

Medical Anatomy and Physiology

Exam Information	Description
Exam number 702 Items 104 National Career Cluster Healthcare & Human Services Certification available Yes	This full-year course provides students with an in-depth study of several healthcare careers. Topics include intermediate anatomy & physiology, medical terminology, diseases and disorders, and medical ethics. The class is designed to prepare students for the Advanced Medical Anatomy and Physiology course and/or for a variety of health science programs.

Exam Blueprint and Performance Skills

Standard	Percentage of exam score
1. Body Plan and Organization	6%
2. Body Chemistry	8%
3. Cells	6%
4. Histology and Integumentary System	5%
5. Skeletal System	8%
6. Muscular System	10%
7. Nervous System and Special Senses	10%
8. Endocrine System	5%
9. Blood	6%
10. Lymphatic System	3%
11. Cardiovascular System	5%

12. Respiratory System	6%
13. Digestive System	6%
14. Urinary System	8%
15. Reproduction System	8%

Standard 1 - Body Plan, Organization, Homeostasis (3% of exam score)

Candidates will develop and utilize models to describe how the body is organized, how it functions, and how it maintains a stable internal environment (homeostasis).

Objective 1 Contrast the sciences of anatomy and physiology.

Objective 2 Describe the six levels of structural organization of the human body and their interrelationship.

1. Chemical
2. Cellular
3. Tissue
4. Organ
5. System
6. Organism

Objective 3 Compare and contrast the types of metabolism:

1. Anabolic
2. Catabolic

Objective 4 Identify commonly used planes to divide the body based upon anatomical position.

1. Sagittal
2. Midsagittal
3. Transverse (horizontal)
4. Frontal (coronal)

Objective 5 Apply directional terms used in human anatomy.

1. Anterior
2. Posterior
3. Medial
4. Lateral
5. Proximal
6. Distal
7. Superficial
8. Deep
9. Superior
10. Inferior
11. Dorsal
12. Ventral

Objective 6 Identify the body cavities and locate the following organs within each cavity.

1. Dorsal Cavity
 - a. Vertebral (spinal) -spinal cord

- b. Cranial-brain
- 2. Ventral Cavity
 - a. Thoracic
 - i. Mediastinum-heart, bronchi, esophagus, thymus.
 - ii. Pericardial-heart
 - iii. Pleural-lungs
- 3. Abdominopelvic Cavity
 - a. Abdominal-liver, spleen, intestines, kidneys, stomach, pancreas
 - b. Pelvic-intestines, urinary bladder, sex organs

Objective 7 Identify the major organ(s) in each abdominal quadrant.

- 1. Right upper quadrant (RUQ)- -liver, gallbladder, right kidney
- 2. Right lower quadrant (RLQ) - -cecum, appendix, right ovary
- 3. Left upper quadrant (LUQ)- -spleen, stomach, left kidney, pancreas
- 4. Left lower quadrant (LLQ)- -left ovary

Objective 8 Examine the effects of stress on homeostasis.

Objective 9 Differentiate between negative and positive feedback mechanisms to maintain homeostasis. Give examples of each.

- 1. Negative feedback examples: blood pressure, blood glucose, thermoregulation, etc.
- 2. Positive feedback examples: childbirth, breast feeding, blood clotting, etc.

Standard 2 - Body Chemistry (4%)

Candidates will develop and utilize models to describe how the body is organized, how it functions, and how it maintains a stable internal environment (homeostasis).

Objective 1 Review the following terms and concepts.

- 1. States of matter
- 2. Elements
- 3. Basic components of the atom
 - a. Nucleus
 - b. Electrons
 - c. Protons
 - d. Neutrons

Objective 2 Identify the four major elements in the body.

- 1. Carbon - C
- 2. Hydrogen - H
- 3. Oxygen - O
- 4. Nitrogen - N

Objective 3 Differentiate between:

- 1. Compound
- 2. Molecule

Objective 4 Describe the characteristics of bonds.

1. Ionic bonds
2. Covalent bonds
 - a. Polar
 - b. Non-polar
3. Hydrogen bonds

Objective 5 Analyze solute ions in a solution (electrolytes) and differentiate between:

1. Cation
2. Anion

Objective 6 Describe the properties of water and how it is utilized in the human body.

1. Universal solvent
2. Transport
3. Lubricant
4. Heat capacity
5. Chemical reactions

Objective 7 Distinguish between inorganic compounds and organic compounds..

Objective 8 Describe the structures and functions of the following organic macromolecules and give an example of each:

1. Carbohydrates
2. Proteins (amino acids)
3. Lipids
4. Nucleic acids (RNA, DNA)

Objective 9 Define pH and identify the different solutions based on the pH scale.

1. Acidic
2. Basic (alkaline)
3. Neutral
4. Blood pH = 7.35 to 7.45

Objective 10 Describe how the body produces energy during cellular respiration.

1. $\text{ATP} \leftrightarrow \text{ADP} + \text{P} + \text{ENERGY}$

Standard 3 - Cells (2%)

Candidates will construct an explanation of the basic principles of body chemistry (matter, structure, and function).

Objective 1 Identify the principal parts of a generalized animal cell and their functions.

