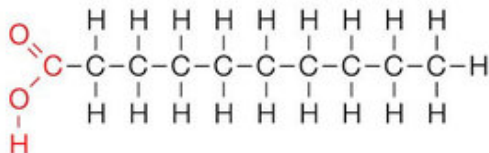


Correct answers are shown in blue.

1. CH₄ 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.
 - struggle for survival due to limited resources
 - more individuals are produced that can survive
 - individuals produce similar offspring
 - offspring can show small variations
7. List at least two of the arguments suggesting that carbon might be a central element also in extraterrestrial biochemistry.
 - carbon is one of the most abundant elements in the Universe
 - it is tetravalent and therefore versatile in that it can bond with a large variety of other chemical groups
 - the bonds are relatively stable, unlike silicon, which is also tetravalent.
 - it can occur in the gas phase as CO₂ and is therefore mobile
8. What are the cell walls of life on Earth made of? Also, list some of the important properties.
 - Cells are made of lipids (fatty acids).
 - They are insoluble in water.
 - They act as an energy substrate.
 - They are semipermeable, allowing nutrients to enter.
9. What are the four building blocks of life?
 - lipids (fatty acids)
 - sugars (carbohydrates)
 - proteins (amino acids)
 - nucleic acids (nucleotides)
10. The gases in the Miller/Urey experiment included H₂, NH₃, CH₄, H₂O. What was the relevant energy supply that led to the formation of amino acids? Why would this energy source be a problem if O₂ were included in this experiment?
 - The relevant energy supply was electricity in the form of sparks. (Heat was also an energy source, but not critical for the formation of amino acids.)
 - The presence of H₂ and O₂ would lead to an explosion (combustion into water) of the apparatus after the first spark.

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

“TAC TTC ACC GGG ATC”.

(i) The sequence of RNA bases that the above sequence would pair with is

“AUG AAG UGG CCC UAG”.

(ii) The amino acid sequence that this RNA sequence would code for is

“Met Lys Trp Pro Stop”.

(iii) Mutated sequences of RNA bases that would result in the same sequence of amino acids are the following

“AUG AAG UGG CCC UAG”,
“AUG AAA UGG CCC UAG”,
“AUG AAG UGG CCU UAG”,
“AUG AAA UGG CCU UAG”,
“AUG AAG UGG CCA UAG”,
“AUG AAA UGG CCA UAG”,
“AUG AAG UGG CCG UAG”,
“AUG AAA UGG CCG UAG”,
“AUG AAG UGG CCC UAA”,
“AUG AAA UGG CCC UAA”,
“AUG AAG UGG CCU UAA”,
“AUG AAA UGG CCU UAA”,
“AUG AAG UGG CCA UAA”,
“AUG AAA UGG CCA UAA”,
“AUG AAG UGG CCG UAA”,
“AUG AAA UGG CCG UAA”,

There are thus 16 possibilities (but only one was asked for).