

ANSWERS and EXPLANATIONS:

1. Correct Answer: A

Explanation: When light waves hit a smooth, shiny object they are reflected or bounce back from the surface. Refraction is a bending of the wave due to a speed change as it passes through a new medium. Diffraction occurs when the wave passes through an opening in a barrier and spreads out on the other side. Polarization would occur if the light were to pass through a filter that restricts the direction in which the wave can vibrate.

2. Correct Answer: D

Explanation: Slate, when exposed to heat and pressure will be changed into the metamorphic rock shale.

3. Correct Answer: D

Explanation: Water's chemical symbol is H_2O . Meaning that water is composed of 2 hydrogen and 1 oxygen.

4. Correct Answer: C

Explanation: Earth's outer core is molten while the inner core is dense and solid.

5. Correct Answer: D

6. Correct Answer: B

Explanation: The only variable out of the 4 choices that could make one stream flow faster than the other is the slope (gradient). For example, if a stream has a slope of 10° compared to 70° the steeper angle (70°) would possess a faster flow rate.

7. Correct Answer: D

Explanation: All have the same volume (take up the same amount of space). Next, we need to look to other variables that will determine the settling rate, shape and density. The material that is the densest will sink the most rapid--choices A and C are now crossed off. From the remaining two choices look to shape. A flat particle (such as a skipping stone, has more surface area) takes longer to settle compared to a round particle. Thus the best answer is D.

8. Correct Answer: B

Explanation: Faulting has caused the hill like feature in the picture above. A fault is a break (crack) in the Earth's interior that causes one side of the crust to be displaced to the other. A fault as seen in the picture above has displacement meaning one side is moved up compared to the other side. Faults are also the origination of earthquakes.

9. Correct Answer: C

Explanation: The Gulf Stream is the only current from the choices that transports warm water to higher latitudes. Due to this, areas further north than NYS affected by the current can experience a warmer climate in the winter season.

10. Correct Answer: D

Explanation: The increase of CO₂ in the Earth's atmosphere has been linked to the increase in the burning of fossil fuels among other factors. The burning of fossil fuels has caused the most damage in terms of global warming (greenhouse effect) is concerned. This form of damage is also man-made and can be controlled by using cleaner burning forms of fuel such as natural gas. Even with a decrease in the burning of fossil fuels there are natural causes such as volcanic eruptions that lead to an increase in CO₂. If CO₂ emissions are not monitored global warming could become out of control.

11. Correct Answer: A

Explanation: For a cloud to form condensation is needed. In the atmosphere condensation occurs when the temperature and dew point are equal or close to one another. An example of this concept can be completed by looking at a Relative Humidity chart. If temperature difference between Dry-Bulb and Wet-Bulb is zero (0), meaning that the two values are the same, then relative humidity is 100%. This means that the air is saturated and precipitation is likely to occur.

12. Correct Answer: A

Explanation: One Earth day is 24 hours. It is also known that the Earth takes 24 hours to make one complete ROTATION. Another fact that supports the answer is that the Earth's rotation rate is 15°/hour.

13. Correct Answer: C

Explanation: The Electromagnetic Spectrum (EMS) chart is based on the differences in wavelength (how strong or weak the wave is). The smaller the wavelength the stronger the energy is... Gamma waves are the strongest and Radio waves are the weakest.

14. Correct Answer: A

Explanation: Due to the Earth's tilt, your latitude will be a determining factor when it comes to sun angle. For example, Syracuse has a latitude of 43°N thus the apparent sun angle will change between a low point of 23° and a high point of 70°. The further north an observer is located the lower the sun angle (cooler) vs. the closer to the equator the higher the sun angle (warmer).

15. Correct Answer: A

Explanation: The Moon (revolves) is a satellite of the Earth and the Earth and Moon (revolve) are satellites of the Sun. Since the Moon revolves around the Earth it is termed geocentric and heliocentric comes from the Earth and Moon revolving around the Sun.

16. Correct Answer: C

Explanation: In the summer in NYS the sun's rays hit the northern hemisphere at a higher angle which means the rays are more intense, this is due to the tilt of the earth. The earth is tilted 23.5 degrees and as it revolves around the sun different points of the earth receive different intensities of sunlight. In the northern hemisphere where NYS is located the sun's rays are highest in the sky on June 21 (first day of summer). This will change and on December 21 (first day of winter) the sun's rays will be at the lowest point. Bottom line is that the earth's tilt along with revolution cause the seasons.

17. Correct Answer: C

Explanation: The Earth receives the Sun's energy in the form of electromagnetic energy called Ultraviolet radiation (UV rays). UV rays are stronger than visible light rays and can be harmful to humans.

18. Correct Answer: A

Explanation: The Sun's APPARENT path through the sky is caused by the earth rotating (spinning) on its axis. The term APPARENT meaning looks like but not truly occurring.

