The authors of the MCAT are the American Association of Medical Colleges (AAMC). They released a book that explains the MCAT exam in depth. They give sample questions and passages and specifically delineate the content that is covered on the MCAT. We have studied this document and have recapitulated the Content Outline here.

Content Category 1A: Structure/function of proteins and their constituent amino acids

Amino Acids/Peptides
- ☐ Absolute configuration at the α position
- ☐ Amino acids as dipolar ions
- ☐ Acidic or basic
- ☐ Hydrophobic or hydrophilic
- ☐ Sulfur linkage for cysteine and cysteine
- ☐ Peptide linkage: polypeptides and proteins
- ☐ Hydrolysis

Proteins
- ☐ 1°, 2°, 3°, 4° structure of proteins
- ☐ Denaturing and folding
- ☐ Hydrophobic interactions
- ☐ Solvation layer (entropy)
- ☐ Role of proline, cysteine and hydrophobic bonding

Protein separation techniques
- ☐ Isoelectric point
- ☐ Electrophoresis

Non-Enzymatic Protein Function
- ☐ Binding
- ☐ Immune system
- ☐ Motors

Enzyme Structure/Function
- ☐ Enzyme function in catalyzing biological reactions
- ☐ Classification of enzymes by reaction type
- ☐ Effects of local conditions on enzyme activity
- ☐ Reduction of activation energy
- ☐ Substrates and enzyme specificity
- ☐ Active Site Model
- ☐ Induced-fit Model
- ☐ Mechanism of catalysis
- ☐ Cofactors and Coenzymes
- ☐ Water-soluble vitamins

Control of Enzyme Kinetics
- ☐ General (catalysis)
- ☐ Michaelis-Menten
- ☐ Cooperativity
- ☐ Feedback regulation

Inhibition
- ☐ Competitive and Non-competitive
- ☐ Mixed
- ☐ Uncompetitive

Enzyme regulation
- ☐ Allosteric enzymes
- ☐ Covalently-modified enzymes
- ☐ Zymogens

Content Category 1B: Transmission of genetic information from the gene to the protein

Nucleic Acid Structure and Function

- ☐ Nucleotides and nucleosides
- ☐ Sugar phosphate backbone
- ☐ Pyrimidine, purine residues
- ☐ Deoxyribonucleic acid (DNA): double helix, Watson–Crick model of DNA structure
- ☐ Base pairing specificity: A with T, G with C
- ☐ Function in transmission of genetic information
- ☐ DNA denaturation, reannealing, hybridization

DNA Replication and Repair

- ☐ Mechanism of replication: separation of strands, specific coupling of free nucleic acids
- ☐ Semi-conservative nature of replication
- ☐ Specific enzymes involved in replication
- ☐ Origins of replication, multiple origins in eukaryotes
- ☐ Replicating the ends of DNA molecules

The Genetic Code

- ☐ Central Dogma: DNA → RNA
- ☐ The triplet code
- ☐ Codon-anticodon relationship
- ☐ Degenerate code, wobble pairing
- ☐ Missense, nonsense codons
- ☐ Initiation, termination codons
- ☐ Messenger RNA (mRNA)

Transcription

- ☐ tRNA and rRNA
- ☐ Mechanism of transcription
- ☐ mRNA processing in eukaryotes, introns, exons
- ☐ Ribozymes, spliceosomes, small nuclear ribonucleoproteins, small nuclear RNA
- ☐ Evolutionary importance of introns

Translation

- ☐ Roles of mRNA, tRNA, rRNA
- ☐ Role and structure of ribosomes
- ☐ Initiation, termination co-factors
- ☐ Post-translational modification of proteins

Eukaryotic Chromosome Organization

- ☐ Chromosomal proteins
- ☐ Single copy vs. repetitive DNA
- ☐ Supercoiling
- ☐ Heterochromatin vs. euchromatin
- ☐ Telomeres, centromeres
- ☐ Repair during replication
- ☐ Repair during replication
- ☐ Repair of mutations
- ☐ Telomeres, centromeres

Gene Expression in Prokaryotes

- ☐ Jacob-Monod Model
- ☐ Gene repression in bacteria
- ☐ Positive control in bacteria

Control of Gene Expression in Eukaryotes

- ☐ Transcriptional regulation
- ☐ DNA binding proteins, transcription factors
- ☐ Gene amplification and duplication
- ☐ Post-transcriptional control, basic concept of splicing (introns, exons)
- ☐ Cancer as a failure of normal cellular controls, oncogenes, tumor suppressor genes
- ☐ Regulation of chromatin structure
- ☐ DNA methylation
- ☐ Non-coding RNAs

Recombinant DNA and Biotechnology

- ☐ Gene cloning and cloned gene expression
- ☐ Restriction enzymes

- ☐ DNA libraries
- ☐ Generation of cDNA
- ☐ Hybridization and Polymerase Chain Reaction
- ☐ Gel Electrophoresis and Southern Blotting
- ☐ DNA sequencing
- ☐ Analyzing gene expression
- ☐ Determining gene function
- ☐ Stem cells
- ☐ Applications of DNA technology: gene therapy, pharmaceuticals, forensic evidence, environmental cleanup, agriculture

Content Category 1C: Transmission of heritable information from generation to generation and the processes that increase genetic diversity

Mendelian Genetics

- ☐ Phenotype and genotype
- ☐ Gene and locus
- ☐ Allele: single and multiple
- ☐ Homozygosity and heterozygosity
- ☐ Wild-type
- ☐ Recessiveness
- ☐ Complete dominance
- ☐ Co-dominance
- ☐ Incomplete dominance, leakage, penetrance, expressivity
- ☐ Hybridization: viability
- ☐ Gene pool

Meiosis and Other Factors Affecting Genetic Variability

- ☐ Significance of meiosis
- ☐ Important differences between meiosis and mitosis
- ☐ Segregation of genes
- ☐ Independent assortment
- ☐ Linkage
- ☐ Recombination
- ☐ Single and double crossovers
- ☐ Synaptonemal complex
- ☐ Tetrad

Sex-linked characteristics

- ☐ Few genes on Y chromosome
- ☐ Sex determination
- ☐ Cytoplasmic/extranuclear inheritance

Mutation

- ☐ Error in DNA sequence
- ☐ Types of mutations: random, translation error, transcription error, base substitution, inversion, addition, deletion, translocation, mis-pairing
- ☐ Advantageous vs. deleterious mutation
- ☐ Inborn errors of metabolism
- ☐ Relationship of mutagens to carcinogens
- ☐ Genetic drift
- ☐ Synapsis or crossing-over mechanism and genetic diversity

Analytic Methods

- ☐ Hardy–Weinberg Principle
- ☐ Testcross (Backcross; parent, F1 and F2 generations)
- ☐ Gene mapping: crossover frequencies
- ☐ Biometry: statistical methods

Evolution

- ☐ Natural selection
- ☐ Fitness concept
- ☐ Selection by differential reproduction
- ☐ Concepts of natural and group selection
- ☐ Evolutionary success as increase in percent representation in the gene pool of the next generation

