ASTR/GEOL-2040-001: Quiz #1 Name: .....
Search for Life in the Universe (September 20, 2017)

Mark the correct answers with a circle. Please provide brief answers; short phrases are acceptable. When appropriate, give the intermediate steps of your working.

1. CH_4 is a

   (a) polar molecule
   (b) nonpolar (or apolar) molecule

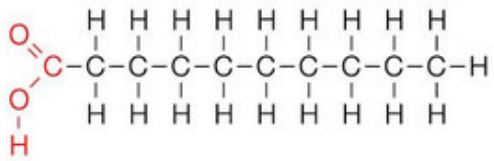
2. Which of the following molecules can act as an enzyme?

   (a) polysaccharides
   (b) amino acids
   (c) proteins
   (d) lipids
   (e) sugars

3. Water is one of a few substances whose liquid phase is denser than its solid phase. How does this trait benefit biological systems on Earth, especially those in the colder climates?

   (a) Ice crystals can provide structure to systems on Earth, specially those in colder climates.
   (b) Water underneath ice has a higher dissolved oxygen content.
   (c) Ice provides a protective insulating barrier to underlying water.
   (d) The trait has no benefit; it is strictly coincidental.

4. What kind of macromolecule is



   (a) lipid (b) polysaccharide (c) protein (d) nucleic acid

5. A 10 g mixture of two unknown chemical powders, one red and one green, is stirred into a 250 mL beaker of water. After one minute of stirring, the green substance has completely dissolved but the red powder has collected on the bottom of the beaker. What could be said about the molecular structure of both substances from this experiment?

   (a) Both substances are non-polar.
   (b) The green substance is polar; the red substance is non-polar.
   (c) Both substances are polar.
   (d) The red substance is polar; the green substance is non-polar.

6. List at least two key aspects of Darwinian evolution.

7. List at least two of the arguments suggesting that carbon might also be a central element in extraterrestrial biochemistry.

8. What are the cell walls of life on Earth made of? Also, list at least two the important properties.

9. What are the four building blocks of life?

10. The gases in the Miller/Urey experiment included H_2, NH_3, CH_4, H_2O. What was the relevant energy supply that led to the formation of amino acids? Why would this energy source be a problem if O_2 were included in this experiment?

11. A given strand of DNA is given by the following sequence of bases:

"TAC TTC ACC GGG ATC".

(i) What is the sequence of RNA bases that you would expect the above sequence would pair with? Hint: remember that letters match in specific pairs and T in DNA is the same as U in RNA.

(ii) Using the table below, write down the amino acid sequence that this RNA sequence would code for.

(iii) Write down a mutated sequence of RNA bases that would result in the same sequence of amino acids.

Second Letter

1st letter	U	C	A	G	3rd letter
U	UUU Phe UUC UUA Leu UUG	UCU UCC Ser UCA UCG	UAU Tyr UAC UAA Stop UAG Stop	UGU Cys UGC UGA Stop UGG Trp	U C A G
C	CUU CUC Leu CUA CUG	CCU CCC Pro CCA CCG	CAU His CAC CAA Gln CAG	CGU CGC Arg CGA CGG	U C A G
A	AUU AUC Ile AUA AUG Met	ACU ACC Thr ACA ACG	AAU Asn AAC AAA Lys AAG	AGU Ser AGC AGA Arg AGG	U C A G
G	GUU GUC Val GUA GUG	GCU GCC Ala GCA GCG	GAU Asp GAC GAA Glu GAG	GGU GGC Gly GGA GGG	U C A G