

Health Science Strands and Standards Revision changes

- Medical Anatomy and Physiology – No strands and standard changes at this time
- Medical Forensics - No strands and standard changes at this time
- Biotechnology – Move to 2019 rotation

STRANDS AND STANDARDS

MEDICAL ANATOMY & PHYSIOLOGY



Course Description

This full-year course provides students with an in-depth study of healthcare careers including actual clinical experience in a variety of areas. Instruction includes intermediate anatomy & physiology, medical terminology, diseases and disorders, medical ethics and first aid. The class is designed to prepare students for the Advanced Health Science course and/or for a variety of health technology programs.

Intended Grade Level	10-12
Units of Credit	1.0
Core Code	36.01.00.00.110
Concurrent Enrollment Core Code	36.01.00.13.110
Prerequisite	None
Skill Certification Test Number	702
Test Weight	1.0
License Type	CTE and/or Secondary Education 6-12or Elementary Education
Required Endorsement(s)	
Endorsement 1	Medical Anatomy & Physiology
Endorsement 2	N/A
Endorsement 3	N/A

STRAND 1

BODY PLAN AND ORGANIZATION-Students will explore and describe the body plan, organization, and homeostasis.

Standard 1

Contrast the sciences of anatomy and physiology.

Standard 2

Describe the six levels of structural organization of the human body and give an example of each level:

- Chemical
- Cellular
- Tissue
- Organ
- System
- Organism

Standard 3

Describe the following:

- Metabolism
 - Anabolic process
 - Catabolic process

Standard 4

Apply directional terms used in human anatomy:

- Posterior/Anterior
- Medial/Lateral
- Proximal/Distal
- Superficial/Deep
- Superior/Inferior

Standard 5

Apply commonly used planes to divide the body:

- Sagittal
- Midsagittal
- Transverse (horizontal)
- Frontal (coronal)

Standard 6

Identify the body cavities and locate the following organs within each cavity:

- Dorsal Cavity
 - Vertebral-spinal cord
 - Cranial-brain

- Ventral Cavity
 - Thoracic-heart, lungs
 - Mediastinum-heart, bronchi, esophagus, thymus.
 - Pericardial-heart
 - Pleural-lungs
 - Abdominopelvic Cavity-liver, spleen, intestines, kidneys, stomach
 - Abdominal-liver, spleen, intestines, kidneys, stomach
 - Pelvic-intestines, urinary bladder, sex organs

Standard 7

Identify the major organ(s) in each abdominal quadrant:

- RUQ-right upper quadrant-liver, gallbladder, right kidney
- RLQ-right lower quadrant-cecum, appendix, right ovary
- LUQ-left upper quadrant-spleen, stomach, left kidney
- LLQ-lower left quadrant-left ovary

Standard 8

Examine the relationship between homeostasis and stress.

Standard 9

Differentiate between negative and positive feedback mechanisms. Give examples of each:

- Be able to describe the following:
 - Childbirth
 - Breast feeding
 - Blood clotting

STRAND 2

BASIC PRINCIPLES OF BODY CHEMISTRY-Students will explain basic principles of body chemistry.

Standard 1

Review the following terms and concepts:

- States of Matter
- Elements
- Basic components of the atom
 - Nucleus
 - Electrons
 - Protons
 - Neutrons
- Ion
 - Electrolyte

Standard 2

Identify the four major elements in the body:

- Carbon
- Hydrogen
- Oxygen
- Nitrogen

Standard 3

Differentiate between:

- Compound
- Molecule

Standard 4

Differentiate between:

- Cation
- Anion

Standard 5

Describe the characteristics of bonds. (no longer place any emphasis on which is the strongest type):

- Ionic
- Covalent
- Hydrogen

Standard 6

Define pH.

Standard 7

Categorize the following based on the pH of a solution:

- Acidic
- Basic
- Neutral

Standard 8

Distinguish between “neutral” pH and the “average” pH range of the blood:

- Neutral pH=7.0
- Average pH of blood=7.35 to 7.45

Standard 9

Describe the properties of water and how it is utilized in the human body:

- Universal solvent
- Transport
- Lubricant
- Heat capacity
- Chemical reactions

Standard 10

Distinguish between:

- Inorganic compounds-do not contain carbon, small molecules, usually form ionic bonds
- Organic compounds-usually contain carbon, large molecules, form covalent bonds, flammable

Standard 11

Describe the structures and functions of the following and give an example of each:

- Carbohydrates
- Proteins
- Lipids
- Nucleic acids
 - RNA
 - DNA
- Amino acids

Standard 12

Describe how the body produces energy during cellular respiration.

- $ATP \leftrightarrow ADP + P + ENERGY$

STRAND 3

CELLS-Students will describe basic concepts of structures and functions of cells.

Standard 1

Identify the four principle parts of a generalized animal cell and their functions:

- Nucleus
- Cytosol
- Organelles
- Cell membrane

Standard 2

Describe the structure and function of the cell membrane.

