

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 UIN 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**

---

Exam 2: Version A

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

- 1) Which of the following places in our Solar System is NOT a place to likely find life?
  - A) The clouds of Venus.
  - B) The subsurface of Mars.
  - C) Under the ice on Europa.
  - D) Near a methane/ethane lake on Titan.
  - E) In the subsurface of Io.
  
- 2) How can we estimate the age of a dinosaur fossil?
  - A) Estimate the amount of wear the fossil has.
  - B) Measure the amount of  $^{14}\text{C}$  in the fossil.
  - C) Measure how much the fossil weighs.
  - D) Measure the amount of  $^{40}\text{K}$  or  $^{235}\text{U}$  in the fossil.
  - E) Estimate the age of the volcano layers of rock above and below the fossil.
  
- 3) What makes us one of the most intelligent species on the planet?
  - A) The information we can store in our cells.
  - B) The fact that we can destroy the planet.
  - C) The information we can store in our genes.
  - D) The information we can store in our brains.
  - E) The variety of smells and tastes we can distinguish.
  
- 4) Which of the following is NOT a place or way to synthesis the polymers of life?
  - A) Probability.
  - B) Clay layers.
  - C) In a comet tail.
  - D) Tide pools (or evaporation pools).
  - E) Some unknown energy producing reaction.
  
- 5) In class, we discussed Alex the Parrot. What was the point?
  - A) To demonstrate intelligence in other species; he was taught to speak and even able to do simple math.
  - B) To demonstrate intelligence in other species; he could smoke.
  - C) To demonstrate intelligence in other species; he could request food with simple sign language.
  - D) To demonstrate intelligence in other species; he could be sued for sexual harassment.
  - E) To demonstrate intelligence in other species; he was able to squawk and fly, at the same time.
  
- 6) Since you were born, you have had a constant  $^{14}\text{C}/^{12}\text{C}$  ratio. Why?
  - A) You are radioactive.
  - B) You are only eating bananas.
  - C) You are absorbing and emitting gases at the same rate.
  - D) You are breathing in  $\text{CO}_2$ .
  - E) You continue to eat plants or food from plants.
  
- 7) Your ancestors collected 1 kg of  $^{14}\text{C}$ , 11,460 years ago. How much would be left today? (Hint: The half-life of  $^{14}\text{C}$  and  $^{238}\text{U}$  is 5730 years and 4.5 billion years, respectively.)
  - A) 4 kg.
  - B) 2 kg.
  - C) 0.5 kg.
  - D) 0.25 kg.
  - E)  $2.5 \times 10^{-6}$  kg.

Exam 2: Version A

- 8) The main legacy of the Miller-Urey experiment was that
- A) it proved that life formed on Earth in water.
  - B) it proved that the early atmosphere was heavily reducing.
  - C) it legitimized the scientific study of the origin of life.
  - D) it legitimized the search for an oxygen-rich atmosphere.
  - E) it proved that life must have come from panspermia.
- 9) Which of the following does NOT well describe DNA?
- A) Resembles a twisted ladder.
  - B) The sides of the ladder are made with sugars/phosphates.
  - C) If you know one side, you can deduce the other.
  - D) The steps or rungs of the ladder are nitrogenous bases.
  - E) If pulled from one of your cells, it would be nearly 1 km in length.
- 10) Which of the following is NOT a useful fact when considering an estimate for  $t_i$ ?
- A) Vocal cords developed early in hominid evolution.
  - B) Complexity can lead to intelligence.
  - C) The exact path of evolution for humans will not occur on other planets.
  - D) Intelligence is a recent development on Earth.
  - E) Humans took 4.5 billion years to evolve.
- 11) Which of the following is/are possibilities for the transition to life?
- A) Primitive life or silicon based life.
  - B) Primitive life or statistical likelihood life.
  - C) Silicon based life.
  - D) Primitive life.
  - E) Primitive life or protolife.
- 12) Which type of life came earliest?
- A) Prokaryotes.
  - B) Proyotes.
  - C) Fruit.
  - D) Eukaryotes.
  - E) Euproyotes.
- 13) Which of the following does NOT well describe a protein?
- A) Does all of the real chemical work of life.
  - B) When wound up, makes the genetic code.
  - C) Sometimes called an enzyme.
  - D) Made up of chains of amino acids.
  - E) Forms the structural components of life.
- 14) What type of life are we most closely related?
- A) true bacteria
  - B) archvillians
  - C) bacteria
  - D) archaea
  - E) eubacteria

