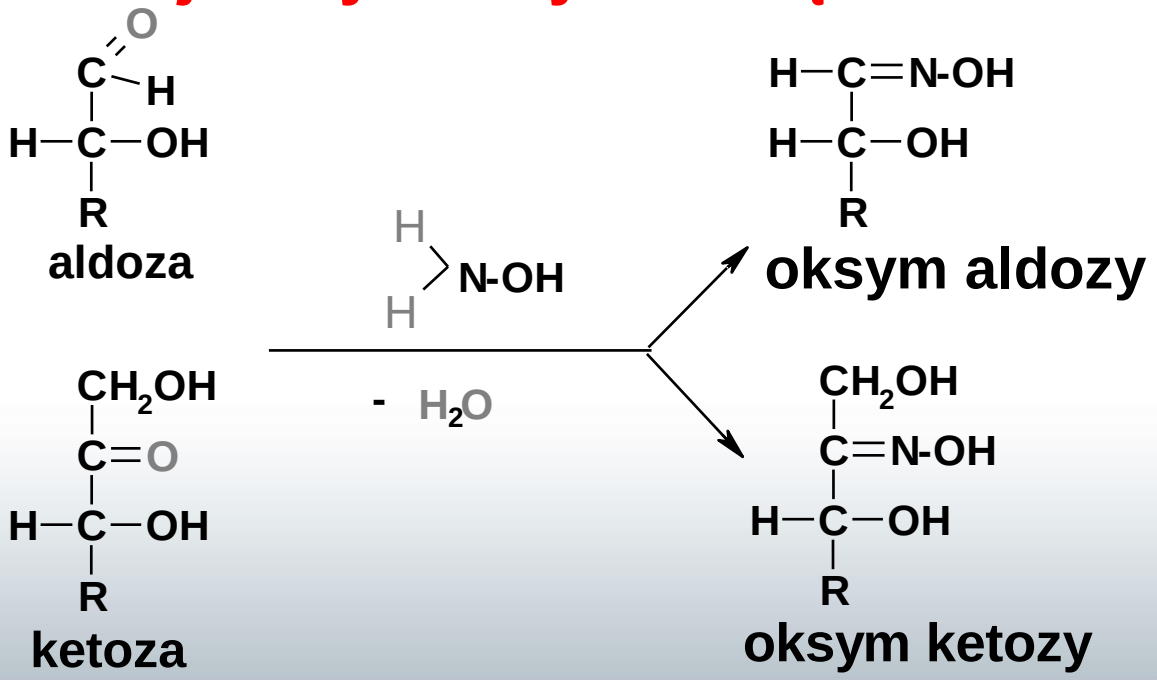
6. Reakcja z fenylohydrazyną



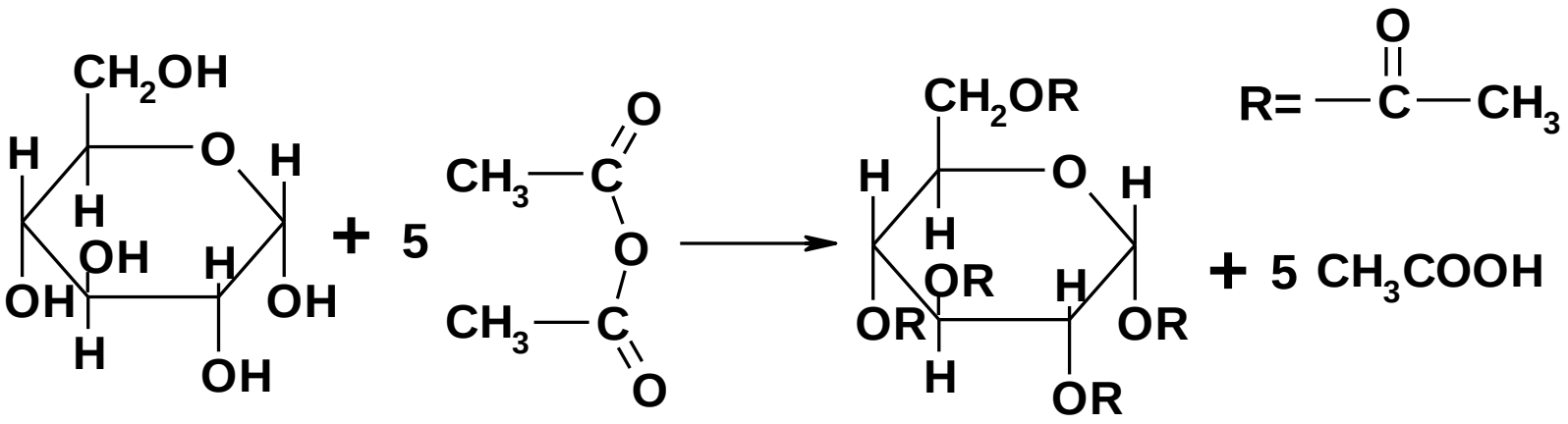
7. reakcja z nadmiarem fenylohydrazyny



8. reakcja z hydroksyloaminą



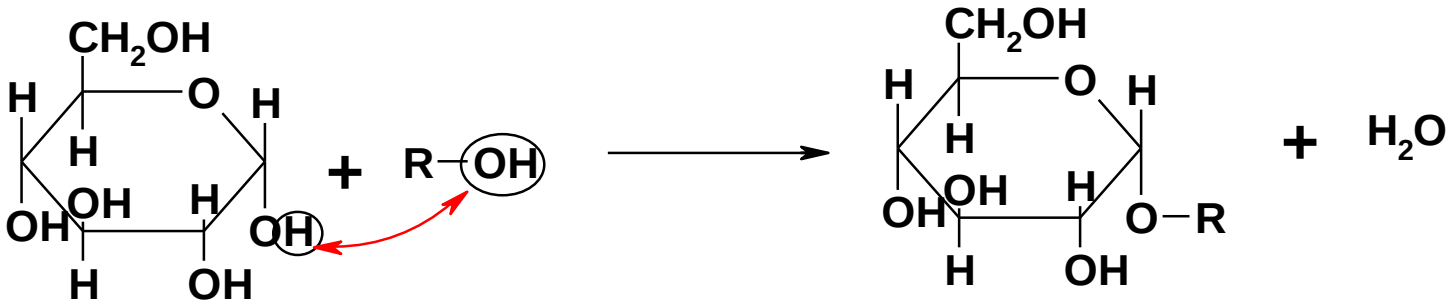
