Larbi Ben M'Hidi university
Exact sciences and NLS faculty
MS department
Master 2 Material Chemistry

Tuesday 13 January 2026

English Language first exam

Text

Cellulose, a renewable biopolymer found abundantly in plants, is converted into nanostructured forms, cellulose nanofibrils and cellulose nanocrystals, through chemical or mechanical processes. These nanoscale materials exhibit exceptional mechanical strength, biodegradability, low density, and tunable surface chemistry, making them ideal for sustainable technological uses.

The structure of cellulose varies from its molecular β-(1,4)-D-glucose chains to the crystalline and amorphous domains forming plant cell walls. The variation in crystallinity and allomorphism of cellulose can be characterized by employing the XRD pattern and NMR spectrum. Various sources of cellulose such as plants, algae, bacteria, and tunicates diverge in terms of yield, purity, and crystallinity. Bacterial nanocellulose offers superior purity, flexibility, and biocompatibility, making it particularly promising for medical and tissue-engineering applications. Nanocellulose exists in several types like microfibrillated cellulose, nanofibrillated cellulose, and nanocrystals each produced by different methods such as acid hydrolysis, high-pressure homogenization, and enzymatic oxidation. The surface modification (via oxidation, esterification, or polymer grafting) improves compatibility between hydrophilic nanocellulose and hydrophobic polymer matrices, enabling the creation of strong, lightweight nanocomposites. Nanocellulose's unique physicochemical properties such as high surface area, crystallinity, film-forming ability, and gas-barrier performance have been analyzed. In terms of applications, nanocellulose has shown outstanding potential in packaging (as an oxygen barrier), biomedical devices, cosmetics, sensors, environmental purification, and electronic components. Its biodegradability and renewability position it as a vital component for future green technologies. Nanocellulose represents a next-generation sustainable material capable of replacing non-renewable polymers in diverse industries, provided that large-scale production, cost reduction, and interfacial optimization challenges are effectively addressed.

Questions:

1- Cellulose, in its nanoscale different forms, presents interesting features; what are these forms and what are their features?
2- Nanocellelos, due to its remarkable properties, presents a future alternative to conventional polymers; but there are some obstacles that must be overcome. What are these obstacles?
3- Give the synonym of the underlined words in the text.
4- Give the antonym of the words crystalline, hydrophobic, homogenization and allomorphism. Use each of them in a sentence.
5- Make sentences with the following words: biodegradability (biodegradable), renewability (renewable) and sustainable (sustainability).
6- How the "-ed" ending is pronounced in the following verbs: addressed, converted and analyzed?
7- What are model verbs? Find a model verb in the text and give its different uses. Give two other examples of model verbs.
8- Give the singular (or the plural) form of the following words: bacteria, spectrum, industries and hydrolysis.

Correction of English Language first exam

1- Cellulose, in its nanoscale different forms, presents interesting features; what are these forms and what are their features?

Cellulose nanofibrils 0,5

Cellulose nanocrystals 0,5

exceptional mechanical strength 0,25

biodegradability 0,25

low density 0,25

tunable surface chemistry 0,25

2- Nanocellelos, due to its remarkable properties, presents a future alternative to conventional polymers; but there are some obstacles that must be overcome. What are these obstacles?

large-scale production 0,5

cost reduction 0,5

interfacial optimization0,5

3- Give the synonym of the underlined words in the text.

Tunable =adjustable 0,5

Promising = encouraging 0,5

Improves = develops 0,5

Outstanding = excellent 0,5

Vital = important 0,5

Next-generation=future0,5

4- Give the antonym of the words crystalline, hydrophobic, homogenization and allomorphism. Use each of them in a sentence.

Crystalline = amorphous 0,5

To diffract X-Rrays, matter must be in its crystalline form. 0,5

Hydrophobic = hydrophilic 0,5

Oil doesn't mix with water because it is hydrophobic 0,5

homogenization = heterogenization 0,5

The homogenization of a multi-element system results in a single uniform phase. 0,5

allomorphism = isomorphisme 0,5

Quartz and cristobalite is an example of allomorphism that exists in silicon dioxide. + 0,5

5- Make sentences with the following words: biodegradability (biodegradable), renewability (renewable) and sustainable (sustainability).

- Polymers obtained from plants are biodegradable. 1
- Sun is a source of renewable energy. 1
- We have to think about new resources and strategies to ensure a sustainable economy. 1

6- How the "-ed" ending is pronounced in the following verbs: addressed, converted and analyzed?

Addressed t 0,5

converted id 0,5

analyzed d 0,5

7- What are model verbs? Find a model verb in the text and give its different uses. Give two other examples of model verbs.

What are model verbs? auxiliary verbs to express ability, possibility, obligation, permission…0,5

Find a model verb in the text: can 0,5

give its different uses: Possibility, ability, permission 0,5

Give two other examples of model verbs: must, might, could, should … 0,5

8- Give the singular (or the plural) form of the following words: bacteria, spectrum, industries and hydrolysis.

Bacteria bacterium 0,5

Spectrum spectra 0,5

industries industry 0,5

hydrolysis hydrolyses 0,5