Standard 3

Describe a selectively permeable membrane and factors which influence permeability.

Standard 4

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

Standard 5

Describe each of the following cellular transport processes and classify them as active or passive:

- Passive processes
 - Diffusion

- Osmosis
- Facilitated diffusion
- Dialysis
- Filtration
- Active processes
 - Phagocytosis
 - Exocytosis
 - Active transport

Standard 6

Review the osmotic effects that occur when a cell is placed in the following:

- Isotonic solution
- Hypotonic solution
- Hypertonic solution

Standard 7

Describe the function of the following structures within the cell:

- Nucleolus
- DNA
- RNA
- Gene
- Chromatin
- Chromosome
- Ribosomes
- Rough endoplasmic reticulum
- Smooth endoplasmic reticulum
- Golgi complex
- Vesicle (vacuole)
- Lysosomes
- Peroxisomes
- Mitochondria
- Cytoskeleton
 - Microfilaments
 - Intermediate filaments
 - Microtubules
- Centrosomes
- Centrioles
- Cellular surface variants
 - Microvilli (absorption)
 - Cilia (transports products along the surface of the cell, “crowd surfers”)
 - Flagella (transports the cell)

Standard 8

Compare and contrast:

- Mitosis
- Meiosis

STRAND 4

HISTOLOGY & INTEGUMENTARY SYSTEM-Students will describe basic concepts of structures and functions of histology, and the integumentary system.

Standard 1

Identify the general characteristics and functions of each of the four principle types of tissues:

- Epithelial-strategies for tissue identification (arrangement & cell shape)
- Connective-adipose, cartilage, dense fibrous, blood, bone
- Muscular-skeletal, smooth, cardiac
- Nervous

Standard 2

Contrast the following:

- Exocrine glands
- Endocrine glands

Standard 3

Differentiate between the four basic types of membranes:

- Mucous
- Serous
- Synovial
- Cutaneous

Standard 4

Describe the structures and functions of the integumentary system components:

- Skin
- Glands
- Hair
- Nails

Standard 5

Describe the major layers of skin:

- Epidermis
- Dermis
- Subcutaneous (hypodermis)

Standard 6

Describe the functions of the following:

- Sudoriferous (sweat) glands
- Sebaceous (oil) glands

Standard 7

Identify the following diseases and disorders of the integumentary system:

- Skin cancers
 - Basal cell carcinoma
 - Squamous cell carcinoma
 - Malignant melanoma
- Decubitus ulcers
- Eczema
- Lesion
- Burns
 - 1st degree
 - 2nd degree
 - 3rd degree

Performance Skills

- Students will explore careers in healthcare. Students will participate in a minimum of three career exploration experiences to investigate a variety of health care careers related to therapeutic services, diagnostic services, health informatics, support services, and biomedical research and development pathways. NOTE: Electronically delivered career exploration experiences are permissible.
- Students will provide an oral and/or written report for each career exploration.

STRAND 5

SKELETAL SYSTEM-Students will describe the structures and functions of the skeletal system and its components.

Standard 1

Identify the general functions of the skeletal system.

Standard 2

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

- Osteoblasts
- Osteocytes
- Osteoclasts

Standard 3

Describe the features of a long bone:

- Periosteum
- Diaphysis

- Epiphysis
- Medullary cavity
- Red marrow
- Yellow marrow
- Articular cartilage
- Endosteum
- Compact bone
- Spongy bone

Standard 4

Identify the four shapes of bones with characteristics and examples of each:

- Long
- Short
- Flat
- Irregular

Standard 5

Describe and locate the following bone markings:

- Foramen
- Meatus
- Sinus
- Fossa
- Condyle
- Tuberosity
- Trochanter
- Tubercle
- Process

Standard 6

Describe and differentiate between the following terms:

- Suture
- Fontanel

Standard 7

Contrast the axial and appendicular skeletons.

Standard 8

Locate the following bones:

- Mandible
- Maxilla
- Zygomatic
- Frontal
- Parietal
- Occipital

- Sphenoid
- Ethmoid
- Hyoid
- Temporal
- Clavicle
- Scapula
- Sternum
- Ribs
- Pubic bone
 - Ilium
 - Ischium
 - Pubis
- Femur
- Patella
- Tibia
- Fibula
- Tarsals
- Metatarsals
- Phalanges
- Humerus
- Ulna
- Radius
- Carpals
- Metacarpals
- Vertebrae

Standard 9

Contrast the average number, location, and function of each of the five groups of vertebrae:

- Cervical
- Thoracic
- Lumbar
- Sacral
- Coccygeal

Standard 10

Explain the structural and functional classifications of articulations:

- Fibrous
- Synovial
- Cartilaginous
- Amphiarthrotic
- Diarthrotic
- Synarthrotic

Standard 11

Differentiate between ligaments and tendons.

