4. Explain the functions of unique plant structures including the cell wall, chloroplasts, and critical parts of the flower and seed

(Page 87)

Plant cells differ from animal cells in many ways. Plant cells have rigid cell walls surrounding their membrane. They also contain chloroplasts, which function in photosynthesis, and a large central vacuole for water storage. Often, plant cells are square shaped or rectangular.

(Ch. 29)

Plants contain xylem and phloem to transport water and minerals, respectively. The reproductive structures of many plants are flowers, which contain stamens (the male organ) and/or pistils (the female organ). The stamen contains pollen and the pistil has a sticky end for collecting pollen.

Name KEY

3. Explain how the cell membrane controls movement of substances both into and out of the cell and within the cell

(Chapter 5)

The cell membrane is made of a phospholipid bilayer. It is selectively permeable, choosing what enters and leaves the cell. Embedded in the phospholipid bilayer are some carrier proteins, ion channels, and other passage ways for specific substances to move in or out. When substances move with their concentration gradient, it is called passive transport. When substances move against their concentration gradient, it requires ATP and is called active transport.

2. Describe the biological criteria that needs to be met in order for an organism to be considered alive

(Chapter 1, section 1)

In order for something to be considered living, it must possess all of the seven characteristics of life.

-Organization (made of cells)

-Response to stimuli (reacting)

-Homeostasis (maintaining balance)

- Metabolism (chemical reactions)

- Growth and development

- Reproduction

- Change over time (evolution)

1. Explain why all scientific knowledge is subject to change as new evidence becomes available to the scientific community

(Page 17)

An experiment can only disprove, not prove, a hypothesis. Acceptance of a hypothesis is always tentative in science. The scientific community revises its understanding of phenomena, based on new data. Scientists always repeat experiments to verify previous findings. This allows science to have a method for self-correction. When a set of related hypothesis is confirmed many times, scientists often reclassify it as a theory.

8. Calculate the mean of a set of values. (5, 13, 27, 1, 23, 11, 9, 10)

5+13+27+1+23+11+9+10= 99

99/8 = 12.375

7. Explain how the cell membrane controls movement of substances both into and out of the cell and within the cell

6. Distinguish between viruses and bacteria, and give examples of each

(Chapter 23 & 24)

The key difference between viruses and bacteria is that viruses are nonliving and bacteria are living. An example of bacteria is streptococcus, which looks like a change of sphere shaped cells. They contain DNA and divide through a process of binary fission. Viruses are infections particles that resemble bacteria in many ways but do not possess all seven characteristics of life. Viruses also contain genetic information, but they are unable to reproduce on their own. They require a host cell to replicate.

5. Explain the interaction between pigments, adsorption of light, and reflection of light

12. Explain how the cell membrane maintains homeostasis

Chapter 5

Cell membranes are made of a phospholipid bilayer. Certain proteins can form pores in the membrane to allow some substances to get across. Cell membranes allow some molecules to pass through, but not others.

The cell membrane is selectively permeable. It gets to decide what enters and leaves a cell. What can be particularly dangerous for a cell is if it is placed in hypertonic or hypotonic solution. (See pg 99)

11. Analyze the similarities and differences among (a) plant verses animal cells and (b) eukaryotic verses prokaryotic cells

(Pg. 90)

For differences between plant and animal cells, refer to #4.

Prokaryotic cells are believed to be more primitive than eukaryotic cells, as they are much simpler. They lack membrane bound organelles (such as mitochondria) and do not have a membrane bound nucleus. Eukaryotic cells DO contain a membrane bound nucleus and organelles.

10. Explain the difference between organic and inorganic compounds

(Pg. 51)

All compounds can be classified in two broad categories: organic compounds and inorganic compounds. Organic compounds are primarily made of carbon atoms. Most matter in living organisms that is not water is made of organic compounds. Inorganic compounds, with few exceptions, do not contain carbon atoms.

9. Identify subatomic particles, and describe how they are arranged in atoms

(Pg. 31 & 32)

The simplest particle of an element that retains all of the properties of that element is an atom. Atoms are composed of three subatomic particles: protons, neutrons, and electrons. Protons are positively charged and located in the nucleus. Neutrons have no charge and are also located in the nucleus. Electrons are negatively charged and are in constant motion, outside the nucleus, spinning around in energy orbitals, or shells.