19. Correct Answer: D

Explanation: The moon phases are caused by the revolution of the moon around the earth that takes about a month. Also, the angle the moon is in respect to the earth causes the moon to APPEAR to have different areas lit.

20. Correct Answer C

Explanation: The worker is pulling with a FORCE. All forces are vectors i.e. have magnitude and direction.

21. Correct Answer: A

Explanation: The basic equation is $v = d/t$. The DISPLACEMENT of the car is 90 m - 40 m = 50 m, the total time is 20s. $V = 50m/20s$

22. Correct Answer: C

Explanation: The equation used is $d=1/2at^2$. The only acceleration the brick feels is the acceleration due to gravity = $9.81m/s^2$.

23. Correct Answer: D

Explanation: For something to change direction or accelerate there must be an UNBALLANCED force acting on it. Newton's 1st law states that an object in motion will stay in motion at constant velocity unless acted upon by an unbalanced force.

24. Correct Answer: B

Explanation: Action /reaction forces are equal.

25. Correct Answer: B

Explanation: Use the equation $m=F/a$ ($F=ma$) to calculate the mass of the object, then use $F=ma$ ($F=2\text{kg} \times 1\text{m/s}^2$) to find the force.

26. Correct Answer: B

Explanation: Basic equation $W=F \times d$. the work is dependent on the distance the box is moved.

27. Correct Answer: D

Explanation: Use the equations $a = \frac{\text{velocity final} - \text{velocity initial}}{\text{Time}}$

The rate of acceleration will then be used to find the force used, $F = ma$

28. Correct Answer: C

Explanation: The equation is $P=W/t$ or $P=Fd/t$. force, distance and time are all given in the question. The mass of the object is extraneous information.

29. Correct Answer: C

Explanation: $PE=mgh$. The weight, 15 N is mg and the height is 0.22 m.

30. Correct Answer: B

Explanation: The kinetic energy is related to the velocity, $KE=1/2mv^2$. As an object falls freely the velocity increases and therefore the kinetic energy increases.

31. Correct Answer: A

Explanation: To make something positive we are essentially making it less negative. To make it less negative we would need to lose electrons. Protons can not be removed from an atom, except in nuclear reaction that release large amounts of energy.

32. Correct Answer: A

Explanation: Protons are positively charged and have a mass of 1.00720 amu; electrons are negatively charged and have a mass of 0.00055 amu.

33. Correct Answer: C

Explanation: A proton has the same mass as a neutron. An electron has the same mass as a beta particle. An alpha particle has a mass of 4: two protons plus two neutrons.

34. Correct Answer: B

Explanation: Isotopes are atoms of the same element (same atomic number) but with a different number of neutrons (different atomic mass). Only B is correct. Choice A: C and N are not the same elements. C: both are the same element but there is no difference in mass. Therefore, they are not isotopes. Choice D: not the same elements.

35. Correct Answer: B

Explanation: The ground state is the lowest energy state. To raise the atom to an excited state, energy must be added. To fall back to the ground state (lowest energy), the energy it had absorbed must be released.

36. Correct Answer: C
Explanation: Atomic mass is found by adding protons plus neutrons. $28 + 34 = 62$. Electrons have a mass of nearly 0 so they are not counted in the formula for atomic mass.
37. Correct Answer: A
Explanation: The number of protons is the same as the atomic number. There are 5 protons so the atomic number is also 5.
38. Correct Answer: B
Explanation: Metals tend to lose electrons and form positive ions. A neutral atom of Li has 3 protons (+) and 3 electrons (-). If it loses an electron, the Li atom now has +3 and -2 or a net charge of +1. Metals also have low electronegativities and low ionization energies.
39. Correct Answer: D
Explanation: Metals tend to lose electrons (becoming smaller ions) while nonmetals tend to gain electrons and become larger ions.
40. Correct Answer: D
Explanation: Electronegativity is a measure of the ability of an atom to attract electrons. The greater the ability to attract, the higher the electronegativity. Chlorine has the highest electronegativity of the choices given.
41. Correct Answer: B
Explanation: Most of the time elements in the same group have the same number of valence electrons. Valence electrons are involved in bonding and this effects how elements react and determines their chemical properties.
42. Correct Answer: A
Explanation: Strontium has 2 valence electrons in its outer shell. It is easier to lose these 2 electrons than it is to gain 6 more electrons. Losing 2 electrons will give the strontium ion a charge of +2. Ions are charged atoms. An neutral atom has no charge because it has the same number of protons and electrons. An ion can have more or less electrons than an atom of the same element does. A strontium atom would have 2 more electrons than a strontium ion.
43. Correct Answer: A
Explanation: By definition, temperature is a measure of the average kinetic energy of the molecules in matter. As the temperature decreases, the average kinetic energy also decreases.
44. Correct Answer: B

Explanation: Heat flow is always from high temperature to low temperature. Watch out for negative numbers. In choice 3, Y is warmer than X and heat would flow from Y to X (not what the question asks).

