Name: **K E Y** Block: _____ Date: _____

Biology 12 - BIOCHEMISTRY REVIEW for Your Massive Test!

1. Biology, like all sciences, use a number of investigative procedures to reveal the secrets of the natural world. These logical procedures are known collectively as the **SCIENTIFIC METHOD**.
2. A tentative explanation of observed phenomena (i.e. an educated guess drawn after careful observation) is called a **HYPOTHESIS**. After this explanation is proposed, scientists will test it by performing repeated **EXPERIMENTS**. *You should be able to design an experiment using the scientific method!*
3. All the things that living beings do to maintain a relatively constant environment are called **HOMEOSTASIS**.
4. In a test of a new headache pill, half of the test group receives a placebo, although they think they are getting the new medicine. The group that receives the placebo is called the **CONTROL** group.
5. The unit molecule of starch is **GLUCOSE**.
6. In **NEGATIVE** feedback, a control center directs the body to behave such that a normal state is regained. Once the normal state is regained, then this adaptive response is shut off.
7. The **POLAR** nature of water is responsible for so many of it's unique properties.
8. Water molecules are cohesive because they form numerous **HYDROGEN**-**BONDS** with each other.
9. Water, because of H-bonds, will absorb a lot of heat before it **HEATS** up and gives off a lot of heat before it cools down. Therefore, water, being the primary component of blood, heat to regulate and stabilize the **TEMPERATURE** of the human body.
10. Water is also the primary ingredient in key fluids that **LUBRICATE** joints to allow them to move smoothly and easily over a lifetime.
11. Substances that don't dissolve in water tend to be hydro**PHOBIC** and **LIPID**-soluble.
12. The process that joins together monomers to produce polymers is called **DEHYDRATION SYNTHESIS**.
13. This polysaccharide is a structural component of insect exoskeletons, and is called **CHITIN**.
14. This polysaccharide is the main form of monosaccharide storage in plants, and is called **STARCH**.
15. This polysaccharide is the main form of monosaccharide storage in animals, and is called **GLYCOGEN**.
16. This polysaccharide is a structural component of plant cell walls, and is called **CELLULOSE**.
17. Acids are compounds that dissociate in **WATER** and release **HYDROGEN** ions.
18. A solution with a pH of 7.0 is said to be **NEUTRAL**.
19. A solution with a pH of 4 is an **ACID**, and is one **MILLION** times less basic than a solution with a pH of 10.
20. Bases are compounds that dissociate in aqueous solution and release **HYDROXIDE** ions.
21. You add some acid to a beaker containing an unknown solution. The pH is only slightly depressed. Then you add some base, and the pH is only slightly elevated. The solution must contain a **BUFFER**.
22. The process that breaks a bond by adding a hydrogen atom and a hydroxide molecule to the atoms joined by the bond is called **HYDROLYSIS**.
23. In a neutralization reaction, an acid and a base will produce a **SALT** and water.
24. The substrate of the enzyme cellulase is most likely **CELLULOSE**.
25. The unit molecules found in neutral fats are **FATTY ACIDS** and **GLYCEROL**.
26. A fatty acid that contains the maximum number of hydrogen atoms possible is called **SATURATED**.
27. The common property of all lipids is that they are all hydro**PHOBIC**.
28. The cell membrane is composed of a fluid sea of **PHOSPHOLIPIDS** into which a mosaic of **PROTEINS** are embedded.
29. The unit molecules found in proteins are called **AMINO ACIDS**.
30. The biological molecules that releases the most ATP when hydrolyzed to CO_2 and H_2O are **LIPIDS**.
31. A linear chain of amino acids in a polypeptide is called a **PRIMARY** structure.
32. There are **20** different amino acids, which differs only in the **-R** group.
33. Amino acids contain an $-NH_3$, called the **AMINO** group, and a -COOH, called the **ACID** group.
34. When amino acids join together, they come together through the process of **DEHYDRATION SYNTHESIS** to form bonds called **PEPTIDE** bonds, which are a type of **COVALENT** bond, and can lead to hydrogen bonding between amino acids, which means of course that these bonds are also **POLAR**.
35. Scientific experiments are controlled so that scientists may establish **CAUSE** and effect.
36. Homeostasis is maintained by **NEGATIVE** feedback mechanisms.
37. Labour is an example of a process that is controlled by a **POSITIVE** feedback mechanism. In labour, the release of the hormone **OXYTOCIN** results in stronger uterine contractions, which in turn cause the release of more **OXYTOCIN**.
38. Starch is broken down by the enzyme **AMYLASE**, which is produced in two places. One place is by the **SALIVARY GLANDS** in the mouth. In this location, the enzyme works at a pH that is **NEUTRAL** (choices:

acidic, basic, neutral). The other organ that produces amylase is the **PANCREAS**, which sends it through a duct to the small **INTESTINE** (to be specific, the **DUODENUM**), where it works at a pH that is **BASIC** (choices: acidic, basic, neutral). This enzyme no matter where it is produced, always breaks starch down to **MALTOSE**, a di**SACCHARIDE** consisting of two **GLUCOSE** molecules.

39. Another **DI**saccharide is **SUCROSE**, which is consists of one **GLUCOSE** and one **FRUCTOSE**. Another name for this carbohydrate is **TABLE** sugar.
40. All **CARBOHYDRATES** have the basic formula $C_n(H_2O)_n$.
41. Proteins have many important functions, including **STRUCTURAL** support (e.g. collagen). The proteins **ACTIN** and **MYOSIN** also components of muscles, which allow organisms to **MOVE**.
42. Proteins have many metabolic functions. Biological catalysts, called **ENZYMES**, are almost without exception made of protein. Another function of proteins is that they form a type of immunoglobulin called **ANTIBODIES**, which fight infection by binding to **ANTIGENS** on the surface of invading pathogens. Another function of protein is *transport* (the tetramer **HEMOGLOBIN** transports O_2 inside blood cells which are properly known as **ERYTHROCYTES**.
43. Yet another function of protein is to serve as chemical messengers, which travel around in the blood to target cells and are called **HORMONES**. Some hormones that are proteins are **INSULIN**, which causes cells to take up glucose after being released into the blood by the **PANCREAS**. Another is **ADH**, which causes the kidney (to be specific, the **DISTAL** convoluted tubule of the **NEPHRON**) to reabsorb more water into the **BLOOD**. Another hormone that is derived from amino acids (and which contains iodine) is **THYROXIN**, which is released from the **THYROID** gland. It acts an most cells and causes them to "speed up" (i.e. increase their rates of cellular respiration.
44. Not all hormones are made of protein. Some are **STEROID** hormones, which are all derived from cholesterol. An example of a steroid hormone is **ALDOSTERONE**, which is released by the **ADRENAL** glands and which causes the kidneys to reabsorb more **SODIUM** ions and excrete (into the **URINE**) more **POTASSIUM** ions. Of course, the male sex hormone **TESTOSTERONE** and the female sex hormones **ESTROGEN** and **PROGESTERONE** are also this class of hormone.
45. More than two amino acids joined together is known as a **POLYPEPTIDE**. If the chain is more than about 75 amino acids in length, it is known as a protein.
46. The hydrogen bonding between amino acids in a primary chain often results in a characteristic **SECONDARY** structure known as a **ALPHA HELIX**.
47. The 3-dimensional shape of a polypeptide chain is called the **TERTIARY** structure. Do all proteins have a this structure?: **YES**.
48. More than one polypeptide chains joined together is known as the **QUATERNARY STRUCTURE**. Do all proteins have this structure?: **NO**.
49. The molecule most associated with short-term energy storage is **GLUCOSE**.
50. The molecule most associated with medium-term energy storage in animals is **GLYCOGEN**, which is stored in the **LIVER** and in muscle cells.
51. The molecule most associated with long-term energy storage are **LIPIDS**, which include **FATS**, oils, and waxes.
52. Vegetable oil contains numerous **UNSATURATED** fatty acids. This means that one or more **DOUBLE** bonds exist between carbon atoms in the chain.
53. In a phospholipid, the "heads" are hydro**PHILIC** and the tails are hydo**PHOBIC**. This is why in cell membranes the phospholipids arrange themselves in a arrangement known as a phospholipid **BILAYER**, in which the heads face outward and the tails face inward.
54. The primary carrier of energy in living systems is a nucleotide known (by its full name) as **ADENOSINE TRIPHOSPHATE**. This is abbreviated as **ATP**. This molecule consists of the 5-carbon **SUGAR** called ribose, the base adenine, and a total of three **PHOSPHATE** groups. The energy is stored in the high-energy **BONDS** between the phosphates.
55. The two nucleic acids are **DNA** and **RNA**, both of which are polymers of **NUCLEOTIDES**.
56. DNA stands for **DEOXYRIBONUCLEIC ACID**. It is composed of 4 nucleotides, which in alphabetical order are **ADENINE**, **CYTOSINE**, **GUANINE**, and **THYMINE**. In RNA, **THYMINE** is replaced by uracil.
57. In DNA, the two pyrimidines (which have a **SINGLE** ring structure) are **THYMINE** and **CYTOSINE**. This, of course mean that the other two nucleotides are **PURINES**, which have a **DOUBLE** ring structure.
58. The DNA sequence **TACCCTTACCGAATT** would direct the formation of a piece of mRNA (during the process of **TRANSCRIPTION**) with the sequence **AUGGGAAUGGCUUAA**. This would code for a polypeptide **FOUR** amino acids long. The sequence of amino acids would be **METHIONINE, GLYCINE, METHIONINE, ALANINE**.