16. Compare the types of bonding between atoms to form molecules.

(Pg. 33 and 34)

Covalent bond: forms when two atoms share one or more pairs of electrons.

\*Ex. H20 (water)

Ionic bond: Attraction between positive and negative charges of ions.

\*Ex. NaCl (table salt)

15. Define and explain the unique properties of water that are essential to living things.

(pg. 39)

Many of water’s biological functions stem from its chemical structure. In a water molecule, one oxygen atom shares electrons with two hydrogen atoms. This is called covalent bonding. Water is a polar molecule. Its oxygen end is more negative than its hydrogen end. Water is called a “universal solvent.” This means that it is really good at dissolving things, with the exception of nonpolar substances such as oil. Water molecules like to cling to one another due to cohesion. Cohesion between water molecules is an attractive force caused by Hydrogen bonds (Van der Waals forces). Water also has a high heat capacity and specific freezing point. Frozen water is less dense than liquid water, which is why ice floats.

14. Define and provide an example of the following: genotype, phenotype, dominant allele, recessive allele, dominant alleles, homozygous, heterozygous, and carrier

(Chapter 9)

Genotype: An organisms genetic makeup.

 \*Aa = heterozygous

 \*AA = homozygous dominant

 \*aa = homozygous recessive

Phenotype: An organisms appearance. Ex. Brown hair.

Allele: Each of two or more alternative forms of a gene.

13. Construct and interpret Punnett squares and pedigree charts (e.g., calculate and predict phenotypic and genotypic ratios and probabilities). Parents are tall (heterozygous) and short.

Punnett squares are used to show possible allele combinations of offspring. There are two types of Punnett squares: monohybrid crosses and dihybrid crosses. (pg. 182-186)

Pedigrees allow you to track certain traits through several generations in a family. Pedigrees show gender, who in the family has the trait in question, and who is a carrier. (pg. 241)

20. Describe and Contrast these types of cell transport: osmosis, diffusion, facilitated diffusion, and active transport

(Chapter 5)

Diffusion: The movement of particles from regions of higher concentration to regions of lower concentration.

Osmosis: The diffusion of water or another solvent from a more dilute solution to a more concentrated solution through a membrane that is permeable to the solvent.

Facilitated diffusion: The transport of substances through a cell membrane along a concentration gradient with assistance from carrier proteins.

Active transport: The movement of chemical substances, usually across the cell membrane, against a concentration gradient; requires ATP (energy)

19. List the 8 levels in the hierarchy of taxa.

(Chapter 17)

Domain

Kingdom

Phylum

Class

Order

Family

Genus

Species

18. Explain the fundamental principles of the pH scale and the consequences of having the different concentrations of hydrogen and hydroxide ions

(Pg. 43&44)

The pH scale is used for comparing the relative concentrations of hydronium ions (H+) and hydroxide ions (OH-) in a solution. It ranges from 0-14 with 0 to 6 indicating an acidic substance, 7 indicating a neutral substance, and 8 to 14 indicating a basic (alkaline) substance.

Acids release more H+ ions.

Bases release more OH- ions.

17. Define and provide examples of each level or organization (organism, organ system, organ, tissue, cell, organelle, molecule, atom, subatomic particle)

**Subatomic particles:** Electrons, protons, and neutrons.

**Atom**: The simplest particle of an element that retains all of the properties of that element.

**Molecule**: The simplest part of a substance that retains all of the properties of that substance and can exist in a free state.

**Organelle**: Subcellular structures that perform specific functions for the cell.

**Cell:** The smallest unit that can carry on all the processes of life.

**Tissue**: A group of similar cells that carry out a specific function.

**Organ**: Groups of tissues that carry out a particular job.

Organ system: A group of organs that accomplish related tasks.

**Organism**: An independent individual that possesses all characteristics of life.

24. Describe the basic process of meiosis

Meiosis 1

 -prophase 1 (crossing over occurs)

 -metaphase 1

 -anaphase 1

 -telophase 1

Meiosis 2

 -prophase 2

 - metaphase 2

 - anaphase 2

 - telophase 2

Meiosis results in 4 haploid, genetically different cells. Meiosis is used to make gametes (sex cells).

