

2020 Academic Super Bowl  
Senior Science  
Final Study Guide  
The Roaring Twenties



- I. Physics - 33%
- A. Size of the Universe
    - 1. Cepheid Variable Stars - distance modulus
    - 2. Hubble's Law and the Redshift of Galaxies
  - B. Bosons and Fermions
    - 1. Fundamental particles: electrons, photons, quarks
    - 2. Composite particles
- II. Chemistry - 33%
- A. Chemistry of Atomic Theory - light, spectra, quantized electrons
    - 1. Meaning of quantization
    - 2. Relationship between color and energy, wavelength and frequency of visible light (ROYGBIV)
    - 3. Need to know the range of visible light in nanometers (red to violet)
    - 4. Calculate energy, velocity, frequency and wavelength of electromagnetic radiation using  $E = hc/\lambda$
    - 5. Relationship between the energy levels in the Bohr atom and transitions requiring or releasing energy when electrons change energy levels.
    - 6. Use the deBroglie equation to calculate wavelength, momentum, mass or velocity of a particle,  $\lambda = h/mv$
    - 7. Calculate the energy of a mole of photons of a particular frequency or wavelength
    - 8. Photoelectric effect with regard to frequency or wavelength of light required for a particular energy change.
  - B. Chemistry of Alcohols
    - 1. Uses and preparations of alcohols, especially ethanol, methanol, isopropanol, glycerin and ethylene glycol
    - 2. Systematic naming of alcohols
    - 3. Oxidation reactions of alcohols: primary, secondary and tertiary
    - 4. Simple dehydration and reduction reactions for producing alcohols
    - 5. Recognize names of common natural alcohols
    - 6. Predicting solubility based on hydrogen bonding
- III. Biology - 33%
- A. Fermentation
    - 1. Definitions and Overview of Cellular Respiration
    - 2. Fermentation
  - B. History and People in Fermentation

*continued on next page*

- C. Insulin and Diabetes
  - 1. Diabetes
    - a. Definitions, Diagnosis, Impacts and Treatments
    - b. Type I and Type II Diabetes
    - c. Pancreas Structure and Function
  - 2. Insulin
    - a. History and People
    - b. Insulin Structure
    - c. Insulin Function in the human body
- D. Earth and Environmental Science
  - 1. Pre-1920: from settlement to 1920's
  - 2. Land Use and land use changes in Indiana from the 1920's until current time
  - 3. For both periods above: Indiana human population and general population distribution; land cover types - approximate percentages; roles of agriculture and forestry; land use changes or impacts generally found within that period

Resources:

[https://www.cs.mcgill.ca/~rwest/wikispeedia/wpcd/wp/l/List\\_of\\_particles.htm](https://www.cs.mcgill.ca/~rwest/wikispeedia/wpcd/wp/l/List_of_particles.htm)

<https://www.learner.org/courses/physics/unit/text.html?unit=6&secNum=5>

internet sites, science textbooks

2020 Outlines were developed by coaches who chose to share ideas at the 2018 Academic Coaches Conference and through email, and further developed by question writers.