fiveable

AP BIOLOGY CRAM CHART // @thinkfiveable // http://fiveable.me

Chemistry of Life
Unit 1 ↓

- Water has **hydrogen bonds** that allow it to have special properties like **cohesion** (water molecules stick to each other), **adhesion** (water molecules stick to other surfaces), and **surface tension.**
- Monomers form polymers via **dehydration synthesis**; in **hydrolysis**, polymers are broken down into monomers.
- **Nucleic acids** are what make up DNA and RNA, and hold a lot of genetic information. They are made up of **nucleotides,** which are composed of a deoxy/ribose, a phosphate, and a nitrogen base.
- **Amino acids** make up a protein, and the specific order of the polypeptide determines the protein's structure and function.
- Sugar monomers bond to form complex **carbohydrates.**
- **Lipids** are nonpolar and can vary in saturation (which affects the structure and function). They are most commonly seen as the cell membrane.

Cell Structure and Function
Unit 2 ↓

- All lifeforms have **ribosomes** since they synthesize proteins.
- Cellular respiration occurs in the **mitochondria**.
- **Chloroplasts** have **thylakoids** and **stroma**. These organelles are responsible for converting light into usable energy for the organism.
- Cell size is very important to its survival, especially the **surface area-to-volume ratio**. The SA should be big enough to be able to exchange materials and eliminate waste products. (High SA, smaller volume = ideal ratio for cells!)
- **Phospholipid bilayers** are **semipermeable membranes.** For nutrients that are unable to pass on its own, they require channel proteins, which can facilitate either **passive** or **active transport**. Particles in passive transport follow a **concentration gradient** (high to low), while those in active transport go AGAINST the gradient (low to high).
- Organisms like plants, prokaryotic cells, and fungi, have **cell walls**, which act as a permeability barrier as well as maintain cell structure and function.

Cellular Energetics
Unit 3 ↓

- **Enzymes** catalyze a chemical reaction by lowering the activation energy required. Enzymes interact with substrates at its **active site**, but are only functional in certain conditions, otherwise they **denature**.
- Reactions can be inhibited by **competitive inhibitors** (which will bind to the enzymes' active sites) or by **noncompetitive inhibitors** (which bind to allosteric sites to change the shape/activity of the enzyme).
- Every enzyme has an optimal **pH**, **temperature**, and **substrate concentration** before it slows down activity and denature.
- There are two parts of **photosynthesis**. First, chlorophylls utilize light energy to charge electrons in **photosystems I and II.** Those electrons are transferred to power the production of carbohydrates in the **Calvin cycle**
- **Cellular respiration** produces ATP. **Fermentation** will occur in the absence of oxygen. Electron transfers result in the formation of a **proton gradient,** which results in the storage of energy in ATP, which is then used throughout the organism.

Cell Communications and Cell Cycle
Unit 4 ↓

- **Paracrine** signaling consists of a signaling molecule being released into the intracellular space between molecules when they are close by.
- **Endocrine** signaling happens over long distances.
- **Signal Transduction Pathways** consist of three stages: **Reception, Transduction,** and **Response.**
- **Reception** is the process by which a **ligand** binds to a receptor on the cell membrane, such as an **Ion-gated channel** or a **G-protein coupled receptor.**
- **Transduction** amplifies the signal by converting it to a form that the cell recognizes.
- The **response** can activate gene transcription or whatever the cell response was meant to be.
- **Negative Feedback** works to reduce the stimulus (ex. insulin regulation of glucose).
- **Positive Feedback** works to increase responses (ex. oxytocin to help with contractions in childbirth).
- The cell cycle has 3 stages of **interphase** (G1, S, G2), followed by **mitosis** (produces identical daughter cells.
- **Cell cycle checkpoints** at the end of G1, G2-M transition, and metaphase prevent cell abnormalities.

Heredity
Unit 5 ↓

- Meiosis has two parts to form **haploid gamete cells**. Each gamete receives a haploid (1n) set of chromosomes after the **homologous chromosomes** separate. This is when crossing over may occur to increase genetic diversity
- **Mendelian genetics** can help predict outcomes of single-gene traits from parent to offspring.
- Some traits do not follow Mendel's laws and therefore will not fit within these predictions. They are more difficult to track, as they are less likely to separate from each other.
- There are three major sources of genetic diversity: **crossing over** in prophase I of meiosis, **independent assortment** (2^{23} combination in humans!) in metaphase I of meiosis, and **random fertilization.**
- Genetic disorders are caused if an allele mutates or a sequence changes (nondisjunction).

Gene Expression and Regulation
Unit 6 ↓

- **DNA** and **RNA** store genetic information. Chromosomes in **prokaryotes** are circular while ones in **eukaryotes** are linear. Bases are **purines** (G and A) with a double ring structure and **pyrimidines** (C, T, U) with a single ring structure.
- DNA replicates from **5' to 3'** and is **semi-conservative**. **Helicase** unwinds the DNA while **topoisomerase** prevents coiling. RNA primers initiate **DNA polymerase**'s DNA synthesis on the **leading** and **lagging** strands. **Ligase** combines the fragments in the lagging strand.
- After **transcription** (copying of DNA to RNA), a GTP cap and poly-A tail are added and introns are removed.
- **Translation** creates proteins by ribosomes reading mRNA and tRNA matching amino acids to codons.
- **Mutations** in DNA lead to a protein losing functions, having more functions, or no change at all.
- **Gel Electrophoresis** separates DNA fragments by size while PCR amplifies DNA segments. DNA sequencing determines the order of nucleotides in a DNA molecule.
- **Bacterial transformation** introduces DNA to bacterial cells.

Natural Selection
Unit 7 ↓

- **Evolutionary fitness** is measured by reproductive success.
- **Competition** is what creates natural selection.
- As environments change, different selective pressures are put on populations that affect phenotypes
- Evolution is also driven by **random** events like mutations, and genetic drifts.
- The **Hardy-Weinberg** equation (see formula sheet!) is used to predict equilibrium frequencies.
- Fossil age can be estimated using carbon-14 dating, geographical data, and identifying the age of rocks surrounding it.
- Organisms are linked thanks to common ancestry, and they keep evolving.
- **Phylogenetic** trees and **cladograms** both show relationships between lineages.
- Extinction provides newly available niches.
- Variation affects population dynamics.

Ecology
Unit 8 ↓

- **Homeostasis** is how organisms respond to external events to maintain internal equilibrium.
- A net gain in energy allows growth in an organism.
- **Endotherms** can use thermal energy to maintain internal temperatures, while **exotherms** cannot.
- Some factors, like population size, population change over time, and carrying capacity, limit populations. These relationships are represented in an **s-curve**.
- **Simpson's Diversity Index** calculates the diversity in an ecosystem.
- The more biodiversity an ecosystem has, the more resilient it is to disruptions.
- There are many kinds of **species interactions**: commensalism, mutualism, parasitism, predator-prey, competition, etc.
- When you go up a trophic level, only **10%** of the energy is transferred; most energy is lost in the form of heat from one trophic level to another.

FRQ TIPS: Be clear and concise 💎 Answer only what the question asks for 💎 Answer short, easy parts first to save time for harder ones 💎 Be confident!