9. reakcja estryfikacji



1,2,3,4,6-pentaoctan

10. Powstawanie glikozydów

O - glikozydy



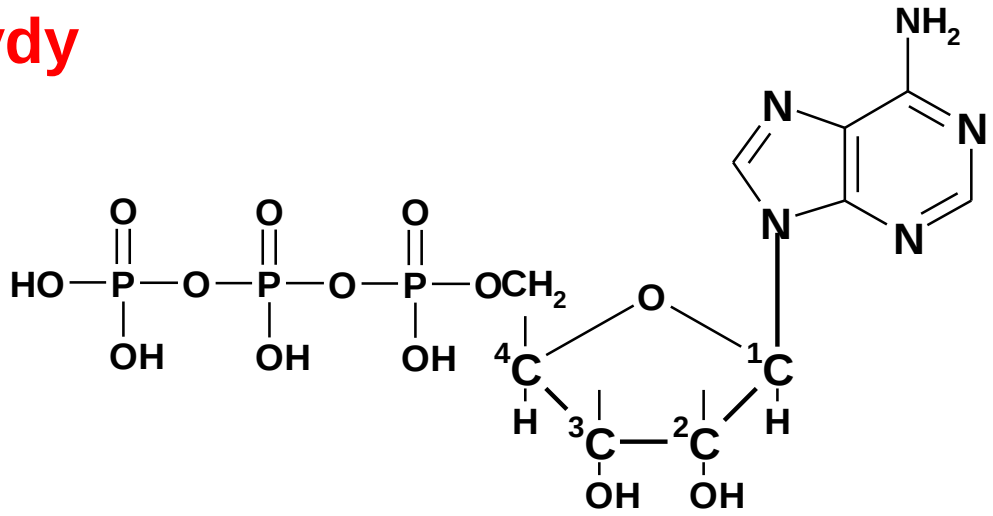
Hemiacetal

Acetal=Glikozyd

D-glukoza $\xrightarrow[\text{t. wrz.12h}]{\text{MeOH, 2\% HCl}}$

