

UGS 303 - EXTRATERRESTRIAL LIFE
COMMON PROBLEMS ON EXAM 3

- (0) Common issues
- (a) Remember to answer all parts of the question. After writing, reread the question and your answer to make sure you have addressed all parts. You will generally receive more credit for incomplete or incorrect answers than for no answer at all.
 - (b) Don't just restate the question, answer with details.
 - (c) Make sure to answer the question that is asked, not a different question.
 - (d) Be concise and use your time wisely. If you are writing three pages you are probably including unnecessary information. Writing takes time; if you are writing a long answer for one question you won't have as much time for other questions.
 - (i) Statements like "studies show", "there is evidence that", etc. are meaningless. What studies? What evidence?
- (1) Biological evolution and f_i .
- (a) Don't just restate the question. The question stated "Explain how biological evolution occurs using an example. Your answer should explain random, inheritable variations and natural selection". Your answer should not say "Evolution occurs by random, inheritable variations causing advantageous traits which are then selected by natural selection".
 - (b) What does 'advantageous trait' mean in terms of biological evolution? If you say this, you must explain what it means.
 - (c) Intelligence is not generally an advantageous trait. Evolution of any arbitrary species will not necessarily (and most likely won't) result in a more intelligent species.
 - (d) Many students cited evidence for increasing complexity as something akin to "at the beginning, life on earth was single celled, then later is was more complex and multicellular lifeforms appear, and eventually humans appear." We were not around to see these things happen - how do we know that they occurred? Cite specific evidence that shows this to be the case. It is also not sufficient to state that the 'fossil record' is evidence. What in the fossil record supports evolution of increasing complexity over time?
 - (e) The idea of convergent evolution in relation to intelligence is that there are niches which favor intelligence, and therefore those niches will be filled. Evolution itself has no goal - intelligence is not the inevitable product of evolution.
 - (f) 'Mutation' means a change in something. Mutations may happen to individuals that are not inheritable, e.g. if you lose a finger in an accident your children will still have all of their fingers. You need to explain what is meant by an inheritable mutation and where it occurs.
 - (g) Mitochondrial DNA is not evidence for evolution; it is evidence that mitochondria were probably once separate life forms.
 - (h) It is not obvious why common DNA in many creatures is evidence for increasing complexity. If you stated this, you must explain it.
- (2) Agriculture as an important step for the development of technological civilization; evolution of the world view; f_c .
- (a) Agriculture: one needs to explain why agriculture can lead to surplus, and then the development of written language, complicated social structure, more advance tools, etc.
 - (b) World view: "Oyster world" → geocentric → heliocentric → discovery of other galaxies, expansion of the Universe, "no-where-centric" view. A lot of people have forgot to mention the current world view.
 - (c) f_c : one is expected to break the problem into "capability" and "interest". One needs to use fact to back up the estimation such as independent discovery of agriculture and written-language, a correct world-view, and technology is or is not likely to occur.

- (3) Man-made and natural catastrophes and lifetime of the communicable civilization
 - (a) There are three parts of the question. Each part counts about 6 points.
 - (b) Man-made problems: One needs to explain the problem, current condition and possible solution (or why it will not work). For example, when talking about energy problem, one needs to talk about current usage, storage, and why there is a crisis in the first place, then analyze possible solutions like solar or wind energy.
 - (c) Natural catastrophes: If choosing the Sun's death as the most probable catastrophe, one needs to explain why we can survive more short term ones such as asteroid impacts.
 - (d) The lifetime needs to be consistent with the first two arguments. As mentioned above, if choosing a longer time scale, one needs to at least mention how we can survive the shorter timescale crises.
- (4) Rockets & terraforming Mars
 - (a) Misunderstanding of Newton's 2nd law as Newton's 1st law. Most know the thrust F comes from Newton's 3rd law, but many don't know how to use 2nd law to explain the details of how the rocket works.
 - (b) Review specific impulse. This part of the problem was often answered incorrectly.
 - (c) Answer all parts of the question: some ignored the "terraforming Mars" question.
 - (d) Many didn't know the mechanism of getting liquid water on Mars. Although they know that we need to heat up Mars, they didn't mention either (a) the greenhouse effect of water vapor or (b) the temperature and pressure suitable for liquid water.
- (5) Chemical - Biological - Cultural evolution
 - (a) Give a specific time for the scales. Don't simply state "Biological evolution takes longer than cultural evolution." How long is 'longer'? Could it be days? Months? a decade? Be specific.
 - (b) Don't be too specific: biological evolution occurs over millions to billions of years, not 6, 20, or 500 million.
 - (c) Chemical evolution refers to the process of developing heavy elements needed for life after the big bang as well as the actual formation of life. A sufficient quantity of C, N, O, P was available to begin forming molecules within about 1 Gy after the big bang. It took about 1 Gy for the chemical reactions to occur on earth. These combined put a timescale of 1-2 Gy.
 - (d) Don't confuse length of time of occurrence with the scale on which events occur. When being asked about the pace, consider how long it takes the factor to change. For example, how long does it take for our culture to change? The answer is the pace of cultural evolution.
 - (e) Make sure to answer the question that is asked. The final part of the question was "Describe the characteristics you would expect to find in a very long-lived technological civilization." Do not describe what an intelligent species would be like, describe the traits of the civilization.
 - (f) You may or may not think that we will be a long-lived civilization. We have only existed as a technological civilization for about 50 years, not 200,000. What traits will a civilization need to be very long-lived? If we will be one, what do we need to do to overcome current short term issues?
 - (g) The timescale of an event is determined by the slowest factor. Biological, not cultural, evolution determines the timescale of evolution of a technological culture. If biological evolution is not necessary then anything with culture would have technology. Humans are not the only creatures with culture.
 - (h) Don't confuse long-lived with technologically advanced. The former will probably be the latter, but the latter is not necessarily the former.