45. Correct Answer: A

Explanation: Sublimation means to go from the solid to gas phase (without passing through the liquid phase).

46. Correct Answer: A

Explanation: By definition compounds are homogenous. They cannot be separated by physical means. A mixture (salad for example) is not homogenous.

47. Correct Answer: B

Explanation: Since the pressure is decreased, the volume will increase. Another way to look at the problem: at constant temperature volume is inversely related to pressure (Boyle Law).

48. Correct Answer: D

Explanation: Liquids and gases take the shape of the container they occupy and both have no regular arrangement (remember solids have a regular arrangement). Both liquids and gases have particles that are in constant straight-line motion. But liquids have a constant volume because the forces of attraction between the particles keep them together. Gases do not have a constant volume and the forces of attraction between particles are weaker.

49. Correct Answer: B

Explanation: Elements cannot be decomposed into simpler substances because an element by definition is one kind of substance, one kind of atom. The other choices are compounds--composed of two or more elements.

50. Correct Answer: C

Explanation: In winter salt is put on ice to melt it because the salt makes the ice melt at a colder (decreased) temperature. Conversely, salt raises the boiling point of water.

51. Correct Answer: D

Explanation: While all the answers are true for iodine, only choice 4 describes a chemical property. The other choices are physical properties.

52. Correct Answer: B

Explanation: Color, turning limewater cloudy, and inability to support combustion (cause a flame to go out) are observations. Figuring out what compound has these characteristics involves making a hunch or adding up the evidence (conclusion). Sort of like Judge Judy on TV. She listens to the facts (observations) and then decides who is at fault (conclusion). Another example: there are muddy footprints on a clean floor (observation). Figuring out who made the footprints is a conclusion. Was it the dog?

53. Correct Answer: D

Explanation: Petroleum is not listed on the Periodic Table so it cannot be an element. A compound is composed of two or more elements with a fixed composition; petroleum does not have a fixed composition. This eliminates B and C.

A substance by definition is matter that has the same properties and composition throughout. Every molecule of oxygen is identical to every other oxygen molecule. Every water molecule has the same formula: H_2O . Not true for air. Air is a mixture (not the same throughout). Tossed salad, a can of mixed nuts, and gravel are mixtures. Mixtures are made of two or more substances that do not combine chemically and do not have a fixed composition. Petroleum is a mixture.

54. Correct Answer: A

Explanation: Endothermic reactions cause heat to be *absorbed*. The potassium nitrate needs heat to dissolve. It takes this heat energy from the water. As the water loses heat energy, the temperature of the water decreases. Note: an exothermic reaction would do the opposite: the temperature would rise as heat was given off

55. Correct Answer: C

Explanation: First pour water into a beaker and take the temperature of the water. Heat of solution will be measured by determining the change of temperature after the solute (NaOH) is added to the water (and stirred). Choices B and D do not make sense as the solute NaOH is added before the temperature of the water is taken: no change of temperature can be measured this way. Choice A takes the temperature of the water before it is added to the beaker. Where does the water come from? Then the final temperature is taken before the solution is stirred. This method gives inaccurate readings as the thermometer could be reading a "hot" or "cold" spot in the unstirred liquid.

56. Correct Answer: D

Explanation: $D = M / V$. First find the volume of the object by subtracting 21.2 mL from 27.8 mL or 6.6 mL

Step 2: $D = M / V$ or $D = 22.4 \text{ g} / 6.6 \text{ mL} = 3.4 \text{ g} / \text{mL}$

57. Correct Answer: D

Explanation: First eliminate C: temp. of salt A increased and temp. of salt B decreased. Both salts did not react the same way.

Exothermic reactions give off heat--this causes temperatures to rise.

Endothermic reactions absorb heat--this causes temperatures to fall.

The temperature of salt A increased (exothermic reaction) while the temperature of salt B decreased (endothermic reaction)

58. Correct Answer: C

Explanation: Reaction rate is affected by nature and concentration of reactants, temperature, surface area and a catalyst. Increasing surface area exposes more particles to contact with reactants, increasing the number of particle collisions. Imagine a cube of chocolate 3 feet by 4 feet and 2 inches thick. Take the same block and make it into a 24 candy bars. A class of chemistry students could eat the bars faster than the single chocolate block.

59. Correct Answer: A

Explanation: A catalyst speeds up a chemical reaction by lowering (decreasing) the activation energy.