59. DNA consists of two chains of nucleotides side-by-side but upside down (this is known as **ANTIPARALLEL**). The two chains are wound into a twisted ladder shape called a **DOUBLE HELIX**. The backbone of the DNA molecule consists of **SUGARS** and **PHOSPHATES**, joined together 3' to 5' by strong **COVALENT** bonds. The "rungs" of the DNA ladder are composed of the nitrogenous **BASES** from each strand, joined together by weak **HYDROGEN** bonds. The base T always joins to **A** and the base **C** always bonds to G. This is known as **COMPLEMENTARY BASE PAIRING**.
60. DNA makes identical copies of itself in a process called **REPLICATION**. In replication, DNA first **UNWINDS** and **UNZIPS**, and the two strands of DNA separate. Then, **COMPLEMENTARY** bases come in and **HYDROGEN** bond with each strand. Then, sugar-phosphate bonds form between adjacent **NUCLEOTIDES**, and the new molecules wind into double helixes. This is known as **SEMI-CONSERVATIVE** replication.
61. Unlike DNA, RNA is **SINGLE**-stranded. It also uses the base **URACIL** instead of thymine. The sugar in RNA nucleotides is **RIBOSE**, rather than **DEOXYRIBOSE** in DNA.
62. In transcription, the strand that is "read" is called the **SENSE** strand. The enzyme involved in transcription is known as RNA **POLYMERASE**.
63. There are three types of RNA: **MESSENGER** RNA, which carries the code from DNA to the ribosome, **RIBOSOMAL** RNA, which is the site of protein synthesis (better known as **TRANSLATION**), and **TRANSFER** RNA, which carries **AMINO ACIDS** to mRNA at the ribosome.
64. Ribosomes are composed of **rRNA** and **PROTEIN**. Ribosomes are small organelles that are not surrounded by **MEMBRANE**.
65. Each of the 20 amino acids is coded for by a three base sequence on mRNA called a **CODON**. The codon which amino acid will be brought to the **RIBOSOME** by tRNA. The 64 codons in mRNA constitute the most important language in life, and this is summarized in a chart known as the **GENETIC CODE**. The code includes "punctuation" (for example, the mRNA codon AUG stands for the amino acid methionine and also for the instruction to **START** translation).
66. The three steps in translation are **INITIATION**, **ELONGATION**, and **TERMINATION**.
67. If in the rare event that DNA nucleotides get lost, rearranged, or paired in error, this change in DNA is known a **MUTATION**.
68. A **GENE** mutation affects only one gene. An example of a disease caused by this sort of mutation is **SICKLE CELL** anemia.
69. While almost all mutations are harmful on not beneficial to the organism, very rarely a mutation will actually improve an organism's chances of survival. In this way, mutations, along with natural selection, is the fuel necessary for **EVOLUTION**.
70. **CHROMOSOMAL** mutations occur when pieces of chromosomes (or even whole chromosomes) are lost, added, or damaged. This sort of mutation will affect many **GENES**.
71. An agent that causes mutations is known as a **MUTAGEN**. Three examples are **DIOXIN**, **BENZENE**, **UV LIGHT**.
72. Three functions of DNA include making exact **COPIES** of itself, **CONTROLLING** cell activities, and undergoing **MUTATIONS**.
73. When biologists isolate, cut, and splice together gene regions from different species, the resulting nucleic acid is known as **RECOMBINANT DNA**.
74. Genetic **ENGINEERING** is the deliberate modification of genes, followed by their insertion into the same individual or a different one.
75. Bacteria often have small, circular, "extra" molecules of DNA called **PLASMIDS**. Bacteria are able to transfer these molecules to their neighbours, and in this way, are able to exchange genetic information even though they reproduce asexually. Enzymes called **RESTRICTION** enzymes are used to "open up" plasmids so that you can insert foreign DNA into the plasmid. The recombinant fragments are sealed together using the enzyme **LIGASE**. The plasmids can then be inserted into host cells to produce **CLONED** DNA (multiple, identical copies of the DNA fragments).
76. Another way of creating large amounts of cloned DNA is the **POLYMERASE CHAIN REACTION**. This reaction uses controlled heating and cooling, plus DNA primers and the enzyme DNA **POLYMERASE** to make huge amounts of cloned DNA is a short amount of time.
77. Another application of restriction enzymes is restriction fragment length polymorphisms (or **RLFP**'s for short), which is useful in creating DNA "fingerprints."
78. Genetically engineered bacteria can now produce human **INSULIN** for the treatment of diabetes.
79. Every last base pair (that's about 3.2 **BILLION** base pairs!) on the 46 human chromosomes are being "mapped" in an ambitious effort known as the "human **GENOME** project." This information will certainly

