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BIOL1101 Examen 1 Bono

1. All the organisms on your campus make up a
2. An ecosystem
3. **A community**
4. A population
5. A taxonomic domain

Explanation: A community is defined as “the array of organisms inhabiting a particular ecosystem”. In this case, the organisms would be the students and staff, which make up different populations (c) and the ecosystem would be the campus, a specific area inhabited by the population (a). Organisms in a campus, referring to both population and ecosystem, make it a community. Taxonomic domain refers to a type of classification for organisms (d).

1. Which of the following best demonstrates the unity among organisms?
2. Emergent properties
3. Descent with modification
4. **DNA structure and function**
5. Natural selection

Explanation: All living organisms have DNA, it is something that organisms have in common. Emergent properties are not relevant to characteristics of organisms (a). Descent with modifications refers to how organisms change and diverge from one another (b). Natural selection also refers to difference in traits between organisms (d).

1. A controlled experiment is one that
2. Proceeds slowly enough that a scientist can make careful records of the results.
3. **Tests experimental and control groups in parallel.**
4. Is repeated many times to make sue the results are accurate.
5. Keeps all variables constant.

Explanation: In a controlled experiment scientists are trying to test a certain variable and to do that they need to have a basis to compare their results to. That basis is the control group, which is kept unaffected, and the experimental group is what is changed and affected throughout the experiment. A slow experiment isn’t necessarily a controlled experiment (a). Repeating an experiment doesn’t make it a controlled experiment (c). Constant variables does not mean its controlled either (d).

1. Which of the best following statements best distinguishes hypotheses from theories in science?
2. Theories are hypotheses that have been proven
3. Hypotheses are guesses; theories are correct answers
4. **Hypotheses are usually relatively narrow in scope; theories have broad explanatory answers**
5. Theories are proved true; hypotheses are often contradicted by experimental results

Explanation: Hypothesis are possible predictions and explanations about the results of an experiment or a question. Theories are hypotheses that have been repeatedly proven true by several different repeated experiments, giving it a validity that a hypothesis does not have in the beginning. It takes more than just proving a hypothesis for it to become a theory (a). Hypotheses are not guesses, they are educated and supported by prior knowledge (b). Hypotheses are not always contradicted by experimental results it depends on the experiment (d).

1. Which of the following best describe the logic of scientific inquiry?
2. If I generate a testable hypothesis, tests and observations will support it.
3. If my predictions are correct, it will lead to a testable hypothesis.
4. If my observations are accurate, they will support my hypothesis.
5. **If my hypothesis is correct, I can expect certain test results.**

Explanation: Hypothesis is an explanation of the results of an experiment, meaning if the hypothesis turns out to be accurate, then the test results are predicted from before the experiment is even done. Having a hypothesis does not automatically mean it will be true (a). A hypothesis comes before a prediction (b). Accurate observations do not translate to a correct hypothesis, because the hypothesis can still be wrong (c).

1. The reactivity of an atom arises from
2. The average distance of the outermost electron shell from the nucleus
3. **The existence of unpaired electrons in the valence shell.**
4. The sum of the potential energies of all the electron shells.
5. The potential energy of the valence shell.

Explanation: An atom with an unpaired electron is an atom which is able to create bonds with other atoms. Presence of valence electrons determines reactivity. The distance an electron has from the nucleus does not determine reactivity (a). Potential energy does not influence the reactivity of the atom either (c). The valence shell does not affect reactivity (d).

1. Which of the following statements correctly describe any chemical reaction that has reached equilibrium?
2. The concentrations of products and reactants are equal.
3. The reaction is now irreversible.
4. Both forward and reverse reactions have halted.
5. **The rates of the forward and reverse reactions are equal.**

Equilibrium: An equilibrium reaction is a reaction in which the forward and reverse parts of the reactions are happening at the same rate, meaning the creations of reactants and products is at an equal rate. This does not mean the concentration is equal or that there are equal amounts (a). An equilibrium reaction comes from a reversible reaction (b). An equilibrium reaction is when both forward and reverse reactions are still happening (c).