Standard 12

Identify the following diseases and disorders of the skeletal system:

- Herniated disk
- Osteoarthritis
- Osteoporosis
- Scoliosis
- Kyphosis
- Lordosis
- Spina bifida
- RA (Rheumatoid arthritis)

STRAND 6

MUSCULAR SYSTEM-Students will describe the structures and functions of the muscular system and its components.

Standard 1

Identify the general functions of the muscular system.

Standard 2

Describe the four characteristics of muscle tissue:

- Elasticity
- Excitability (irritability)
- Extensibility
- Flexibility

Standard 3

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

- Skeletal
- Smooth
- Cardiac

Standard 4

Contrast thick and thin myofilaments:

- Actin
- Myosin

Standard 5

Describe the sliding-filament theory of muscle contraction.

Standard 6

Describe what occurs at the neuromuscular junction.

Standard 7

Define the following terms:

- Origin
- Insertion

Standard 8

Explain the role of the following:

- Prime movers (agonists)
- Antagonists
- Synergist
- Fixators

Standard 9

Describe the locations and functions of the following skeletal muscles:

- Biceps brachii
- Triceps brachii
- Brachialis
- Flexors
- Extensors
- Pronator
- Supinator
- Rotator cuff
 - Supraspinatus
 - Infraspinatus
 - Teres minor
 - Subscapularis
- Sternocleidomastoid
- Trapezius
- Deltoid
- Diaphragm
- Rectus abdominis
- Pectoralis major
- Latissimus dorsi
- External oblique
- Gastrocnemius
- Tibialis anterior
- Soleus
- Hamstrings
 - Semimembranosus
 - Semitendinosus
 - Biceps femoris
- Quadriceps
 - Rectus femoris

- Vastus lateralis
- Vastus medialis
- Vastus intermedius
- Gluteus maximus
- Gluteus medius
- Sartorius
- Gracilis
- Masseter

Standard 10

Identify the following diseases and disorders of the muscular system:

- Fibromyalgia
- Muscular dystrophy
- Medial tibial stress syndrome
- Compare and contrast the following, describe the three degrees of injury:
 - Sprain
 - Strain

STRAND 7

NERVOUS SYSTEM/SPECIAL SENSES-Students will describe the structures and functions of the nervous system and special senses.

Standard 1

Restate the three broad functions of the nervous system:

- Sensory
- Integration
- Motor

Standard 2

Describe the general organization of the nervous system:

- Central Nervous System (CNS)
 - Spinal nerves
 - 31 pairs
 - Cranial nerves
 - I-XII
- Subdivisions
 - Autonomic Nervous System (ANS)
 - Sympathetic
 - Parasympathetic
 - Somatic Nervous System

Standard 3

List the functions and structures of neurons and neuroglial cells:

- Neuron
- Astrocytes
- Microglia
- Oligodendrocytes
- Ependymal cells
- Schwann cells
- Satellite cells

Standard 4

Contrast white and gray matter of nervous tissue.

Standard 5

Describe the location and function of CSF:

- Ventricles
 - Choroid Plexus
- Subarachnoid space

Standard 6

Identify the structures responsible for the maintenance and protection of the central nervous system:

- Meninges
 - Dura mater
 - Arachnoid mater
 - Pia mater

Standard 7

Identify the four principal parts of the brain:

- Cerebrum
- Cerebellum
- Brain stem
- Diencephalon

Standard 8

Describe the functions of the three structures of the brain stem:

- Medulla oblongata
- Pons
- Midbrain

Standard 9

Describe the structures and functions of the diencephalon:

- Thalamus
- Hypothalamus

Standard 10

Describe the locations and functions of the four lobes of the cerebrum:

- Frontal
- Parietal
- Temporal
- Occipital

Standard 11

Explain the major functions of the cerebellum.

Standard 12

Sequence the major events when the nerve impulse (action potential) is initiated and transmitted through a neuron:

- All or None Principle

Standard 13

Explain the role of each of the components of a reflex arc:

- Reflex
- Reflex arc
- Receptor
- Sensory neuron
- Association (interneuron) neuron
- Motor neuron
- Effector

Standard 14

Identify the following diseases and disorders of the nervous system:

- ALS
- Alzheimer's
- Bacterial meningitis
- Cerebral palsy
- Epilepsy
- Multiple sclerosis
- Guillain-Barre syndrome
- Parkinson's
- Cerebral Vascular Accident (CVA)-stroke

Standard 15

Describe the principle anatomical structures of the eye:

- Accessory structures
 - Eyelid
 - Conjunctiva
 - Lacrimal apparatus
 - Extrinsic muscles

- Layers of the eyeball
 - Fibrous tunic
 - Sclera
 - Cornea
 - Vascular tunic
 - Choroid
 - Ciliary body
 - Iris
 - Lens
 - Pupil
 - Nervous tunic
 - Retina

Standard 16

Describe the principle anatomical structures of the ear:

- Outer ear
 - Auricle
 - Auditory Canal
- Middle ear
 - Tympanic cavity
 - Tympanic membrane
 - Auditory (Eustachian) tube
 - Auditory ossicles
 - Malleus
 - Incus
 - Stapes
- Inner ear
 - Bony labyrinth
 - Membranous labyrinth
 - Semicircular canals
 - Vestibule
 - Cochlea
 - Organ of Corti

Standard 17

Identify the following diseases and disorders associated with special senses:

- Ametropia-abnormal refracted light
 - Myopia
 - Hyperopia
 - Presbyopia
 - Cataracts
 - Conjunctivitis
 - Strabismus

- Glaucoma
- Macular degeneration
- Vertigo
- Tinnitus
- Middle ear infection (Otitis Media)
- Deafness
 - Conductive
 - Sensorineural

STRAND 8

ENDOCRINE SYSTEM-Students will describe the structures and functions associated with the endocrine system.