1. Nucleus
 - a. Nucleolus
 - b. Chromosome
 - i. Chromatin
 - ii. Gene (DNA, RNA)
2. Cytoplasm
 - a. Cytosol
3. Organelles
 - a. Ribosome
 - b. Endoplasmic Reticulum (smooth, rough)
 - c. Golgi complex (body)
 - d. Lysosome
 - e. Mitochondria
 - f. Centrosome (centrioles)
4. Cell membrane
 - a. Components of the phospholipid bilayer
 - b. Modifications of the cell membrane
 - i. Microvilli - absorption
 - ii. Cilia - transports products along the surface of the cell
 - iii. Flagella – transports

Objective 2 Describe a selectively permeable membrane and factors which influence permeability.

Objective 3 Contrast intracellular and extracellular fluid in terms of location and composition.

Objective 4 Describe each of the following cellular transport processes and classify them as active or passive.

1. Passive processes
2. Simple diffusion
3. Facilitated diffusion
4. Filtration (dialysis)
5. Osmosis
6. Active processes
7. Endocytosis (phagocytosis)
8. Exocytosis
9. Active transport (Sodium/Potassium pump)

Objective 5 Compare and contrast epithelial and connective tissue membranes.

1. Isotonic
2. Hypotonic

3. Hypertonic

Objective 6 Compare and contrast skeletal, cardiac, and smooth muscle tissue.

1. Mitosis
2. Meiosis

Objective 7 Describe and identify the key features of nervous tissue.

1. Neuron
2. Glial cells

Standard 4 - Histology and Integumentary System (3%)

Candidates will plan and carry out an investigation to compare and contrast the basic structures and functions of histology, and the integumentary system.

Objective 1 Identify and describe the general characteristics and functions of each of the four principal types of tissues.

1. Epithelial-squamous, cuboidal, columnar
2. Connective-adipose, cartilage, dense fibrous, blood, bone
3. Muscular-skeletal, smooth, cardiac
4. Nervous – neurons, neuroglial cells

Objective 2 Differentiate between the four basic types of tissue membranes.

1. Mucous
2. Serous
3. Visceral
4. Parietal
5. Synovial
6. Cutaneous

Objective 3 Identify and describe the structures and functions of the integumentary system components.

1. Skin
2. Glands
3. Hair
4. Nails

Objective 4 Identify the major layers of skin.

1. Epidermis
2. Dermis
3. Subcutaneous (hypodermis)

Objective 5 Contrast the following types of glands:

1. Exocrine glands (sudoriferous, sebaceous)
2. Endocrine glands (hormones)

Objective 6 Explain the following diseases and disorders of the integumentary system.

1. Skin cancers
 - a. Basal cell carcinoma
 - b. Squamous cell carcinoma
 - c. Malignant melanoma
2. Decubitus ulcers
3. Eczema
4. Acne
5. Lesion
6. Burns
7. 1st degree (superficial)
8. 2nd degree (partial thickness)
9. 3rd degree (full thickness)

Objective 7 Identify nerve endings of the integumentary system and describe their functions.

1.

Objective 8 Describe the structures and functions of accessory structures of the integumentary system.

1. Hair
2. Nails

Objective 9 Explain the role of skin in the maintenance of body temperature (thermoregulation).

Standard 5 - Skeletal System (8%)

Candidates will develop and use models to relate the structure of the skeletal system to its functional role in movement, protection, and support.

Objective 1 Describe the general functions of the skeletal system.

1. Structure/support
2. Muscle attachment/movement
3. Mineral storage
4. Hematopoiesis

Objective 2 Identify the roles of the following in bone growth and ossification:

1. Osteoblasts
2. Osteocytes
3. Osteoclasts

Objective 3 Identify the four shapes of bones with characteristics and examples of each.

1. Short
2. Flat
3. Irregular
4. Long

Objective 4 Identify the features of a long bone.

1. Periosteum
2. Diaphysis
3. Epiphysis
4. Medullary cavity
5. Red marrow
6. Yellow marrow
7. Articular cartilage
8. Endosteum
9. Compact bone
10. Spongy bone

Objective 5 Define and locate the following bone markings.

1. Foramen
2. Meatus
3. Sinus
4. Fossa
5. Condyle
6. Tuberosity
7. Trochanter
8. Tubercle
9. Process

Objective 6 Describe and differentiate between the following terms:

1. Suture
2. Fontanel

Objective 7 Locate the following bones of the axial and appendicular skeletons.

1. Axial Skeleton
 - a. Mandible
 - b. Maxilla
 - c. Zygomatic
 - d. Frontal
 - e. Parietal
 - f. Occipital
 - g. Sphenoid
 - h. Ethmoid
 - i. Hyoid
 - j. Temporal
 - k. Vertebrae
 - l. Ribs
 - m. Sternum
2. Appendicular Skeleton
 - a. Clavicle
 - b. Scapula
 - c. Pelvic bone
 - i. Ilium
 - ii. Ischium
 - iii. Pubis

- d. Femur
- e. Patella
- f. Tibia
- g. Fibula
- h. Tarsals
- i. Metatarsals
- j. Phalanges (hands and feet)
- k. Humerus
- l. Ulna
- m. Radius
- n. Carpals
- o. Metacarpals

Objective 8 Contrast the average number, location, and function of each of the five groups of vertebrae.