Speciation

- ☐ Polymorphism
- ☐ Adaptation and specialization
- ☐ Inbreeding

- ☐ Outbreeding
- ☐ Bottlenecks
- ☐ Evolutionary time as measured by gradual random changes in genome

Content Category 1D: Principles of bioenergetics and fuel molecule metabolism

Principles of Bioenergetics
- ☐ Bioenergetics/thermodynamics
- ☐ Free energy/K_{eq} and Equilibrium constant
- ☐ Relationship of the equilibrium constant and $\Delta G°$
- ☐ Le Châtelier's Principle
- ☐ Endothermic/exothermic reactions
- ☐ Free energy: G, Spontaneous reactions and $\Delta G°$
- ☐ Phosphoryl group transfers and ATP
- ☐ ATP hydrolysis $\Delta G << 0$
- ☐ ATP group transfers
- ☐ Half-reactions in biological redox reactions
- ☐ Soluble electron carriers
- ☐ Flavoproteins

Carbohydrates
- ☐ Nomenclature and classification
- ☐ Absolute configuration
- ☐ Cyclic structure and conformation
- ☐ Epimers and anomers
- ☐ Hydrolysis of the glycoside linkage
- ☐ Mono, di and polysaccharides

Glycolysis, Gluconeogenesis, and the Pentose Phosphate Pathway
- ☐ Glycolysis (aerobic), substrates and products
- ☐ Feeder pathways: glycogen, starch metabolism
- ☐ Fermentation (anaerobic glycolysis)
- ☐ Gluconeogenesis, Pentose phosphate pathway
- ☐ Net molecular and energetic results of respiration processes

Principles of Metabolic Regulation
- ☐ Regulation of metabolic pathways
- ☐ Maintenance of a dynamic steady state
- ☐ Regulation of glycolysis and gluconeogenesis
- ☐ Metabolism of glycogen
- ☐ Regulation of glycogen synthesis and breakdown of Allosteric and hormonal control
- ☐ Analysis of metabolic control

Citric Acid Cycle
- ☐ Acetyl-CoA production
- ☐ Reactions of the cycle, substrates and products
- ☐ Regulation of the cycle
- ☐ Net molecular and energetic results of respiration processes

Metabolism of Fatty Acids and Proteins
- ☐ Description of fatty acids
- ☐ Digestion, mobilization, and transport of fats
- ☐ Oxidation of fatty acids - Saturated and unsaturated fats
- ☐ Ketone bodies
- ☐ Anabolism of fats
- ☐ Biosynthesis of lipids and polysaccharides
- ☐ Metabolism of proteins

Oxidative Phosphorylation
- ☐ Electron transport chain and oxidative phosphorylation, substrates and products, general features of the pathway
- ☐ Electron transfer in mitochondria
- ☐ NADH, NADPH

- ☐ Flavoproteins
- ☐ Cytochromes
- ☐ ATP synthase, chemiosmotic coupling
- ☐ Proton motive force
- ☐ Net molecular and energetic results of respiration processes
- ☐ Regulation of oxidative phosphorylation
- ☐ Mitochondria, apoptosis, oxidative stress

Hormonal Regulation & Integration of Metabolism

- ☐ Higher level integration of hormone structure and function
- ☐ Tissue specific metabolism
- ☐ Hormonal regulation of fuel metabolism
- ☐ Obesity and regulation of body mass

Category 2A: Assemblies of molecules, cells, and groups of cells within single cellular and multicellular organisms

Plasma Membrane

- ☐ General function in cell containment
- ☐ Composition of membranes
- ☐ Lipid components
- ☐ Phospholipids (and phosphatids)
- ☐ Steroids
- ☐ Waxes
- ☐ Protein components
- ☐ Fluid mosaic model
- ☐ Membrane dynamics
- ☐ Solute transport across membranes
- ☐ Thermodynamic considerations
- ☐ Osmosis
- ☐ Colligative properties, osmotic pressure
- ☐ Passive transport
- ☐ Active transport
- ☐ Sodium/potassium pump
- ☐ Membrane channels
- ☐ Membrane potential
- ☐ Membrane receptors
- ☐ Exocytosis and endocytosis

Intercellular junctions

- ☐ Gap junctions
- ☐ Tight junctions
- ☐ Desmosomes

Membrane-Bound Organelles and Defining Characteristics of Eukaryotic Cells

- ☐ Defining characteristics of eukaryotic cells: membrane bound nucleus, presence of organelles, mitotic division

Nucleus

- ☐ Compartmentalization, storage of genetic information
- ☐ Nucleolus: location and function
- ☐ Nuclear envelope, nuclear pores

Mitochondria

- ☐ Site of ATP production
- ☐ Inner and outer membrane structure
- ☐ Self-replication
- ☐ Lysosomes: membrane-bound vesicles containing hydrolytic enzymes

Endoplasmic reticulum

- ☐ Rough and smooth components
- ☐ Rough endoplasmic reticulum site of ribosomes
- ☐ Double membrane structure
- ☐ Role in membrane biosynthesis
- ☐ Role in biosynthesis of secreted proteins

☐ Golgi apparatus: general structure and role in packaging and secretion
☐ Peroxisomes: organelles that collect peroxides

Cytoskeleton
☐ General function in cell support and movement
☐ Microfilaments: composition and role in cleavage and contractility
☐ Microtubules: composition and role in support and transport
☐ Intermediate filaments, role in support
☐ Composition and function of cilia and flagella
☐ Centrioles, microtubule organizing centers

Tissues Formed From Eukaryotic Cells
☐ Epithelial cells
☐ Connective tissue cells

Content Category 2B: The structure, growth, physiology, and genetics of prokaryotes and viruses

Cell Theory
☐ History, development, impact on biology

Classification and Structure of Prokaryotic Cells
☐ Prokaryotic domains: Archaea and Bacteria
☐ Major classifications of bacteria by shape: Bacilli, Spirilli or Cocci
☐ Lack of nuclear membrane and mitotic apparatus
☐ Presence of cell wall in bacteria
☐ Flagellar propulsion, mechanism

Growth and Physiology of Prokaryotic Cells
☐ Reproduction by fission
☐ High degree of genetic adaptability, acquisition of antibiotic resistance
☐ Exponential growth
☐ Existence of anaerobic and aerobic variants
☐ Parasitic and symbiotic
☐ Chemotaxis

Genetics of Prokaryotic Cells
☐ Existence of plasmids, extragenomic DNA
☐ Transformation: incorporation into bacterial genome of DNA fragments from external medium

☐ Conjugation
☐ Transposons (including eukaryotic cells)

Virus Structure
☐ General structural characteristics (nucleic acid and protein, enveloped and non-enveloped)
☐ Lack organelles and nucleus
☐ Structural aspects of typical bacteriophage
☐ Genomic content - RNA or DNA
☐ Size relative to bacteria and eukaryotic cells