60. Correct Answer: A

Explanation: Entropy is a measure of the disorder or randomness (lack of order) of a system. Molecules in gases have no definite volume and are more free to move than molecules in solids. As molecules change phase from a gas to a solid, the molecules are becoming more orderly and therefore have less disorder, less entropy. Compare the room of a teenage to the room of a parent. The teen has a more disorderly room (higher entropy). As the teen gets older and becomes a parent, the disorder in the room decreases.

61. Correct Answer: C

Explanation: This is an easy but tricky question. Choices A and B make KCl dissolve *faster* (rate of reaction) but do not increase the solubility of KCl. A glass of soda pop goes flat as it warms up on the counter; hot chocolate can dissolve more marshmallows than a cup of cold chocolate milk can. Temperature affects solubility.

In the case of HCl, increasing the temperature, increases the solubility. The solubility curve of KCl increases as the temperature increases.

62. Correct Answer: D

Explanation: Because carbon has 4 valence electrons, it can form 4 shared (covalent) bonds. Refer to the Periodic Table for the number of valence electrons in the element carbon.

63. Correct Answer: A

Explanation: In general, organic molecules contain carbon and organic chemistry is the study of carbon compounds.

64. Correct Answer: C

Explanation: Matter can never be created or destroyed but it can change its form. Mass is always conserved in chemical reactions. Because the loss of electrons (by oxidation) must equal the gain of electrons (by reduction), charge must also be conserved. Only choice C includes conservation of charge and mass.

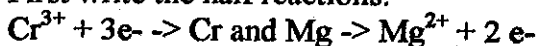
65. Correct Answer: B

Explanation: Electrochemical cells do what their names suggests: they make electricity from chemicals stored in the cell by redox reactions. A battery is a great example of this. The chemicals are stored in the cell until you complete the connection (turn on the flashlight, boom box, or car). Choices A and C *use electricity* for electrolysis and plating metal on objects (gold and silver plating). Electromagnetic usually refers to electric and magnetic fields oscillating at right angles to each other.

66. Correct Answer: A

Explanation: Correctly balancing the equation requires several steps.

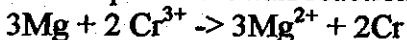
First write the half reactions:



Remember electrons lost must equal electrons gained.

2 ($\text{Cr}^{3+} + 3\text{e}^- \rightarrow \text{Cr}$) equals 6 e⁻ gained; 3 ($\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}^-$) equals 6 e⁻ lost. >BR>

Last step: add the half reactions and ignore the electrons:



3 plus 2 plus 3 plus 2 = 10

67. Correct Answer: D

Explanation: Red litmus turns blue when a base is present. Hint: blue for base. Choice A is an acid; choice B is a salt and salts neutralize acids and bases. The litmus does not change color with salts. Choice C is an alcohol not a base. NaOH is a strong base and will change red litmus to blue.

68. Correct Answer: B

Explanation: CH_3COOH is an organic acid, acetic acid also called ethanoic acid. Choice A will yield the OH^- ion in solution (this compound is therefore a base). Choice C is an alcohol. Salts are ionic compounds that do not form OH^- or H^+ ions. KCl forms K^+ and Cl^- ions. Therefore it is a salt.

69. Correct Answer: D

Explanation: By definition neutralization occurs when equal quantities of an acid (H^+) react with equal quantities of a base (OH^-) to form water.

70. Correct Answer: C

Explanation: On the pH scale, a pH of less than 7 is acidic; a pH of more than 7 is basic. A neutral solution such as pure water has a pH of 7.

71. Correct Answer: A

Explanation: Safety Rule: always add acid to water; This prevents the acid from splattering. *Never add water to acid.* Place a glass stirring rod in the water and slowly pour the acid along the rod. Some concentrated acids like HCl have an exothermic reaction in water, releasing a large amount of heat and causing the water-acid solution to

boil. Constant stirring diffuses the acid throughout the solution, helping to evenly distribute the generated heat.

72. Correct Answer: C

Explanation: Only charged particles can be accelerated in a magnetic field. A neutron does not have a charge.

73. Correct Answer: D

Explanation: The elements given are used as fuel in fission reactors. Water, heavy water, air, and molten sodium are examples of coolants. Boron and cadmium make good control rods. Moderators like graphite and heavy water slow down neutrons.

74. Correct Answer: B

Explanation: In fusion light nuclei like hydrogen (deuterium) join to form heavier nuclei like helium. Because these nuclei are positively charged, they repel each other. Hint: law of charges states like charges repel and unlike charges attract.

75. Correct Answer: B

Explanation: Although all of these elements are found in living cells, the most abundant are carbon, hydrogen and oxygen (for carbohydrates and lipids) and nitrogen (for proteins and nucleic acids).

76. Correct Answer: B

Explanation: Although virus' contain genetic material, they can not reproduce without being inside of a host cell. Many scientists question if they can be considered living or not, as this is the only life function they are capable of performing.