- 1. Cervical
- 2. Thoracic
- 3. Lumbar
- 4. Sacral
- 5. Coccygeal

Objective 9 Explain the structural and functional classifications of articulations.

- 1. Structural:
 - a. Fibrous
 - b. Cartilaginous
 - c. Synovial
- 2. Functional:
 - a. Synarthrotic
 - b. Amphiarthrotic
 - c. Diarthrotic

Objective 10 Differentiate between ligaments and tendons.

Objective 11 Describe the different movements of a joint.

- 1. Herniated disk
- 2. Osteoarthritis
- 3. Osteoporosis
- 4. Scoliosis
- 5. Kyphosis
- 6. Lordosis
- 7. Spina bifida
- 8. Rheumatoid arthritis (RA)

Standard 6 - Muscular System (3%)

Candidates will develop and use models to relate the structure of the muscular system to its functional role in movement, protection, and support.

Objective 1 Describe the general functions of the muscular system.

1. Thermogenesis
2. Produce movement (muscle contractions)
3. Maintains posture
4. Protects internal organs
5. Controls volume of hollow body organs

Objective 2 Describe the four characteristics of muscle tissue.

1. Elasticity
2. Excitability (irritability)
3. Extensibility
4. Contractility

Objective 3 Contrast the general location, microscopic appearance, control, and functions of the three specific types of muscle tissue.

1. Skeletal muscle
2. Smooth muscle
3. Cardiac muscle

Objective 4 Identify the proteins of the sarcomere.

1. Actin (thin filament)
2. Myosin (thick filament)

Objective 5 Describe what occurs at the neuromuscular junction.

1. Nerve impulse (action potential)
2. Acetylcholine (Ach) neurotransmitter
3. Muscle contraction stimulated

Objective 6 Describe the sliding-filament theory of muscle contraction.

Objective 7 Define the following terms:

1. Origin
2. Insertion

Objective 8 Review terms of movement:

1. Flexion/extension
2. Abduction/adduction
3. Plantar flexion/dorsiflexion

4. Rotation

Objective 9 Explain the role of the following:

1. Prime movers (agonists)
2. Antagonists
3. Synergist
4. Fixators

Objective 10 Describe the locations and functions of the following skeletal muscles:

1. Masseter – jaw elevation
2. Sternocleidomastoid – neck lateral flexion
3. Trapezius – shoulder elevation
4. Biceps brachii- elbow and shoulder flexion
5. Triceps brachii- elbow extension
6. Deltoid – abduction of arm
7. Diaphragm – inflation of lungs
8. Pectoralis major – shoulder horizontal adduction
9. Latissimus dorsi – shoulder extension and adduction
10. Rectus abdominis – trunk flexion
11. External oblique – trunk flexion and rotation
12. Gastrocnemius – ankle plantarflexion
13. Tibialis anterior – ankle dorsiflexion
14. Soleus – ankle plantarflexion
15. Hamstrings
 - a. Semimembranosus – knee flexion
 - b. Semitendinosus – knee flexion
 - c. Biceps femoris – knee flexion
16. Quadriceps
 - a. Rectus femoris – knee extension and hip flexion
 - b. Vastus lateralis - knee extension
 - c. Vastus medialis - knee extension
 - d. Vastus intermedius - knee extension
17. Gluteus maximus – hip extension
18. Sartorius – hip flexion, abduction and external rotation

Objective 11 Explain the following diseases and disorders of the muscular system.

1. Fibromyalgia
2. Muscular dystrophy
3. Medial tibial stress syndrome
4. Compare and contrast the following, describe the three degrees of injury:
 - a. Sprain
 - b. Strain

Standard 7 - Nervous System and Special Senses (2%)

Candidates will develop and use models to relate the structure of the nervous system and special senses to its functional roles in detection, interpretation and response to information.

Objective 1 Describe the three broad functions of the nervous system.

1. Sensory
2. Integration
3. Motor

Objective 2 Describe the general organization of the nervous system.

1. Central Nervous System (CNS)
 - a. Brain
 - b. Spinal Cord
2. Peripheral Nervous System (PNS)
 - a. Spinal nerves
 - i. 31 pairs
 - b. Cranial nerves
 - i. I-XII
 - c. Subdivisions
 - i. Autonomic Division
 1. Sympathetic
 2. Parasympathetic
 - ii. Somatic Division

Objective 3 List the functions, structures, and locations of neurons and neuroglial cells.

1. Neuron
2. Astrocytes
3. Microglia
4. Oligodendrocytes
5. Ependymal cells
6. Schwann cells
7. Satellite cells

Objective 4 Contrast white matter and gray matter of nervous tissue.

Objective 5 Identify the structures responsible for the maintenance and protection of the central nervous system.

1. Meninges
 - a. Dura mater
 - b. Arachnoid mater
 - c. Pia mater

Objective 6 Describe the location and function of cerebrospinal fluid (CSF).

1. Ventricles
2. Subarachnoid space

Objective 7 Identify and describe the structures and functions of the brain.

