Section 1 Astronomy 330 Spring 2009

Midterm

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 and your name 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

MC Questions (2.5 points each):

1. One of the problems with the idea of interstellar panspermia is

   A) that life needs oxygen to exist.
   B) that it is a made-up word.
   C) that we have never found any meteorites from other planets on Earth.
   D) that bacteria are quite fragile.
   E) that the exchange of material between star systems must be rare.

2. Dark Energy is

   A) making the Universe expand.
   B) required to explain the recent accelerating expansion of the Universe.
   C) related to dark matter by $E=mc^2$.
   D) probably made out of WIMPS.
   E) making the Universe collapse.

3. An active Earth surface (i.e. volcanoes) is good because

   A) it allows a recycling of bioelements.
   B) it promotes clean gums.
   C) it keeps life on its toes.
   D) it destroys evidence of ETs.
   E) it allows for nuclear reactions in the Earth core.

4. Which of the following is proof of Dark Energy?

   A) The amount of ordinary matter in the Universe.
   B) CMB measurements that show we live in an open Universe.
   C) CMB measurements that show we live in a flat Universe.
   D) Dark Matter.
   E) CMB measurements that show we live in a closed Universe.

5. The Habitable Zone is defined as

   A) The zone around a planet where water will likely be liquid.
   B) The zone around a star where life will likely exist.
   C) The zone around a star where water will likely be liquid.
   D) Ocean front property.
   E) The zone around a planet where life will likely exist.

6. Which elements are thought to be the basic elements for life?

   A) H_2O, O, N, CO_2
   B) H_2O, O
   C) H_2O, O, N
   D) C,O,N,H
   E) H_2, O

7. The CMB has small fluctuations. These are

   A) the seeds of antimatter.
   B) the seeds of galaxies.
   C) the seeds of apples.
   D) the seeds of stars.
   E) the seeds of space.

8. Why have we mostly detected Jupiter-like exoplanets?

   A) More of them out there.
   B) Lower mass planets are probably swallowed by their star.
   C) Easier to detect using today's technology.
   D) They are just hotter.
   E) Jupiter-like planets are more interesting.

9. Which of the following is NOT a good fact to use when estimating f_p?

   A) Extrasolar planet searches have about 3-10% detection rate.
   B) About 2/3 of all stars are in multiple systems, but disks are also common in binary systems.
   C) The location of the Habitable Zone depends on the mass of the star.
   D) Circumstellar disks are common.
   E) The formation of the Solar System is consistent with our understanding of star formation.

10. The Earth's atmosphere at about 1 billion years after the Earth's formation was

    A) mostly N and CO_2.
    B) mostly H and N.
    C) mostly H and He.
    D) Trick question. The Earth had no atmosphere at that time.
    E) mostly N and O.

11. An advanced civilization is on a planet 500 light years away. Which of the following is the fastest way to communicate with this civilization?

    A) Radio waves.
    B) Optical light pulses.
    C) The Space Shuttle
    D) A or B
    E) A or C

12. Stars are born

    A) only during supernova explosions.
    B) in black holes.
    C) in movies.
    D) in molecular clouds.
    E) in empty space.

13. A circumstellar disk around the young Sun can explain which of the following facts?

A) The planetesimals that formed the planets.
B) The exoplanets detected so far.
C) The orbits of the planets in a flattened disk, going the same way.
D) Exoplanet transits.
E) The radioactive material found in meteorites.

14. Where is the Sun located in our Galaxy?

A) In the center about 4 light years from the very center.
B) In the bulge about 30,000 light years from the center.
C) In the disk about 100,000 light years from the center.
D) In the disk about 30,000 light years from the center.
E) In the bulge about 100,000 light years from the center.

15. A new exoplanet is discovered. Most likely it was detected using which method?

A) Transit: star occultation
B) Direct Detection: Exoplanet Imaging
C) Astrometry: see stars move
D) Radial velocity: stars wobble
E) None of the above.