77. Correct Answer: C

Explanation: Organic means that the molecule contains carbon bonded to hydrogen. Only glucose, whose molecular formula is $C_6H_{12}O_6$, has this. Although most cells also have an abundant amount of water (H_2O) it is inorganic, as is sodium chloride ($NaCl$) and oxygen gas (O_2).

78. Correct Answer: C

Explanation: Organic compounds contain carbon and hydrogen bonds. Both nucleic acids and proteins contain these. Water (H_2O) and salts (ex: $NaCl$) do not.

79. Correct Answer: D

Explanation: Kingdom is the broadest category of which there are 5: Monera (bacteria and blue green alga), Protista (ameba, paramecium and alga), Fungi (mushrooms and yeast), Plants and Animals. All of these organisms are animals. The organisms are then broken up by phylum, class, order, family, genus and species.

80. Correct Answer: D

Explanation: Materials must be able to cycle between organisms in an ecosystem or it will die. Materials are recycled between organisms labeled A (heterotrophs) and

organisms B (autotrophs). Both types of organisms must be found but not in equal numbers, in fact, the numbers will always be fluctuating.

81. Correct Answer: A

Explanation: From small to large, the order is organelle, cell, tissue, organ.

82. Correct Answer: B

Explanation: Heterotrophs developed the ability to break down glucose, releasing the energy found within. In this process, carbon dioxide is released as a waste product. Autotrophs were able to use this waste gas in photosynthesis.

83. Correct Answer: B

Explanation: The nucleus is the large dark spot in cells. Inside are the chromosomes (pieces of DNA) which contain genes (pieces of chromosomes which correspond to our traits), as well as nucleoli (which are the sites of ribosome synthesis).

84. Correct Answer: A

Explanation: A mitochondria is the powerhouse of the cell, where respiration occurs. The Golgi body packages proteins, the endoplasmic reticulum is for transport of materials, and the nucleus of a cell controls all cell activities and contains the DNA.

85. Correct Answer: D

Explanation: Animal cells contain centrioles, cylindrical organelles that direct the movement of the chromosomes during mitosis. Plant cells tend to have bigger vacuoles and they also have rigid cell walls. Both have nuclei to control the cell.

86. Correct Answer: D

Explanation: Diffusion, passive transport and osmosis are examples of movement that does not require cellular energy. Since sodium ions are pumped against the concentration gradient, it requires work and is called active transport.

87. Correct Answer: A

Explanation: Osmosis is the diffusion of water across a membrane and is a passive process. Therefore, movement occurs due to a concentration gradient set up on either side of the membrane. If there is more water inside the cell than outside, water tends to move out.

88. Correct Answer: B

Explanation: Pinocytosis, or pinching in of the cell membrane, allows cells, such as the Paramecium, to capture larger food molecules. Hydrolysis, is the process of using water to split molecules apart. Cyclosis is a mechanism for transporting materials within a cell, by the cytoplasm swirling. Synthesis is the process of building up molecules within the cell.

89. Correct Answer: D

Explanation: A circulatory system contains three components: a fluid to transport materials, a pump to pump the fluid to all cells, and a network of vessels to carry the fluid. A central nervous system will control and coordinate the body, hydrolytic enzymes will break down complex food molecules in the digestive tract and sense receptors will detect stimuli.

90. Correct Answer: D

Explanation: Hemoglobin acts like glue attaching oxygen to the surface of the red blood cell so it can be transported to needed cells throughout the body. Urea is the nitrogenous waste product filtered by the kidneys. Water provides much of the fluid needed to transport substances, but does not specifically bind to molecules, and acetylcholine is a specific type of neurotransmitter that allows impulses to travel from one nerve cell to another in the nervous system

91. Correct Answer: B

Explanation: The grasshopper takes in oxygen through openings called spiracles. Air then travels through a series of tracheal tubes and the exchange of gases occurs at tiny air sacs located throughout the body. Phloem tubes are food transporting tubes in plants, ganglia are bunches of nerve cells in earthworms and grasshoppers, and setae are locomotive structures used in the earthworm.

92. Correct Answer: A

Explanation: Red blood cells and some white blood cells are produced in the marrow of long bones in our bodies. Muscle cells attach to the outside of bone to allow locomotion. Bile and urea are both produced in the liver.

93. Correct Answer: D

Explanation: DNA is composed of nucleotides which contain a phosphate group, a sugar called deoxyribose, and one of 4 nitrogenous bases (adenine, thymine, guanine, or cytosine).

94. Correct Answer: B

Explanation: The air sacs in the lungs are called alveoli. They are the respiratory surface of humans where the exchange of oxygen from the air is exchanged with carbon dioxide from the blood.

95. Correct Answer: A

Explanation: Enzymes are necessary for most chemical reactions that occur in our bodies. DNA controls the production of proteins, of which enzymes are an example of, in a process called protein synthesis.

