Jerusalem Science Contest 5786
Astronomy
Test 2
Form B- Answer Key

1) According to the tradition received from great Torah sages of past generations, what are three conditions for the student of Torah to keep in mind when approaching the study of science?
   a) (1) One should only have teachers who are observant Jews; (2) One should study only a science that is included in the "Seven Wisdoms"; (3) One should stop studying science once one has achieved mastery over it.
   b) (1) One should try to study the science in Hebrew; (2) One should study only a science that is discussed by the Talmud; (3) One should say a special prayer every day before studying scienc
   c) (1) The student must first "fill up" with Torah; (2) The study of science should be for the sake of enhancing one's service of Hashem and not for the independent sake of the scientific study itself; (3) One's primary focus should remain on the study of Torah.
   d) All of the above.

2) Weight
   a) is the same as mass except in spaceships, where everything is weightless.
   b) is the gravitational force needed to make a mass move.
   c) is a different term for mass.
   d) measures how big something is while mass measures how much stuff something is made of.

3) After stars form, they
   a) naturally form disks, in which planets, asteroids and comets form.
   b) spin faster and faster, resulting in little objects (planets, asteroids, comets) being flung outwards from the forming protostar.
   c) are left without planetary systems unless they encounter and collide with other forming stars.
   d) sweep up planets, asteroids and comets from residual material in interstellar clouds.

4) Which of the following are different kinds of galaxies?
   a) Star clusters, barred spirals, ellipticals
   b) Spirals, ellipticals, whirlpools
   c) Protostars, spirals, ellipticals
   d) Spirals, barred spirals, ellipticals

5) Which of the following statements is correct?

a) The calculation in the Gemara of the number of stars in the universe is exactly the same as NASA's 2021 estimate.

b) The calculation in the Gemara of the number of stars in the universe is far more than today's scientific estimates.

c) The calculation in the Gemara of the number of stars in the universe is the most in line with today's scientific estimates of all ancient estimates.

d) The calculation in the Gemara of the number of stars in the universe is in the range of all other ancient estimates.

6) The mass of an object

a) is the force needed to accelerate an object.

b) is the same as the weight of an object.

c) is the amount of matter in an object and is independent of location.

d) depends on the strength of the local gravitational field.

7) Thermal pressure

a) exists in the cores of interstellar clouds where the temperature is too cold for gravity to act.

b) is another term for anti-gravity.

c) keeps a neutron star from collapsing into a black hole.

d) describes how the temperature of a volume of gas causes the gas to expand or contract.

8) To what degree did Torah scholars throughout the generations excel in the study of astronomy?

a) They often surpassed the expertise of the non-Jewish scholars, and they made significant contributions to the field of astronomy.

b) Only a small number of Torah scholars throughout the generations excelled in the study of astronomy; most remained focused exclusively on Torah study.

c) They had a strong grasp of all known areas of astronomy, but they did not reach the expertise of non-Jewish scholars.

d) They knew only as much as they needed to know in order to understand the Jewish calendar.

9) As a fragment of an interstellar cloud first starts collapsing due to the force of gravity, the increased heat of the gas

a) increases the internal cloud pressure and permanently stops the cloud from further collapse.

b) triggers nuclear explosions, which stops the cloud from further collapse.

c) is radiated away into space because the cloud is transparent.

d) makes the cloud spin faster, leading to the formation of a circumstellar disk and planets.

10) Interstellar clouds are places in galaxies

a) where new stars are born.

b) that are dark because the interstellar dust is so thick and dense that stars cannot emit light.

c) that are the homes of the densest, most populous star clusters.

d) where stars don't exist.

11) According to the verses and the Gemara, Hashem's creation of the immensity of the cosmos was for what purpose?

a) To show how significant and important mankind is in Hashem's immense universe.

b) To give mankind a taste of the infinitude of the Creator.

c) To show how insignificant and unimportant mankind is in the grand scheme of the universe.

d) Both b and c.

12) The gravitational collapse of a protostar starts to slow down

a) the force of gravity gets too tired from pulling so hard for so long.

b) when light can no longer change from infrared to visible.

c) when the cloud becomes dense and transparent, which traps heat inside.

d) when the cloud becomes dense and opaque, which traps some heat inside.

13) The similarities between the shapes of a spiral galaxy, a planetary system around a star, and a ring-moon system around a planet

a) are accidental, the result of different physical processes producing the same structures.

b) exist because of the competition between the inward pull of gravity and the opposing pressure from heat.

c) are the result of the role rotation plays when gravity acts to make a spherical volume of gas smaller.

d) exist because clouds of matter, at both big and small spatial scales in the universe, tend to be flat, even before gravity starts to act on them.

14) The large-scale structure of the universe --- clusters and superclusters and filaments of galaxy clusters --- exists because

a) the universe formed with filament-shaped space, and matter had no choice but to flow into and fill the filaments.

b) the universe is embedded in a fishing-net shaped super-structure.

c) The tips of spiral arms of spiral galaxies attract the tips of the spiral arms in other galaxies, leading to long strings of galaxies.

d) gravity, acting on denser parts of the universe, created these structures.

15) The Orion Nebula is

a) an interstellar cloud where new stars are forming.

b) the brightest star seen in the Orion constellation.

c) the most massive nebula in the Milky Way.

d) a small star cluster.

16) In chapter 19 of Tehillim, King David describes the wonders of the celestial bodies, and then he suddenly switches to describing the Torah, Mitzvos, and fear of G-d. What is the logical transition from one topic to the next?

a) G-d's giving the Torah at Sinai is proof that He created the cosmos.

b) A person can serve G-d by either studying the cosmos or by fulfilling the Torah.

c) Contemplation of the cosmos brings one to an awareness of G-d, and that awareness is supposed to arouse in him the question of what is his own purpose in life.

d) G-d's creation of the cosmos is proof that He gave the Torah at Sinai.

17) The force of gravity between any two masses

a) is zero on the surfaces of tiny moons.

b) is zero inside superfast rockets.

c) is zero anytime one of the masses weighs less than 0.0000000001 grams.

d) is never ever zero, even if the two masses are on opposite sides of the universe.

18) As a collapsing protostar gets smaller the force of gravity

a) becomes less important because the cloud particles collide and get bigger.

b) that is pulling the mass together gets stronger because the cloud particles get closer together.

c) remains constant because of Newton's gravitational constant G.

d) gets smaller because of the increasing thermal pressure.

19) The force of gravity between two masses

a) decreases if the masses are greater and increases if the distance between them is greater.

b) decreases if the masses are greater and decreases if the distance between them is greater.

c) Increases if the masses are greater and increases if the distance between them is greater.

d) Increases if the masses are greater and decreases if the distance between them is greater.

20) Some interstellar clouds do not form new stars because they are

a) too big.

b) too hot.

c) too cold.

d) too dense.