Standard 1

Identify the general functions of the endocrine system.

Standard 2

Describe a “hormone” and how it functions in the body.

Standard 3

Describe a “hormone” and how it functions in the body:

- Hypothalamus
 - Growth Hormone Releasing Hormone (GHRH)-targets anterior pituitary
 - Thyrotropin Releasing Hormone (TRH)-targets anterior pituitary
 - Corticotropin Releasing Hormone (CRH)-target anterior pituitary
 - Antidiuretic Hormone (ADH)
 - Produced in hypothalamus
 - Stored in posterior pituitary
 - Oxytocin Hormone (Oxt)
 - Produced in hypothalamus
 - Stored in posterior pituitary
- Pituitary Gland-found in the hypophyseal fossa “Sella Turcica”
 - Anterior Pituitary (adenohypophysis)
 - Human Growth Hormone (HGH)
 - Targets cells stimulating growth
 - Thyroid Stimulating Hormone (TSH)
 - Targets thyroid gland
 - Adrenocorticotrophic Hormone (ACTH)
 - Targets adrenal cortex
 - Posterior Pituitary (neurohypophysis)
 - Antidiuretic Hormone (ADH)
 - Neural stimulus releases ADH to target kidneys for water retention

- Oxytocin Hormone (Oxt)
 - Neural stimulus releases Oxt to target uterus for child birthing
 - Neural stimulus releases Oxt to target breast tissue for milk letdown
- Thyroid Gland-found inferior to the Larynx
 - Thyroxine (T4)
 - Targets cells increasing metabolism
 - Triiodothyronine (T3)
 - Targets cells increasing metabolism
- Adrenal Gland-found atop the kidneys
 - Adrenal Cortex
 - Adrenocorticotrophic Hormone (ACTH)
 - Stimulates the release of cortisol
 - Cortisol
 - Anti-inflammatory by suppressing white blood cells
 - Adrenal Medulla-sympathetic stimulus for sustained "Fight or Flight"
 - Epinephrine-adrenaline increasing cell metabolism
 - Norepinephrine-noradrenaline increasing cell metabolism
- Pancreas Gland-Exocrine/Endocrine gland in LUQ posterior to the stomach
 - Insulin
 - Released from Beta cells to target cells to decrease blood sugar
 - Glucagon
 - Released from Alpha cells to break down glycogen to increase blood sugar

Standard 4

Identify the following diseases and disorders of the endocrine system:

- Dwarfism
- Gigantism
- Acromegaly
- Hypothyroidism
 - Myxedema
 - Cretinism-congenital hypothyroidism
- Hyperthyroidism (Graves' disease)
 - Goiter
 - Exophthalmos
- Diabetes mellitus
 - Type I
 - Type II
- Diabetes insipidus
- Cushing's syndrome

STRAND 9

BLOOD-Students will describe the components and functions associated with blood.

Standard 1

Identify the components of blood and their functions:

- Erythrocytes
- Leukocytes
- Thrombocytes
- Plasma

Standard 2

Describe erythrocytes, including the structure of hemoglobin.

Standard 3

Define leukocyte and list the two major groups with their cell types and their function:

- Granulocytes
 - Neutrophils
 - Basophils
 - Eosinophils
- Agranulocytes
 - Monocytes
 - Lymphocytes

Standard 4

Describe the process of hemostasis.

- Vascular spasm
- Platelet plug formation
- Coagulation

Standard 5

Contrast a thrombus and an embolus.

Standard 6

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

Standard 7

Identify the following diseases and disorders associated with the blood.

- Anemias
 - Nutritional
 - Pernicious
 - Hemorrhagic
 - Hemolytic
 - Sickle cell

- Aplastic
- Hemolytic disease of the newborn
- Hemophilia
- Leukemia
- Mononucleosis
- Polycythemia

STRAND 10

LYMPHATIC SYSTEM-Students will describe the structures and functions of the lymphatic system.

Standard 1

Identify the components of the lymphatic system:

- Tonsils
- Spleen
- Thymus
- Lymph nodes
- Bone marrow
- Lymph vessels

Standard 2

Describe how lymph is moved through the body.

Standard 3

Contrast antigens and antibodies.

Standard 4

Describe the general roles of T-cells and B-cells in the immune response.

