



Jerusalem Science Contest 5785

Nanotechnology

Test 6

Form – A

Answer Key

- 1) Which of the following is a true statement about the mechanical properties of wood?
 - a) They are mainly attributed to the content of lignin.
 - b) They are mainly attributed to cellulose nanocrystals.**
 - c) They make the wood useless.
 - d) They depend on the water content of the wood.

- 2) Which of the following is true about CNCs?
 - a) It stands for Copy Nano Carriers.
 - b) They are made of sucrose.
 - c) They are made of highly crystalline cellulose chains.**
 - d) They are proteins.

- 3) Which of the following is a property of cellulose nanocrystals?
 - a) They make liquid crystals at a concentration lower than 0.2% weight per volume of water.
 - b) They make spiral crystal structures at a concentration above 2.5% weight per volume of water.**
 - c) They are positively charged.
 - d) They are not biodegradable.

- 4) Which of the following is true about cellulose nanocrystal self-assembled films?
 - a) They are strong due to covalent bonding.
 - b) They require heat to form.
 - c) They are excellent oxygen barriers.**
 - d) They are conductive.

- 5) Which of the following is responsible for the color in cellulose nanocrystal films?
 - a) Pigments
 - b) Quantum dots
 - c) Different nanofiber lengths
 - d) Constructive and destructive interference of reflected light**

- 6) Why is it helpful to add zinc oxide nanoparticles to food packaging?
- a) To prevent heat from spoiling food
 - b) To make the packaging stronger in transport
 - c) To prevent UV light from spoiling food**
 - d) To make the packaging water resistant
- 7) Which of the following statements is true about the process of increasing the strength of synthetic polymers like polyvinyl alcohol (PVA)?
- a) It is done by heat treatment.
 - b) It is achieved by combining cellulose nanocrystals with PVA in a 1:1 ratio.
 - c) It is achieved by combining cellulose nanocrystals with PVA in a 1:5 ratio to cause crystallization.**
 - d) It makes PVA insoluble in water.
- 8) Which of the following statements is FALSE regarding cellulose nanocrystal (CNC) 3D printing?
- a) It may be done at room temperature.
 - b) It relies on the thixotropy, or change in viscosity with force, of CNC in water.
 - c) The material changes from a solid to a liquid after printing.**
 - d) It self-assembles into a structure.
- 9) Which of the following accurately describes cellulose nanocrystal/carbon nanotube films?
- a) May be semi-transparent and conductive**
 - b) Are black, opaque, and conductive
 - c) Are excellent capacitors
 - d) Are water resistant
- 10) When dip coating is used to surround cellulose nanocrystals with the nanomaterial MXene, what is the result?
- a) An unbreakable superconductor
 - b) A conductive outer layer with a nonconductive inner core**
 - c) An insulating outer layer with a conductive inner core
 - d) A nonbiodegradable material
- 11) What is one application of material made with both cellulose nanocrystals and MXene?
- a) Flexible electronics**
 - b) More protective food packaging
 - c) Stronger plastics
 - d) Biodegradable 3D printing material

- 12) What is the result of combining cellulose nanocrystals with different proteins?
- a) Conductive film
 - b) UV resistant film
 - c) Edible film
 - d) *The ability to tune the dielectric permittivity and resistivity of the film***
- 13) What property of nanocellulose makes trees so strong?
- a) *It is composed of nanofibers arranged in crystalline structures.***
 - b) It is extremely heat-resistant.
 - c) It is a symmetrical polymer.
 - d) It is nonbiodegradable.
- 14) Which of the following is true of the quantum confined Stark effect of quantum dots in cellulose nanocrystals?
- a) It increases the fluorescence of the film.
 - b) *It results in a red-shift of the emitted spectrum of the quantum dots.***
 - c) It is affected by oxygen.
 - d) It may be useful in the food industry.
- 15) Which of the following is true of films consisting of quantum dots combined with cellulose nanocrystals?
- a) *They may be used to monitor the structural health of bridges.***
 - b) They are made of inorganic matter.
 - c) They may be used as capacitors.
 - d) They may be used as resistors.
- 16) What practical question have advances of nanotechnology in the field of genetic epidemiology raised for virtually every Jewish young person?
- a) Should I pursue a career in science?
 - b) Should I attempt to cure any illness I might have (i"n) by submitting to clinical trials of gene editing?
 - c) Should I submit to genetic testing in order to clarify my Jewish lineage and ancestry?
 - d) *Should I participate in pre-marital genetic testing in order to prevent the occurrence of rare genetic diseases in my offspring?***
- 17) Which of the following teachings of the Gemara is a potential support *not* to carry-out marital compatibility genetic testing?
- a) "Blessing is found only in something which is hidden from the eye." (Bava Metzia 42a)
 - b) "One who marries a woman must first check her brothers." (Bava Basra 110a)
 - c) Those who are involved in a mitzvah will not be harmed." (Pesachim 8b)
 - d) *Both (a) and (c).***

- 18) Which of the following teachings is a potential support to carry-out marital compatibility genetic testing?
- a) “The foolish [form of] fear is when a person wants to add guards upon guards and fear upon fear, and he makes precautions for his precautions in such a way that it results in the neglect of Torah study and Divine service.” (Mesilat Yesharim, ch. 9)
 - b) “... Therefore a person must distance himself from things that harm the body, and accustom himself to things that are healthy and revitalizing.” (Rambam, Hilchot De’ot, ch. 4)**
 - c) “Conduct yourself with Him with simple trust, and depend on Him, and do not inquire of the future.” (Rashi, Devarim 18)
 - d) . “[When the verse says that one should hide himself from evil,] this is speaking only about avoiding the evil that one actually sees – not [avoiding] that which might be able to become possible that it might happen.”
- 19) How do the Poskim who advocate pre-marital genetic testing respond to the argument that the verse “You shall be wholehearted with Hashem” (Devarim 18:13) tells us to trust in Hashem fully and not be concerned about future adverse occurrences?
- a) That verse is not talking about taking normal and natural precautions.
 - b) That verse is written in the context of divining through witchcraft and sorcery.
 - c) That verse is not saying that when there is a clear and obvious danger in front of your eyes, you should not do anything about it.
 - d) **All of the above.**
- 20) In what way has the nanotechnology used to make the genotyping chips and sequencing platforms used in genetic testing benefited the Jewish community?
- a) It has prevented non-Jews from infiltrating the Jewish community.
 - b) It has provided a way to cure people who are suffering from diseases that are common in the Jewish community.
 - c) It has enabled far more recessive disease genes to be identified, facilitating the screening out of those diseases from the Jewish community.**
 - d) It has provided a way to identify authentic Kohanim and Leviyim among the Jewish populace.