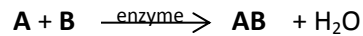
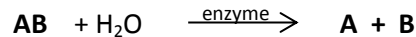


Keystone Biology Cram Sheet: MODULE 1

1. Because *carbon* has 4 electrons it can form 4 covalent bonds with other atoms. This makes it the only atom that can be used to build the variety of molecules needed for complex life.
2. Carbon can be used to build large molecules (*polymers, macromolecules*) like carbohydrates (sugars), lipids (fats), proteins (including enzymes) and nucleic acids (DNA, RNA).
3. This formula shows how large molecules are built in living things. The process is called *dehydration synthesis* because water is taken out of the smaller molecules to synthesize/build a larger one.



4. This formula shows how large molecules are broken down in living things. The process is called *hydrolysis* because water is added to the larger molecule to lyse/break it down into a smaller one.



5. Enzymes (catalysts) make all life-sustaining reactions possible.
As in #3 and #4, enzyme-regulated reactions can be written:



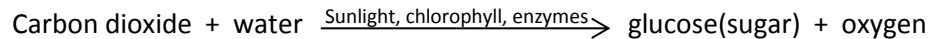
or



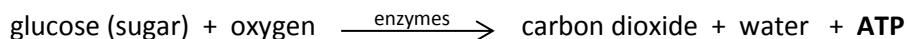
IMPORTANT: Enzymes are not used up or otherwise changed by the reactions they control!

IMPORTANT: Enzyme (and EVERYTHING else) shape determines its function.

6. **All living things need/use energy.** Enzymes make this possible.
7. *Autotrophs* (plants, some bacteria) make their own energy by *photosynthesis*.



8. *Heterotrophs* get energy by eating autotrophs or other heterotrophs. They and all living things (autotrophs, too) use the energy to make **ATP** by the process of *cellular respiration*.



(this is essentially the reverse of photosynthesis)

9. **ATP is the form of energy ultimately used by all living things. Anything a cell does (move, change, grow, produce, respond) requires ATP. Any question involving energy will likely include "ATP" in the answer. Any question involving ATP will likely include "energy" in the answer.**
10. **All living things need energy in the form of ATP.** This does *not* mean they breathe or need oxygen to get ATP, although it's the best way. Cells can also make a little ATP without oxygen.
AEROBIC = needs oxygen, produces lots of ATP, with carbon dioxide and water as waste.
ANAEROBIC = doesn't need oxygen, less ATP produced, with alcohol, carbon dioxide and/or lactic acid as waste. (occurs in some bacteria and fatigued muscle cells)

11. **ALL living things are made up of cells.**

Cells = structure (how living things are built)

Cells = function (what living things do)

12. Cells are like mini-protein factories because

Proteins = structure (how living things are built)

Proteins = function (what living things do) (ENZYMES!)

13. Cells build the proteins according to the “recipe” written in the nucleus in DNA.

DNA sequence (code)	=	CTG	ATT	GGC	ATT	...
Protein structure	=	amino acid	amino acid	amino acid	amino acid	...

14. mRNA takes the code from the DNA in the nucleus to ER in the cytoplasm.

15. The ER is like a protein assembly line. The workers along it are ribosomes, which actually line up the amino acids in the right order (according to the DNA code)

16. The proteins are finished, tweaked, modified, packaged and shipped by Golgi.

17. Vesicles carry the final protein products throughout the cell (& may be secreted out of the cell)

18. Nuclei, ER, Golgi and vesicles can join their membranes and separate then as needed.

19. Bacteria can't do #18, because they don't have membranes inside their cells.

20. Bacteria are prokaryotes (no internal membranes, no nucleus). Everything else is a eukaryote.

21. All eukaryotes have *mitochondria*, membrane structures where respiration occurs and **ATP** is made.

22. Autotrophs *also* have *chloroplasts*, where chlorophyll allows sunlight, CO₂ and H₂O to become carbohydrate.

RANDOM MISCELLANEOUS PIECE of ADVICE: When in doubt, answer with “surface area”. It's a huge deal in biology and everywhere else.