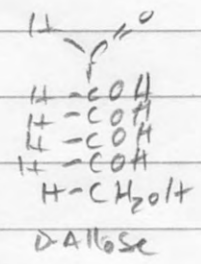
Hw7: Chapter 7: 2, 7, 15, 17, 20, 27, Crossword 7

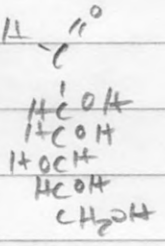
(2) a) Epimers of D-allose @ C-2, C3 and C-4

D-Allose > C-2 epimer: D-Altrose
C-3 epimer: D-Glucose
C-4 epimer: D-Gulose



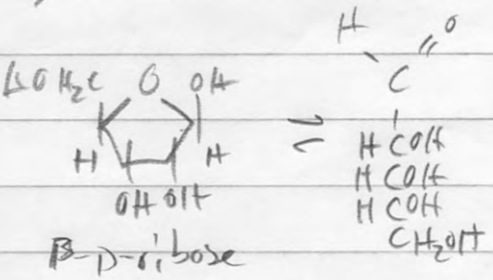
b) Epimers of D-Gulose @ C2, C-3 and C-4

C2 epimer: D-Idose
C3 epimer: D-Galactose
C4 epimer: D-Allose

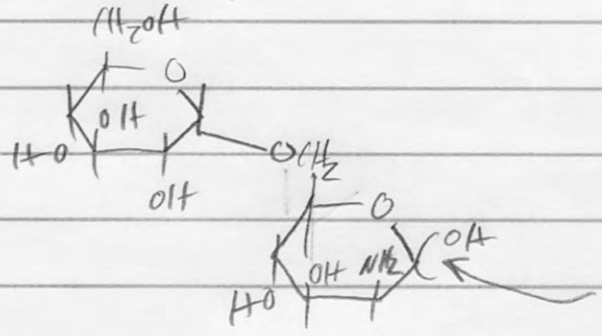


c) Epimers of D-Ribose @ C-2, C3, C4

C2 epimer: D-Arabinose
C3 epimer: D-xylose
C4 epimer: None exists
If would become
L-Ribose

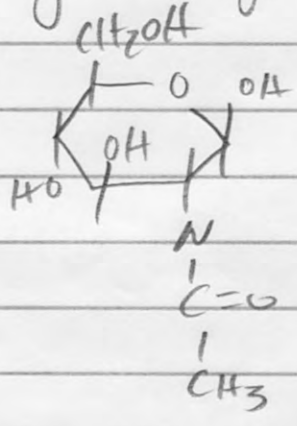


(7) α-D-glucosyl (1→6) D-mannosamine



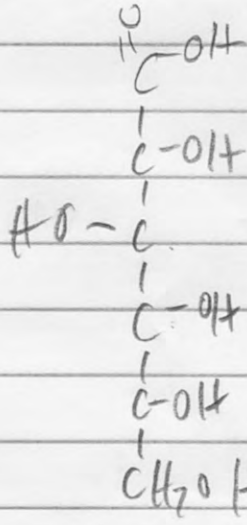
Anomeric carbon on mannosamine makes this a reducing sugar.

(15) a) N-acetyl-β-D-glucosamine a reducing sugar? Yes.



C-1 is a free anomeric carbon and is capable of returning to the aldehyde state

b) Is D-Gluconate a reducing sugar?



D-gluconate has a carboxylic acid @ C-1 so it cannot be oxidized anymore, so NO, it is not a reducing sugar.

(15) d) GlcN ($\alpha 1 \rightarrow 1\alpha$) Glc is not a reducing sugar because it has no free anomeric carbons

(17) The cellulose has β 1,4 linkages between the glucose monomers whereas glycogen has α 1,4 linkages.

cellulose adopts an extended conformation that favours stacking of anti type sheets via hydrogen bonding. This makes it so insoluble

glycogen adopts a helical conformation that can easily be opened up. This is necessary for the organism to be able to rapidly digest glycogen to obtain free glucose!

(20) $\frac{120\ \mu mol\ glucose\text{-}1\text{-}Phosphate}{min}$ liberated

muscle mass is 0.35% glycogen
Assume 1.0 g of muscle tissue, then there are 0.35×10^{-2} g of glycogen

How many moles of glucose are in 0.35 g of glycogen? Assuming glycogen is nothing but glucose &

0.35×10^{-2} g glycogen = 0.35×10^{-2} g glucose $\times \frac{1\ mole\ glucose}{162\ g}$

2.16×10^{-5} moles $\times \frac{1 \times 10^{6}\ \mu moles}{mole} = 21.6\ \mu moles\ glucose$

This would be consumed in:

$\frac{21.6\ \mu moles}{120\ \mu moles/min} = 0.18\ min \times \frac{60\ sec}{min} = \boxed{10.8\ sec}$

(27) a) If the glucose residue is involved in a 1,6 bond, the reducing terminal residue (the one on the 6 position of the glycosidic bond) will not have any methyl groups on carbons 1, 4 and 6 since those carbons are involved in glycosidic bonds

b) 258 mg amylopectin ⇒ 12.4 mg 2,3 dimethylglucose

How many moles of glucose are in 258 mg of amylopectin?