1. Cerebrum
 - a. Frontal
 - b. Parietal
 - c. Temporal

- d. Occipital
- 2. Cerebellum
- 3. Brain stem
 - a. Medulla oblongata
 - b. Pons
 - c. Midbrain
- 4. Diencephalon
 - a. Thalamus
 - b. Hypothalamus

Objective 8 Sequence the major events when the nerve impulse (action potential) is initiated and transmitted through a neuron. (All or None Principle).

Objective 9 Explain the role of each of the components of a reflex arc.

- 1. Reflex
- 2. Reflex arc
 - a. Receptor
 - b. Sensory neuron
 - c. Association (interneuron) neuron
 - d. Motor neuron
 - e. Effector

Objective 10 Explain the following diseases and disorders of the nervous system.

- 1. Amyotrophic Lateral Sclerosis (ALS)
- 2. Alzheimer's Disease
- 3. Bacterial meningitis
- 4. Cerebral palsy
- 5. Epilepsy
- 6. Multiple Sclerosis (MS)
- 7. Guillain-Barre syndrome
- 8. Parkinson's Disease
- 9. Cerebrovascular Accident (CVA)-stroke

Objective 11 Identify the principle anatomical structures and functions of the eye.

- 1. Accessory structures
 - a. Eyelid
 - b. Conjunctiva
 - c. Lacrimal apparatus
 - d. Extrinsic muscles
- 2. Layers of the eyeball
 - a. Fibrous tunic
 - i. Sclera
 - ii. Cornea
 - b. Vascular tunic
 - i. Choroid
 - ii. Ciliary body
 - iii. Iris
 - iv. Lens
 - v. Pupil

- c. Nervous tunic
 - i. Retina

Objective 12 Identify the principle anatomical structures and functions of the ear.

1. Outer ear
 - a. Auricle
 - b. Auditory Canal
2. Middle ear
 - a. Tympanic cavity
 - b. Tympanic membrane
 - c. Auditory (Eustachian) tube
 - d. Auditory ossicles
 - i. Malleus
 - ii. Incus
 - iii. Stapes
3. Inner ear
 - a. Semicircular canals
 - b. Vestibule
 - c. Cochlea & Organ of Corti

Objective 13 Identify and describe the principle anatomical structures and functions associated with sense of taste and smell.

1. Gustatory cells (taste buds)
2. Olfactory bulb

Objective 14 Explain the following diseases and disorders associated with special senses.

1. Ametropia – abnormal refracted light
 - a. Myopia
 - b. Hyperopia
 - c. Presbyopia
2. Cataracts
3. Conjunctivitis
4. Strabismus
5. Glaucoma
6. Macular degeneration
7. Vertigo
8. Tinnitus
9. Middle ear infection (Otitis Media)
10. Deafness
 - a. Conductive
 - b. Sensorineural

Standard 8- Endocrine System (7%)

Candidates will investigate and analyze how the hormones of the endocrine system regulate (effect) physical and chemical processes to maintain homeostasis.

Objective 1 Describe the general functions of the endocrine system.

1. Regulates body processes.
2. Regulates growth, development, and maturation.

Objective 2 Describe a hormone and how it functions in the body.

Objective 3 Describe the location, secretion, and functions of the major endocrine glands.

1. Pituitary Gland-found in the hypophyseal fossa “Sella Turcica”
 - a. Anterior Pituitary (adenohypophysis)
 - i. Human Growth Hormone (HGH) – stimulates cell growth
 - ii. Thyroid Stimulating Hormone (TSH) – targets thyroid gland
 - iii. Adrenocorticotrophic Hormone (ACTH) – targets adrenal cortex to release cortisol
 - b. Posterior Pituitary (neurohypophysis)
 - i. Antidiuretic Hormone (ADH); also known as vasopressin – targets kidneys for water retention
 - ii. Oxytocin Hormone (OT) – targets uterus for child birthing; targets breast tissue for milk release
2. Thyroid Gland-found inferior to the larynx
 - a. Thyroxine (T4) – targets cells increasing metabolism
 - b. Triiodothyronine (T3) – targets cells increasing metabolism
3. Adrenal Gland-found atop the kidneys
 - a. Adrenal Cortex
 - i. Cortisol
 1. Coping with long term stress
 2. Anti-inflammatory by suppressing white blood cells
4. Adrenal Medulla- sympathetic stimulus for sustained “Fight or Flight”
 - a. Epinephrine- (adrenaline) – increasing cell metabolism
 - b. Norepinephrine- (noradrenaline) - increasing cell metabolism
5. Pancreas Gland-Exocrine/Endocrine gland in LUQ posterior to the stomach
 - a. Insulin – released from beta cells to target cells to decrease blood sugar
 - b. Glucagon - released from alpha cells to break down glycogen to increase blood sugar

Objective 4 Explain the following diseases and disorders of the endocrine system.

1. Dwarfism
2. Gigantism
3. Acromegaly
4. Hypothyroidism
 - a. Myxedema
 - b. Congenital hypothyroidism
5. Hyperthyroidism (Graves’ disease)
 - a. Goiter
 - b. Exophthalmos
6. Diabetes mellitus
 - a. Type I
 - b. Type II
7. Diabetes insipidus
8. Cushing’s syndrome

Standard 9 - Blood (7%)

Candidates will obtain, evaluate and communicate information that explains how the blood obtains oxygen, transports nutrients, and removes waste (matter).