Viral Life Cycle
☐ Self-replicating biological units that reproduce within host cell
☐ Generalized phage and animal virus life cycles
☐ Attachment to host, penetration of cell membrane or cell wall, and entry of viral genetic material
☐ Use of host synthetic mechanism to

replicate viral components
☐ Self-assembly and release of new viral particles
☐ Transduction: transfer of genetic material by viruses
☐ Retrovirus life cycle: integration into host DNA, reverse transcriptase, HIV
☐ Prions and viroids: subviral particles

Content Category 2C: Processes of cell division, differentiation, and specialization

Mitosis and mitotic structures
☐ Mitotic process: prophase, metaphase, anaphase, telophase, interphase
☐ Centrioles, asters, spindles
☐ Chromatids, centromeres, kinetochores
☐ Nuclear membrane breakdown and reorganization
☐ Mechanisms of chromosome movement
☐ Phases of cell cycle: G0, G1, S, G2, M
☐ Growth arrest
☐ Control of cell cycle
☐ Loss of cell cycle controls in cancer cells

Biosignalling
☐ Oncogenes, apoptosis

Reproductive System
☐ Gametogenesis by meiosis
☐ Ovum and sperm - differences in formation and morphology
☐ Relative contribution to next generation
☐ Reproductive sequence: fertilization, implantation, development, birth

Embryogenesis
☐ Stages of early development (order and general features of each stage)
☐ Fertilization
☐ Cleavage
☐ Blastula formation
☐ Gastrulation
☐ First cell movements
☐ Formation of primary germ layers (endoderm, mesoderm, ectoderm)
☐ Neurulation
☐ Major structures arising out of primary germ layers
☐ Neural crest
☐ Environment–gene interaction in development

Development – Cell specialization
☐ Determination
☐ Differentiation
☐ Tissue types
☐ Cell–cell communication in development
☐ Cell migration
☐ Pluripotency: stem cells
☐ Gene regulation in development
☐ Programmed cell death
☐ Existence of regenerative capacity in various species
☐ Senescence and aging

Content Category 3A: Structure and functions of the nervous and endocrine systems and ways in which these systems coordinate the organ systems

Nervous System: Structure and Function

- ☐ High level control and integration of body systems
- ☐ Adaptive capability to external influences
- ☐ Organization of vertebrate nervous system
- ☐ Sensor and effector neurons
- ☐ Sympathetic and parasympathetic nervous systems: antagonistic control
- ☐ Feedback loop, reflex arc
- ☐ Role of spinal cord and supraspinal circuits
- ☐ Feedback control with endocrine system

Nerve Cell and Electrochemistry

- ☐ Cell body: site of nucleus, organelles
- ☐ Dendrites: branched extensions of cell body
- ☐ Axon: structure and function
- ☐ Myelin sheath, Schwann cells, insulation of axon
- ☐ Nodes of Ranvier: propagation of nerve impulse along axon
- ☐ Synapse: site of impulse propagation between cells
- ☐ Synaptic activity: transmitter molecules
- ☐ Resting potential: electrochemical gradient
- ☐ Action potential: threshold, all-or-none
- ☐ Sodium/potassium pump
- ☐ Excitatory and inhibitory nerve fibers: summation, frequency of firing
- ☐ Glial cells, neuroglia
- ☐ Concentration cell: direction of electron flow, Nernst equation

Bio-signaling

- ☐ Voltage and ligand gated ion channels
- ☐ Receptor enzymes
- ☐ G protein-coupled receptors

Lipids

- ☐ Structures
- ☐ Steroids
- ☐ Terpenes and terpenoids

Endocrine System

- ☐ Function of endocrine system: specific chemical control at cell, tissue, and organ level
- ☐ Definitions of endocrine gland, hormone
- ☐ Major endocrine glands: names, locations, products
- ☐ Major types of hormones
- ☐ Neuroendrocrinology — relation between neurons and hormonal systems

Mechanisms of Hormone Action

- ☐ Cellular mechanisms of hormone action
- ☐ Transport of hormones: blood supply
- ☐ Specificity of hormones: target tissue
- ☐ Integration with nervous system: feedback control regulation by second messengers
- ☐ Regulation by second messengers

Category 3B: Structure and integrative functions of the main organ systems

Respiratory System - general function
- ☐ Gas exchange, thermoregulation
- ☐ Protection against disease: particulate matter
- ☐ Structure of lungs and alveoli
- ☐ Breathing mechanisms
- ☐ Diaphragm, rib cage, differential pressure
- ☐ Resiliency and surface tension effects
- ☐ Thermoregulation: nasal and tracheal capillary beds; evaporation, panting
- ☐ Particulate filtration: nasal hairs, mucus/cilia system in lungs
- ☐ Alveolar gas exchange
- ☐ Diffusion, differential partial pressure
- ☐ Henry's Law
- ☐ pH control
- ☐ Regulation by nervous control - CO_2 sensitivity

Circulatory System
- ☐ Functions: circulation of oxygen, nutrients, hormones, ions and fluids, removal of metabolic waste
- ☐ Role in thermoregulation
- ☐ Four-chambered heart: structure and function
- ☐ Endothelial cells
- ☐ Systolic and diastolic pressure
- ☐ Pulmonary and systemic circulation
- ☐ Arterial and venous systems (arteries, arterioles, venules, veins)
- ☐ Structural and functional differences, pressure and flow characteristics of arterial and venous systems

Capillary beds
- ☐ Mechanisms of gas and solute exchange
- ☐ Mechanism of heat exchange
- ☐ Source of peripheral resistance

Composition of blood
- ☐ Plasma, chemicals, blood cells
- ☐ Erythrocyte production and destruction; spleen, bone marrow
- ☐ Regulation of plasma volume
- ☐ Coagulation, clotting mechanisms

Oxygen transport by blood
- ☐ Hemoglobin, hematocrit
- ☐ Oxygen content and affinity
- ☐ Carbon dioxide transport and level in blood
- ☐ Nervous and endocrine control

Lymphatic System
- ☐ Structure of lymphatic system
- ☐ Equalization of fluid distribution
- ☐ Transport of proteins and large glycerides

- ☐ Production of lymphocytes involved in immune reactions
- ☐ Return of materials to the blood

Immune System
- ☐ Innate (non-specific) vs. adaptive (specific) immunity
- ☐ Adaptive immune system cells
- ☐ T-lymphocytes and B-lymphocytes
- ☐ Innate immune system cells - Macrophages and Phagocytes
- ☐ Tissue – Bone marrow, Spleen, Thymus and Lymph nodes
- ☐ Concept of antigen and antibody
- ☐ Antigen presentation
- ☐ Clonal selection
- ☐ Antigen-antibody recognition
- ☐ Structure of antibody molecule
- ☐ Recognition of self vs. non-self, autoimmune diseases
- ☐ Major histocompatibility complex

Digestive System
- ☐ Ingestion
- ☐ Saliva as lubrication and source of enzymes
- ☐ Ingestion; esophagus, transport function

