M.S. Comprehensive Exam Study Topics

Exercise Physiology (PEP 426) 25%

- Muscle fiber anatomy
- Troponin & tropomyosin
- All or none motor recruitment phenomenon
- Fast vs. slow twitch fibers
- Action potential (role of sodium & potassium)
- Nerve anatomy
- Muscle spindle
- Golgi tendon organ
- Key hormones of glycogenolysis
- Calcium storage site
- Motor end plate
- Acetycholine
- Sarcomere/ sarcolemma
- Roles of O2 and CO2 in respiration
- Ventilation perfusion ratio
- Exercise induced hypoxia/ hypoxemia
- Myoglobin, hemoglobin
- Ventilatory control during submax exercise
- Chemoreceptors in blood (partial pressures of CO2 & O2)
- Buffers (acid/base regulation)
- Cardiovascular system: function and basic anatomy of heart
- Electrical conduction system
- Time frames of systole & diastole
- Pulse pressure
- EKG strips
- Medulla oblongata (brain control system)
- Sympathetic & parasympathetic systems
- Blood flow through arteries (enhance/slow down)
- Peripheral resistance
- Ohm’s Law (cardiac output)
- Frank/Starling Effect
- Hormones that maintain glucose levels during exercise
- Max HR, Q, VO2
- Arterial/venous O2 difference
- Purpose of enzymes
- Food substrates role in exercise (Carbohydrates, Fats, Proteins)
- Glycolysis (generally known)
- Regulating enzymes for glycolysis
- Endergonic & exergonic reactions
- Entropy
- Fatty acids
- ATP & creatine phosphate roles in energy production
- Adenylate reaction (AMP)
- TCA/ electron transport chain
- Role of NADH, NADH+, and FAD
- Lactate > pyruvate
- Fats: beta oxidation
- Watts
- Blood vessels: know most/least resistance
- Pulmonary transit time
- T-tubules
- Arterial blood oxygen content
- Lipids use in exercise
- What breaks down ATP, Creatine phosphate
- How efficient is our body
- Direct calorimetry; Kcals
- RER
- ATP/CP: Which is limiting factor
- Q vs. VO2
- Enzyme reactions
- Ejection fraction
- Know resting EF value, ventilation (L/min) value, SV value
- Coenzyme A
- Recruitment order of fast twitch vs. slow twitch fibers
- EPOC
- Oxygen deficit
- S1 Units (heavy/light chains)
- FICK equation
- BOHR effect
- How much O2 binds to hemoglobin (ml/g)
- pO2/pCO2 at sea level
- Vasodilation/constriction
- Bicarbonate system (CO2 going back to heart)
- Contractility of heart
- BP of systemic & pulmonary systems
- (In exercise) Function of pituitary gland, adrenal cortex, adrenal medulla, pancreas, growth hormones, epinephrine/norepinephrine, insulin, lactate threshold
- Hypoglycemia/hyperglycemia
- Endothelium

**Physiological Assessment (PEP 470, PEP 530, PEP 532) 15%**

- BMI
- Sit and reach test
- Baroreceptor reflex
- Submax field tests and accuracy in VO2 estimation (% error?)
- MET values for different activities
- Target HR calculation
- Criteria to stop VO2 max test
- Interpretation of HR, BP, RPE
- Skinfold recommendations (prediction equations for men/women)
- Residual lung volume
- Vital capacity
- Max expiratory capacity (lung capacity)
- Importance of lung volume exhalation during hydrostatic weighing
- Percent error in skinfolds & hydrostatic weighing
- How are equations developed for race/sex
- NIR, BIA, SKF, Circumferences

**Exercise Programming and Prescription (PEP 470) 15%**

- Hr max, %HR max, HR reserve, Karvonen, RPE
- MET method calculations
- Typical improvement in VO2 (with CV exercise)
• ACSM prescription: days/week, intensity, mode
• Karvonen calculations
• METs to VO2
• Resistance training: constant, variable, accommodating
• ACSM recommendations for resistance training
• Review strength chapter in Dr. Heyward’s text
• Stretching techniques: ballistic, CR, CRAC, static
• PNF techniques
• High volume vs. low volume resistance training
• Hypertrophy recommendations
• Progressive overload principle
• Specificity of training principle
• Adaptation principle

**Exercise, Health, and Disease (PEP 426, PEP 470) 10%**

• Lack of physical activity ramifications
• Hypertension numbers
• Risk factors for coronary artery disease
• LDL/HDL numbers
• Which type of blood pressure cuff is preferable
• ACSM recommendations for health
• Basic guidelines for submax/max testing (When is Dr. required)
• Hyperlipidemia
• Diabetes (Type I and II)
• Cancer
• Smoking
• Low Back Pain

**Clinical Applications (PEP 426, PEP 475, PEP 476) 10%**

• Best 3 leads
• QRS/ PR times/ boxes
• T waves
• Know what is happening during each wave
• R to R method
• Regular vs. irregular rates
- NSR criteria
- Tachycardia, bradycardia
- SA node, AV node (Electrical conduction system)
- PVC, PAC
- Effect of beta blockers, calcium channel blockers
- AV block
- ST depression/elevation
- Sensitivity & specificity
- Atrial fibrillation
- Systole/ asystole
- Right bundle branch block
- Leads on frontal & horizontal planes
- Ischemia
- Most common treadmill protocol
- Bipolar leads, unipolar leads, precordial leads
- Cardiac arrest
- Basic arrhythmias

**Nutrition and Exercise (PEP 426, PEP 470) 10%**

- Hormones associated with Fat metabolism
- Kcals
- Effect of low fat diets on hypercholesterolemia
- Dietary goals (% fat, carbohydrates, protein)
- Harris Benedict Formula
- Hydration in exercise
- Acidosis
- Macro/micro nutrients
- Glycemic index
- RDA of protein, carbohydrate, fat (g/body weight)
- Carbohydrate concentration for quickest gastric emptying
- Ergogenic aids
- Glycogen sparing in fatty acid oxidation
Research Design and Statistics  (PEP 507, Ed Psy 603) 10%

- Factorial Experiment
- Dependent variable, independent variable, control variable
- Purpose of T-test
- When analysis of variance used
- Multiple analysis of variance (alpha @ .05); how would you keep it there with multiple ANOVAs (.05/# of t-tests = .01)
- What is good size for correlational study
- How to determine variance if given correlation coefficient
- Prediction study...criterion variable
- Causal comparative research
- Purpose of experiments
- Cause vs. effect
- Experimental treatment
- Good sample size for experimental research
- Hawthorne effect, Hawthorne halo, Novelty
- Extraneous variables/ randomization (purpose)
- Threats to internal/external validity
- Skew, positive/negative, bimodal
- Measures of central tendency
- Measures of variability
- Mean, Median, Mode
- Standard deviation (percentages)
- Good correlation/ poor correlation
- Alpha

Kinesiological Analysis of Exercise/Biomechanics (undergrad requirements) 5%

- Sagittal, frontal, horizontal planes
- Plantar flexion
- Types of joints
• First, second, third class levers
• Connective tissues
• Basic anatomy
• Force velocity relationship
• Isometric contraction
• Tensor fascia latae, IT band
• Low back syndrome
• Basic movement patterns
  o Eccentric/concentric
  o Flexion/extension
  o Adduction/abduction

END