

## 6 Hot water treatment

6.1. Describe the steam explosion process? [1]

6.2. What is the purpose of a prehydrolysis step with water prior to kraft cooking? [1]

### Grading:

Total number of questions: 30

Total number of points: 48

5 > 42.0

42.0 ≥ 4 > 36.0

36.0 ≥ 3 > 29.5

9.5 ≥ 2 > 24.0

24.0 ≥ 1 > 19.0

0 ≤ 19.0

5.5. What is the H-factor concept? For what H-factor control is used? [1]

5.6. Donnan equilibrium in kraft pulping: What happens with the  $[\text{OH}^-]$  in the fiber wall when an inert Na salt, e.g. NaCl, is added to the kraft cooking liquor? And why? [2]

5.7. How to prepare a polysulfide solution in industry? [2]

5.2. Describe the phenomenon of *xylan redeposition*? [1]

5.3. Composition of white liquor? Effective cooking chemicals? [1]

5.4. Origin of the strong smell of a kraft pulp mill? [1]

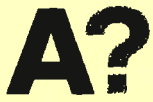
**4. Extractives**

4.1. Steps of CTO production? [2]

4.2. What is the basic chemical structure of flavonoids? [1]

**5 Chemistry of alkaline treatments of biomass**

5.1. Describe the peeling/stopping mechanisms? [3]



3.2. Describe the EMAL method for the isolation of the lignin? [2]

3.3. Please describe **3 different types** of lignin-carbohydrate complexes (LCC) [2]

3.4. Explain the principle of thioacidolysis and the results obtained thereof? [2]



2.9. What is a cellulose microfibril? What is the current view on the dimensions of the cross-section of a microfibril (cellulose crystal)? [2]

2.10. What is the Level-off DP? What does a LODP tell us? [1]

### **3. Lignin Chemistry**

3.1. List the three lignin precursors [1]



2.5. Explain the "Cellulose polymorphism"? [2]

2.6. What is the unit cell of Cellulose I $\beta$ ? [1]

2.7. Explain Bragg's law? [1]

2.8. Which methods are used for the determination of the crystallinity of cellulose? [2]



**2. Cellulose Chemistry**

2.1 What kind of polymer is cellulose? [1]

2.2. Please specify the different possible conformations of the O6H group? [2]

2.3. Which equation is used for the calculation of the DP<sub>v</sub> of cellulose? Explain the details of the equation? [2]

2.4. How is the polydispersity of a macromolecule defined? [1]



- 1.3. Explain what “meso” means and list two meso-compounds [2]
- 1.4. Please list 4 important aldoses which are present in lignocellulosic substrates? [1]
- 1.5. Which reactions allow the prolongation of the chain length of sugar molecules?  
Please list all the possible reactions? [3]

Professor Herbert Sixta  
Biorefineries

EXAM on the Module 2 lecture  
**Advanced Chemistry of Biomass Fractionation**

Dear Student,

Please be aware of the following instructions:

- Read the questions very carefully!
- Include your answer(s) between the individual questions. There is enough space. Be very short, but precise in your answers. Avoid telling stories!
- The full point(s) are given, see in square bracket, when the question is precisely answered. In the case that the question was not answered precisely leads to the deduction of points in 0.5 increments.
- Good luck!

**1. Carbohydrate Chemistry**

1.1. Define the difference between diastereoisomers and enantiomers? [1]

1.2. Rhamnose, a naturally occurring deoxy-sugar: [3]

1.2.1. Is rhamnose a chiral compound?

1.2.2. Designate the R/S conformation of C-3 and C-5 in D-mannose?

