# Section 1 Astronomy 330 Spring 2010

## Exam 2

**Test Form A**

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1. **DO NOT OPEN THIS EXAM UNTIL INSTRUCTED TO DO SO.**
2. Write the multiple-choice answers on your Scantron form.
3. Make sure to mark your test form, name, and netID on your form. I do not need your social security number.
4. Answer *ALL* of the questions. There is no penalty for guessing.
5. Don't get stalled on any one question.
6. Choose the **best** answer for each problem.

**DO NOT FORGET TO FILL IN "TEST FORM" A**

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1. What can we say about intelligent life in our Solar System?
   A) No conclusive evidence besides the Earth.
   B) Good evidence on Mars.
   C) Good evidence on Jupiter.
   D) No conclusive evidence to exist at all.
   E) Good evidence on Europa.

2. I have a model that I made using 20 different colors of Lego blocks. I put those 20 colors together in a specific pattern of 100 blocks. What is this a model of?
   A) A nucleic acid.
   B) A tower.
   C) A carbon chain.
   D) A protein.
   E) An amino acid.

3. Imagine that we receive our first ET visitor, but their stomachs do not agree with Earth food. Why might this be true?††
   A) ETs will probably be allergic to water, and our food is mostly water.
   B) Chirality: they are right-handed life.†
   C) As we are further out in the Galaxy, our food has less iron.
   D) Chirality: they are left-handed life.†
   E) They actually eat humans, but are too polite to destroy our race.†

4. What the best evidence for ice in the Martian soil today?
   A) The polar caps.
   B) The Mars rovers found rocks with substances that had to be formed in liquid water.
   C) The Phoenix lander uncovered crystals that sublimated too slowly to be dry ice.
   D) The Mars Reconnaissance Orbiter images ice from low orbit.
   E) The Mars rover Opportunity found it in rocks.

5. Life on Earth took about 700 million years to form on Earth, but Leslie often says life happened fast, less than 10 million years to form. Why is there a difference?
   A) The impact of the Moon.
   B) Aliens.
   C) The atmosphere was polluted.
   D) Comet formation timescales.
   E) The heavy bombardment.

6. Which of the following is not a pathway to monomer synthesis?
   A) Formation in clay.
   B) Formation in a reducing atmosphere with energy and water source.
   C) Formation in the circumstellar disk, transported by comets or asteroids.
   D) Formation in a Miller-Urey-like method.
   E) Formation around hot vents.

7. Which of the following is not an important issue to consider when estimating $n_p$?
   A) The age of the star.
   B) Greenhouse gases.
   C) The size of the habitable zone.
   D) The amount of liquids accessible.
   E) The atmospheric pressure of a planet.

8. Only two bodies have liquids on the surface. One is Earth, and the other is
   A) Titan
   B) Enceladus
   C) Europa
   D) Mars
   E) The Moon

9. Sex in space, or on Earth, is important because
   A) it allows the genetic material of the better organisms to survive.
   B) it allows animals to ìcross-fertilizeî across species
   C) it leads to greater genetic diversity of a species and an increase of positive mutations in the offspring.
   D) sex, although fun, also stimulates gene mutations.
   E) mutations can only occur in sexual reproduction.

10. Which of the following does not well describe the early Earth?
   A) Big rocks impacted the Moon, saving the Earth from massive impacts.
   B) No life
   C) No atmosphere
   D) No water
   E) High temperature

11. Which of the following is not an important issue to consider when estimating $f_s$?
   A) The mass of stars.
   B) Binarity of stars.
   C) How many stars are main sequence.
   D) The number of stars with circumstellar disks.
   E) How many metal-rich stars.

12. Why is the Murchison meteorite so interesting?
   A) It suggests that life started in space, then moved to planets later.
   B) It is made of unobtainium.
   C) It hit Frank Drake on the head.
   D) It proves that amino acids can form in space.
   E) It is a piece of Mars with possible fossils of life.

13. Which of the following is not a pathway to polymer synthesis?
   A) Formation in hot space.
   B) Formation in tide pools.
   C) Formation by clay enhanced polymerization.
   D) Formation using some energy producing reaction.
   E) Formation by chance.

14. What is the chicken/egg problem of nucleic acids and proteins?
    A) mRNA is a leftover from an early evolutionary sequence, but that we can not tell the origin of the first type of life.
    B) Proteins synthesis must be directed by nucleic acids, but nucleic acid transcription requires enzymes
    C) That the problem of protein encoding has never been figured out.
    D) That DNA encoding is under constrained, allowing for many mistakes that don't mean anything.
    E) The fact that the chicken came first due to the definition of chicken being the being who evolved to lay an egg.