Stomach
- ☐ Storage and churning of food
- ☐ Low pH, gastric juice, mucal protection against self-destruction
- ☐ Production of digestive enzymes, site of digestion
- ☐ Structure (gross)

Liver
- ☐ Structural relationship within gastrointestinal system
- ☐ Production of bile
- ☐ Role in blood glucose regulation, detoxification

Bile
- ☐ Storage in gall bladder
- ☐ Function

Pancreas
- ☐ Production of enzymes
- ☐ Transport of enzymes to small intestine

Small Intestine
- ☐ Absorption of food molecules and water
- ☐ Function and structure of villi
- ☐ Production of enzymes, site of digestion
- ☐ Neutralization of stomach acid
- ☐ Structure (anatomic subdivisions)

Large Intestine
- ☐ Absorption of water
- ☐ Bacterial flora
- ☐ Structure (gross)
- ☐ Rectum: storage/elimination of waste
- ☐ Muscular control: peristalsis
- ☐ Endocrine control: hormones and targets tissues
- ☐ Nervous control: the enteric nervous system

Excretory System
Roles in homeostasis
- ☐ Blood pressure
- ☐ Osmoregulation
- ☐ Acid-base balance
- ☐ Removal of soluble nitrogenous waste

Kidney structure
- ☐ Cortex
- ☐ Medulla
- ☐ Nephron structure
- ☐ Glomerulus
- ☐ Bowman's capsule
- ☐ Proximal tubule
- ☐ Loop of Henle, distal tubule, collecting duct
- ☐ Glomerular filtration
- ☐ Secretion and reabsorption of solutes
- ☐ Concentration of urine
- ☐ Counter-current multiplier mechanism
- ☐ Storage and elimination: ureter, bladder, urethra
- ☐ Osmoregulation: capillary reabsorption of H_2O, amino acids, glucose, ions
- ☐ Muscular control: sphincter muscle

Reproductive System
- ☐ Male and female reproductive structures and their functions
- ☐ Gonads
- ☐ Genitalia
- ☐ Differences between male and female structures

Hormonal control of reproduction
- ☐ Male and female sexual development
- ☐ Female reproductive cycle
- ☐ Pregnancy, parturition, lactation
- ☐ Integration with nervous control

Muscle System - Function
- ☐ Support: mobility
- ☐ Peripheral circulatory assistance
- ☐ Thermoregulation (shivering reflex)
- ☐ Structure of three basic muscle types: striated, smooth, cardiac

Muscle structure and control of contraction
- ☐ T-tubule system
- ☐ Contractile apparatus
- ☐ Sarcoplasmic reticulum
- ☐ Fiber type
- ☐ Contractile velocity of different muscle types
- ☐ Regulation of cardiac muscle contraction
- ☐ Oxygen debt: fatigue

Nervous control
- ☐ Motor neurons
- ☐ Neuromuscular junction, motor end plates
- ☐ Sympathetic and parasympathetic innervation
- ☐ Voluntary and involuntary muscles

Specialized Cell - Muscle Cell
- ☐ Structural characteristics of striated, smooth, and cardiac muscle
- ☐ Abundant mitochondria in red muscle cells: ATP source
- ☐ Actin and myosin filaments, cross-bridge cycle,

sliding filament model
- ☐ Sarcomeres: "I" and "A" bands, "M" and "Z" lines, "H" zone
- ☐ Presence of troponin and tropomyosin
- ☐ Calcium regulation of contraction

Skeletal System
- ☐ Functions of Structural rigidity and support
- ☐ Calcium storage
- ☐ Physical protection
- ☐ Skeletal structure
- ☐ Specialization of bone types, structures
- ☐ Joint structures
- ☐ Endoskeleton vs. exoskeleton

Bone structure
- ☐ Calcium and protein matrix
- ☐ Cellular composition of bone
- ☐ Cartilage: structure and function
- ☐ Ligaments, tendons
- ☐ Endocrine control

Integumentary System (Skin)
- ☐ Layer differentiation, cell types
- ☐ Relative impermeability to water
- ☐ Functions in homeostasis and osmoregulation
- ☐ Functions in thermoregulation
- ☐ Hair, erectile musculature
- ☐ Fat layer for insulation
- ☐ Sweat glands, location in dermis
- ☐ Vasoconstriction and vasodilation in surface capillaries
- ☐ Nails, calluses, hair
- ☐ Protection against abrasion, disease organisms
- ☐ Hormonal control: sweating, vasodilation, and vasoconstriction

Content Category 4A: Translational motion, forces, work, energy, and equilibrium in living systems

Translational motion
- ☐ Units and dimensions
- ☐ Vectors, vector addition
- ☐ Speed, velocity, acceleration

Force and Equilibrium
- ☐ Newton's First Law, inertia
- ☐ Newton's Second Law (F=ma)
- ☐ Newton's Third Law, forces equal and opposite
- ☐ Torques, lever arms
- ☐ Friction, Static and kinetic, Center of mass
- ☐ Vector analysis of forces acting on a point object

Work and Energy
- ☐ Work done by a constant force ($W=Fd\cos\theta$)
- ☐ Mechanical advantage
- ☐ Work Kinetic Energy Theorem
- ☐ Kinetic Energy: $KE= \frac{1}{2} mv^2$, units
- ☐ Potential Energy ($PE=mgh, PE_e=\frac{1}{2} kx^2$ spring)
- ☐ Conservation of energy and forces
- ☐ Power, units

Periodic Motion
- ☐ Amplitude, frequency, phase
- ☐ Transverse and longitudinal waves: wavelength and propagation on speed

Content Category 4B: Fluids in blood circulation, gas movement and gas exchange

Fluids
- ☐ Density, specific gravity
- ☐ Buoyancy, Archimedes' Principle ($F_B=\rho mg$)
- ☐ Hydrostatic pressure, $P=\rho gh$ (pressure vs depth)
- ☐ Pascal's Law $(F_1/A_1) = (F_2/A_2)$
- ☐ Viscosity: Poiseuille Flow
- ☐ Continuity equation (Av=constant)
- ☐ Turbulence at high velocities
- ☐ Surface tension
- ☐ Bernoulli's equation

☐ Venturi effect, pitot tube

☐ Arterial and venous systems; pressure and flow characteristics

Gas Phase
☐ Absolute temperature, Kelvin Scale (K)
☐ Pressure, simple mercury barometer
☐ Molar volume at 0°C and 1 atm = 22.4 L/mol

Ideal gas
☐ Definition
☐ Ideal Gas Law: $PV = nRT$
☐ Boyle's Law: PV = constant
☐ Charles' Law: V/T = constant
☐ Avogadro's Law: V/n = constant
☐ Kinetic Molecular Theory of Gases
☐ Heat capacity at constant volume and at constant pressure
☐ Boltzmann's Constant
☐ Deviation of real gas behavior from Ideal Gas Law: both Qualitative and Quantitative (Van der Waals' Equation)
☐ Partial pressure, mole fraction
☐ Dalton's Law relating partial pressure to composition