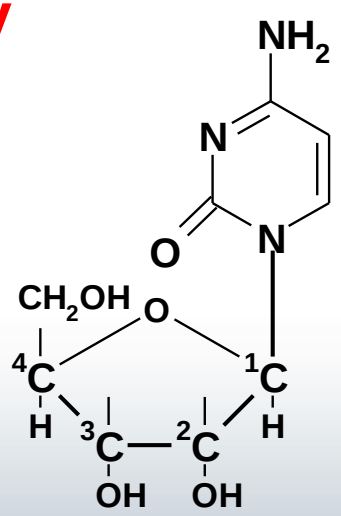
α –metyloglukopiranozyd (66%)
β - metyloglukopiranozyd (32,5%)
β - metyloglukofuranozyd (0,9%)
α - metyloglukofuranozyd (0,6%)

Nukleotydy

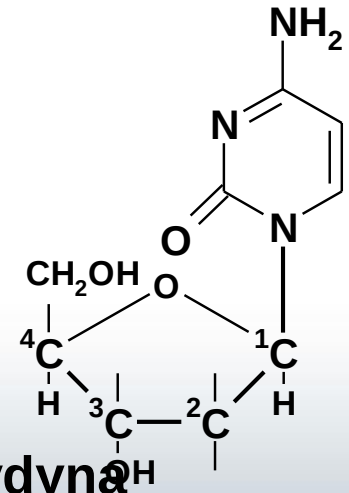


Adenozyno-5-trójfosforan(ATP)