15. Why is Leslie so excited about Europa?
    A) The strange radio signals that are detected coming from Jupiter could be intelligent life.
    B) The protection of the moon by Jupiter's magnetic field.
    C) He loved traveling through much of Europe when he lived in Munich.
    D) The core of the Moon is likely pure iron.
    E) The possibility of a liquid ocean plus hydrothermal vents.

16. Which of the following is not a monomer of life?
    A) nitrogenous bases
    B) proteins
    C) amino acids
    D) sugars
    E) phosphates

17. What is the main feature of life that allows for intelligent creatures to evolve?
    A) Photosynthesis evolved.
    B) Brains.
    C) Genetic diversity.
    D) Sex.
    E) Asteroids from space.

18. How do you date dinosaur fossils?
    A) Estimate the age of volcanic rocks above and below the fossil using carbon-14 radioactive dating.
    B) Estimate the age based on how intelligent it was.
    C) Estimate the age of volcanic rocks above and below the fossil using potassium-40 or uranium-235 radioactive dating.
    D) Estimate the age on the number of base pairs that have been broken.
    E) Estimate the age based on physical differences: the more complex, the older.

19. Which of the following is not a way to detect exoplanets?
    A) Gravitational Boost (measuring the effect of the Galaxy on the Star)
    B) Radial Velocity (wobbles)
    C) Astrometry (see the stars move)
    D) Transit Method (occultation)
    E) Direct Detection (imaging)

20. If life exists on Venus, it may be
    A) located in the clouds as large floating creatures that feed on plankton-like creatures called floaters/sinkers.
    B) located on the surface, but it would be unlike any life we know of since the planet surface is so cold and likely uses liquid methane as a solvent.
    C) located under the ice sheet, near deep hot vents.
    D) located underground, where water is still plentiful.
    E) located in the clouds where the temperature and pressure are reasonable and where there seems to be an excess of Hydrogen sulfide and sulfur dioxide.

21. You travel back in time 1 billion years. What happens to you?
    A) Nothing.
    B) You are likely attacked by large land animals.
    C) You are likely attacked by dinosaurs.
    D) You die from a lack of oxygen.
    E) You die from a large asteroid impact.

22. Extremophiles are
    A) microbes that live only in the most the extreme heat and salty environments.
    B) microbes that live in places that would kill most other lifeforms.
    C) microbes that live in dirt.
    D) microbes that live in toxic dumps.
    E) microbes that live in X-sports equipment.

23. What molecule carries the genetic information of an organism?
    A) Enzymes.
    B) RNA.
    C) Nucleic acids.
    D) Proteins.
    E) Amino-acids.

24. If one looks at the hominid species over time, one can see
    A) that all continents had evolving and complex hominids that then competed for resources on a global scale.
    B) that diversity of lifestyles and cultural evolution was driving biological evolution.
    C) an evolution path of improvement and refinement leading up to Homo-Sapiens.
    D) multiple species living at the same time, competing for resources.
    E) that most of the evolution of Homo-Sapiens is unknown.

25. Life uses carbon for making long molecular chains because
    A) it likes to share 4 electrons.
    B) it is the most abundant element.
    C) it is much more abundant than silicon.
    D) it is abundant in the ocean.
    E) it makes chains that are not easily broken.

26. Which of the following is not an important issue to consider when estimating $f_i$?
    A) Life on Earth happened fast.
    B) Polymerization and the transition to life steps are still mysterious.
    C) The early Earth did not have an oxygen-rich atmosphere.
    D) Existence of organic molecules in space implies that amino acid complexity is common.
    E) On Earth polymers arose and evolved to life.

27. The Moon may have played a large role in life on Earth. How was the Moon formed?
    A) A meteor shower.
    B) Accretion around the proto-Earth from the early circumstellar disk.
    C) A captured asteroid.
    D) We aren't sure, but it likely formed with the Earth.
    E) A Mars-sized object impacted the proto-Earth.

28. Which of the following is not an important issue to consider when estimating $f_i$?
    A) A continuum of intelligence that tends to correlate complexity with intelligence.
    B) Intelligent life is a recent development on Earth with the emergence of the primates, hominids, and H. sapiens.
    C) Humans took 4.5 billions years to evolve.
    D) Alex the parrot and Koko the gorilla.
    E) Evolution is a random process, so intelligent life is unlikely to happen on planets.