1. Many mammals control their body temperature by sweating. Which property of water is most directly responsible for the ability of sweat to lower body temperature?
2. Water’s change in density when it condenses
3. Water’s ability to dissolve molecules in the air
4. The release of heat by the formation of hydrogen bonds
5. **The absorption of heat by the breaking of hydrogen bonds**

Explanation: When the hydrogen bonds in water in the form of sweat on our skin break in order for the sweat to become water vapor, this absorbs the heat from our skin which lowers the temperature in the place where the sweat evaporated. Density and condensation aren’t related to how sweating works (a). Dissolving molecules in the air isn’t related to sweating (b). The release of heat with the formation of hydrogen bonds would do the opposite of what sweating is intending to do, which is to cool down the organism (c).

1. We can be sure that a mole of table sugar and a mole of vitamin C are equal in their
2. Mass
3. Volume
4. Number of atoms
5. **Number of molecules**

Explanation: A mole is defined as a specific number, being 6.022 x 10^23 molecules. If both substances have the same moles, then that means there is the same exact number of molecules for each respective molecule. A mole doesn’t refer to mass, the two substances wouldn’t have the same mass (a). They wouldn’t have the same volume either (b). They would have the same number of atoms because they have different molecules made up different amounts of atoms (c).

1. Measurements show that the pH of a particular lake is 4.0. What is the hydrogen ion concentration of the lake?
2. 4.0 M
3. **10^-4 M**
4. 10^4 M
5. 10^-10 M

Explanation: The pH of something is found using the formula pH=-log[H+]. The hydrogen ion concentration is represented from a scale of 10^-1 to 10^-14 M. 4.0 M is too big of a number (a). 10^4 M doesn’t have a negative exponent, which isn’t accurate (c). 10^-10 M would be something with a 10 pH, not 4 pH (d).

1. The atomic number of sulfur is 16. Sulfur combines with hydrogen by covalent bonding to form a compound, hydrogen sulfide. Based on the number of valence electrons in a sulfur atom, predict the molecular formula of the compound.
2. HS
3. HS2
4. **H2S**
5. H3S2

Explanation: Since sulfur has 16 electrons, that means it has 6 electrons in its outer electron shell meaning it needs 2 other electrons to complete its electron shell. 2 hydrogens satisfy this requirement, as they each provide one hydrogen, and both need 1 for themselves. In this way sulfur and the two hydrogens covalently bond and share electrons. One hydrogen wouldn’t satisfy the requirement (a). Having 2 sulfurs bonded together with one hydrogen wouldn’t satisfy the valence electron requirement (b). 3 hydrogens and 2 sulfurs wouldn’t satisfy electron requirements either (d).

1. What coefficients must be placed in the following blanks so that all atoms are accounted for in the products.

C6H12O6 🡪 \_\_\_C2H6O + \_\_\_CO2

1. 1;2
2. 3;1
3. 1;3
4. **2;2**

Explanation: Having a coefficient of 2 for both products would balance the number of atoms on both sides of the reaction. This is necessary because the number of atoms in the product must be equal to the number of atoms in the reactants. None of the other options would satisfy this requirement (a), (b), (c).

1. A slice of pizza has 500kcal. If we could burn the pizza and use all the heat to warm a 50-L container of cold water, what would be the approximate increase in the temperature of the water? (Note: A liter of cold-water weighs about 1 kg.)
2. 50ºC
3. 5ºC
4. 1ºC
5. **10ºC**

Explanation: 1 Kcal is equal to the quantity of heat needed to raise the temperature of 1 Kg of water 1ºC. If there is 500kcals of the pizza and 50kg of the water, the temperature will increase by 10ºC. The other options are not correct answers (a), (b), (c).

1. Choose the term that correctly describes the relationship between these two sugar molecules:
2. **Structural isomers**
3. Cis-trans isomers
4. Enantiomers
5. Isotopes

Explanation: The two molecular structures shown, portray structural isomers. A structural isomer is when two molecules with the same molecular formula have a difference in their covalent arrangements. In this example, the double bound is found in different places, creating a different shape for the molecules. A cis-trans isomer is related to the position of specific functional groups, which does not apply (b). An enantiomer is when they are mirror images, which does not apply in this case either (c). An isotope refers to when two atoms of the same element have a different number of neutrons, which isn’t relevant in this case (d).