96. Correct Answer: C

Explanation: If each parent contributes only one gene of its pair to the offspring, the parental genes of Gg x gg would produce the following offspring: Gg or gg. Gg would

appear gray while gg would produce black fur. The first cross would produce only gray squirrels since one parent always gives a G, masking the g given by the other parent. The second cross only has G so all offspring would have to be gray, and the last cross would not produce any gray squirrels since there are no G.

97. Correct Answer: A

Explanation: Adenine joins with thymine and guanine joins with cytosine in DNA molecules. Uracil is a nitrogenous base found only in RNA nucleotides.

98. Correct Answer: C

Explanation: We all possess 2 genes for every trait that are located on homologous chromosomes. A homozygous genotype means that an individual has the same genes for a particular trait on the homologous chromosomes. We represent genes as letters and for any one trait we must use the same letter, a capital letter meaning the dominant gene while a lower case letter meaning a recessive gene.

99. Correct Answer: D

Explanation: To get a child with blood type O, each parent must contribute the recessive blood type allele, O, as indicated in the fourth cross.

100. Correct Answer: C

Explanation: If two traits tend to be inherited together it is likely they are located close together on the same chromosomes. Therefore, when the sex cell undergoes meiosis, those traits migrate together to the mature sex cell used in fertilization.

101. Correct Answer Number: 1

Explanation: A female carrier has one normal X chromosome and one defective X chromosome with respect to color blindness and a normal male has a normal X and a Y chromosome. A Punnett square reveals that 1 is the only choice.

102. Correct Answer: C

Explanation: A zygote is the fertilized egg, formed by the union of the sperm and egg cells. Each sex cell, or gamete, provides the new cell with half of the needed genetic material. This genetic material, the chromosomes, now completes the new cell (zygote) with homologous pairs.

103. Correct Answer: D

Explanation: Mitosis, the method of asexual reproduction, involves one parent producing two identical daughter cells. Examples of asexual reproduction are budding, binary fission, sporulation, regeneration, and vegetative propagation.

104. Correct Answer: C

Explanation: The man can give either his A or his O to his child. Same with the woman. The possible combinations of these include: AA, AO, or OO, which amount to blood types A, A, and O, respectively.

105. Correct Answer: B

Explanation: Only females give an X-chromosome to their sons, the males give the Y-chromosome. Therefore, it doesn't matter if the father is a hemophiliac or not in terms of his son, he can't give his defective gene to his son.

106. Correct Answer: A

Explanation: A hybrid black-coated guinea pig has a genotype of Bb. During meiosis, 50% the resulting sperm cells will receive a B and the other 50% will receive a b.

107. Correct Answer: D

Explanation: When two heterozygous (hybrid) tall pea plants are crossed with genotypes of Tt, the resulting offspring will most likely be: 25% TT, 50% Tt, and 25% tt.

108. Correct Answer C

Explanation: Independent assortment is the principle that states that genes located on different homologous chromosomes will be distributed independently of each other. This allows for greater variety in the offspring.

109. Correct Answer: B

Explanation: A genotype is the actual genetic makeup that is expressed in a phenotype. An allele is a gene located at a specific location on corresponding homologous chromosomes

110. Correct Answer: C

Explanation: If a farmer sees a plant or animal with exceptional characteristics, he or she may purposely breed that plant or animal with a similar one with similar characteristics to perpetuate those desirable traits. Natural selection is when the plant or animal breed without any intervention from humans.

111. Correct Answer: D

Explanation: Gregor Mendel used simple mathematics and kept careful records of his pea plant crosses to arrive at his conclusions. He did not know about genes and did no dissections.

112. Correct Answer: C

Explanation: Comparative biochemistry shows that the more similar two species DNA is, the more closely related they are, and the more recently they evolved separately. This is evidenced in the fact that humans and apes have more than 99% similar DNA sequences!

113. Correct Answer: A

Explanation: By forcefully ejecting their seeds, it ensures that they get scattered all over, and are hopefully carried by the wind to other appropriate locations to germinate.

114. Correct Answer: C

Explanation: Protozoans are a group of animal-like unicellular Protists. From unicellular organisms, multicellular organisms theoretically arose. Coelenterates, of which the Hydra and jellyfish belong, would be more advanced than protozoans but more primitive than arthropods, of which the grasshoppers belong. The reptiles are more advanced than the arthropods.

115. Correct Answer: D

Explanation: Organic means living. Evolution means change through time. Ecology is the study of organisms in their environment. Embryology is the study of developing organisms. Spontaneous generation is the theory that living things can arise from nonliving materials, and has since been disproved.