29. Why is the RNA World framework preferred over the proteinoid framework?
    A) RNA molecules will also form before proteins.
    B) RNA molecules are easier to make than 10,000 encoded proteins.
    C) RNA can perform some enzyme functions.
    D) Proteins can form cell-like structures.
    E) Proteins are not life.

30. What is the habitable zone?
    A) The range of orbits around a star where water can be liquid.
    B) The distance from a star that is a minimum for UV radiation.
    C) The position that a planet needs to be located to minimize asteroid impacts.
    D) The zone that is inhabited.
    E) The location along the equator of a planet that is suitable for life.

31. Right now, the best option for finding Earth-like exoplanets is
    A) the Hubble Space Telescope.
    B) the Space Station.
    C) the Keck Telescope.
    D) a future space mission.
    E) the Kepler Spacecraft mission.

32. What type of life is most closely related to us?
    A) True Bacteria
    B) The first life.
    C) Eubacteria
    D) Archaea
    E) Martians

33. The Codon code is
    A) how nucleic acids encode mRNA to create proteins.
    B) how RNA encodes the 10,000 proteins by using bases.
    C) a three letter word using the 20 letters of the Wasibi alphabet.
    D) a bad movie starring Tom Hanks.
    E) how DNA encodes the 20 amino acids by using three bases.

34. How did Cyanobacteria (also called blue-green algae) change the world?
    A) It created the first light sensitive organs (eyes).
    B) It was the first photosynthesis organism.
    C) It polluted the atmosphere, killing off some life, but giving an opportunity for aerobic metabolism.
    D) It was the first photosynthesis organism to move to land.
    E) It evolved into all the plant life we know today.

35. Which lifeform has more genes?
    A) Your Uncle
    B) Onion
    C) Mosquito
    D) Your Aunt
    E) Carp

36. Arguably, the most important legacy of the Miller-Urey experiment is that
    A) it allows us to calculate an estimate of total amino acids available on the early Earth.
    B) it proved the early atmosphere was mostly methane.
    C) it proves that life started in the water.
    D) it legitimized the scientific study of the origin of life.†
    E) we now know how some amino acids were formed on the early Earth.†

37. Which of the following is not something to consider when estimating $n_e$?
    A) The fraction of stars whose properties are suitable for life to develop on one of its planets.
    B) How long a star lasts on the main sequence.
    C) The number of planets suitable for life per planetary system.
    D) The number of exoplanets detected so far.
    E) The greenhouse effect on planets.

38. Which of the following is not a pathway to the transition to life?
    A) Life started somewhere/somehow else and moved to current life.
    B) RNA world
    C) Primitive life.
    D) In the oceans, using energy sources and the early atmosphere of Earth (assuming reducing atmosphere).†
    E) Proteinoids

39. What is the main reason that the inner planets of our Solar System are rocky and the ones farther out are gaseous?
    A) We don't know, but suspect it has something to do with gravity instabilities.
    B) Density in the disk.
    C) The initial composition in the disk.
    D) Mass in the disk.
    E) Temperature in the disk.

40. The best type of life sustaining stars are
    A) Stars off the main sequence; as they have lived the longest, they are the best chance for finding intelligent life.
    B) Middle mass stars (less than 1.25 and more than 0.5 solar masses), as they are long-lived and don't require planets to orbit too closely.
    C) Binary stars, as they double the chances of life.
    D) Massive stars (more than 2 solar masses), as they have more mass from which to form planets.
    E) Low mass stars (less than 0.5 solar masses), as life can exist nearer the star where more terrestrial planets are probably located.

41. DNA uses the 4 possible bases in combinations of three to encode an amino acid because
    A) there are only 3 amino acids in a typical protein.
    B) three is the nearest integer to pi.
    C) three is the general chain of carbohydrate groups to make lipids.
    D) three bases in a row allow one to encode up to 64 amino acids; two bases would only allow 16 amino acids.
    E) three is more stable than two or four, so nature chose it.

42. What is the primary role of water for life on Earth?
    A) Tastes great without being high in calories.
    B) Oxidizer.
    C) Ice floats.
    D) Solvent.
    E) Holds together carbon atoms

43. Overall, the evolution of H. Sapiens was
    A) an awkward path of evolution with many surprises.
    B) a smooth and direct path.
    C) likely orchestrated by aliens.
    D) depended only upon the local environment in Africa.
    E) simple and inevitable, after the extinction of the dinosaurs.