Standard 5

Distinguish between active and passive immunity and natural vs. artificial acquisition of immunity.

Standard 6

Identify the following diseases and disorders associated with the lymphatic System:

- AIDS
- Measles
- Mumps
- Rubella
- Tetanus

Performance Skills

- Students will select a topic and defend their position on a current medical ethics dilemma.

STRAND 11

CARDIOVASCULAR SYSTEM-Students will describe the structures and functions of the cardiovascular system.

Standard 1

List the general functions of the cardiovascular system.

Standard 2

Describe the layers of the heart:

- Epicardium
- Myocardium
- Endocardium

Standard 3

Identify the chambers of the heart:

- Atria
- Ventricles

Standard 4

Locate the great blood vessels of the heart:

- Superior vena cava
- Inferior vena cava
- Pulmonary trunk
- Pulmonary arteries
- Pulmonary veins
- Aorta
- Branches of the aorta

Standard 5

Identify the valves of the heart:

- Tricuspid
- Pulmonary semilunar
- Bicuspid (mitral)
- Aortic semilunar

Standard 6

Trace blood flow through the heart.

Standard 7

Identify the components of the conduction system of the heart and trace the pathway:

- SA node
- AV node
- AV bundle
- Bundle branches

- Purkinje fibers

Standard 8

Sequence the principle events of the cardiac cycle in terms of systole and diastole.

Standard 9

Define cardiac output and identify factors that influence it:

- Heart rate
- Stroke volume

Standard 10

Contrast the structures and functions of arteries, capillaries, and veins.

Standard 11

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

Standard 12

Describe blood pressure and how to measure it.

Standard 13

Contrast pulmonary and systemic circulation.

Standard 14

Identify the following diseases and disorders of the cardiovascular system:

- Aneurysm
- Arteriosclerosis
- Atherosclerosis
- Cerebrovascular accident/stroke
- Coronary artery disease
- Hypertension
- Murmur
- Myocardial infarction

STRAND 12

RESPIRATORY SYSTEM-Students will describe the structures and functions associated with the respiratory system.

Standard 1

Identify the general functions of the respiratory system.

Standard 2

Sequence the organs of the respiratory system in the order which air will pass through them from the exterior:

- Nose/mouth
- Pharynx

- Larynx
- Trachea
- Bronchi
- Bronchioles
- Alveolar duct
- Alveoli

Standard 3

Identify the three regions of the pharynx:

- Nasopharynx
- Oropharynx
- Laryngopharynx

Standard 4

Identify the following anatomical features of the larynx:

- Epiglottis
- Glottis
- Hyoid bone
- Thyroid cartilage
- Cricoid cartilage
- True vocal cords
- False vocal cords

Standard 5

Identify the coverings of the lungs and the gross anatomical features of the lungs:

- Apex
- Base
- Lobes
- Visceral pleura
- Parietal pleura
- Pleural cavity

Standard 6

Identify the site at which gas exchange occurs in the lungs (alveoli).

Standard 7

Identify the volumes and capacities of air exchanged during ventilation:

- Tidal volume
- Vital capacity

Standard 8

Differentiate between the following:

- Ventilation
- External respiration

- Internal respiration

Standard 9

Describe the effects of carbon dioxide on ventilation.

Standard 10

Identify the following diseases and disorders of the respiratory system:

- Chronic Obstructive Pulmonary Disorder
- Emphysema
- Influenza
- Lung cancer
- Pneumonia
- SIDS
- Tuberculosis
- Cystic Fibrosis
- Respiratory Syncytial Virus (RSV)
- Respiratory distress

STRAND 13

DIGESTIVE SYSTEM-Students will describe the structures and functions associated with the digestive system.

Standard 1

Identify the general functions of the digestive system.

Standard 2

Contrast chemical and mechanical digestion.

Standard 2

Differentiate between the following:

- Alimentary canal structures
 - Mouth
 - Pharynx
 - Esophagus
 - Stomach
 - Small intestines
 - Large intestines
 - Rectum
 - Anus
- Accessory structures
 - Salivary glands (parotid)
 - Pancreas
 - Gallbladder
 - Liver

Standard 4

Describe the functions of saliva and salivary amylase in digestion.

Standard 5

Identify the following parts of a typical tooth:

- Crown
- Neck
- Root
- Gingiva
- Periodontal ligament
- Enamel
- Dentin
- Pulp
- Root canal

Standard 6

Define the following:

- Deglutition
- Mastication
- Maceration
- Segmentation
- Peristalsis
- Haustral churning

Standard 7

Identify the anatomical features of the stomach:

- Fundus
- Body
- Pylorus
- Rugae
- Cardiac sphincter
- Pyloric sphincter

Standard 8

Identify the basic components and functions of gastric juice:

- Chief cells
 - Pepsinogen
- Parietal cells
 - Hydrochloric acid
- Goblet cells
 - Mucus

Standard 9

Identify the location and digestive functions of the pancreas.