Nukleozydy



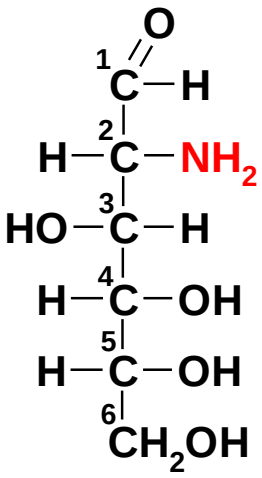
cytydyna



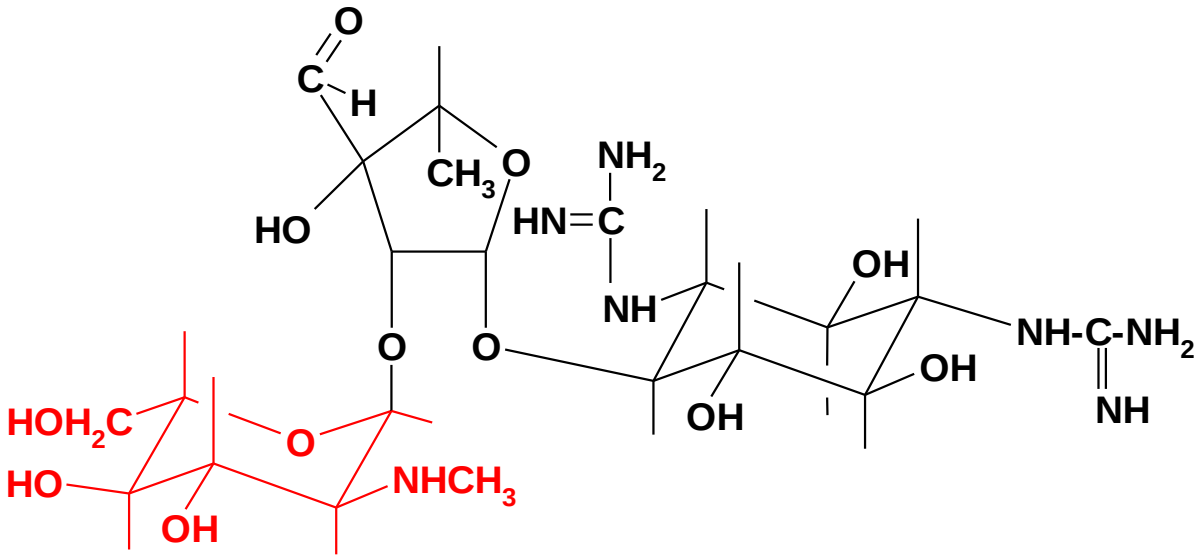
deoksycytydyna

Aminocukry

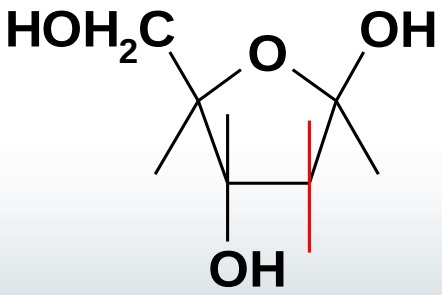
Glukozamina



Streptomycyna



Deoksycukry



2-deoksy-D-ryboza

Disacharydy

$C_{12}H_{22}O_{11}$

REDUKUJĄCE

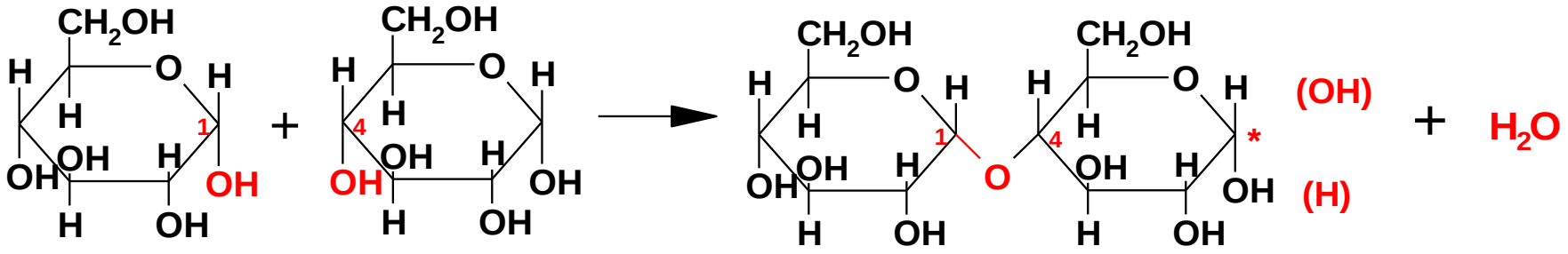
Maltoza (α-1,4)
Celobioza (β-1,4)
Laktoza (β-1,4)