open the doors to gene **THERAPY**, the transfer of one or more normal or modified genes into body cells of an individual to correct a genetic defect or boost resistance to disease.

80. Recombinant DNA is useful in **AGRICULTURE**, where biologists have been able create new, genetically engineered strains of plants that resist decay, or resist infection by insects or blights.
81. **TRANS**genic organisms have been created that can produce medicines for humans (e.g. cows have been engineered that secrete human medicine into their milk. To take the medicine, the patients merely drink the milk).
82. The **FLUID** **MOSAIC** model is our most current model of the structure of cell membranes. The cell membrane has the property of being **SELECTIVELY** **PERMEABLE** (that is, it can tell the difference between two molecules of the same size). It is the **PROTEIN** channels that give it this property.
83. The organelle in which aerobic cellular respiration occurs is the **MITOCHONDRION**, sometimes called the "powerhouse" of the cell.
84. Rough **ENDOPLASMIC** reticulum is peppered with **RIBOSOMES**, and is the site of **PROTEIN** synthesis. The molecules thus made are modified in the ER and then sent to the **GOLGI** bodies for packaging and transport out of the cell. The process by which a vesicle fuses with the cell membrane and its contents are delivered to the outside of the cell is called **EXOCYTOSIS**. The opposite of this process is called **ENDOCYTOSIS**, and it has two sub-types, **PHAGOCYTOSIS** ("cell-eating") and **PINOCYTOSIS** ("cell-drinking").
85. A large vesicle is called a **VACUOLE**. Plants usually have one large **CENTRAL** one that stores water. The force of water pressing out against the walls of the vacuole help to keep the plant rigid, and is known as **TURGOR** pressure.
86. The organelle in animal cells that contains a variety of hydrolytic enzymes and which functions in cellular digestion is known as the **LYSOSOME**.
87. The nucleus controls all cell activities as it contains **DNA**. It also may have one or more dark staining regions known as (plural form, please) **NUCLEOLI**, which are the site of production of **RIBOSOMES**. In order for material to get in and out, materials must pass through the double membrane that surrounds the nucleus. This double membrane has numerous pores and is called the **NUCLEAR** **ENVELOPE**.
88. Inside the nucleus, DNA can be found tightly packaged into **CHROMOSOMES** if it isn't being immediately used. Human body cells have 23 **PAIRS** of these rod-shaped DNA "warehouses," each of which may have thousands of **GENES** (a discrete instruction for the making of one polypeptide).
89. **SMOOTH** endoplasmic **RETICULUM** functions in producing **LIPIDS** (such as phospholipids and the molecule from which all steroids are derived, **CHOLESTEROL**) and also in **DETOXIFYING** drugs and chemicals.
90. Plants contain plasmids containing pigments that capture the sun's energy. The most prominent plasmid is the **CHLOROPLAST**, which looks green because it contains the pigment **CHLOROPHYLL**. In this organelle, the process of **PHOTOSYNTHESIS** takes place. This process has produces essentially all of the atmospheric **OXYGEN** that we breathe, though the main purpose of the process is to produce **GLUCOSE** from **CO_2** and **H_2O**.
91. Animal cells have two cylindrical bodies called **CENTRIOLES** that are located near the nucleus, have a **9+0** arrangement of microtubules, and function in cell **DIVISION**.
92. Sperm are propelled by a single long **FLAGELLUM**, which, like their shorter cousins, **CILIA**, have a **9+2** arrangement of microtubules.
93. As a cell gets bigger, its **VOLUME** increases at a faster rate than its **SURFACE** **AREA**. This means that, as a cell gets larger, its SA:V ratio **DECREASES**. One thing that a growing cell can do as it gets larger to overcome this problem is to **DIVIDE** into two. It can also **SLOW** down its metabolic rate, or it can change its **SHAPE** to maximize its SA:V ratio.
94. The process of diffusion can be sped up by **RAISING** the temperature and **DECREASING** the size of the diffusing molecules.
95. The diffusion of water across a selectively permeable membrane is known as **OSMOSIS**.
96. Red blood cells are added to a 0.9% salt solution. You observe no change in the red blood cells. The 0.9% salt solution must be **ISOTONIC** to red blood cells. If more salt were added to the solution, the cells would **SHRINK** because the solution would now be **HYPERTONIC** to the cells (another way of saying it is that the cells are now **HYPOTONIC** to the solution).
97. If a poison that destroyed mitochondria were added to cells, which process would be affected first? *facilitated transport, active transport, osmosis, diffusion* ANSWER: **ACTIVE TRANSPORT**
98. All the chemical reactions occurring constantly in the cell that maintain homeostasis is known as **METABOLISM**. An orderly step-wise series of chemical reaction from the initial reactants to the final