116. Correct Answer: A

Explanation: Nondisjunction is the result of the paired homologous chromosomes separating unequally during meiosis. So instead of one of a particular chromosome going to each of the 4 resulting sex cells, one cell gets two chromosomes of that type. Then during fertilization that zygote gets three of that particular chromosome instead of the normal two, resulting in one extra chromosome. That zygote then undergoes mitosis, resulting in all of the organisms cells containing one extra chromosome.

117. Correct Answer: A

Explanation: It is believed that certain pathogens have adapted to the antibodies that we have, becoming resistant. These species are actually evolving, or changing through time, to include the resistant gene for the antibiotics. Therefore the pathogens with the gene survive, and pass on the resistant gene, which causes it to increase.

118. Correct Answer: A

Explanation: Mutations increase variety in a species and sexual reproduction increases variety because of crossing over, two different parents combining genes, and because of the way the chromosomes line up at the equator during metaphase I of meiosis.

119. Correct Answer: A

Explanation: Mutations, which usually happen randomly, increase variety in the offspring. It is this variety that allows species to survive in a changing environment.

120. Correct Answer: C

Explanation: Mitosis is the division of the nucleus into two nuclei with identical sets of DNA. Cytokinesis, or cytoplasmic division, is when the cytoplasm and other organelles split in to, producing two new cells. If only mitosis occurred, you would get one cell with two identical nuclei.

121. Correct Answer: A

Explanation: In the modern classification system, all living things are divided into 5 kingdoms. Each of these kingdoms are then further subdivided into phylums, classes, orders, families, genuses and species. The kingdoms are the broadest division while the species is the narrowest division, that is, organisms in the same kingdom may be very different from each other, but in the same species, organisms will be very similar.

122. Correct Answer: D

Explanation: Meiosis in a human male is called spermatogenesis. Four haploid (half the number of chromosomes as normal cells) sperm cells are made by the two cytoplasmic divisions, beginning with one diploid (normal number of chromosomes) cell. In human females, oogenesis only produces one larger haploid cell and three small polar bodies that die

123. Correct Answer: A

Explanation: Binary fission is a type of asexual reproduction whereby a cell (such as an Ameba) replicates its DNA and splits its DNA and cytoplasm equally. Regeneration is also a type of asexual reproduction but is performed by simple multicellular animals such as lobsters and flatworms. Ovulation is the release of an egg to be used in sexual reproduction and nondisjunction is when the chromosomes split unequally in sexual reproduction.

124. Correct Answer: A

Explanation: The ovule contains the egg cell which is formed by meiosis. The sperm cells move to the egg cell where fertilization occurs. The ovules are located in the ovary of the flower. The stigma collects pollen, the anther produces pollen and the petal attracts insects and birds to the nectar, who in turn place the pollen on the stigma.

125. Correct Answer: C

Explanation: Ovules are the female gametes, or eggs, in plants. If many seeds are produced than many eggs were present to be fertilized. Sepals and petals are used to protect the flower and attract insects and birds for pollination, anthers are the male reproductive organs that produce pollen, or plant sperm, and stamens are the whole male reproductive organs that include the anther and the filament to hold up the anther.

126. Correct Answer: D

Explanation: A sex cell contains half the number of chromosomes so that when it combines with another sex cell, the diploid ($2n$) number of chromosomes is restored. Autosomes are all of the chromosomes found in a cell except for the sex cells. A normal female body cell contains 44 autosomes and two X-chromosomes. A normal female sex cell contains half of that.

127. Correct Answer: C

Explanation: In plant sexual reproduction, pollination (the transfer of pollen to the stigma of the pistil) occurs before the pollen grain germinates (grows) down to the ovary where the ovule (egg cell) is found. Then when the pollen grain reaches the ovule, fertilization occurs.

128. Correct Answer: D

Explanation: Photosynthesis makes carbohydrates, of which starch and glucose are examples. However, glucose is a simple sugar made specifically by photosynthesis and is then combined with other glucose's to make starch by the process of dehydration synthesis. Starch doesn't get metabolized or broken down into less complex molecules by dehydration synthesis, but by hydrolysis.

129. Correct Answer: D

Explanation: Invertebrates, animals without a backbone such as an earthworm, are simpler than vertebrates such as a human. Therefore, their cells are not as complex and they may be able to regenerate or grow lost body parts easier than a more complex animal.

130. Correct Answer: a

Explanation: Lactic acid is a product of anaerobic respiration in humans. It is converted back to pyruvic acid when oxygen is again present. Glycogen is a complex carbohydrate and is the form we store our sugar in our liver, carbon dioxide is produced during anaerobic activity but also during aerobic activity, and alcohol is a waste product of anaerobic activity of certain organisms such as yeast, not humans.

131. Correct Answer: A

Explanation: Photosynthesis is the process of making organic food (glucose) by combining the hydrogen from water with carbon dioxide. The oxygen from splitting water is released into the atmosphere. Aerobic respiration takes in the oxygen from the atmosphere, dehydration synthesis is a mechanism of building up molecules by removing water, not oxygen, and fermentation is a form of anaerobic respiration which is done in the absence of oxygen.

