

**INSTRUCTIONS:**

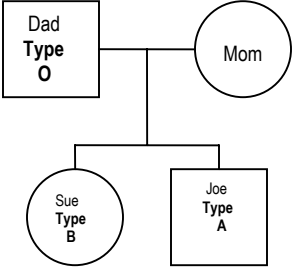
Below you will find 42 questions that explore your understanding of science. Each question is numbered in the left-hand column and has only one correct response (A, B, C, or D). There are also two occasions where you are asked to look at a figure and then use it to answer two questions that follow.

Indicate your answer to each question by using your pencil to darken the appropriate line on your Scantron answer form.

1.	<p>In a multicellular animal, a cell is the unit of structure as well as a unit of</p> <ul style="list-style-type: none"><li>A) function.</li><li>B) meiosis</li><li>C) mutation.</li><li>D) natural selection.</li></ul>
2.	<p>Which of the following is <u>most</u> important when considering efficiency of diffusion of materials into cells for cell survival?</p> <ul style="list-style-type: none"><li>A) weight</li><li>B) volume</li><li>C) surface area</li><li>D) surface area/volume ratio</li></ul>
3.	<p>When plant tissues are boiled, their enzymes cease to function. That is because</p> <ul style="list-style-type: none"><li>A) enzymes work only in living cells.</li><li>B) the substrate molecules are moving too fast to react.</li><li>C) some bonds holding the enzyme's special shape are broken.</li><li>D) the activation energy becomes greater than the heat of reaction.</li></ul>

4.	<p>The genetic code in DNA is written in the sequence of</p> <ul style="list-style-type: none"><li>A) deoxyribose molecules.</li><li>B) nucleotide bases.</li><li>C) phosphate groups.</li><li>D) ribose molecule.</li></ul>
5.	<p>Research indicates that cancer cells</p> <ul style="list-style-type: none"><li>A) always develop into a tumor.</li><li>B) are unable to complete the cell cycle after the S phase.</li><li>C) contain more than the normal number of chromosomes.</li><li>D) can form from normal cells when the genes involved in the control of mitosis are altered.</li></ul>
6.	<p>Photosynthesis <u>consumes</u> ...</p> <ul style="list-style-type: none"><li>A) O<sub>2</sub>.</li><li>B) CO<sub>2</sub>.</li><li>C) sugar.</li><li>D) organic nutrients.</li></ul>
7.	<p>Photosynthesis <u>produces</u> ...</p> <ul style="list-style-type: none"><li>A) O<sub>2</sub>.</li><li>B) CO<sub>2</sub>.</li><li>C) chlorophyll <i>b</i>.</li><li>D) inorganic nutrients.</li></ul>

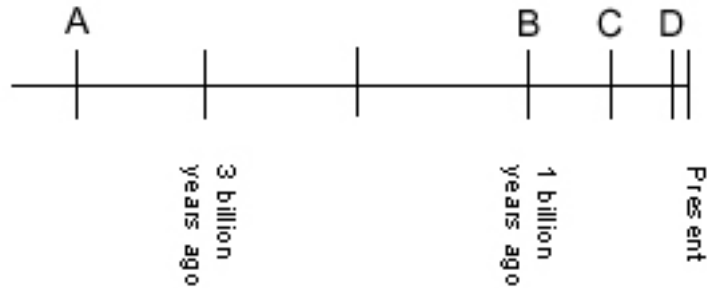
8.	<p>An important difference between autotrophs and heterotrophs is that</p> <ul style="list-style-type: none"><li>A) heterotrophs require oxygen.</li><li>B) heterotrophs have mitochondria.</li><li>C) heterotrophs have cellular respiration.</li><li>D) autotrophs can live on nutrients that are entirely inorganic.</li></ul>
9.	<p>The most important result of mitosis is that it ensures</p> <ul style="list-style-type: none"><li>A) variation in the new cells.</li><li>B) formation of DNA from RNA.</li><li>C) control of cellular processes by DNA.</li><li>D) genetic continuity from one cell to the next.</li></ul>
10.	<p>Your bone cells, muscle cells, and skin cells look different because</p> <ul style="list-style-type: none"><li>A) they contain different numbers of genes.</li><li>B) different genes are active in each kind of cell.</li><li>C) different mutations have occurred in each kind of cell.</li><li>D) different kinds of genes are present in each kind of cell.</li></ul>
11.	<p>The DNA molecule can carry a vast amount of hereditary information in its</p> <ul style="list-style-type: none"><li>A) sequence of bases.</li><li>B) phosphate-sugar backbone.</li><li>C) complementary pairing of bases.</li><li>D) side groups of nitrogenous bases.</li></ul>