23. Describe the basic structure and function of DNA, mRNA, tRNA, amino acids, and proteins

DNA is a double helix molecule which carries all of the genetic information for an individual, but in order for that information to be expressed, it must be turned into protein.

Through the process of transcription, we turn DNA into messenger RNA (mRNA). This is necessary because mRNA is the only thing capable of carrying the message of the DNA from the nucleus to the cytoplasm, where ribosomes are located.

Once in the cytoplasm, mRNA attaches to a ribosome. Ribosomes are the site of protein synthesis. Here, the process of translation takes place in which we turn the RNA into protein. Transfer RNA (tRNA) builds a protein by matching up the 3 base codons with their appropriate amino acids. Amino acids are the building blocks of protein.

22. Contrast the structure and function of subcellular components of motility (e.g., cilia, flagella)

21. Describe the general structure and function(s), including common functional groups, of monosaccharaides, disaccharides, polysaccharides, carbohydrates, fatty acids, glycerol, glycerides, lipids, amino acids, dipeptides, polypeptides, proteins, and nucleic acids

28. Explain why men are more likely to get colorblindness, baldness, or other sex linked traits.

(Pg 244 -245)

Females have two X chromosomes for sex chromosomes (XX). Males have an X and a Y chromosome for sex chromosomes (XY). If a disorder is carried on the X chromosome, it is unlikely that females will show the trait because they have a backup X chromosome. For females to show an X linked trait, they would have to receive the trait from both her mother AND her father.

27. Transcribe this sequence

A T C A A G G C A

Transcription is the process of turning DNA into RNA. Remember, RNA has uracil instead of thymine.

UAG UUC CGU

26. Describe the experiments of major scientists in determining the structure of DNA

<http://www.nature.com/scitable/topicpage/discovery-of-dna-structure-and-function-watson-397>

25. Explain how photosynthetic organisms use the processes of photosynthesis and respiration

During the process of photosynthesis, autotrophs capture energy from sunlight to make organic molecules such as glucose. While glucose is typically referred to as “food for the plant” in its own form, it cannot sustain a plant. Plants must use the process of cellular respiration to break down the glucose to acquire ATP, the energy currency of cells.

32. Explain the binomial nomenclature system

(Pg. 339)

Linnaeus gave an organism a species name, or scientific name, with two parts: the genus name followed by the species identifier. This system of two-part names is known as binomial nomenclature. The species name for humans is *Homo sapiens*. The species name is written in italics with the genus name capitalized. The species name generally comes from Latin roots and are intended to be the same for all countries and in every language.

31. What is the difference between ancestral and derived traits?

(Pg. 342 & 343)

Derived traits are criteria for grouping taxa in cladistics. They are features that evolved only within the group under consideration. Derived traits were not necessarily present in the common ancestor.

Ancestral traits refer to those characteristics that were present in the common ancestor and have been passed down to the organism being studied.

30. Describe the light-dependent and the light-independent reactions of photosynthesis

Refer to #35 and page 114 in your text book.

The Light Dependent Reaction, or light reaction, is the process by which plants produce oxygen gas from the splitting of a water molecule. Light energy is actively absorbed during this step.

The Light Independent reaction, aka the Calvin Cycle, does not require active absorption of light. During this process plants open stomata to let CO2 in. CO2 is then used to make glucose.

29. What is trisomy 21 (downs syndrome) and how is it caused?

(Pg. 239)

Downs Syndrome is caused by a chromosome mutation called non-disjunction. This is when a chromosome fails to separate from its homologous pair during meiosis. Therefore, we end up with three chromosomes where we should just have the 21st pair.

36. Explain the biological definition of evolution.

(Pg. 297)

An accumulation of adaptations over time.

OR

The development of new types of organisms from preexisting types of organisms over time.

An individual cannot evolve in its lifetime. Instead, we see entire populations undergoing gradual change over many generations.

35. In photosynthesis, how do the products of the light-dependent reaction relate to the products of the light-independent reactions?

