

Essential Facts for Life Science

Scientific Investigation

1. The control group is the group that does not receive the manipulated variable and is the group to which the others are compared.
2. The constants of an experiment are elements that do not change.
3. The hypothesis should be stated in such a way that it identifies the independent variable (what is changed) and the dependent variable (the response that can be measured because of the change in the independent variable) and the relationship between. If...then...
4. The multiple trials of an experiment must be conducted to verify the results.
5. Analysis of observed results includes construction and interpretation of graphs.

Life Processes

6. Living organisms require food, water, air, shelter, energy, and space to survive.
7. Life functions (processes) of organisms are growth, response, reproduction, metabolism, and movement.
8. Cells are the smallest units that carry out all of the activities of life in organisms.
9. The three components of the Cell Theory are: 1) All organisms are made up of one or more cells, 2) Cells are the basic unit of structure and functions in all organisms, and 3) All cells come from cells that already exist.
10. Cells perform numerous functions and processes including respiration, waste removal, growth, irritability, and reproduction.
11. Cells that have the same goal group together to form tissues; tissues that have the same goal group together to form organs; organs with the similar goals group to work in an organ system.
12. The differences between plant cells and animal cells are: plant cells have chloroplasts, cell walls, and larger vacuoles, and animal cells have centrioles during mitosis.
13. The cell membrane forms the outer boundary of the cell and only allows certain things to enter and exit the cell.
14. The nucleus directs all of the activities of the cell and contains all of the genetic blueprints for the operations of the cell.
15. Cytoplasm is the gel-like material inside the cell membrane and outside of the nucleus.
16. The endoplasmic reticulum acts as the highway system of the cell and moves materials around the cell.
17. Golgi bodies of the cell packages materials to be moved to the outside of the cell.
18. The mitochondria of a cell are the powerhouse of the cell that breaks down food molecules and produces energy for the cell.
19. Lysosomes of a cell digest and destroy waste products and worn-out cell parts.
20. Ribosomes make proteins for the cell and are attached to the (rough) endoplasmic reticulum.
21. Chloroplasts are organelles in plant cells that transform light energy into chemical energy in the form of sugar (glucose).
22. The cell wall, only found in plant cells outside of the cell membrane, is to support and protect the cell.
23. Vacuoles are temporary storage units for the cells that may contain food, water, or waste.
24. Diffusion is the net movement of molecules from an area where there are many to an area where there are few.
25. Osmosis is the diffusion of water through a cell membrane.
26. Mitosis is the process in which the nucleus of a cell divides and replicates to form two identical nuclei in a series of 5 phases: interphase, prophase, metaphase, anaphase, and telophase.
27. Meiosis is the process of division in cells that produces sex cells.
28. Unicellular organisms are made of only one cell.
29. Multicellular organisms are made of many cells.
30. Multicellular organisms are complex in that there is a division of labor for carrying out the necessary life processes.

Ecosystems

31. The life needs of plants are light, energy source, water, gases, and nutrients.
32. The life needs of animals are food, water, gases, shelter, and space.
33. In the plant and animal world, organisms are arranged into kingdom, phylum, class, order, family, genus, and species.
34. Science nomenclature is the system used for classifying organisms.
35. Chlorophyll is a chemical in chloroplast that can absorb or trap energy.
36. Photosynthesis is a necessary life process that transforms light energy into chemical energy.
37. Photosynthesis involves a series of chemical reactions in which light is used to change raw materials ($CO_2 + H_2O$) into products (sugar and oxygen).
38. In plants, energy is stored in the chemical bonds of glucose molecules.
39. Photosynthesis is critical to producers.
40. Producers are the foundation of food webs.
41. Energy passes through an ecosystem as one organism eats another and is in turn eaten.
42. Energy movement through an ecosystem can be modeled through simple food chains or the more complex food webs.
43. Materials are recycled by decomposers.
44. An energy pyramid models the amount of energy available to each successive trophic level.

45. The amount of energy in each trophic level decreases (producer, first order consumer, second order consumer, third order consumer).
46. Populations have social order to ensure that labor and resources are shared.
47. Independent behavior and group behavior can influence a population.
48. Establishment of a territory ensures that members of a population have adequate habitat to provide for basic resources.
49. Energy resources within a community are shared through the interactions of producers, consumers, and decomposers.
50. Predator prey is an interaction between a consumer that hunts for another consumer for food.
51. Populations of one species may compete with populations of another species for resources.
52. Symbiotic relationships can exist between two or more species when they live and work together.
53. Symbiotic relationships include mutualism, commensalism, and parasitism.
54. Mutualism is when both organisms benefit from the relationship.
55. Commensalism is when one organism benefits and the other is unaffected.
56. Parasitism is when one organism benefits and the other is harmed.
57. Every organism fills a specific niche or role in its community.
58. Examples of ecosystems are forests, tidal pools, and ponds.
59. Ecosystems, living community, and their physical environment are functional units with the biome.
60. Conditions in a biome include climate range and how organisms have adapted.
61. Biomes are smaller divisions of ecosystems.
62. Organisms have specific structures, functions, and behaviors that enable them to survive the conditions of a particular biome.
63. Organisms adapt to abiotic and biotic factors in their biome.
64. Communities, with the physical environment, form ecosystems.
65. Changes in seasons can affect organisms over time.
66. Plants respond to light by growing toward it or away from it (phototropism).
67. Animals respond to cold conditions with a period of lowered metabolism (hibernation).
68. Organisms may respond to adverse conditions with a period of lower or suspended metabolism (dormancy).
69. Examples of large-scale changes are changes in: climate, catastrophic events such as fire, drought, flood, and earthquakes. (eutrophication: addition of nutrients)
70. Human interaction can directly alter habitat size, quality of resources, and structure in a habitat.
71. Human input can disturb the balance of populations.
72. Human interaction can lead to concerns for the ecosystem's health in the areas of water supply, air quality, energy product, and waste management.

Genetics and Evolution

73. DNA is a double helix molecule.
74. DNA is a molecule that includes four different components. The arrangement of these four components within the double helix forms a chemical code.
75. Chromosomes are strands of DNA.
76. Genes are sections of a chromosome that carry the code for a particular trait.
77. The basic laws of Mendelian genetics can explain the transmission of some traits that can be inherited from generation to generation.
78. Genetic engineering manipulates the genetic code to obtain a desired product.
79. Genetic engineering has numerous practical applications in medicine, agriculture, and biology.
80. The mechanisms through which evolution takes place are a related set of processes that include mutation, adaptation, natural selection, and extinction.
81. Mutations are inheritable changes because a mutation is a change in the DNA code.
82. Adaptations are structures, functions, or behaviors that enable a species to survive.
83. A mutation may result in a favorable change or adaptation in genetic information that improves a species' ability to exist in its environment or a mutation may result in an unfavorable change that does not improve or impedes a species' ability to exist in its environment.
84. Individuals of a population exhibit a range of variations in a trait as a result of the variations in their genetic codes.
85. The evidence for evolution is drawn from data including the fossil record, radiometric dating, genetic information, the distribution of organisms, and anatomical and developmental similarities across species.
86. Natural selection is the survival and reproduction of the individuals in a population that exhibit the traits that best enable them to survive in their environment.
87. If a species does not include traits that enable them to survive in its environment, or to survive changes in the environment, then the species may become extinct.