12.	<p>In an analysis of the nucleotide composition of DNA,</p> <ul style="list-style-type: none"><li>A) <math>A = C</math>.</li><li>B) <math>A = G</math> and <math>C = T</math>.</li><li>C) <math>A + T = G + C</math>.</li><li>D) <math>A + C = G + T</math>.</li></ul>
13.	<p>The family pedigree diagrammed below indicates the known blood type of its members. (<math>I^A</math> = the type A allele, <math>I^B</math> = the type B allele, and <math>i</math> = the type O allele).</p>  <p>The pedigree diagram shows a family with four members. The father (Dad) is a square labeled "Dad Type O". The mother (Mom) is a circle labeled "Mom". They are connected by a horizontal line. A vertical line descends from the center of this horizontal line, branching into two horizontal lines that connect to two children. The daughter (Sue) is a circle labeled "Sue Type B". The son (Joe) is a square labeled "Joe Type A".</p> <p>What is Joe's probable genotype?</p> <ul style="list-style-type: none"><li>A) homozygous <math>I^A I^A</math></li><li>B) heterozygous <math>I^A i</math></li><li>C) heterozygous <math>I^A I^B</math></li><li>D) homozygous <math>ii</math></li></ul>
14.	<p>Sexual reproduction in organisms</p> <ul style="list-style-type: none"><li>A) creates new genes.</li><li>B) creates new combinations of alleles.</li><li>C) allows for a method of separating species.</li><li>D) produces equal numbers of males and females.</li></ul>

15.	<p>One major function of meiosis is to</p> <ul style="list-style-type: none"><li>A) produce mutations.</li><li>B) prevent genetic recombination.</li><li>C) lower the rate of crossing-over among chromosomes.</li><li>D) maintain a constant chromosome number in the species.</li></ul>
16.	<p>A mutation is</p> <ul style="list-style-type: none"><li>A) a gene that causes a disease.</li><li>B) a random change in an organism's DNA.</li><li>C) the immigration of alleles into a gene pool.</li><li>D) the emigration of alleles out of a gene pool.</li></ul>
17.	<p>The growth of bacterial populations resistant to antibiotics results from</p> <ul style="list-style-type: none"><li>A) the needs of the bacteria.</li><li>B) a change in the strength of the antibiotics.</li><li>C) selection of naturally-occurring resistant strains.</li><li>D) creation of new bacterial strains by the antibiotics themselves.</li></ul>

The following graph represents the timeline of the history of life on earth. A number of important events for life on earth are recorded in the fossil record and marked here with letters.

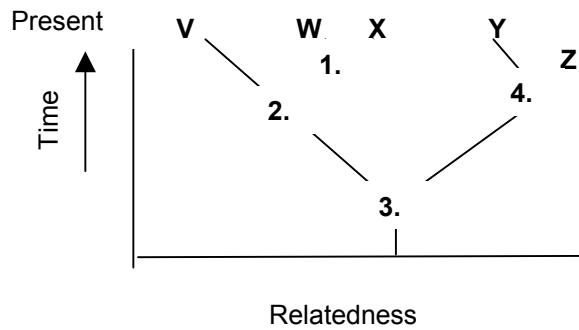
Use these letters as a key to answer the next two questions.



18. Which letter marks the Cambrian explosion—the time when many of major groups of animals first appeared in the fossil record?
- A) A.
  - B) B.
  - C) C.
  - D) D.
19. Which letter marks the time in earth's history when fossil evidence for life first appears?
- A) A.
  - B) B.
  - C) C.
  - D) D.