- Pancreatic Islets
- Acini Cells

Standard 10

Describe the function of bile (emulsification).

Standard 11

Identify the three sections of the small intestine and describe the functions:

- Duodenum
- Jejunum
- Ileum

Standard 12

Identify the structures and sections of the large intestine and describe the Functions:

- Cecum
- Colon
 - Ascending
 - Transverse
 - Descending
 - Sigmoid
- Rectum
- Anal canal

Standard 2

Identify the following diseases and disorders of the digestive system:

- Appendicitis
- Cirrhosis
- Colorectal cancer
- Gallstones
- Hepatitis
- Obesity
- Ulcers
- Celiac disease
- Crohn's disease
- Irritable Bowel Syndrome (IBS)

STRAND 14

URINARY SYSTEM-Students will describe the structures and functions associated with the urinary system.

Standard 1

Identify the general functions of the urinary system.

Standard 2

Identify the four major organs of the urinary system:

- Kidneys
- Ureters
- Bladder
- Urethra

Standard 3

Identify the gross anatomy of the kidney:

- Renal cortex
- Renal medulla
- Renal pyramids
- Renal pelvis
- Renal capsule
- Calyces

Standard 4

Identify the microscopic structures of the nephron:

- Renal corpuscle
- Glomerulus
- Glomerular (Bowman's) capsule
- Afferent arteriole
- Efferent arteriole
- Renal tubule
 - Proximal convoluted tubule
 - Descending limb
 - Nephron loop
 - Ascending limb
 - Distal convoluted tubule
 - Collecting duct
- Peritubular capillaries

Standard 5

Describe the three basic physiological processes and the structures involved in urine formation:

- Filtration
- Reabsorption
- Secretion

Standard 6

Identify abnormal constituents of urine and possible causes of each:

- Glucose
- Ketones
- Erythrocytes

- Leukocytes
- Bilirubin
- Microbes
- Albumin

Standard 7

Describe the methods of fluid intake and output:

- Intake
 - Oral
 - Liquid
 - Solid
 - Intravenous
 - Metabolic
- Output
 - Micturition
 - Voiding
 - Sweat
 - Feces
 - Exhaled vapor

Standard 2

Identify the following diseases and disorders associated with the urinary system:

- Cystitis
- Glomerulonephritis
- Incontinence
- Kidney stones
- Polyuria
- Renal failure
- Urinary tract infections (UTI)

STRAND 15

REPRODUCTIVE SYSTEM-Students will describe the structures and functions associated with the reproductive system.

Standard 1

Identify the general functions of the reproductive system.

Standard 2

Describe the anatomy of the male genitalia:

- External
 - Penis
 - Scrotum
 - Testes

- Internal
 - Epididymis
 - Ductus deferens
 - Ejaculatory duct
 - Urethra
- Accessory
 - Seminal vesicles
 - Prostate
 - Bulbourethral gland

Standard 3

Identify the function of the testes.

Standard 4

Identify the functions of testosterone in the male.

Standard 5

Describe the anatomy of the female reproductive structures:

- External
 - Vulva
 - Labia majora
 - Clitoris
 - Labia minora
 - Mons pubis
 - Vestibule
- Internal
 - Ovaries
 - Uterus
 - Uterine tubes
 - Vagina
- Accessory
 - Mammary glands
 - Perineum

Standard 6

Identify the functions of the ovaries.

Standard 7

Identify the structures and functions of the uterine tubes, including fimbriae and infundibulum.

Standard 8

Describe the structures and function of the uterus:

- Perimetrium
- Myometrium

- Endometrium
 - Stratum functionalis
 - Stratum basalis
- Fundus
- Cervix

Standard 9

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

Standard 10

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

Standard 11

Contrast the general outcomes of spermatogenesis vs. oogenesis.

Standard 12

Define the following sequence of events that occur during human development:

- Fertilization
- Zygote
- Implantation
- Embryo
- Fetus

Standard 13

Identify the principle events associated with the three stages of labor:

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

Standard 14

Identify the following diseases and disorders of the reproductive system:

- Reproductive cancers
 - Breast
 - Testicular
 - Cervical
 - Ovarian
 - Prostate
 - Uterine
- Endometriosis
- Impotence
- Polycystic Ovarian Syndrome
- Sexually Transmitted Infections (STI)
 - Gonorrhea
 - Syphilis

MEDICAL ANATOMY & PHYSIOLOGY

- Genital herpes
- Chlamydia
- Trichomoniasis
- Genital warts
- Human Papilloma Virus (HPV)

Performance Skills

Explore three careers in health care (Job shadow, speaker, Work based learning, etc.)

Performance Skills

Give an oral and/or written report for each Career Exploration experience.

Performance Skills

Select a topic and defend your position on a CURRENT Medical Dilemma. (Essay, Debate, Etc.)