Content Category 4C: Electrochemistry and electrical circuits and their elements

Electrostatics
☐ Charge, conductors, charge conservation
☐ Insulators
☐ Coulomb's Law
☐ Electric field E
☐ Field lines
☐ Field due to charge distribution
☐ Electrostatic energy, electric potential at point in space

Circuit elements
☐ Current I =ΔQ/Δt, sign conventions, units
☐ Electromotive force, voltage
☐ Resistance and Ohm's Law: I = V/R
☐ Resistors in series and parallel
☐ Resistivity ρ=RA/L

Capacitance
☐ Parallel plate capacitor
☐ Energy of charged capacitor
☐ Capacitors in series
☐ Capacitors in parallel
☐ Dielectrics
☐ Conductivity
☐ Metallic
☐ Electrolytic
☐ Meters

Magnetism
☐ Definition of magnetic field B
☐ Motion of charged particles in magnetic field; Lorentz force

Electrochemistry
☐ Electrolytic cell
☐ Electrolysis
☐ Anode, cathode
☐ Electrolyte
☐ Faraday's Law relating to the amount of elements deposited (or gas liberated) at an electrode to current
☐ Electron flow; oxidation, and reduction at the electrodes

Galvanic or Voltaic cells
☐ Half-reactions
☐ Reduction potentials, cell potential
☐ Direction of electron flow
☐ Concentration cell

Batteries
☐ Electromotive force, Voltage
☐ Lead-storage batteries
☐ Nickel-cadmium batteries

Specialized nerve cell
☐ Myelin sheath, Schwann cells, insulation of axon
☐ Nodes of Ranvier: propagation of nerve impulse along axon

4D: How light and sound interact with matter

Sound

☐ Production of sound
☐ Relative speed of sound in solids, liquids, and gases
☐ Intensity of sound, decibel units, log scale
☐ Attenuation (Damping)
☐ Doppler Effect: moving sound source or observer, reflection of sound from a moving object
☐ Pitch
☐ Resonance in pipes and strings
☐ Ultrasound
☐ Shock waves

Light, Electromagnetic Radiation

☐ Concept of Interference; Young Double-slit Experiment
☐ Thin films, diffraction grating, single-slit diffraction
☐ Other diffraction phenomena, X-ray diffraction
☐ Polarization of light: linear and circular
☐ Properties of electromagnetic radiation
☐ Velocity equals constant *c*, *in vacuo*
☐ Electromagnetic radiation consists of perpendicularly oscillating electric and magnetic fields; direction of propagation is perpendicular to both
☐ Classification of electromagnetic spectrum, photon energy $E = hf$
☐ Visual spectrum, color

Molecular Structure and Absorption Spectra

☐ Infrared region
☐ Intramolecular vibrations and rotations
☐ Recognizing common characteristic group absorptions, fingerprint region
☐ Visible region
☐ Absorption in visible region gives complementary (e.g. carotene)
☐ Effect of structural changes on absorption (e.g. indicators)
☐ Ultraviolet region
☐ π-electron and non-bonding electron transitions
☐ Conjugated systems
☐ NMR spectroscopy
☐ Protons in a magnetic field; equivalent protons
☐ Spin-spin splitting

Geometrical Optics

☐ Reflection from plane surface: angles of incidence and reflection
☐ Refraction, refractive index *n*, Snell's law: $n_1 \sin\theta_1 = n_2 \sin\theta_2$
☐ Dispersion, change of index of refraction with wavelength
☐ Conditions for total internal reflection
☐ Spherical mirrors
☐ Center of curvature
☐ Focal length
☐ Real and virtual images
☐ Thin lenses
☐ Converging and diverging lenses
☐ Use of $1/p + 1/q = 1/f$, with sign conventions
☐ Lens strength, diopters
☐ Combination of lenses
☐ Lens aberration
☐ Optical Instruments, including

Content Category 4E: Atoms, nuclear decay, electronic structure, and atomic chemical behavior

Atomic Nucleus
- ☐ Atomic number, atomic weight
- ☐ Neutrons, protons, isotopes
- ☐ Nuclear forces, binding energy
- ☐ Radioactive decay (α, β, γ)
- ☐ Half-life, exponential decay, semi-log plots
- ☐ Mass spectrometer

Electronic Structure
- ☐ Orbital structure of hydrogen atom, principal quantum number *n*, number of electrons per orbital
- ☐ Ground state, excited states
- ☐ Absorption and emission line spectra
- ☐ Use of Pauli Exclusion Principle
- ☐ Paramagnetism and diamagnetism
- ☐ Conventional notation for electronic structure
- ☐ Bohr atom
- ☐ Heisenberg Uncertainty Principle
- ☐ Effective nuclear charge
- ☐ Photoelectric effect

The Periodic Table
- ☐ Alkali metals
- ☐ Alkaline earth metals: their chemical characteristics
- ☐ Halogens: their chemical characteristics
- ☐ Noble gases: their physical and chemical characteristics
- ☐ Transition metals
- ☐ Representative elements
- ☐ Metals and non-metals
- ☐ Oxygen group
- ☐ Valence electrons
- ☐ First and second ionization energy: prediction of electronic structure for elements in different groups or rows
- ☐ Electron affinity and variation with group and row
- ☐ Electronegativity: Comparative values for some representative elements and important groups
- ☐ Electron shells and the sizes of atoms and ions

Stoichiometry
- ☐ Molecular weight
- ☐ Empirical versus molecular formula
- ☐ Metric units commonly used in the context of chemistry
- ☐ Description of composition by percent mass
- ☐ Mole concept, Avogadro's number N_A
- ☐ Density
- ☐ Oxidation number
- ☐ Common oxidizing and reducing agents
- ☐ Disproportionation reactions
- ☐ Description of reactions by chemical equations and writing conventions
- ☐ Balancing equation
- ☐ Limiting reactants
- ☐ Theoretical yields

Foundation 5A: Unique nature of water and its solutions

Acid/Base Equilibria
☐ Bronsted-Lowry acids and bases
☐ Ionization of water, *Kw*
☐ Definition of pH: pH of pure water
☐ Conjugate acids and bases (e.g. NH_4^+ and NH_3)
☐ Strong acids and bases (e.g. nitric, sulfuric)
☐ Dissociation of weak acids and bases with and without added salts
☐ Hydrolysis of salts of weak acids or bases
☐ Calculation of pH of solutions of salts of weak acids or bases
☐ Equilibrium constants K_a and K_b: pK_a, pK_b
☐ Definition and concepts of common buffer systems
☐ Influence on titration curves

Ions in Solutions
☐ Anion, cation: common names, formulas and charges for common ions
☐ Hydration, the hydronium ion

Solubility
☐ Units of concentration (e.g. molarity)
☐ Solubility product constant; K_{sp}
☐ Common-ion effect, its use in laboratory separations
☐ Complex ion formation and solubility
☐ Solubility and pH

