



## Jerusalem Science Contest 5785

### Nanotechnology

#### Test 5

#### Form – A

#### Answer Key

- 1) **What is the first step in preparing a single-walled carbon nanotube (SWCNT)/peptide sensor?**
  - a) *Suspending the SWCNT/peptide in water by sonication*
  - b) Illuminating the SWCNT by laser
  - c) Printing
  - d) Turning off the light in the room
  
- 2) **Which case serves as a Halachic precedent for determining whether nanomaterials produced from a non-kosher source have the same status as their source?**
  - a) The case of microorganisms, with legs and claws and teeth, not visible to the eye, that are found (with a microscope) in water or food.
  - b) *The case of steam created from a non-kosher food.*
  - c) The case of stem-cells taken from a non-kosher animal to produce cultured meat.
  - d) The case of letters of a holy text written on the nanoscale.
  
- 3) **What is the Midrash's proof that we are expected to utilize the material resources of the world in order to produce food?**
  - a) G-d afflicts man with illness, and yet gives permission to the doctor to heal.
  - b) *G-d provides us with soil and seeds and water, and expects us to work the land to make to bring forth its produce.*
  - c) G-d would not have created so many raw materials in the world with no useful purpose.
  - d) Both (a) and (b).
  
- 4) **Which of the following is a true statement about the near-infrared optical nose?**
  - a) It is made of only biological materials.
  - b) It measures only individual volatile compounds.
  - c) *The sensor is a camera that detects fluorescence.*
  - d) It is a disposable device

- 5) **What can the near-infrared optical nose be trained to do with machine learning?**
- a) To attract insects
  - b) To increase signal to noise ratio
  - c) To educate the user on how to use the device
  - d) To differentiate between wine and beer**
- 6) **Which of the following is a true statement regarding volatile organic compounds?**
- a) They are used by humans to sense taste.
  - b) They are used to communication between plants about insects.**
  - c) They are organic and therefore safe.
  - d) They are toxic.
- 7) **Which statement is most accurate regarding a dog's ability to smell fear?**
- a) Dogs can smell fear only if the person is carrying explosives.
  - b) Dogs can smell fear.**
  - c) Dogs can taste explosives.
  - d) Dogs do not smell fear
- 8) **What can the near-infrared optical nose be used to differentiate between?**
- a) Taste and flavor
  - b) Metal and organic compounds
  - c) Different VOCs (volatile organic compounds)**
  - d) Near to far infrared light
- 9) **Which of the following correctly completes the statement below?**  
***Single-walled carbon nanotubes used in optical sensors...***
- a) are solid tubes.
  - b) are semiconductors.**
  - c) emit light in the visible spectrum.
  - d) are conductive.
- 10) **What is the equipment used to identify explosives in airport terminals?**
- a) Spectrophotometer
  - b) AFM
  - c) Mass Spectrometer**
  - d) Dogs

- 11) **How is combining combinatorial peptide libraries with single-walled carbon nanotubes useful?**
- a) It creates a statistical tool.
  - b) It is mainly used to stabilize the sensors.
  - c) It can combine biological molecules.
  - d) It may be used to increase specificity and sensitivity to a certain substance.**
- 12) **Which of the following is true about the images generated by the near-infrared optical nose of wine with or without acetic acid?**
- a) They can be analyzed by computer vision analytical tools.**
  - b) They can be used directly to determine wine quality.
  - c) They can be discriminated from one another by the naked eye.
  - d) They can be used to prepare peptides.
- 13) **Is the process of producing cultured meat a nanotechnology?**
- a) Yes, because biopsying the source tissue from the animal, embryo, or egg utilizes nanotechnology.
  - b) Yes, because the genetic makeup of the DNA of the stem-cells has to be modified in order to cultivate the meat, and genetic modification is a nanotechnology.
  - c) No, only the supporting processes, such as the materials in the culture used to grow and stabilize the cells, involve nanotechnology.**
  - d) Yes, because the stem-cells taken from an animal to grow the cultured meat are on the nanoscale.
- 14) **What is a combinatorial peptide library?**
- a) A tool used in protein synthesis
  - b) A library of genes
  - c) A mathematical tool to analyze complex biological systems
  - d) A step by step method to select amino acid sequences for certain functionality**
- 15) **Which of the following is a true statement about analyzing similar alcohols with the near-infrared optical nose?**
- a) It is useless because the method has poor accuracy.
  - b) It can be used to set the baseline of the sensor.
  - c) It is enabled by a statistical method called principle component analysis.**
  - d) It is useless since they are so similar to one another.
- 16) **If nanoparticles from a non-kosher source are not visible, and they constitute a tiny fraction of the total ingredients in a food item, why might they not be annulled in the mixture?**
- a) Since they are on the nanoscale, they are not considered to exist according to Halachah.
  - b) They might have the status of a “ma’amid”, an additive which has a perceptible effect on the overall food even if it itself is not perceptible.**
  - c) They are annulled, and the food item is kosher.
  - d) No non-kosher ingredient in a food can ever be annulled.

- 17) **What is the consensus of opinion regarding whether cultured meat is considered real meat from the halachic standpoint?**
- a) It is considered real meat only if the stem-cells used to make it come from a kosher animal.
  - b) Such meat is not permitted to be consumed and therefore the question is irrelevant.
  - c) It is not considered real meat.
  - d) *It is considered real meat.***
- 18) **Which of the following statements is true of the human olfactory system?**
- a) *It contains hundreds of different sensors/receptors.***
  - b) Each sensor can bind only one type of molecule.
  - c) It is fully functional only in adults
  - d) It is unique to humans
- 19) **On what is the near-infrared optical nose's ability to detect and identify bacteria in urine based?**
- a) It is not possible for it to identify bacteria in urine.
  - b) It is based on the electron microscopy image of the bacteria.
  - c) It is based on DNA analysis.
  - d) *It is based on the binding and release kinetics of the volatiles to the sensors.***
- 20) **Which of the following correctly completes the statement below?**  
**Single-walled carbon nanotubes...**
- a) are made of oxygen.
  - b) *may change their binding specificity by peptides that wrap around the nanotube.***
  - c) are very expensive.
  - d) are easily suspended in water.