Skill Certificate Test Points by Strand

Test Name	Test #	Number of Test Points by Standard															Total Points	Total Questions
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Medical Anatomy & Physiology	702	11	3	3	8	9	10	10	5	7	3	5	7	7	8	8	104	71

STRANDS AND STANDARDS

MEDICAL FORENSICS



Course Description

This year-long course is designed to create an awareness of the branch of health science relating to medical forensics. This course focuses on introductory skills and assessment in order to develop the ability to identify, analyze, and process logically using deductive reasoning and problem solving. Medical forensics involves many aspects of health science instruction including laboratory skills and safety, microscopy, toxicology, measurement, physical evidence identification, pathology, anthropology, entomology, psychology, blood spatter analysis, and career exploration.

Intended Grade Level	11-12
Units of Credit	1.0
Core Code	36.01.00.00.085
Concurrent Enrollment Core Code	36.01.00.13.085
Prerequisite	Biology
Skill Certification Test Number	730
Test Weight	1.0
License Type	CTE and/or Secondary Education 6-12
Required Endorsement(s)	
Endorsement 1	Medical Forensics
Endorsement 2	
Endorsement 3	

STRAND 1

Introduction to Medical Forensics-Students will explore the fundamental aspects of Medical Forensics.

Standard 1

Detail the history and development of medical forensics.

- Create a historical timeline.
- Explore a variety of careers associated with medical forensics professions.
 - Crime laboratory analyst
 - Clinical laboratory technician
 - Microbiologist
 - Fingerprint analyst
 - Criminalist
 - Crime scene photographer
 - Phlebotomist
 - Forensic serology DNA criminalist
 - Serology technician
 - Forensic psychologist
 - Mental health counselor
 - Toxicologist
 - Biochemist
 - Pharmacologist
 - Geneticist
 - Medical examiner

Standard 2

Discuss the organization of the crime laboratory and detail the functions it serves.

- Discuss the federal programs established in the United States to investigate crimes.
 - ATF
 - FBI
 - Post Office
 - DEA
- Describe the organization of the Utah Crime Lab.
- Compare and contrast the Utah Crime Lab with a crime lab from another state and an international crime lab.

Standard 3

Describe the importance of physical evidence and observation.

- List the types of evidence.
 - Eyewitness
 - Class evidence
 - Physical evidence
 - Trace

- Circumstantial
- Individual
- Class
- Discuss how evidence is used to convince a jury of guilt.
- Review and practice the steps of becoming an accurate observer.
 - Observe systematically
 - Turn off filters
 - Interpret information later
 - Documentation
 - Written
 - Photographs

STRAND 2

Fundamental Laboratory Skills-Students will explore essential laboratory safety skills and fundamental skills related to microscopy and measurement.

Standard 1

Demonstrate appropriate use of personal protective devices.

- Describe how personal protective devices protect the evidence and the lab worker.
- Demonstrate how to properly use personal protective devices (e.g., lab coats, gloves, safety glasses).
- Demonstrate safe removal of gloves.

Standard 2

Exhibit appropriate behavior in the lab.

- Explain the dangers of evidence contamination through food, drink, cosmetics, lotion, eye drops, and contact lenses.
- Follow proper disposal and clean-up procedures with respect to chemicals and laboratory equipment.
- Demonstrate proper hand washing technique.

Standard 3

Use laboratory equipment correctly and safely.

- Demonstrate the proper use of equipment.
 - Micropipette
 - Centrifuge
 - Spectrophotometer
 - Electrophoresis apparatus-DNA
 - Thermocycler
 - Microscope
 - Balance
 - Water bath
 - Vernier calipers

- Glassware (metric units)
- Rulers/Measuring tapes
- Demonstrate proper use, handling, and components of a compound microscope and a stereoscope.
- Demonstrate the ability to create a wet mount slide.

Standard 4

Follow laboratory procedures.

- Understand the purpose of individual steps within a protocol.
- Perform the steps of laboratory protocols accurately and in sequence.

Standard 5

Comply with policies and requirements for maintaining a lab manual.

- Follow standard operating procedures for maintaining a lab manual.
- Document laboratory work following the steps of the Scientific Method.
 - Objectives
 - Material
 - Procedures
 - Data/Results
 - Conclusion

Standard 6

Demonstrate proper handling of chemicals.

- Communicate the rationale for laboratory labeling procedures.
- Recognize and comply with the labeling of chemicals used in a laboratory setting for safe handling and storage (flammability, corrosiveness, biohazards, toxicity, etc.).
- Reference and interpret the guidelines in Safety Data Sheets (SDS).

Performance Skills

Demonstrate appropriate use of personal protective devices.

- Demonstrate safe removal of gloves.
- Demonstrate how to properly use lab coats, gloves, and safety glasses.

Performance Skills

Maintain an accurate lab manual.

- Follow standard operating procedures for maintaining a lab manual.
- Document laboratory work following the steps of the Scientific Method.

STRAND 3

Medical Forensics Investigation-Students will describe techniques used to process a homicide crime scene and preserve the evidentiary value of the scene.

Standard 1

Describe how various medical forensics professionals process a crime scene.