Titration
☐ Indicators and Neutralization
☐ Interpretation of the titration curves
☐ Redox titration

5B: Nature of molecules and molecular interactions

Covalent Bond
☐ Lewis Electron Dot formulas
☐ Resonance structures
☐ Formal charge
☐ Lewis acids and bases
☐ Partial ionic character: Dipole Moment
☐ Role of electronegativity in charge distribution
☐ σ and π bonds : Hybrid orbitals; sp^3, sp^2, sp and respective geometries
☐ VSEPR theory and the predictions of shapes of molecules (e.g. NH_3, H_2O, CO_2)
☐ Structural formulas for molecules involving H, C, N, O, F, S, P, Si, Cl
☐ Delocalized electrons and resonance in ions and molecules
☐ Multiple bonding
☐ Effect on bond length and bond energies
☐ Rigidity in molecular structure

Stereochemistry of covalently bonded molecules
☐ Structural isomers
☐ Stereoisomers (e.g. enantiomers, diastereomers and cis/trans isomers)
☐ Conformational isomers
☐ Polarization of light, specific rotation
☐ Absolute and relative configuration (R and S forms, E and Z forms)

Liquid phase-intermolecular force
☐ Hydrogen bonding
☐ Dipole interactions
☐ Van der Waals' forces (London dispersion forces)

5C: Separation and Purification Techniques including proteins and peptides

Separation and Purification Methods
- ☐ Extraction and Distillation
- ☐ Chromatography: Basis principles of separation
- ☐ Gas-liquid chromatography
- ☐ HPLC
- ☐ Paper and Thin-layer chromatography
- ☐ Size exclusion chromatography
- ☐ Ion exchange chromatography
- ☐ Affinity chromatography
- ☐ Electrophoresis
- ☐ Quantitative analysis
- ☐ Racemic mixtures, separation of enantiomers

5D: Structure, function, and reactivity of biologically relevant molecules

Nucleotides and Nucleic Acids
- ☐ Nucleotides and nucleosides: composition
- ☐ Sugar phosphate backbone
- ☐ Pyrimidine, purine residues
- ☐ Deoxyribonucleic acid: DNA, double helix
- ☐ Chemistry and additional functions

Amino Acids/Peptides
- ☐ Absolute configuration at the α position
- ☐ Amino acids as dipolar ions
- ☐ Acidic or basic
- ☐ Hydrophobic or hydrophilic, Hydrolysis
- ☐ Synthesis of α-amino acids: Strecker and Gabriel
- ☐ Sulfur linkage for cysteine and cysteine
- ☐ Peptide linkage: polypeptides and proteins
- ☐ Isoeletric point

Proteins
- ☐ 1°, 2°, 3°, 4° structure of proteins
- ☐ Role of proline, cystine, hydrophobic bonding
- ☐ Denaturing and folding
- ☐ Hydrophobic interactions
- ☐ Solvation layer (entropy)

Non-Enzymatic Protein Function
- ☐ Binding
- ☐ Immune system
- ☐ Motor

Types of Lipids
- ☐ Storage including triacylglycerols
- ☐ Free fatty acids: saponification

Structural
- ☐ Phospholipids and phosphatids
- ☐ Sphingolipids and Waxes

Lipids as Signaling molecules and cofactors
- ☐ Fat-soluble vitamins
- ☐ Steroids and Prostaglandins

Carbohydrates
- ☐ Nomenclature and classification, common names
- ☐ Absolute configuration
- ☐ Cyclic structure and conformations of hexoses
- ☐ Epimers and anomers
- ☐ Hydrolysis of the glycoside linkage
- ☐ Keto-enol tautomerism of monosaccharides
- ☐ Disaccharides, Polysaccharides

Aldehydes and Ketones
- ☐ Nomenclature
- ☐ Physical properties
- ☐ Nucleophilic addition reactions at C=O bond
- ☐ Formation of Acetal, hemiacetal
- ☐ Imine, enamine and Cyanohydrin
- ☐ Hydride reagents
- ☐ Oxidation of aldehydes
- ☐ Reactions at adjacent positions: enolate chemistry
- ☐ Keto-enol tautomerization (racemization)
- ☐ Aldol condensation, retro-aldol
- ☐ Kinetic versus thermodynamic enolate
- ☐ Effect of substituents on reactivity of C=O; steric hindrance
- ☐ Acidity of α-H; carbanions

Alcohols

☐ Nomenclature

☐ Physical properties (acidity, hydrogen bonding)
☐ Oxidation, Substitution reactions: S_N1 or S_N2
☐ Protection of alcohols
☐ Preparation of mesylates and tosylates

Carboxylic Acids

☐ Nomenclature
☐ Physical properties
☐ Carboxyl group reactions
☐ Amides (and lactam), esters (and lactone), anhydride formation
☐ Reductions and Decarboxylation
☐ Reactions at 2-position, substitution

Acid Derivatives (Anhydrides, Amides, Esters)

☐ Nomenclature and physical properties
☐ Nucleophilic substitution
☐ Hydrolysis of amides and Transesterification
☐ Relative reactivity of acid derivatives
☐ Steric effects
☐ Electronic effects
☐ Strain (β-lactams)

Phenols

☐ Oxidation and reduction (e.g., hydroquinones), ubiquinones: biological 2e– redox centers

Polycyclic and Heterocyclic Aromatic Compounds

☐ Biological aromatic heterocycles

5E: Principles of chemical thermodynamics and kinetics

Enzymes

☐ Enzyme classification by reaction type
☐ Substrates and specificity
☐ Active site model
☐ Induced-fit model
☐ Cofactors, coenzymes and vitamins
☐ General Kinetics and catalysis
☐ Michaelis-Menten
☐ Cooperativity
☐ Effects of local conditions on enzyme activity
☐ Inhibition
☐ Regulatory enzymes
☐ Allosteric
☐ Covalently modified

Principles of Bioenergetics

☐ Bioenergetics/thermodynamics
☐ Free energy/K_{eq}, Concentration
☐ Phosphorylation/ATP
☐ ATP hydrolysis and ATP group transfers
☐ Biological oxidation–reduction
☐ Half-reactions
☐ Soluble electron carriers
☐ Flavoproteins

Energy changes in chemical reactions

☐ Thermodynamic system – state function
☐ Zeroth Law – concept of temperature
☐ PV diagram: work done = area under or enclosed by curve
☐ First Law: $\Delta E = Q - W$ (conservation of energy)
☐ Second Law – concept of entropy and as a measure of disorder
☐ Relative entropy for gas, liquid, and crystal states
☐ Calorimetry, heat capacity, specific heat
☐ Heat transfer – conduction, convection, radiation
☐ Endothermic/exothermic reactions
☐ Enthalpy, H, and standard heats of reaction and formation
☐ Hess' Law of Heat Summation
☐ Bond dissociation energy as related to heats of formation
☐ Free energy: G and spontaneous reactions $\Delta G°$
☐ Coefficient of expansion
☐ Heat of fusion, heat of vaporization
☐ Phase diagram: pressure and temperature