(Chapter 6)

During the light reaction, light energy from the sun is converted into chemical energy and is temporarily stored in ATP and NADPH.

The Calvin Cycle, or light-independent reaction, creates glucose using CO2 and the chemical energy stored in ATP and NADPH.

34. Construct a dichotomous key for the following objects: a tennis ball, a soccer ball, and a football

1a. Is round…. Go to 2

1b. Isn’t round…. football

2a. Is smooth on the surface… soccer ball

2b. Is fuzzy on the surface… tennis ball

Dichotomous keys DO NOT show evolutionary relationships like cladograms do. Instead, they are used to identify unknown organisms and sort organisms into like groups based on their physical characteristics.

33. What are the functions of xylem and phloem?

(Pg. 564)

Xylem carries absorbed water and inorganic nutrients in one direction, from the roots to the stems and leaves. Phloem carries organic compounds, such as carbohydrates, and some inorganic nutrients, in any direction, depending on the plant’s needs.

40. What are the steps of the scientific method?

(Pg. 13)

1. Make an observation.
2. Develop a hypothesis.
3. Predict.
4. Experiment and collect data.
5. Analyze data.
6. Publish results.

39. How does ATP store energy? (Hint: What is the difference between ADP and ATP?)

(Pg. 54)

ATP stands for adenosine triphosphate. This is the energy currency for cells. The “triphosphate” part of the name indicates that there are three phosphate groups attached to this molecule. Energy is stored in the bonds between the phosphate groups. If we break off a phosphate group, energy is released and we are left with two phosphate groups. This molecule is then called adenosine diphosphate.

38. Describe the process of how proteins are made. (Start with DNA and finish with amino acids being strung together).

(Chapter 10)

DNA is turned into RNA via a process called transcription. This takes place in the nucleus of the cell.

RNA is turned into Protein via a process called translation. This takes place in the cytoplasm of a cell, in association with a ribosome.

37. What was Mendel’s law of independent assortment?

(Pg. 178)

The law of independent assortment states that factors (Alleles) separate independently of one another during the formation of gametes.

44. What is the difference between primary and secondary succession?

<http://www.dna2life.com/environment/7-major-differences-between-primary-secondary-succession>

43. What is natural selection?

Natural selection is the process by which nature acts on already existing traits to select for individuals who are best suited for survival in that ecosystem.

For example, if there are white bunnies and brown bunnies in an area that is normally covered in snow, the brown bunnies won’t be able to hide from predators as easily. Therefore, brown bunnies are more likely to be eaten and less likely to pass their traits on to their offspring.

In order for natural selection to occur, there have to be the following conditions in place.

1. Variation of traits
2. Overproduction of offspring
3. Struggle for existence

42. Compare Darwin’s theories to Lamarck’s theories.

Lamarck believed that organisms changed over time due to use or disuse of body parts. For example, if a giraffe tries every day to stretch out its neck and succeeds in lengthening his neck by 3 inches, then that giraffe’s offspring will also have a neck 3 inches longer.

Darwin recognized that this idea was flawed. He proposed that nature acted on the variety of traits that were already in the population (ex. Short necks vs. long necks) and that the individuals best suited for survival would be more likely to pass down their traits to their offspring. This is the idea of natural selection through survival of the fittest.

So, a variety of traits has to already exist before nature can act on them. The variety in traits arise due to mutations, changes in DNA.

41. Draw a cladogram for the following organisms: a mini pony, a horse, and a unicorn.

48. What is the difference between a food chain and food web?

Food web



Food chain



47. What 5 responses which allow species to adapt to their environment?

46. What is antibiotic resistance? What causes it and how can you prevent it?

Antibiotic resistance is the process by which bacteria, such as *Staphylococcus aureus,* are not harmed by antibiotics, such as penicillin. Antibiotic resistance occurs through the process on natural selection after one or more of the bacterial cells develop a mutation which makes them more resistant to drugs than the rest.

Some things that can increase the risk of bacteria developing resistance are:

- Overusing antibiotics and/or taking them for viruses

- Not completing the entire course of your antibiotic

45. What are the major systems and organs of the human body?