1. Which functional group is not present in this molecule?
2. Carboxyl
3. **Sulfhydryl**
4. Hydroxyl
5. Amino

Explanation: In this molecule, the only functional group not present is sulfhydryl, which is -SH. There is a -COOH, carboxyl (a). There is -OH, hydroxyl (c). There is also -NH2, amino (d).

1. Which chemical group is most likely to be responsible for an organic molecule behaving as a base?
2. Hydroxyl
3. Carbonyl
4. **Amino**
5. Phosphate

Explanation: Amino (-OH) would cause the molecule to behave as a base due to how it causes the molecule to accept hydrogen ions, which makes the molecule a base. None of the other options would do that (a), (b), (d).

1. Which of the following categories includes all others in the list?
2. Disaccharide
3. Starch
4. **Carbohydrate**
5. Polysaccharide

Explanation: A carbohydrate is a type of macromolecule which contains several types of polysaccharides and monosaccharides. Disaccharide, starch, and polysaccharide are types of carbohydrates. Disaccharide is made up of two monosaccharides, which is a carbohydrates monomer (a). Starch is a type of storage polysaccharide (b). A polysaccharide is made up of many monosaccharides (d).

1. The structural level of a protein least affected by a disruption in hydrogen bonding is the
2. **Primary level**
3. Secondary level
4. Tertiary level
5. Quaternary level

Explanation: A primary structure of a protein chain is made up of covalent bonds called peptide bonds, which aren’t influenced by hydrogen bonds. This means a disruption in hydrogen bonds won’t affect the structure as a whole. The other structural levels of protein contain hydrogen bonds so they would get affected by a disruption (b), (c), (d).

1. Enzymes that break down DNA catalyze the hydrolysis of the covalent bonds that join nucleotides together. What would happen to DNA molecules treated with these enzymes.
2. The two strands of the double helix would separate.
3. **The phosphodiester linkages of the polynucleotide back-bone would be broken.**
4. The pyrimidines would be separated from the deoxyribose sugars.
5. All bases would be separated from the deoxyribose sugars.

Explanation: The polynucleotide backbone of the protein chain is made up of nucleotides joined by a covalent bond called a peptide bond that are created through a dehydration reaction. If the enzyme catalyzes the hydrolysis of that dehydration reaction, that will affect the peptide bonds and polynucleotide backbone. The double helix wouldn’t be affected cause that is cause by hydrogen bonds (a). The bond between pyrimidines and deoxyribose sugars wouldn’t be affected by the enzyme because it is a glycosidic bond (c). The bases are bonded by glycosidic bonds which aren’t affected (d).

1. Which of the following hydrocarbons has a double bond in its carbon skeleton?
2. C3H8
3. C2H6
4. **C2H4**
5. C2H2

Explanation: Carbon requires 4 bonds to complete it outer electron shell and hydrogen requires 2. In a molecule with 2 carbons and 4 hydrogens, there would be 2 hydrogens bonded to each carbon, meaning each carbon would still need another bond to complete its outer electron shell. Therefore, the carbons will bond through a double bond instead of a single bond to complete the electron shell for all the atoms in the molecule. The other molecules listed complete their electron shells with only a single bond between the carbons (a), (b), (d).

1. The molecular formula for glucose is C6H12O6. What would be the molecular formula for a polymer made by linking ten glucose molecules together by dehydration reactions.
2. **C60H120O60**
3. C60H102O51
4. C60H100O50
5. C60H111O51

Explanation: A polymer made up of 10 glucose molecules would contain the number of atoms in a glucose molecule multiplied by 10. In this case it would be 60 carbons (6 x 10), 120 hydrogens (12 x 10), and 60 oxygens (6 x10). The other polymers listed do not contain the correct number of atoms needed for a polymer containing 10 glucose molecules (b), (c), (d).