## Exam 2: Version A

- 15) Which of the following is NOT a fact for estimating  $f_s$ , the fraction of stars that have properties that are suitable for life to develop around one of their planets?
- A) The size of the star's habitable zone.
  - B) The multiplicity of the star.
  - C) The mass of the star.
  - D) The amount of heavy elements (i.e. heavier than hydrogen) in the star.
  - E) The age of the star.
- 16) What is the most prevalent model for the transition to life?
- A) Astro 330.
  - B) Proteinoids.
  - C) Biological evolution.
  - D) Protein life.
  - E) The RNA world.
- 17) Sex in space, or on Earth, is important because
- A) mutations can only occur in sexual reproduction.
  - B) it leads to greater genetic diversity and an overall increase of positive mutations in the offspring
  - C) it allows humans to breed with aliens.
  - D) sex, although fun, also stimulates gene mutations.
  - E) it allows the genetic material of the better organisms to survive
- 18) What can we say about macroscopic life?
- A) It is not as much fun as it sounds.
  - B) The oldest fossils of this type were found 3.8 billion years ago.
  - C) It has only been around for the last 600 Myrs, 1/6th the history of life.
  - D) It is only prokaryotes.
  - E) It is the only type of life to make fossils.
- 19) What is a gene?
- A) A sequence of codons that specifies a protein.
  - B) A sequence of RNA that specifies a DNA strand.
  - C) A sequence of bases that specifies an amino acid.
  - D) A sequence of stars that specify a Galaxy.
  - E) A sequence of proteins that specifies an amino acid.
- 20) Extremophiles are
- A) microbes that live in dirt.
  - B) microbes that live in water.
  - C) microbes that live in toxic debts.
  - D) microbes that live in the most difficult places on Earth.
  - E) microbes that live only in the most the extreme heat and salty environments.
- 21) What is the chicken or egg problem with respect to the molecular basis of life?
- A) Nucleic acid transcription must have been too difficult on the early Earth, so something else might have happened.
  - B) Nucleic acid transcription must be directed by amino acids.
  - C) Nucleic acid synthesis must be directed by nucleic acids.
  - D) Protein synthesis must be directed by nucleic acids, but nucleic acid transcription requires nucleic acids.
  - E) Protein synthesis must be directed by nucleic acids, but nucleic acid transcription requires enzymes (proteins).

## Exam 2: Version A

- 22) The fact that life on Earth uses the most generic and abundant elements on Earth suggests that
- A) life should exist everywhere in the Universe.
  - B) Trick question. Life on Earth is not made of the most abundant elements on Earth.
  - C) life needs these specific elements to survive.
  - D) we are all made from the same stuff.
  - E) life had many options, but chose the elements that worked best.
- 23) Could galaxies be alive?
- A) Yes, we are the Galaxy understanding itself.
  - B) Yes, that explains my dreams.
  - C) Nope.
  - D) Perhaps, with stars being the monomers of life, but it would be at an early stage. Really, it is very unlikely though.
  - E) No, that's nuts.
- 24) What lifeform caused the world's first pollution crises?
- A) Radioactive bacteria
  - B) Aliens
  - C) Cyanbacteria
  - D) Dinosaurs
  - E) Humankind
- 25) What is a good definition for intelligence?
- A) The ability to model the world for food/poison.
  - B) The ability to communicate with members of the organism's species, through chemical or visual means.
  - C) That which does not kill you makes you stronger.
  - D) The ability to communicate with ETs.
  - E) The ability to model the world, including the organism's own self
- 26) Which of the following is a true statement about early life on Earth?
- A) It arose quickly, taking no more than 10-100 million years after the heavy bombardment.
  - B) It was immune to meteorites.
  - C) It used oxygen to create energy.
  - D) It existed in clay.
  - E) It lived on the land before it was cool.
- 27) Which of the objects in our Solar System would float in water?
- A) Saturn
  - B) Jupiter
  - C) Titan
  - D) Io
  - E) Europa
- 28) If you were to travel back in time, how far could you go without needing a breathing mask to explore Earth?
- A) 5 billion years ago.
  - B) 10 billion years ago.
  - C) 1 million years ago.
  - D) 2 million years ago.
  - E) 2 billion years ago.