$$0.258\text{ g glucose} \times \frac{1\text{ mol glucose}}{162\text{ g}} = 1.59\times10^{-3}\text{ moles glucose}$$

How many moles of 2,3-di-O-methylglucose (molecular weight: 208)

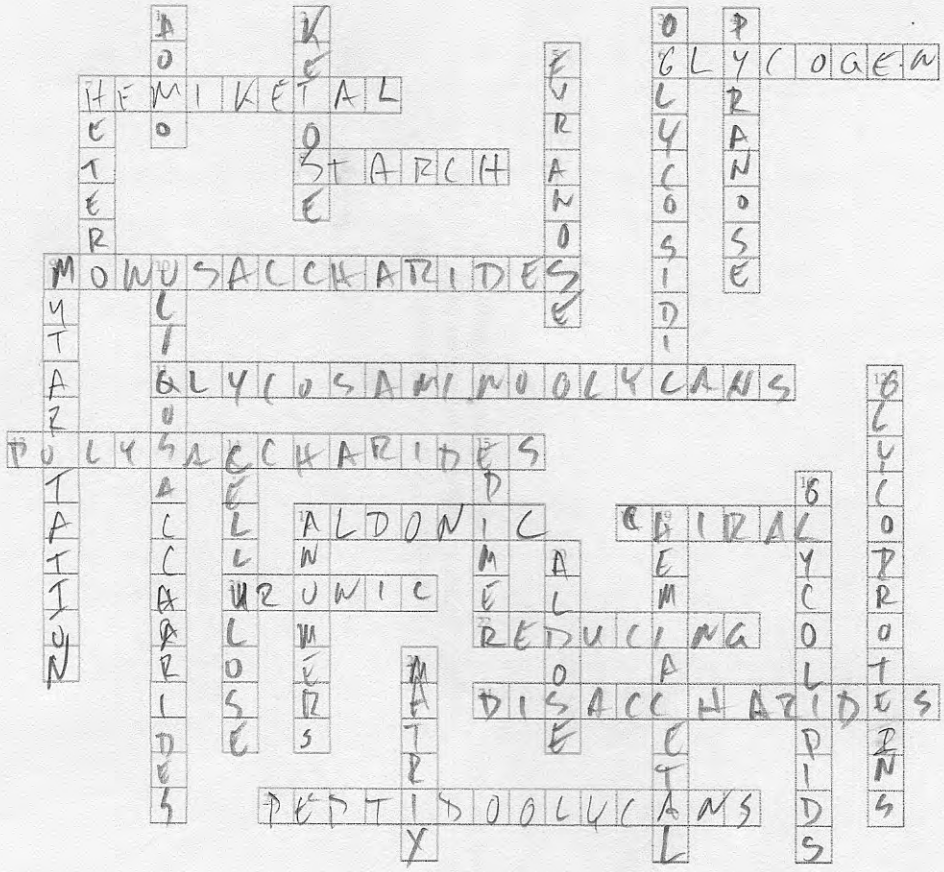
$$12.4\times10^{-3}\text{ g} \times \frac{1\text{ mol 2,3 di-methylglucose}}{208\text{ g}} = 5.96\times10^{-5}\text{ moles}$$

$$\left(\frac{5.96\times10^{-5}\text{ moles 2,3-di-O-methylglucose}}{1.59\times10^{-3}\text{ moles glucose}}\right)\times100 =$$

3.75% of the residues have 1,6 branches

SELF-TEST

Do You Know the Terms?



ACROSS

6. A homopolysaccharide of glucose; it is highly branched and found exclusively in animal cells.
7. Formed by cyclization of a ketose sugar.
8. A homopolysaccharide of glucose units connected by ($\alpha 1 \rightarrow 4$) glycosidic bonds; found exclusively in plants.
9. Simple sugars.
11. Heteropolysaccharides such as hyaluronate.
13. Glycogen and cellulose, with thousands of simple sugar subunits, are examples.
17. Oxidation of the carbonyl carbon of sugars (except glucose) results in the formation of _____ acids.
18. A compound with an asymmetrical atom allowing formation of mirror-image isomers has one or more _____ centers.
21. β-D-glucuronate is an example of a _____ acid.
22. End of a polysaccharide chain that is not involved in a glycosidic bond and has a free anomeric carbon.
24. Lactose and sucrose are examples.
25. Polysaccharides cross-linked by peptides; found in bacterial cell walls.

DOWN

1. A _____ polysaccharide is a polymer of repeating monosaccharides.
2. A sugar with a carbonyl group at C-2 (or any position other than C-1).
3. Carbohydrate moieties are attached to glycoproteins through either *N*- or _____-_____ bonds.
4. Six-membered ring form of sugars.
5. Five-membered ring form of sugars.
7. A polysaccharide containing more than one type of sugar is a _____ polysaccharide; an example is chondroitin sulfate.
9. Process that interconverts isomers of pyranoses.
10. Lectins are proteins that bind to specific _____.
12. Glycoconjugates containing protein and oligosaccharide portions; for example, glycophorin A.
14. A homopolysaccharide of glucose units connected by ($\beta 1 \rightarrow 4$) glycosidic bonds; it is found exclusively in plants.
15. An isomer that differs at only one of two or more chiral centers.