Objective 1 Identify and describe the components of blood and their functions.

1. Erythrocytes
 - a. Shapes (normal and abnormal)
 - b. Function of hemoglobin
2. Leukocytes
 - a. Granulocytes
 - i. Neutrophils
 - ii. Basophils
 - iii. Eosinophils
 - b. Agranulocytes
 - i. Monocytes
 - ii. Lymphocytes
3. Thrombocytes
4. Plasma

Objective 2 Describe the process of hemostasis.

1. Vascular spasm
2. Platelet plug formation
3. Coagulation

Objective 3 Contrast a thrombus and an embolus.

Objective 4 Identify the antigens found on the erythrocytes and the antibodies that determine the ABO blood types and the Rh factor.

Objective 5 Explain the following diseases and disorders associated with the blood.

1. Anemias
 - a. Nutritional
 - b. Pernicious
 - c. Hemorrhagic
 - d. Hemolytic
 - e. Sickle cell
 - f. Aplastic
2. Hemolytic disease of the newborn
3. Hemophilia
4. Leukemia
5. Mononucleosis
6. Polycythemia

Standard 10 - Lymphatic System (7%)

Candidates will construct an explanation describing the structures and functions of the lymphatic system.

Objective 1 Identify the components of the lymphatic system.

1. Lymph nodes
2. Tonsils
3. Spleen
4. Thymus
5. Red bone marrow
6. Lymph vessels

Objective 2 Describe how lymph is moved through the body.

Objective 3 Contrast antigens and antibodies.

Objective 4 Describe the general roles of lymphocytes (T-cells and B-cells) in the immune response.

Objective 5 Distinguish between types of immunity.

1. Active immunity
2. Passive immunity
3. Natural immunity
4. Artificial immunity

Objective 6 Explain the following diseases and disorders associated with the lymphatic system.

1. Acquired immunodeficiency syndrome (AIDS)
2. Measles
3. Mumps
4. Rubella
5. Tetanus

Standard 11 - Cardiovascular System (12%)

Candidates will develop and use a model to describe the structures and functions of the cardiovascular system.

Objective 1 List the general functions of the cardiovascular system.

7. Transports nutrients and waste
8. Transports heat
9. Transports oxygen to body cells and carries carbon dioxide away from body cells

10. Transports hormones to target tissues
11. Transports antibodies

Objective 2 Identify the layers of the heart.

1. Parietal pericardium
2. Visceral pericardium
3. Epicardium
4. Myocardium
5. Endocardium

Objective 3 Identify the chambers of the heart.

6. Atria
7. Ventricles

Objective 4 Identify the valves of the heart.

1. Tricuspid/atrioventricular
2. Pulmonary semilunar
3. Bicuspid/atrioventricular (mitral)
4. Aortic semilunar

Objective 5 Locate the great blood vessels of the heart.

1. Superior vena cava
2. Inferior vena cava
3. Pulmonary trunk
4. Pulmonary arteries
5. Pulmonary veins
6. Aorta
7. Sections of the aorta
 - a. Ascending
 - b. Aortic arch
 - c. Descending

Objective 6 Trace blood flow through the heart.

Objective 7 Contrast pulmonary circulation and systemic circulation.

Objective 8 Identify the components of the conduction system of the heart and trace the pathway.

1. Sinoatrial (SA) node
2. Atrioventricular (AV) node
3. AV bundle (Bundle of His)
4. Bundle branches
5. Purkinje fibers

Objective 9 Sequence the principal events of the cardiac cycle in terms of systole and diastole.

Objective 10 Define cardiac output (CO) and identify factors that influence it.

1. Heart rate (HR)
2. Stroke volume (SV)

Objective 11 Compare and contrast the structures and functions of arteries, capillaries, and veins.

Objective 12 Define pulse and identify the general location of arteries where pulse may be felt.

1. Carotid - neck
2. Radial – thumb side of wrist
3. Brachial – medial antecubital fossa of arm

Objective 13 Describe blood pressure and explain the results.

Objective 14 Describe the following diseases and disorders of the cardiovascular system.

1. Aneurysm
2. Arteriosclerosis
3. Atherosclerosis
4. Cerebrovascular accident/stroke (CVA)
5. Coronary artery disease
6. Hypertension
7. Murmur
8. Myocardial infarction/heart attack (MI)

Standard 12 - Respiratory System (8%)

Candidates will construct an explanation describing the structures and functions associated with the respiratory system.

Objective 1 Describe the general functions of the respiratory system.

Objective 2 Identify and sequence the organs of the respiratory system in the order which air will pass through them from the exterior.

1. Nose/mouth
2. Pharynx
 - a. Nasopharynx
 - b. Oropharynx
 - c. Laryngopharynx
3. Larynx
4. Trachea
5. Bronchi
6. Bronchioles
7. Alveolar duct
8. Alveoli

Objective 3 Identify the following structures associated with the larynx.