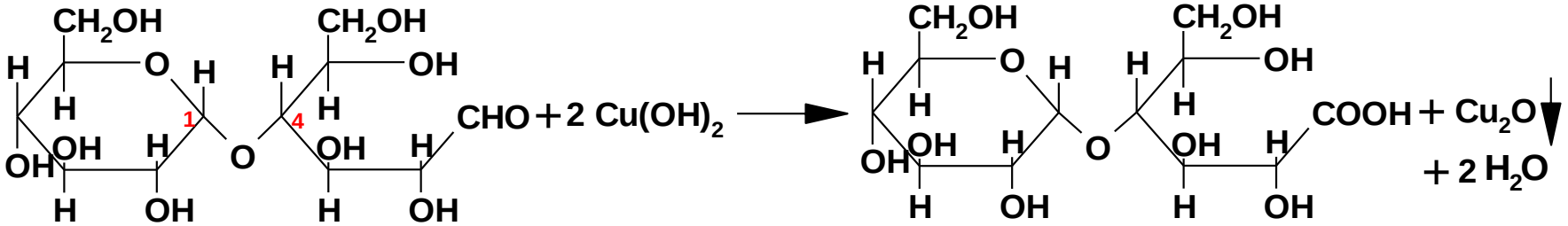
NIEREDUKUJĄCE

Sacharoza (1,2)
Trehaloza (1,1)

DISACHARYDY REDUKUJĄCE

Maltoza



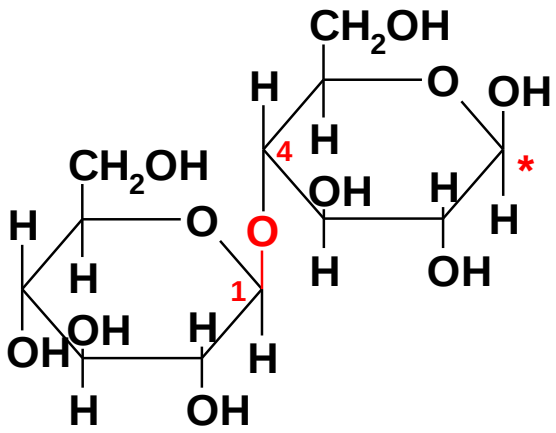


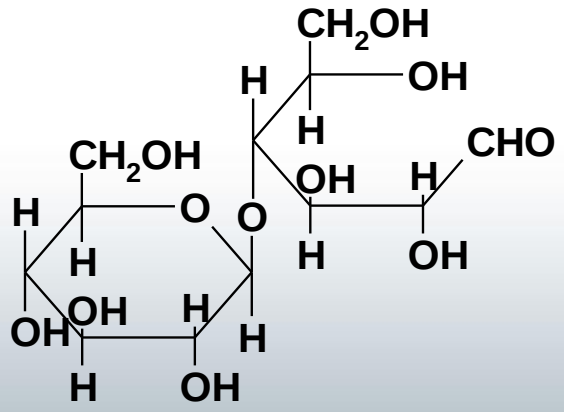
$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{H^+} 2\ C_6H_{12}O_6$$