132. Correct Answer: A

Explanation: Dehydration synthesis is the process of building up molecules by removing water. A hydroxyl molecule (-OH) is broken off one organic molecule and a hydrogen atom (H) is removed from the other organic molecule. These combine to form water (H₂O), a waste molecule. The two organic molecules are now unstable and bond to each other.

133. Correct Answer: B

Explanation: ATP is the molecule that stores energy made during respiration and all living organisms synthesize or make this from ADP. Cellulose is the large sugar that composes the cell walls of plants, ethyl alcohol is produced during anaerobic respiration by such organisms as yeast, and chlorophyll is the green pigment which is used to capture the sun's energy in plants.

134. Correct Answer: A

Explanation: Phagocytic white blood cells engulf bacteria much like an amoeba engulfs paramecium. They are involved in our second line of defense against harmful pathogens. The first line is protective barriers meant to prevent the pathogens from entering our body such as skin, tears, and mucus. If the phagocytes can't destroy all bacteria, then the third line of defense goes into action, namely our immune system, where antibodies are made to fight the invading pathogen.

135. Correct Answer: C

Explanation: Chlorophyll is a pigment that captures light energy and transfers it into usable energy in plants.

136. Correct Answer: B

Explanation: Abiotic factors are nonliving factors in an ecosystem such as the amount of water, light, pH, temperature, etc. These are climatic conditions that control what plants can live there. Obviously, a seaweed can't live in the desert.

137. Correct Answer: B

Explanation: Biotic means living. The only living factor of the choices given is the carnivore. Abiotic factors, or nonliving factors, are represented by the other choices.

138. Correct Answer: D

Explanation: The biosphere is the largest organizational grouping in ecology, it includes everywhere life is found on Earth. A population is all of 1 species in 1 area at 1 time, a community is all of the species in 1 area at 1 time, and a biome is a specific climax community established by the climate, which controls the plants living there, which in turn, control the animals living there.

139. Correct Answer: C

Explanation: If an ecosystem is to be self-sustaining, materials such as oxygen, carbon dioxide, water and nitrogen must be able to recycle between the organisms.

140. Correct Answer: C

Explanation: Because the scorpion stalks, kills and eats its food, it is a predator. Because it eats a spider it is a carnivore. Because it ingests food it is a consumer. A producer is an autotroph which is an organism that makes its own food from inorganic substances. A decomposer breaks down dead matter and a herbivore eats only plants

141. Correct Answer: B

142. Correct Answer: C

Explanation: For an ecosystem to be self-sustaining there must be a constant source of energy (usually the sun), there must be organisms that can use this energy to produce organic compounds, and there must be a recycling of all materials in the ecosystem. Without decomposers, nutrients remain in the dead organisms and the ecosystem eventually breaks down.

143. Correct Answer: D

Explanation: Secondary consumers eat primary consumers, which eat producers. In this diagram, algae and floating plants are producers, the primary consumers are the aquatic crustaceans and minnows, and the secondary consumers are the carnivorous fish and ducks. The raccoons are the tertiary consumers.

144. Correct Answer: B

Explanation: If population B increased while population A decreased, these organisms were probably in competition for the same food (grass) and population B was better adapted.

145. Correct Answer: D

Explanation: Both organisms benefit from this relationship, which is why it is called mutualism. The human gets vitamin K and the bacteria get a place to live. Commensalism is when one organism benefits and the other is not affected. Parasitism is when one organism benefits at the other organisms expense.

146. Correct Answer: C

Explanation: Scavengers are organisms that eat dead animals. They are important in the ecosystem as they recycle needed nutrients. Producers make their own food, usually by photosynthesis. Herbivores are an example of primary consumers, organisms that eat the producers, usually plants.

148. Correct Answer: B

Explanation: A community is all of the living, or biotic, things in one place at one time. A population is just one species in one area at one time. A phylum is a subdivision of a kingdom.

147. Correct Answer: A

Explanation: A lichen is an example of a pioneer organism, one of the first organisms to inhabit an area. Succession on land usually starts with lichen on bare rock, which will build up soil, allowing weeds to grow. The weeds soon get crowded out by the shrubs, which then get overpowered by the trees.

149. Correct Answer B

Explanation: One positive thing humans are doing is trying to preserve species that may be endangered. Wildlife refuges (where hunting is not allowed) and game laws (that limit the number of organisms hunted) have both helped.

150. Correct Answer: D

Explanation: Attracting insects with their own sex hormones, or pheromones, and then trapping them is an example of a biological control because you use only a natural mechanism of attracting them. Pesticides are chemicals that kill insects and are not normally found in nature. Herbicides are chemicals that kill plants.