1. Epiglottis
2. Glottis
3. Hyoid bone
4. Thyroid cartilage
5. Cricoid cartilage
6. True vocal cords
7. False vocal cords

Objective 4 Identify the coverings of the lungs and the gross anatomical features of the lungs.

1. Apex
2. Base
3. Lobes
4. Visceral pleura
5. Parietal pleura
6. Pleural cavity

Objective 5 Identify the volumes of air exchanged during ventilation.

1. Tidal volume (TV)
2. Inspiratory Reserve Volume (IRV)
3. Expiratory Reserve Volume (ERV)
4. Residual Volume (RV)

Objective 6 Differentiate between the following:

1. Ventilation
2. Respiration
 - a. External Respiration
 - b. Internal Respiration

Objective 7 Describe the effects of carbon dioxide (CO₂) on ventilation.

Objective 8 Explain the following diseases and disorders of the respiratory system.

1. Chronic Obstructive Pulmonary Disorder
 - a. Emphysema
 - b. Bronchitis
2. Asthma
3. Influenza
4. Lung cancer
5. Pneumonia
6. Sudden Infant Death Syndrome (SIDS)
7. Tuberculosis (TB)
8. Cystic Fibrosis (CF)
9. Respiratory Syncytial Virus (RSV)

Objective 9 Define and apply Boyle's Law and its impact of volume and pressure related to inspiration and expiration.

Objective 10 State the four respiratory volumes and four respiratory capacities. Identify each of these on a spirogram.

1. Tidal volume (TV)
2. Inspiratory reserve volume (IRV)
3. Expiratory reserve volume (ERV)
4. Residual volume (RV)
5. Vital capacity (VC)
6. Inspiratory capacity (IC)
7. Functional residual capacity (FRC)
8. Total lung capacity (TLC)

Standard 13 - Digestive System (8%)

Candidates will ask questions to construct an explanation to describe the structures and functions associated with the digestive system.

Objective 1 Describe the general functions of the digestive system.

1. Ingestion
2. Digestion
3. Absorption
4. Excretion

Objective 2 Contrast chemical digestion and mechanical digestion.

Objective 3 Differentiate between the following:

1. Alimentary canal structures
 - a. Mouth
 - b. Pharynx
 - c. Esophagus
 - d. Stomach
 - e. Small intestines
 - f. Large intestines
 - g. Rectum
 - h. Anus
2. Accessory structures
 - a. Salivary glands (parotid)
 - b. Pancreas
 - c. Gallbladder
 - d. Liver

Objective 4 Describe the functions of saliva and salivary amylase in digestion.

Objective 5 Identify the following parts of a typical tooth.

1. Crown
2. Neck
3. Root

4. Gingiva
5. Periodontal ligament
6. Enamel
7. Dentin
8. Pulp
9. Root canal

Objective 6 Define the following:

1. Deglutition
2. Mastication
3. Maceration
4. Segmentation
5. Peristalsis
6. Haustral churning

Objective 7 Identify the anatomical features of the stomach.

1. Lower esophageal sphincter
2. Fundus
3. Body
4. Rugae
5. Pylorus
6. Pyloric sphincter

Objective 8 Identify the basic components and functions of the creation of pepsin in gastric juices.

1. Chief cells - pepsinogen
2. Parietal cells – hydrochloric acid
3. Goblet cells - mucus

Objective 9 Identify the location and digestive functions of the pancreas.

1. Acini Cells – cluster or group of acinar cells arranged in a rounded structure responsible for synthesis and secretion of hydrolytic enzymes.

Objective 10 Describe the function of bile (emulsification).

Objective 11 Identify and describe the structures and functions of the three sections of the small intestine.

1. Duodenum
2. Jejunum
3. Ileum

Objective 12 Identify and describe the structures and functions of the sections of the large intestine.

1. Cecum
2. Colon
 - a. Ascending colon

- b. Transverse colon
- c. Descending colon
- d. Sigmoid colon
3. Rectum
4. Anal canal

Objective 13 Explain the following diseases and disorders of the digestive system.

1. Appendicitis
2. Cirrhosis
3. Colorectal cancer
4. Gallstones
5. Hepatitis
6. Lactose intolerance
7. Ulcers
8. Celiac disease
9. Crohn's disease
10. Irritable Bowel Syndrome (IBS)
11. Gastroesophageal Reflux Disease (GERD)

Standard 14 - Urinary System (8%)

Candidates will obtain, evaluate and communicate information about the structures and functions associated with the urinary system.

Objective 1 Describe the general functions of the urinary system.

1. Regulates the volume and composition of blood.
2. Excretes body waste.

Objective 2 Identify the four major organs of the urinary system.

1. Kidneys
2. Ureters
3. Bladder
4. Urethra

Objective 3 Identify the gross anatomy of the kidney

1. Renal capsule
2. Renal cortex
3. Renal medulla
4. Renal pyramids
5. Renal pelvis
6. Calyces

Objective 4 Identify the microscopic structures of the nephron.

1. Afferent arteriole
2. Renal corpuscle
 - a. Glomerulus

- b. Glomerular (Bowman's) capsule
- 3. Efferent arteriole
- 4. Renal tubule
 - a. Proximal convoluted tubule
 - b. Descending limb
 - c. Nephron loop (Loop of Henle)
 - d. Ascending limb
 - e. Distal convoluted tubule
 - f. Collecting duct
- 5. Peritubular capillaries

Objective 5 Describe the three basic physiological processes and the structures involved in urine formation.