maltoza — maltaza — alfa-glukoza

DISACHARYDY REDUKUJĄCE

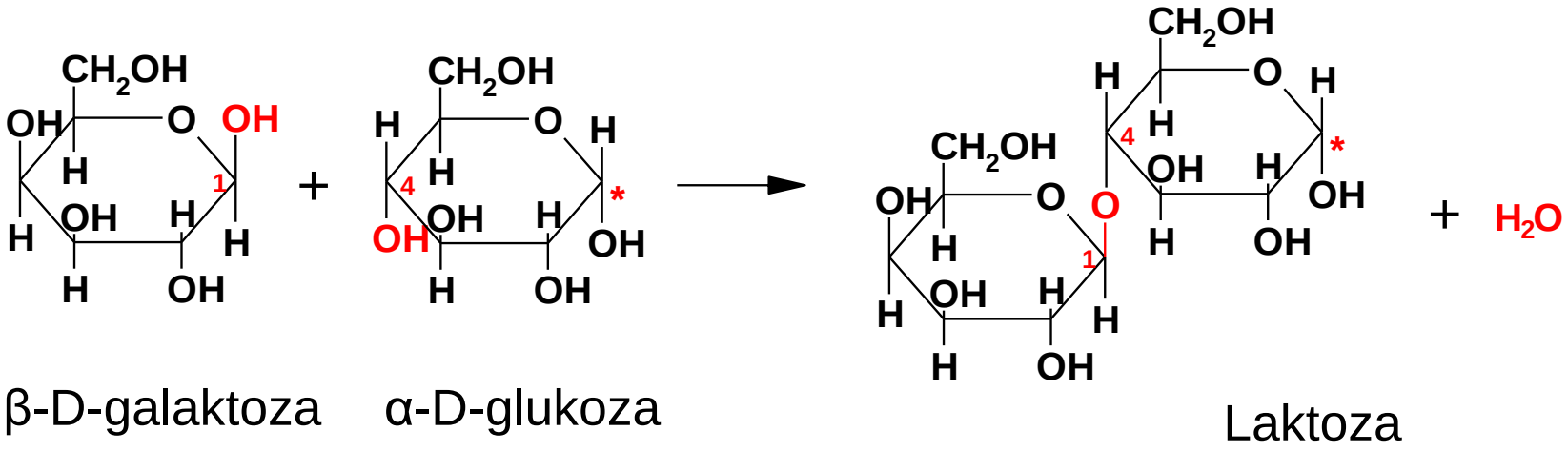
Celobioza





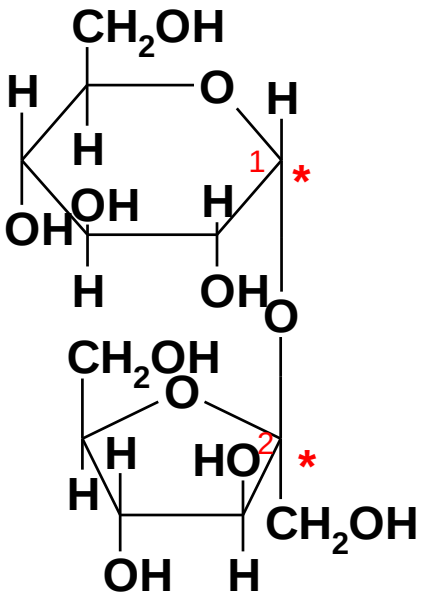
DISACHARYDY REDUKUJĄCE

Laktoza

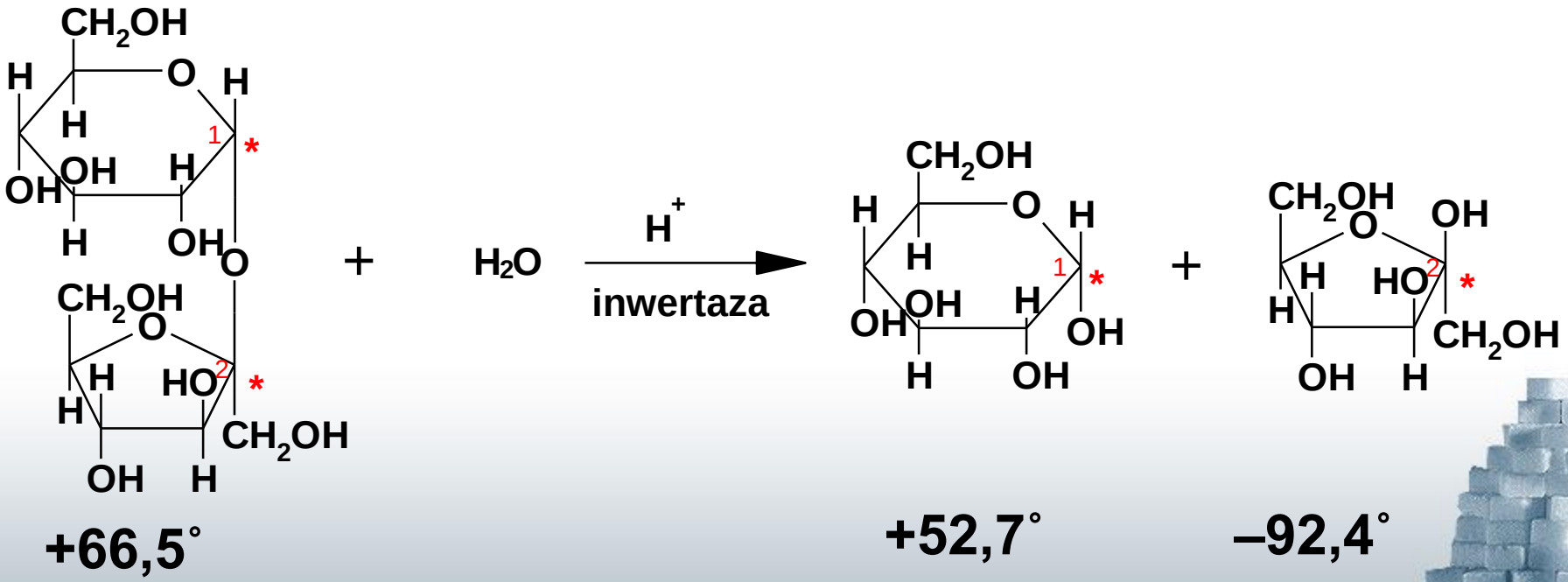


