



Jerusalem Science Contest 5785

Nanotechnology

Test 7

Form A

Answer Key

- 1) Which of the following is true about medical implants made from synthetic materials?
 - a) They are the optimal choice.
 - b) They self-assemble.
 - c) They promote tissue growth and integration.
 - d) *Their biomechanical properties do not fit their surrounding tissues.***

- 2) Which of the following is true of collagen?
 - a) It is a minor protein in our bodies.
 - b) It is a polysaccharide.
 - c) *It is the most abundant nano-bio-building block in our bodies.***
 - d) It is the outer layer of our skin.

- 3) Which of the following is an accurate statement about animal derived collagen?
 - a) It is very safe for injection.
 - b) *It can potentially carry human pathogens.***
 - c) It is never a good fit for use in humans.
 - d) It is made of five different proteins.

- 4) Which of the following is true of most implanted heart valve leaflets today?
 - a) They are made from human collagen.
 - b) *They are made from animal tissue.***
 - c) They are not approved by the FDA.
 - d) They are inexpensive.

- 5) Which of the following is a true statement about P4H alpha and P4H beta?
 - a) They have a very acidic pH.
 - b) They are nanofibers made of collagen.
 - c) *They are enzymes that stabilize collagen.***
 - d) They are genes that encode for collagen.

6) Which of the following can produce human collagen?

- a) **Transgenic tobacco plants**
- b) Hydrothermal synthesis
- c) E. coli bacteria
- d) Inorganic nanoparticles

7) Which of the following is true of a diabetic foot ulcer?

- a) It is a type of cancer.
- b) It is easily cured by iodine.
- c) It is treated by insulin.
- d) **It may result in an amputation.**

8) Which of the following is a true statement about live cells in the periphery (edges) of a wound?

- a) They do not bind collagen.
- b) **They bind to collagen via an integrin receptor.**
- c) They stop proliferation in the presence of collagen.
- d) They are comprised of only blood cells.

9) Which of the following is true about methacrylate-collagen?

- a) **It is a photo-curable bio-ink.**
- b) It is water insoluble.
- c) It is a two nanometer long particle.
- d) It is made only from human tissue.

10) Which of the following is true about nano-bio-ink?

- a) It is used in a thermoplastic Ink-jet printer.
- b) It is used in RGB printing.
- c) **It may be used to 3D print tissues and organs.**
- d) It is non-degradable.

11) What is the main benefit of growing antibodies in plants to treat rheumatoid arthritis?

- a) **This reduces the cost of production, increasing the affordability of the treatment.**
- b) This allows people to simply eat the antibodies within the plant.
- c) This allows larger quantities of the antibodies to be produced at once.
- d) This ensures the antibodies are uncontaminated.

12) Which of the following is a true statement about the anti-TNF alpha antibody?

- a) It protects cells from diabetes.
- b) **It binds to TNF to treat autoimmune inflammatory disease.**
- c) It is produced by bacteria in a very expensive bioreactor.
- d) It is a good vaccine.

- 13) Which of the following statements is true about resilin?
- a) ***It is an elastic-resilient protein.***
 - b) It is made from oil.
 - c) It is made by a rubber tree.
 - d) It protects insects from herbivores.
- 14) Which of the following is a true statement about CBD Resilin?
- a) It is made from cannabis.
 - b) It is more potent than THC.
 - c) ***It binds to cellulose.***
 - d) It binds to chitin.
- 15) What is the result of adding 5% resilin to collagen fibers?
- a) ***An increase in the mechanical properties of the collagen fibers***
 - b) The collagen fibers become softer and less crystalline
 - c) An increase in crystallinity of the collagen fibers
 - d) It makes the collagen fibers biodegradable
- 16) The Torah tells us that
- a) The Torah contains spiritual, moral, and ethical wisdom, but no information about the physical world.
 - b) All of the wisdom of the world that is relevant to fulfilling the Mitzvos of the Torah is contained within the Torah.
 - c) All of the wisdom of the world that was known by mankind at the time the Torah was given at Sinai is contained within the Torah.
 - d) ***All of the wisdom of the world, including all of material and physical sciences, is contained within the Torah.***
- 17) If the Torah contains information, or חכמות, which is not accessible to the ordinary person who studies the Torah, then what is the point in telling us that it contains that information?
- a) To tell us that if we toil studiously enough, we will eventually be able to access all of the wisdom that is hidden in the Torah.
 - b) ***To tell us that even though we might not be able to discern all of the information hidden in the Torah, it is important for us to be aware of the loftiness and greatness of the Torah.***
 - c) To inspire us to study the sciences to complement our Torah learning.
 - d) All of the above.

- 18) Where in the Torah sources do we find a paradigm of the concept of nanoscience that everything in the physical world is comprised of very small particles of a finite variety but of an unlimited number of combinations and permutations?
- a) ***The 22 letters of the Hebrew alphabet are the basic “particles” of reality, as described by the Sefer Yetzirah.***
 - b) The 92 naturally occurring elements of the Periodic Table are alluded to in the account of Creation in Bereishis.
 - c) All 118 elements of the Periodic Table are alluded to in the account of Creation in Bereishis.
 - d) No such concept is found in any classical Torah source.
- 19) In the era of redemption (the times of Mashiach), the world will be fundamentally transformed, and nothing will be the same as it is in the present era.
- a) This is the unanimous view of all opinions in the Gemara.
 - b) This is not the view of any opinion in the Gemara.
 - c) ***This is the subject of dispute between Shmuel and Rabbi Yochanan in the Gemara.***
 - d) This topic is not addressed by the Gemara or the commentaries.
- 20) The Rambam writes (Hilchos Melachim 12:1), “Do not think that in the era of Mashiach any aspect of the world's normal functioning will be annulled, or that there will be any new reality in the work of Creation. Rather, the world will continue according to its normal functioning.” However, the Rambam then writes (ibid., 12:5), “In that era, there will be neither famine nor war, and no envy or rivalry, for good will flow in abundance and all of the luxuries will be freely available like dust. The occupation of the entire world will be solely to know Hashem.” How can the Rambam say that the world will function in its normal way, and yet there will be no famine or war, and there will be economic prosperity for all?
- a) This is a contradiction in the words of the Rambam which the commentaries have not answered.
 - b) When the Rambam says that “the world will continue according to its normal functioning,” he means that it will mostly function in the normal manner, but there will also be supernatural interventions.
 - c) When the Rambam says that there will be no famine or war, and prosperity for all, he means that there won't be as much famine or war or poverty as there is today, but there still will be such things in the world.
 - d) ***With the proliferation of nanotechnological developments of the last two decades, we can understand how it could be possible for the Rambam's description of the era of Mashiach to become a reality.***