products is known as a **METABOLIC PATHWAY**. Each step along the way is catalyzed by its own specific **ENZYME** (proteins that speed up chemical reactions without being themselves consumed).

99. The reactants that bind to an enzyme are called **SUBSTRATES**. They bind to the enzyme at a place called the **ACTIVE SITE**.
100. In thermodynamic terms, enzymes work by lowering the **ACTIVATION ENERGY** necessary for a reaction to proceed.
101. The original model that was developed to explain how enzymes work stated that enzyme and substrate are so shaped as to fit together perfectly. This model is known as the **LOCK** and **KEY** model.
102. The protein part of an enzyme that bestows upon the enzyme its particular specificity is called the **APOENZYME**. The smaller, non-protein part of an enzyme that occupies part of the active site and may help out the reaction by accepting or donating atoms is called the **COENZYME**. Many **VITAMINS** are this latter type of molecule. Your body can't produce them, and so must be obtained from **FOOD**, though they are normally only needed in small quantities each day.
103. If the **pH** of a solution is raised or lowered above or below the preferred range of an enzyme, this will reduce the rate of reaction, and if the change is large enough, it could cause the protein to lose its shape (this would therefore **DENATURE** the enzyme).
104. Heavy metals such as **LEAD**, **MERCURY**, and cadmium will all **DENATURE** proteins, and therefore adding any of these to an enzyme-catalyzed reaction will **REDUCE** the rate of product formation.
105. Lowering the temperature will reduce the rate of product formation in an enzyme-catalyzed reaction (though it will not necessarily **DENATURE** the enzyme). Raising the temperature above about 45°C will **DENATURE** enzymes, but moderately warming an enzyme-catalyzed reaction will **INCREASE** the rate of product formation. Humans usually die when internal body temperature reaches 44ºC (112 ºF).
106. Increasing the concentration of **SUBSTRATE** will increase the rate of reaction up to a certain point, but then it will level off as the enzymes become **SATURATED**.
107. The concentration of **ENZYME** is what limits the rate of an enzyme-catalyzed reaction. The more you add, the more the rate of product formation **INCREASES**.
108. **COMPETITIVE** inhibitors bind to the same place (i.e. the **ACTIVE** site) that the **SUBSTRATE** bind to. Thus, adding these inhibitors to an enzyme-catalyzed reaction will **LOWER** the rate of reaction.