Kinetics and equilibrium in chemical reactions

☐ Reaction rate, rate law and rate constant
☐ Dependence of reaction rate upon concentration of reactants
☐ Reaction order
☐ Rate determining step
☐ Dependence of reaction rate on temperature
☐ Activation energy
☐ Activated complex or transition state
☐ Interpretation of energy profiles showing energies of reactants, products, activation energy ΔH for the reaction
☐ Use of the Arrhenius Equation
☐ Kinetic control versus thermodynamic control
☐ Catalysts
☐ Equilibrium in reversible chemical reactions
☐ Law of Mass Action
☐ Equilibrium Constant
☐ Application of Le Chatelier's principle
☐ Relationship of the equilibrium constant and $\Delta G°$

6A: Sensing the environment

Sensory Processing

☐ Sensation and thresholds
☐ Weber's Law
☐ Signal detection theory
☐ Sensory adaptation, Psychophysics
☐Sensory receptors, types and pathways

Vision

☐ Structure and function of the eye
☐ Visual processing and pathways in the brain
☐ Parallel processing and feature detection

Hearing

☐ Structure and function of ear
☐ Auditory processing and pathways in the brain
☐ Sensory reception by hair cells

Other Senses

☐ Somatosensation and pain perception
☐ Taste and Taste buds/chemoreceptors
☐ Smell; olfactory cells/chemoreceptors
☐ Pheromones and olfactory pathways in the brain
☐ Kinesthetic sense and vestibular sense

Perception

☐ Bottom-up/Top-down processing
☐ Perceptual organization (e.g., depth, form, motion, constancy)
☐ Gestalt principles

6B: Making sense of the environment

Attention

☐ Selective and divided attention

Cognition

☐ Information-processing model
☐ Cognitive development
☐ Piaget's stages of cognitive development
☐ Cognitive changes in late adulthood
☐ Role of culture in cognitive development
☐ Influence of heredity and environment on cognitive development
☐ Biological factors that affect cognition
☐ Types of problem solving and decision making
☐ Barriers to effective problem solving
☐ Approaches to problem solving
☐ Heuristics, biases, intuition, and emotion
☐ Overconfidence and belief perseverance
☐ Intellectual functioning
☐ Theories of intelligence
☐ Influence of heredity and environment on intelligence
☐ Variations in intellectual ability

Consciousness

☐ States of consciousness, Alertness
☐ Sleep and Stages of sleep
☐ Sleep cycles, circadian rhythms
☐ Dreaming, Sleep-wake disorders
☐ Hypnosis and meditation
☐ Consciousness altering drugs and their effects on the nervous system and behavior
☐ Drug addiction and the reward pathway in the brain

Memory

☐ Encoding and processes that aid encoding memories
☐ Process of encoding information
☐ Types of memory storage (e.g., sensory, working, long-term)
☐ Semantic networks and spreading activation
☐ Recall, recognition, and relearning
☐ Role of emotion and memory retrieval and retrieval cues
☐ Aging and memory

☐ Memory dysfunctions (Alzheimer's disease, Korsakoff's syndrome)
☐ Decay and forgetting
☐ Interference and Long-term potentiation
☐ Memory construction and source monitoring
☐ Changes in synaptic connections underlie memory and learning
☐ Neural plasticity, memory and learning

Language

☐ Theories of language development (e.g., learning, Nativist, Interactionist)
☐ Influence of language on cognition
☐ Different brain areas control language and speech

6C: Responding to the World

Emotion

☐ Cognitive, physiological, and behavioral components of emotion
☐ Universal emotions (e.g., fear, anger, happiness, surprise, joy, disgust, sadness)
☐ Adaptive role of emotion

Theories of emotion

☐ James-Lange theory
☐ Cannon-Bard theory
☐ Schachter-Singer theory
☐ Biological processes and perception of emotion
☐ Brain regions in generation and experience of emotions
☐ The role of the limbic system in emotion
☐ Emotion and the autonomic nervous system
☐ Physiological markers of emotion (signatures of emotion)

Stress

☐ The nature of stress
☐ Appraisal
☐ Different types of stressors
☐ Effects of stress on psychological functions
☐ Stress outcomes/response to stressors
☐ Emotional
☐ Behavioral
☐ Stress management

7A: Individual influences on behavior - biological bases of behavior

The nervous system
☐ Neurons (e.g. the reflex arc)
☐ Neurotransmitters
☐ Structure and function of peripheral nervous system
and central nervous system
☐ The brain
☐ The Forebrain, Midbrain, Hindbrain
☐ The cerebrum
☐ The spinal cord
☐ Lateralization of cortical functions
☐ Methods of studying the brain
☐ Neurons communicate and influence behavior
☐ Influence of neurotransmitters on behavior

The endocrine system
☐ Components of the endocrine system
☐ Role of the endocrine system in behavior
☐ Behavioral genetics
☐ Genes, temperament, and heredity
☐ Adaptive value of traits and behaviors
☐ Interaction between heredity and environmental influences

Genetic and environmental factors contribute to the development of behaviors
☐ Experience and behavior
☐ Regulatory genes and behavior
☐ Genetically based behavioral variation in natural populations
☐ Human physiological development
☐ Prenatal development
☐ Motor development
☐ Developmental changes in adolescence

Personality
☐ Theories of personality
☐ Psychoanalytic perspective
☐ Humanistic perspective
☐ Trait perspective
☐ Social cognitive perspective
☐ Biological perspective
☐ Behaviorist perspective
☐ Situational approach to explaining behavior

Psychological Disorders
☐ Biomedical vs. biopsychosocial approaches
☐ Classifying psychological disorders
☐ Rates of psychological disorders
☐ Anxiety disorders, Obsessive-compulsive disorder
☐ Somatic symptom and related disorders
☐ Depressive disorders
☐ Schizophrenia, Bipolar and related disorders
☐ Dissociative and Personality disorder
☐ Trauma and stressor related disorders

Biological bases of nervous system disorders
☐ Schizophrenia
☐ Depression
☐ Alzheimer's disease
☐ Parkinson's disease
☐ Stem cell-based therapy to regenerate neurons in CNS

Motivation
☐ Factors that influence motivation
☐ Instinct
☐ Arousal
☐ Drives (e.g. negative feedback systems)
☐ Needs
☐ Drive reduction theory
☐ Incentive theory
☐ Cognitive and need based theories
☐ Biological and Socio-cultural motivators that regulate behavior (e.g. hunger, sex-drive, substance addiction)

Attitudes
☐ Components of attitudes (i.e., cognitive, affective, and behavioral)
☐ The link between attitudes and behavior
☐ Processes by which behavior influences attitudes (e.g. Foot-in-the door phenomenon, Role-playing effects)
☐ Processes by which attitudes influence behavior
☐ Cognitive dissonance theory

7B: Social processes that influence human behavior

How the Presence of Others Affects Individual Behavior
☐ Social facilitation
☐ Deindividuation
☐ Bystander effect
☐ Social loafing, social control
☐ Peer pressure, Conformity, Obedience