DISACHARYDY NIEREDUKUJĄCE

Sacharoza

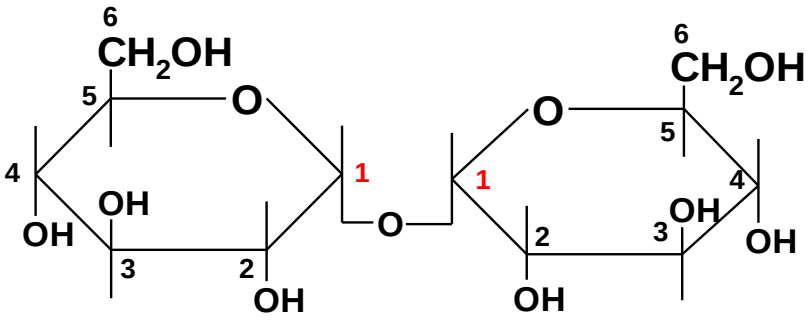


Inwersja sacharozy



DISACHARYDY NIEREDUKUJĄCE

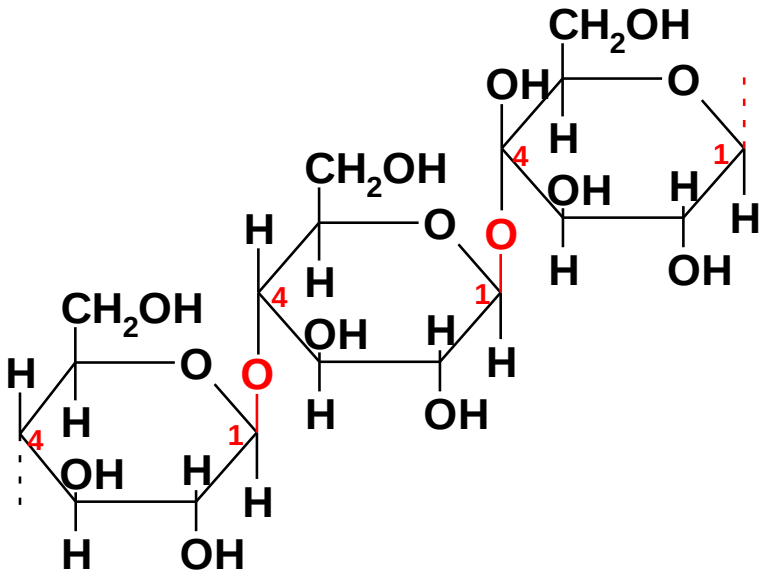
Trehaloza



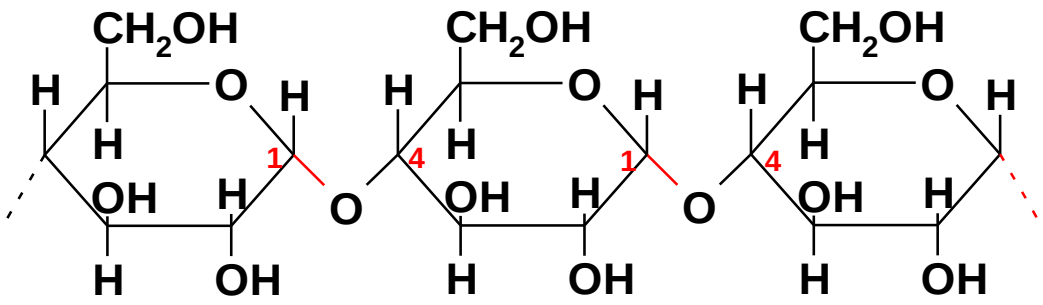