20.	<p>The human genes responsible for producing insulin and human growth hormone have been successfully transplanted into a number of other organisms, such as bacteria, yeast and Chinese hamsters. These organisms then produce these <u>human</u> hormones.</p> <p>The fact that human genes can produce normal human enzymes (hormones) in other organisms is evidence that all living organisms</p> <ul style="list-style-type: none"><li>A) secrete the same hormones.</li><li>B) have the same DNA sequence.</li><li>C) are closely related structurally.</li><li>D) have a universal DNA language.</li></ul>
21.	<p>Which of the following is <u>not</u> an observation or inference on which Darwin's theory of natural selection is based?</p> <ul style="list-style-type: none"><li>A) Poorly adapted individuals never produce offspring.</li><li>B) Unequal reproductive success can lead to adaptations.</li><li>C) There is variation between individuals that is inherited.</li><li>D) Individuals with inherited traits that best fit them to the environment will generally produce more offspring.</li></ul>
22.	<p>The <u>best</u> evidence for a common ancestry of <u>all</u> life is</p> <ul style="list-style-type: none"><li>A) that the structure of the nucleus is similar in eukaryotic cells.</li><li>B) that the structure of chloroplasts are similar in all plant cells.</li><li>C) that the genetic code is universal.</li><li>D) that all living systems rely on catalysts.</li></ul>

Use the figure below to answer the next two questions.



23.

A common ancestor for species X and Z could be at position number

- A) 1.
- B) 2.
- C) 3.
- D) 4.

24.

Which two living species are most closely related to each other?

- A) V and W
- B) V and X
- C) W and X
- D) W and Y

25.

In a typical ecosystem, everything cycles except

- A) carbon.
- B) energy.
- C) nitrogen.
- D) oxygen.

26.	<p>Consumers depend upon producers for their energy. The energy trapped by producers is</p> <ul style="list-style-type: none"><li>A) not used by consumers.</li><li>B) used by consumers only.</li><li>C) partially available to consumer.</li><li>D) totally used by producers themselves.</li></ul>
27.	<p>For most ecosystems the ultimate <u>source</u> of energy is in the form of</p> <ul style="list-style-type: none"><li>A) heat.</li><li>B) light.</li><li>C) plants.</li><li>D) producers.</li></ul>
28.	<p>Energy <u>leaves</u> most ecosystems in the form of</p> <ul style="list-style-type: none"><li>A) animals.</li><li>B) heat.</li><li>C) light.</li><li>D) producers.</li></ul>
29.	<p>Which of the following <u>best</u> illustrates ecological succession?</p> <ul style="list-style-type: none"><li>A) A mouse eats seeds and an owl eats the mouse.</li><li>B) Overgrazing causes a loss of nutrients from soil.</li><li>C) Imported pheasants increase, while local quail disappear.</li><li>D) Grass grows in a deserted field, then shrubs, and then trees.</li></ul>

30.	<p>Which of the following are important biotic factors that can affect the structure and organization of biological communities?</p> <ul style="list-style-type: none"><li>A) Predation, competition, disease</li><li>B) Precipitation, wind, temperature</li><li>C) Nutrient availability, soil pH, light intensity</li><li>D) The frequency of fire</li></ul>
31.	<p>Local conditions such as heavy rainfall or the removal of plants may limit the amount of nitrogen, phosphorus, or calcium available to the particular ecosystem, but the amount of carbon available to the system is seldom a problem. Why?</p> <ul style="list-style-type: none"><li>A) Organisms do not need very much carbon.</li><li>B) Symbiotic bacteria help plants capture carbon.</li><li>C) Plants are much better at absorbing carbon from the soil.</li><li>D) While many nutrients come from soil, carbon comes from air.</li></ul>
32.	<p>Skyrocketing growth of the human population since the beginning of the Industrial Revolution appears to be mainly a result of</p> <ul style="list-style-type: none"><li>A) the concentration of humans in cities.</li><li>B) better nutrition boosting the birth rate.</li><li>C) migration to thinly settled regions of the globe.</li><li>D) a drop in the death rate due to better health care.</li></ul>
33.	<p>Which of the following forms of energy is the <u>most</u> randomized?</p> <ul style="list-style-type: none"><li>A) Heat energy</li><li>B) Light energy</li><li>C) Electrical energy</li><li>D) Chemical potential energy</li></ul>