Exam 2: Version A

- 29) Why is the Murchison meteorite so interesting?
- A) It contained amino acids, with a slight left-handed preference.
  - B) It landed on Frank Drake's head.
  - C) It proved that aliens are also left-handed life.
  - D) It contained evidence of life on Mars.
  - E) It proved that large molecules exist in space.
- 30) Which of the following is NOT a place to synthesis the monomers of life?
- A) Possibly the surface of Titan.
  - B) Hot underwater vents.
  - C) Anywhere with liquid water, dry land, energy sources, and a slightly reducing atmosphere.
  - D) In an oxygen rich atmosphere, near an ocean, with lightning.
  - E) Interstellar space.
- 31) What can we say about life in our Solar System?
- A) Good evidence of life on Jupiter.
  - B) No conclusive evidence for life besides the Earth.
  - C) No conclusive evidence for life exists at all.
  - D) Good evidence of life on Europa.
  - E) Good evidence of life on Mars.
- 32) Why carbon based life?
- A) Exhaling makes  $\text{CO}_2$ .
  - B) The electronic structure allows for long chains.
  - C) It ends up being a lot cheaper.
  - D) It is the most abundant element in the Earth's crust.
  - E) The nuclear reactions are stronger than any other molecule.
- 33) Which moon in the Solar System has a significant atmosphere?
- A) Io.
  - B) Titan.
  - C) Enceladus.
  - D) Europa.
  - E) The Moon.
- 34) Which of the following is NOT a monomer of nucleic acids?
- A) nitrogenous bases
  - B) sugars
  - C) guanine
  - D) amino acids
  - E) phosphates
- 35) Why is it thought that Europa has water under its ice?
- A) It is heated from below by radioactive elements.
  - B) Since it is located in the habitable zone.
  - C) Incorrect statement, it is not thought to have water under the ice, but on top.
  - D) Tidal forces from Jupiter heat the center.
  - E) It is heated from below by gravity.

Exam 2: Version A

- 36) Which of the following is NOT an important question to ponder for estimating fj.
- A) How easy is it for polymerization to occur?
  - B) Are tides necessary?
  - C) Is a reducing atmosphere required?
  - D) Is the day long enough for life to occur?
  - E) Are alternative life forms possible?
- 37) What is the Codon code?
- A) How nucleic acids encode amino acids using bases.
  - B) A bad movie starring Tom Hanks.
  - C) A three letter word that nucleic acids use to encode bases.
  - D) How amino acids figure out how to hook up with other amino acids.
  - E) A three letter word that proteins use in encoding bases.
- 38) Which of the following is NOT a polymer?
- A) nucleic acid
  - B) enzyme
  - C) protein
  - D) mDNA
  - E) amino acid
- 39) What is a chromosome?
- A) A way to visualize proteins based on their colors.
  - B) DNA wrapped around proteins.
  - C) A way to visualize nucleic acid based on their colors when using an infrared light source.
  - D) Controls the transcription of genes.
  - E) Makes Carps very intelligent, for fish.
- 40) Hominid evolution
- A) was quick.
  - B) was not a smooth and steady path.
  - C) led to the biggest brains.
  - D) is the summit of evolution.
  - E) was a clear evolution toward intelligence.
- 41) Which of the following is an incorrect statement about Mars?
- A) The canals were not built by Martians, but by liquid water flowing from the polar caps to the equator.
  - B) There is evidence of flood erosion on the surface.
  - C) There is ice in the polar caps.
  - D) Sometimes there are clouds with ice crystals.
  - E) Sometimes there is frost on rocks.
- 42) What was the key for intelligence to arise on this planet?
- A) Genetic diversity.
  - B) The ability to choose sexual partners.
  - C) The mass extinction of the dinosaurs.
  - D) The ability to type.
  - E) The ability to climb trees.