POLISACHARYDY

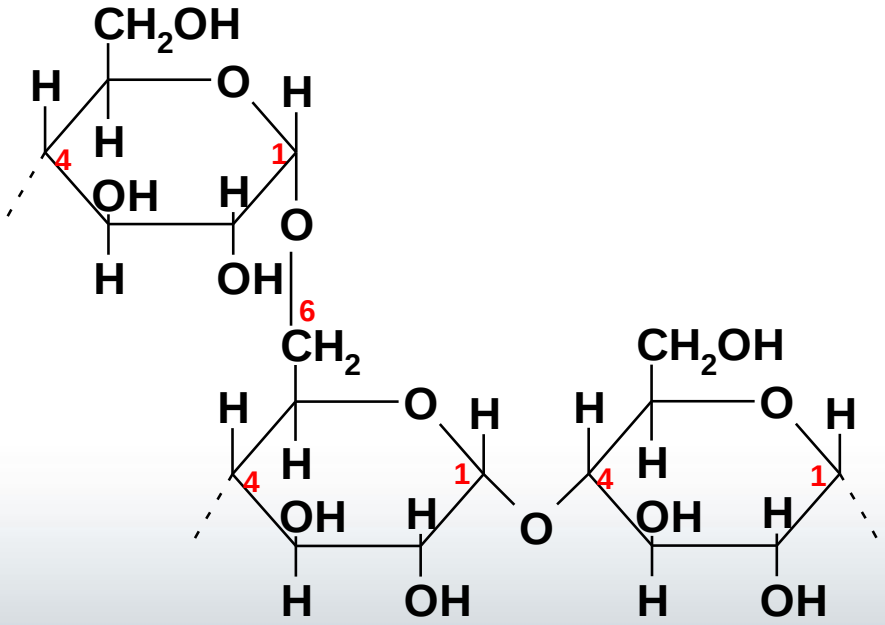
$(C_6H_{10}O_5)n$

CELULOZA

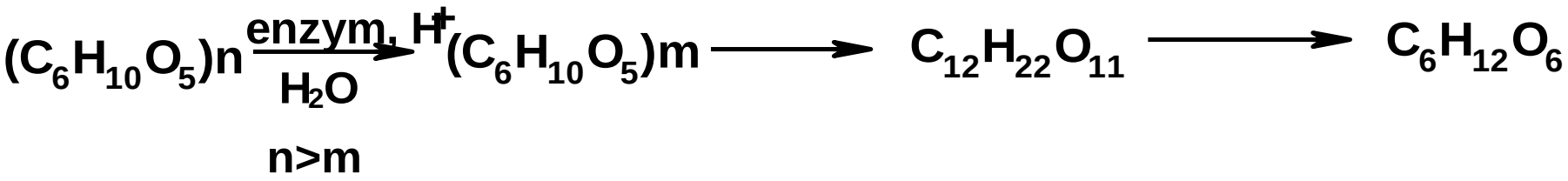


SKROBIA $(C_6H_{10}O_5)_n$





HYDROLIZA SKROBI



skrobia **dekstryny** **maltoza** **α–D-glukoza**