- 1. Filtration
- 2. Reabsorption
- 3. Secretion

Objective 6 Identify abnormal constituents of urine and possible causes of each.

- 1. Glucose
- 2. Ketones in excessive levels
- 3. Erythrocytes
- 4. Leukocytes
- 5. Bilirubin
- 6. Microbes
- 7. Albumin

Objective 7 Describe the methods of fluid intake and output.

- 1. Intake
 - a. Oral
 - i. Liquid
 - ii. Solid
 - b. Intravenous
 - c. Metabolic
- 2. Output
 - a. Urination (micturition or voiding)
 - b. Sweat
 - c. Feces
 - d. Exhaled vapor

Objective 8 Explain the following diseases and disorders associated with the urinary system.

- 3. Glomerulonephritis
- 4. Incontinence
- 5. Kidney stones
- 6. Polyuria
- 7. Renal failure
- 8. Urinary tract infections (UTI)

Standard 15 - Reproductive System (7%)

Candidates will develop and use models to describe the structures and functions associated with the reproductive system.

Objective 1 Describe the general functions of the reproductive system.

1. Production of gametes (egg and sperm) by the gonads.
2. Production of hormones to help in the maturation process.

Objective 2 Identify and describe the structures and functions of the male genitalia.

1. External
 - a. Penis
 - b. Scrotum
 - c. Testes
2. Internal
 - a. Epididymis
 - b. Ductus deferens (vas deferens)
 - c. Ejaculatory duct
 - d. Urethra
3. Accessory
 - a. Seminal vesicles
 - b. Prostate
 - c. Bulbourethral gland (Cowper's gland)

Objective 3 Describe the functions of testosterone in the male.

Objective 4 Identify and describe the structures and functions of the female reproductive system.

1. External
 - a. Vulva
 - b. Labia majora
 - c. Clitoris
 - d. Labia minora
 - e. Mons pubis
 - f. Vestibule
2. Internal
 - a. Ovaries
 - b. Uterine tubes (Fallopian tubes)
 - i. Infundibulum and fimbriae
 - ii. Ampulla
 - iii. Isthmus
 - c. Uterus
 - d. Vagina
3. Accessory
 - a. Mammary glands
 - b. Perineum

Objective 5 Describe the structures and functions of the uterus.

1. Perimetrium
2. Myometrium
3. Endometrium
 - a. Stratum functionalis
 - b. Stratum basalis
4. Fundus
5. Cervix

Objective 6 Define the menstrual cycle including the ovarian cycle and uterine cycle and changes that occur during menopause.

Objective 7 Describe the physiological effects of estrogens, progesterone, and relaxin.

Objective 8 Contrast the general outcomes of spermatogenesis vs. oogenesis.

Objective 9 Explain the following sequence of events that occur during human development:

1. Fertilization
2. Zygote
3. Implantation
4. Embryo
5. Fetus

Objective 10 Describe the principal events associated with the three stages of labor.

1. Stage 1-dilation and effacement
2. Stage 2-delivery and birth
3. Stage 3-placental expulsion

Objective 11 Explain the following diseases and disorders of the reproductive system.

1. Reproductive cancers
 - a. Breast cancer
 - b. Testicular cancer
 - c. Cervical cancer
 - d. Ovarian cancer
 - e. Prostate cancer
 - f. Uterine cancer
2. Endometriosis
3. Impotence
4. Infertility
5. Polycystic Ovarian Syndrome (POS)
6. Sexually Transmitted Infections (STI)
 - a. Gonorrhea
 - b. Syphilis
 - c. Genital herpes
 - d. Chlamydia
 - e. Trichomoniasis
 - f. Genital warts

g. Human Papilloma Virus (HPV)

Performance Skills

1. Candidates will explore careers in healthcare. Candidates will participate in a minimum of three career exploration experiences to investigate a variety of health care careers related to behavioral and mental health, community and social services, personal care services, physical health, and biotechnology research and development pathways. NOTE: Electronically delivered career exploration experiences are permissible.
2. Candidates will provide an oral and/or written report for each career exploration.
3. Candidates will select a topic and defend their position on a current medical ethics dilemma.

Durable Skills

1. Professionalism
2. Collaboration
3. Communication
4. Leadership
5. Innovation
6. Adaptability

KEY VOCABULARY CLARIFICATIONS

Standard 1: Body Plan, Organization, and Homeostasis

Mediastinum: The central compartment of the thoracic cavity, containing the heart, bronchi, esophagus, and thymus.

Negative feedback: A mechanism that counteracts a change in the body to return it to a set point (e.g., regulating blood pressure or body temperature).

Positive feedback: A mechanism that amplifies a change in the body, moving it further from the set point (e.g., childbirth or blood clotting).

Standard 2: Body Chemistry

Cellular respiration: A series of chemical reactions by which cells convert glucose and oxygen into energy (ATP), carbon dioxide, and water.

Nucleic acids (RNA, DNA): Organic macromolecules that carry genetic information and are involved in protein synthesis.

