

What is the main advantage of supercapacitors to batteries?

- a. They use less electrolyte than batteries
- b. They have higher maximum voltages than batteries
- c. They provide higher power density than batteries**
- d. They provide higher energy density than batteries

Why is it necessary to activate wood fibers during carbonization?

- a. To shorten the fibers length
- b. To remove impurities
- c. To increase the surface area and pore volume**
- d. To increase carbon yield

In what components of energy storage devices are wood fibers mostly used?

- a. Current collectors
- b. Separators
- c. Electrolytes
- d. Electrodes**

The main swelling constituent of pulp fibers is:

- a. Cellulose
- b. Extractives
- c. Lignin
- d. Hemicellulose**

The highest concentration of cellulose in typical wood is:

- a. In the middle lamellae
- b. In the S3 layer
- c. In the S2 layer**
- d. In the S1 layer

Which of the following factors leads to a high fiber stretch (strain at rupture):

- a. An especially thick S₃ layer
- b. A small fibril angle in S₂
- c. A large fibril angle in S₂**
- d. A high concentration of hemicelluloses on the fiber surface

The size of fibril aggregates in wood pulp fibers is typically:

- a. 3-4 nm
- b. Greater than 1 μm
- c. 10-30 nm**
- d. About as large as 3 water molecules.

Which of the following is not related to pulp reactivity:

- a. The pulp swelling
- b. The fiber length**
- c. The fiber surface area
- d. The water accessible hydroxyl groups

Pulp fiber bonds are:

- a. Primarily intermolecular bonds
- b. Are dependent on fiber swelling
- c. Are composed mainly of van der Waal and hydrogen bonds
- d. All of the above**

Which of the following is true?

- a. Internal fibrillation involves delamination of the cell wall layers
- b. External fibrillation is important in both kraft and mechanical pulps
- c. Internal fibrillation increases fiber flexibility, external fibrillation increases interfiber bonding
- d. All of the above**

Fiber-fiber bonding in paper/board is promoted to a significant degree by:

- a. Mechanical entanglement of fibers
- b. Large enough amount of foam in water/foam mixture – there is smaller friction for free fiber movement/contact
- c. Surface tension of water in consolidation**
- d. Hydroxyl groups (-OH) of lignin on fiber surfaces

Secondary fines in chemical pulps have which effects on paper sheet properties:

- a. Increase both tensile strength and light scattering
- b. Increase elastic modulus and decrease bulk**
- c. Increase permeability and printability
- d. Increase opacity and tensile strength

Which of the following does not affect pulp fiber swelling

- a. **Fiber coarseness**
- b. Salt content of aqueous media
- c. Amorphous cellulose content
- d. Acid group content of fiber

Which cell wall constituent is the load bearing element in pulp fibers

- a. Pectin
- b. **Cellulose**
- c. Lignin
- d. Hemicelluloses

Which fiber type does not hornify extensively:

- a. Kraft pulp
- b. **TMP**
- c. Hardwood
- d. Sulphite pulp

Answer with one sentence.

What is a hydrogen bond?

Why do long fibers worsen paper formation?

Define elastic modulus

What is fiber coarseness?

What limits the number of times a pulp fiber can be recycled?

Match the fiber property to its most suitable paper property. Each property can only be used once.

High mechanical pulp fines content → high light scattering

Short fiber length → Good formation

High fiber length → high tear strength

High refining degree → poor dewatering

Low hemicellulose content → High reactivity