Group Processes
☐ Group polarization
☐ Groupthink

Normative and Non-normative Behavior
☐ Social norms and Sanctions
☐ Folkways, mores and taboos
☐Anomie
☐ Perspectives on deviance (e.g. differential association, labeling theory, strain theory
☐ Aspects of collective behavior (e.g. fads, mass hysteria, riots)

Socialization
☐Agents of socialization (e.g. family, mass media, peers, work place)

7C: Attitude and behavior change

Habituation and Dishabituation
Associative Learning

☐Classical conditioning
☐ Neutral, conditioned, and unconditioned stimuli
☐ Conditioned and unconditioned response
☐ Processes: acquisition, extinction, spontaneous recovery, generalization, discrimination
☐ Operant conditioning
☐ Processes of shaping and extinction
☐ Types of reinforcement: positive, negative, primary, conditional
☐ Reinforcement schedules: fixed-ratio, variable-ratio, fixed-interval, variable-interval
☐ Punishment
☐ Escape and avoidance learning
☐ Role of cognitive process in associative learning
☐ Biological processes that affect associative learning (e.g. biological predisposition, instinctive drift)

Observational Learning
☐ Modeling
☐ Biological processes that affect observational learning
☐ Mirror neurons
☐ Role of the brain in experiencing vicarious emotions
☐ Applications of observational learning to explain individual behavior

Theories of Attitude and Behavior Change
☐ Elaboration Likelihood Model
☐ Social Cognitive theory
☐ Factors that affect attitude change (e.g. changing behavior, characteristics of the message and target, social factors)

8A: Self identity

Self-Concept and Identity

☐ Definitions of self-concept, identity, and social identity
☐ The role of self-esteem, self-efficacy, and locus of control in self-concept and self-identity
☐ Different types of identities (e.g., race/ethnicity, gender, age, sexual orientation, class)

Formation of Identity

☐ Theories of identity development (e.g., gender, moral, psychosexual, social)
☐ Influence of social factors on identity formation
☐ Influence of individuals (e.g., imitation, role-taking)
☐ Influence of group (e.g., reference group)
☐ Influence of culture and socialization on identity formation

8B: Social thinking

Attributing Behavior to Persons or Situations

☐ Attribution processes (e.g. Fundamental attribution error, role of culture in attributions)
☐ How self-perceptions shape our perceptions of others
☐ How perceptions of the environment shape our perceptions of others

Prejudice and Bias

☐ Stereotypes, Stigma
☐ Ethnocentrism vs. cultural relativism
☐ Power, prestige, and class
☐ The role of emotion in prejudice
☐ The role of cognition in prejudice

Processes Related to Stereotypes

☐ Self-fulfilling prophecy
☐ Stereotype threat

8C Social Interactions

Elements of Social Interaction

☐ Statuses (e.g. achieved, ascribed)
☐ Role conflict, role strain and role exit
☐ Groups: primary and secondary
☐ In-group vs. Out-group, Group size (e.g. dyads, triads)
☐ Networks
☐ Organization: Formal organization
☐Characteristics of ideal bureaucracy, perspective on bureaucracy (e.g. iron law of oligarchy, McDonaldization)

Self-presentation and Interacting with Others

☐ Expressing and detecting emotion
☐ Role of gender and culture in expression and detection of emotion

Impression management

☐ Front stage vs. back stage self (Dramaturgical approach)
☐ Verbal and nonverbal communication
☐ Animal signals and communication

Social Behavior

☐ Attraction, attachment
☐ Aggression
☐ Social support

Biological explanations of social behavior in animals

☐ Foraging behavior
☐ Mating behavior and mate choice
☐ Applying game theory
☐ Altruism
☐ Inclusive fitness

Discrimination

☐ Individual vs. institutional discrimination
☐ Prejudice and discrimination

☐ How power, prestige, and class facilitate discrimination

9A: Understanding Social Structure

Theoretical Approaches

☐ Microsociology vs. macrosociology
☐ Functionalism
☐ Conflict theory
☐ Symbolic interactionism
☐ Social constructionism
☐ Exchange-rational choice
☐ Feminist theory

Social Institutions

☐ Education: hidden curriculum, teacher expectancy and educational segregation and stratification
☐ Family: forms of kinship, diversity in family forms
☐ Marriage and divorce
☐ Violence in family (e.g. child, elder and spousal abuse)
☐ Religion: religiosity
☐ Types of religious organizations (e.g. church, sect, cult)
☐ Religion and social change (e.g. modernization, secularization, fundamentalism)
☐ Government and economy: Power and authority
☐ Comparative economics, political systems and division of labor
☐ Health and medicine: Delivery of health care
☐ The sick role, illness experience
☐ Medicalization and social epidemiology

Culture

☐ Elements of culture (e.g. beliefs, language, rituals, symbols, values)
☐ Material vs. symbolic culture
☐ Culture lag, culture shock
☐ Assimilation and Multiculturalism
☐ Subculture and counterculture
☐ Mass media and popular culture
☐ Evolution and human culture
☐ Transmission and diffusion

9B: Demographic characteristics and processes

Demographic characteristics and processes

☐ Aging and the life course
☐ Age cohorts and social significance of aging
☐ Sex vs. gender
☐ Social construction of gender and gender segregation
☐ Race and ethnicity: social construction of race
☐ Racialization and racial formation
☐ Patterns of immigration and intersections with race and ethnicity
☐ Sexual orientation

Demographic Shifts and Social Change

☐ Theories of demographic change (e.g. Malthusian theory and demographic transition)
☐ Population growth and decline (e.g. population projections, population pyramids)
☐ Fertility and mortality rates (e.g. total, crude, age-specific)
☐ Patterns in fertility and mortality
☐ Push and pull factors in migration
☐ Organization of social movements; strategies and tactics
☐ Relative deprivation
☐ Factors contributing to globalization (e.g. communication technology, economic interdependence)
☐ Perspectives on globalization
☐ Social changes in globalization (e.g. civil unrest, terrorism)
☐ Industrialization and urban growth
☐ Suburbanization and urban decline
☐ Gentrification and urban renewal

10A: Social inequality

Spatial Inequality
☐Residential segregation
☐ Environmental justice (location and exposure to health risks)
☐ Neighborhood safety and violence

Social Class
☐ Aspects of social stratification
☐ Social class and socioeconomic status
☐ Class consciousness and false consciousness
☐ Cultural capital and social capital
☐ Social reproduction
☐ Power, privilege and prestige
☐ Intersectionality (e.g. race, gender and age)

Patterns of social mobility
☐ Intergenerational and intra-generational mobility
☐ Vertical and horizontal mobility
☐ Meritocracy

Poverty
☐ Relative and absolute
☐ Social exclusion (segregation and isolation)

Health Disparities
☐ Race, gender, and class inequalities in health

Healthcare Disparities
☐ Race, gender, and class inequalities in healthcare