Standard 3: Cells

Active transport (Sodium/Potassium pump): A process that uses energy to move substances across the cell membrane against their concentration gradient (e.g., the sodium-potassium pump).

Endocytosis (phagocytosis): The process by which cells take in substances by engulfing them in a vesicle.

Phagocytosis is a type of endocytosis where the cell “eats” large particles.

Exocytosis: The process by which cells release substances by fusing vesicles with the cell membrane.

Standard 4: Histology and Integumentary System

Visceral (membrane): The layer of a serous membrane that covers an organ.

Parietal (membrane): The layer of a serous membrane that lines the wall of a cavity.

Serous membrane: A membrane that lines body cavities closed to the exterior and secretes serous fluid.

Standard 5: Skeletal System

Articulation (joint): Point where two or more bones meet.

Fibrous joint: An immovable joint where bones are joined by fibrous tissue.

Cartilaginous joint: A slightly movable joint where bones are joined by cartilage.

Synovial joint: A freely movable joint characterized by a joint cavity containing synovial fluid.

Synarthrotic joint: An immovable joint.

Amphiarthrotic joint: A slightly movable joint.

Diarthrotic joint: A freely movable joint.

Standard 6: Muscular System

Acetylcholine (ACh): A chemical messenger released at the neuromuscular junction that stimulates muscle contraction.

Sliding-filament theory: The explanation for how muscles contract, involving the sliding of actin filaments past myosin filaments.

Standard 7: Nervous System and Special Senses

Diencephalon: A region of the brain located above the brain stem, containing the thalamus and hypothalamus.

Neuroglial cells: Non-neuronal cells that support and protect neurons (e.g., astrocytes, microglia, oligodendrocytes, ependymal cells, Schwann cells, satellite cells).

Standard 8: Endocrine System

Myxedema: A severe form of hypothyroidism in adults, characterized by swelling and thickening of the skin.

Standard 9: Blood

Agranulocytes: A type of white blood cell that does not contain granules in their cytoplasm (e.g., monocytes, lymphocytes).

Basophils: A type of white blood cell involved in allergic reactions and inflammation.

Granulocytes: A type of white blood cell that contains granules in their cytoplasm (e.g., neutrophils, basophils, eosinophils).

Eosinophils: A type of white blood cell involved in allergic reactions and fighting parasitic infections.

Lymphocytes: A type of white blood cell that plays a key role in the immune system (T-cells and B-cells).

Monocytes: Large white blood cells that can transform into macrophages and engulf pathogens.

Neutrophils: The most common type of white blood cell, involved in fighting bacterial infections.

Standard 10: Lymphatic System

B-cells: A type of lymphocyte that produces antibodies.

T-cells: A type of lymphocyte that directly attacks infected cells or cancer cells.

Active immunity: Immunity developed by an individual's own immune system in response to an infection or vaccination.

Artificial immunity: Immunity acquired through medical intervention, such as vaccination or receiving antitoxins.

Natural immunity: Immunity acquired through natural exposure to a pathogen or through maternal antibodies.

Passive immunity: Immunity acquired by receiving antibodies from another source (e.g., from mother to baby).

or through an injection).

Standard 11: Cardiovascular System

Endocardium: The innermost layer of the heart wall, lining the chambers and valves.

Myocardium: The middle, muscular layer of the heart wall, responsible for pumping blood.

Parietal pericardium: The outer layer of the pericardium, a sac that surrounds the heart.

Visceral pericardium (Epicardium): The inner layer of the pericardium, which is also the outermost layer of the heart wall.

Standard 12: Respiratory System

Parietal pleura: The outer layer of the pleura, lining the chest wall.

Expiratory Reserve Volume (ERV): The extra amount of air that can be exhaled after a normal breath.

Inspiratory Reserve Volume (IRV): The extra amount of air that can be inhaled after a normal breath.

Residual Volume (RV): The amount of air remaining in the lungs after a maximal exhalation.

Tidal volume (TV): The amount of air inhaled or exhaled during normal, quiet breathing.

Visceral pleura: The inner layer of the pleura, covering the surface of the lungs.

Standard 13: Digestive System

Accessory structures (of digestion): Organs that aid in digestion but are not part of the alimentary canal (e.g., salivary glands, pancreas, gallbladder, liver).

Alimentary canal (Gastrointestinal [GI] tract): The continuous tube that extends from the mouth to the anus, through which food passes.

Emulsification: The process of breaking down large fat globules into smaller ones, aided by bile.

Haustral churning: Slow, segmental movements in the large intestine that mix the contents.

Segmentation: Localized contractions of the small intestine that mix food with digestive juices.

Standard 14: Urinary System

Glomerulonephritis: Inflammation of the glomeruli in the kidneys.

Standard 15: Reproductive System

Endometrium: The innermost lining of the uterus, which thickens during the menstrual cycle and is shed if pregnancy does not occur.

Myometrium: The middle, muscular layer of the uterine wall, responsible for contractions during childbirth.

Oogenesis: The process of egg cell production in females.

Stratum functionalis: The superficial layer of the endometrium that is shed during menstruation.

Stratum basalis: The deeper layer of the endometrium that remains after menstruation and regenerates the functionalis layer.