16. An interesting aspect (from the point of view of this class) of molecules in space is that

A) Trick question. Molecules are never interesting to ETs.
B) space noodles.
C) we can find molecules with greater than 50 atoms.
D) we can find molecules containing HONC nearly everywhere.
E) molecules are used for life and used by molecular clouds.

17. Which of the following is NOT evidence of the Big Bang?

A) Cosmic Microwave Background
B) CMB
C) Dark Energy
D) Big Bang Nucleosynthesis
E) Hubble's Law

18. In the Drake Equation, we estimate $f_l = 0.50$. In that case, which of the following can not be equal to 0?

A) f_p
B) f_i
C) L
D) N
E) f_c

19. What kind of Universe do we currently think we live in?

A) An open Universe.
B) A messed-up Universe.
C) A multi-verse Universe.
D) A flat Universe.
E) A closed Universe.

20. The Universe is expanding, but Urbana is not expanding because

A) it is held together by the nuclear strong force.
B) local forces hold it together.
C) it's not close enough to the edge of the expansion wave.
D) it is stuck in the gravity field of Champaign.
E) where's it going to go.

21. Which of the following best describes the early Earth.

A) No atmosphere, no water, moderate temperatures.
B) No atmosphere, no water, high temperature.
C) Hot atmosphere, hot water, just plain hot.
D) Life had to adapt to the deep oceans.
E) Big rocks falling into the deep oceans, creating significant amounts of water vapor.

22. In this class, the Drake term n_e is broken down into two terms

A) n_s (the number of planets with greenhouse gases per planetary system) and f_s (the fraction of stars with hydrogen and helium on the surface)
B) n_p (the number of planets suitable for life per planetary system) and f_p (the fraction of stars whose properties are suitable for life to develop on one of its planets)
C) n_p (the number of planets per planetary system) and f_p (the fraction of stars with planets)
D) n_s (the number of planets with life per planetary system) and f_s (the fraction of stars with life on one of its planets)
E) None of the above.

23. In the beginning of the Universe, there was

A) N
B) a sea of energy, free quarks, free anti-quarks, photons, and other basic particles.
C) H
D) O
E) HONC

24. Molecular clouds, where stars form, are mostly comprised of

A) a rich assortment of molecules that range from alcohol to vinegar.
B) water.
C) dust.
D) H_2.
E) hydrogen.

25. What can one say about the elemental make-up of life on Earth, the Earth, and the Universe?

A) They are made up of the same elements but in very different concentrations
B) Life on Earth and the Universe are mostly carbon.
C) The Universe is mostly hydrogen, but the Earth and life on Earth are mostly oxygen.
D) All three are made up of the same elements in the exact same amounts.
E) The Earth and the Universe are mostly hydrogen.

26. Most, but not all, of the four main elements of life on Earth were made

A) in the cores of 1st and 2nd generation stars.
B) during the Big Bang.
C) in the cores of stars.
D) during a supernova.
E) in the cores of 2nd generation stars.

27. We can say that circumstellar disks are

A) imaged at millimeter wavelengths. Leslie showed a new CARMA map of HL Tauri. He was scarily excited.
B) about the size of our Solar System.
C) very common.
D) where planets form.
E) All of the above.

28. When did the first complete hydrogen atom (not ionized) show up?

A) Annihilation of the anti-matter.
B) Quark confinement: when the free quarks condensed
C) Big Bang Nucleosynthesis
D) Inflation: when the Universe inflated by a factor of 10^{50}!
E) Era of recombination: when the CMB was emitted.

29. When a star forms from a cloud, the material collapses, but not all mass falls in directly. Why?

A) Some gas forms planets.
B) Some gas forms molecular outflows.
C) The gas has a small spin that preferentially causes the formation of a flattened object.
D) The gravity of the gas and dust pushes the material together.
E) Resistance in the mass from magnetic fields.

30. Some people think that the Moon is/was important for life on Earth. Which of the following is a good reason for this?