34.	<p>The primary source of energy for living organisms on earth is</p> <ul style="list-style-type: none"><li>A) electricity.</li><li>B) gravity.</li><li>C) sunlight.</li><li>D) water.</li></ul>
35.	<p>The main function of <u>photosynthesis</u> is to</p> <ul style="list-style-type: none"><li>A) create energy.</li><li>B) produce food for the human population.</li><li>C) release carbon dioxide to the atmosphere.</li><li>D) convert light energy to the chemical energy stored in sugar.</li></ul>
36.	<p>The main function of <u>cellular respiration</u> is to</p> <ul style="list-style-type: none"><li>A) use sunlight to produce sugar.</li><li>B) break ATP down to ADP so that cells can perform work.</li><li>C) get rid of the carbon dioxide that builds up in working cells.</li><li>D) use the energy stored in food to generate ATP for cellular work..</li></ul>
37.	<p>Which of the following orders the levels of biological organization from simplest to most complex?</p> <ul style="list-style-type: none"><li>A) Hydrogen, water, heart muscle cell, nucleus, heart, human</li><li>B) Hydrogen, water, nucleus, heart muscle cell, heart, human</li><li>C) Hydrogen, water, nucleus, heart, heart muscle cell, human</li><li>D) Water, hydrogen, nucleus, heart muscle cell, human, heart</li></ul>

38.	<p>If a population of plants contains 10,000 kilocalories, what would be a reasonable estimate of the number of kilocalories found in a population that feeds on nothing but that population of plants?</p> <ul style="list-style-type: none"><li>A) 1,000 kilocalories</li><li>B) 10,000 kilocalories</li><li>C) 20,000 kilocalories</li><li>D) 100,000 kilocalories</li></ul>
39.	<p>The fundamental difference between matter and energy in ecosystems is that</p> <ul style="list-style-type: none"><li>A) matter is cycled through ecosystems but energy is not.</li><li>B) energy is cycled through ecosystems but matter is not.</li><li>C) energy can be converted to matter but matter cannot be converted to energy.</li><li>D) matter can be converted into energy but energy cannot be converted into matter.</li></ul>
40.	<p>During a field trip, the instructor touched the body of a moth that was resting on a tree trunk. The moth raised its forewings, revealing large eye-spots on its hind wings. The instructor asked the class why the moth raised its wings.</p> <ul style="list-style-type: none"><li>• One student said that certain sensory receptors had fired and these triggered a reflex that caused the muscles in the wing to contract.</li><li>• A second student responded that the behavior might frighten would-be predators.</li></ul> <p>What can you say about the explanations given by these two students?</p> <ul style="list-style-type: none"><li>A) The first response is correct, while the second is incorrect</li><li>B) The first explanation is testable as a scientific hypothesis, while the second is not.</li><li>C) The first response answers a “how” question describing the mechanisms for the behavior; the second response answers an evolutionary question that describes the function of the behavior.</li></ul>

41.	<p>After eating a monarch butterfly and regurgitating, a bird will usually avoid orange and black butterflies. Which of the following behaviors does <u>not</u> describe the bird's behavior?</p> <ul style="list-style-type: none"><li>A) Learning.</li><li>B) Conditioning.</li><li>C) Innate behavior.</li><li>D) Adaptive behavior.</li></ul>
42.	<p>Read the 3 statements below. Which of the following statements about the evolution of animal behavior is <u>not</u> true?</p> <ul style="list-style-type: none"><li>A) An animal may show behavior that maximizes reproductive fitness.</li><li>B) Natural selection favors behavior that enhances survival and reproduction.</li><li>C) If a behavior is less than optimal, it is not yet completely evolved and will eventually become optimal.</li></ul>