A) Stable orbit. The Moon stabilizes the tilt of Earth.
B) Metals. The heavy elements (i.e. iron) on the surface of Earth may be from the core of the impactor that created the Moon.
C) Tides. Tides move water.
D) All of the above.

31. What does the Drake equation really tell us?

A) It allows us to estimate the age of the Universe.
B) It calculates the number of advanced civilizations in our Galaxy.
C) It means nothing, a fake equation. It is only meant to guide our thinking about the relevant questions.
D) It calculates the number of advanced civilizations in the Universe.
E) It gives us an exact number of alien lifeforms (intelligent or not) in the Galaxy.

32. All of the gold (a heavier element than Fe) on Earth came from

A) chemical reactions.
B) atomic fusion in the interior of a massive star.
C) the transmutation of lead.
D) a supernova explosion.
E) the Big Bang

33. Which of the following is NOT a good fact to use when estimating R_*?

A) The possibility of a starburst in the Milky Way in the past.
B) The number of stars in the Universe.
C) The number of stars in the Galaxy.
D) The collection of new gas into the Milky Way from our satellite galaxies.
E) The age of the Galaxy.

34. How was most of the nitrogen in our atmosphere created?

A) Proton-protons fusion in the 3rd generation of stars.
B) Comets.
C) CNO cycle in 2nd generation of stars.
D) Proton-proton fusion in the 2nd generation of stars.
E) CNO cycle in 3rd generation of stars.

35. If a star is high-mass (>10 solar masses), how does its life span compare to a low-mass star, like our Sun?

A) much shorter.
B) Trick question. We can not live long enough to estimate. Stars live for a freaky long time.
C) much longer.
D) depends on the enrichment from supernova or planetary nebula.
E) about the same.

36. This actually raises the Earth's temperature by about 15% naturally, i.e. no artificial greenhouse gases.

A) Orbital variations.
B) Solar system metals.
C) Cometary water.
D) Greenhouse effect.
E) Solar brightness fluctuations.

37. Where did the Big Bang occur?

A) At the edge of the Universe, right past the CMB.
B) Everywhere.
C) Somewhere in the waste of space.
D) Kam's last Saturday night.
E) At the edge of the observable Universe.

38. Which of the following facts is useful for making an estimate for n_p?

A) The number of stars in the local group.
B) The amount of asteroids per cubic parsec.
C) The natural regulation of greenhouse gases in the atmosphere of Earth.
D) The natural regulation of the orbital period of the Earth.
E) The amount of carbon in most molecular clouds.

39. In about 3 billion years, the Milky Way and Andromeda galaxies will collide. Should we be worried about being splatted by another star?

A) No, in about 1 billion years the human race will be destroyed by the aging Sun anyway.
B) Yes, we will likely collide with another star and explode!
C) Yes, the Earth is doomed.
D) Yes, due to a new estimate of the Milky Way mass, it will happen sooner than we thought.
E) No, galaxies are mostly empty space, so we will likely be okay, but the Sun's orbit around the Galaxy may be messed up.

40. What is an idea that has survived repeated and repeated testing, but has not been establish as a scientific law?

A) Prediction.
B) Occam's Razor.
C) Results.
D) Theory.
E) Hypothesis.

41. Hubble's Law tells us that the further away a galaxy is the faster it is moving away from us. What does this mean?

A) The Universe is exploding outward from the Big Bang.
B) The Universe is expanding from the Big Bang, and the galaxy motions look the same from everywhere.
C) We are the center of the Universe.
D) We aren't well liked.
E) The Universe is expanding from the Big Bang, and we are specially located at the center.

42. Why are the planets in the Solar System different, i.e. terrestrial, gas giant, or ice?

A) temperature of the greenhouse gases in the atmosphere of the young Earth.
B) temperature in the circumstellar disk that surrounded the young Sun.
C) temperature of the planetesimals that surrounded the young Earth.
D) temperature in space.
E) None of the above.