- Responding officer
- Crime Scene Investigator
- Crime Scene Photographer
- Medical Examiner

Standard 2

Demonstrate or describe proper procedures of evidence collection.

- Trace (demonstrate)
- Biological (describe)
- Drugs, Plants, and Drug Paraphernalia (Describe)
- Weapons (describe)
- Fingerprint (demonstrate)

Standard 3

Identify how a crime scene and evidence may be compromised.

- Contamination (family, law enforcement, crime scene workers, etc.)
- Chain of custody (evidence lost, etc.)
- Environmental conditions (temperature, moisture, etc.)
- Preservation of the crime scene (value of evidence, etc.)
- Processing at the lab

Performance Skills

Collect and properly label evidence.

STRAND 4

Students will identify and analyze trace evidence, emphasizing hair and fiber.

Standard 1

Examine trace evidence using a microscope, chromatography, and other techniques.

- Define and list examples of trace evidence.
- Collect and analyze various types of trace evidence (dust, pollen, fiberglass, etc.)
- Define and identify a variety of microbes.
- Use a compound microscope to identify microbes.

Standard 2

Examine and analyze the forensic aspects of hair.

- Describe the microscopic structure of hair.
 - Shaft
 - Cortex
 - Cuticle
 - Medulla
 - Root
 - Follicle
- Describe the location of nuclear and mitochondrial DNA associated with hair.

- Shaft
- Root
- Describe the hair growth cycle and how it relates to trace evidence.
 - Anagen, catagen, telogen
 - Chemical absorption

Standard 3

Examine and analyze the forensic aspects of fibers by using physical (microscopic) and chemical (burn, acid, base, acetone) testing methods.

- Natural fibers
 - Wool
 - Silk
 - Cotton
 - Cashmere
 - Etc.
- Synthetic
 - Polyester
 - Spandex
 - Acrylic
 - Nylon
 - Etc.

STRAND 5

Fingerprint Identification-Students will explore fingerprint identification.

Standard 1

Describe fingerprint classification.

- Describe the 3 fundamental principles of fingerprinting.
 - First degree
 - Second degree
 - Third degree
- Identify the degrees of fingerprinting
 - First degree
 - Second degree
 - Bifurcation
 - Ridge ending
 - Short ridge
 - Island/Dot
 - Double bifurcation
 - Crossover
 - Enclosure
 - Third degree

Standard 2

Identify and classify fingerprint and ridge patterns.

- Classify fingerprints into 3 basic patterns.
 - Loops
 - Right
 - Left
 - Whorls
 - Double
 - Plain
 - Central
 - Accidental
 - Arches
 - Tented
 - Plain
- Identify individualization of fingerprints.
 - Ridge characteristics
 - Ridge count
- Describe the IAFIS System of fingerprint identification.

Standard 3

Compare and contrast latent, plastic, and visible fingerprints.

- Develop latent fingerprints using dusting, staining, and chemical fuming.
- Develop a plastic fingerprint using a mold (wax, soap, putty, etc.)
- Create and document visible fingerprints using digital photography.

Performance Skills

Develop a latent fingerprint and identify 10 ridge characteristics.

STRAND 6

Students will investigate the characteristics of blood, blood testing, and bloodstain analysis.

Standard 1

Identify the components and chemical properties of blood.

- List the components of blood.
 - Plasma
 - Erythrocytes (red blood cells)
 - Leukocytes (white blood cells)
 - Thrombocytes (platelets)
- Identify the antigens and antibodies that determine ABO blood types and the Rh factor.

Standard 2

Determine genetic probabilities using blood types.

- Use a Punnett Square to determine blood type probabilities.
- Apply the use of a Punnett Square to solve paternity questions.

Standard 3

Examine and analyze blood spatter.

- Illustrate size, shape, and directionality of blood spatter in a laboratory experiment.
- Compare and contrast low, medium, and high velocity blood spatter.
- Examine different types of blood spatter patterns.
 - Drip
 - Castoff
 - Transfer
 - Swipe
 - Wipe
 - Arterial
 - Expired
 - Misting
 - Void

Standard 4

Describe proper procedures for blood stain evidence collection, presumptive testing (Kastle-Meyer), and preservation.

- Describe how to collect a wet stain and a dry stain.
- Demonstrate how to collect a large object in reference to blood evidence collection (i.e. sheets, blankets, clothing, etc.)
- Using residual blood from a mammal, perform and explain a presumptive blood test.
 - i.e. Absorption pads from ground beef

Performance Skills

Classify blood spatter by velocity.

- High
- Medium
- Low

STRAND 7

Students will investigate various aspects of death.

Standard 1

Describe correct anatomical position and the role it plays in death investigation.

- Describe anatomical position.
- Apply directional terms related to autopsy.
 - Superior
 - Inferior
 - Anterior

- Posterior
- Dorsal
- Ventral
- Medial
- Lateral
- Proximal
- Distal
- Deep Superficial
- Supine
- Prone

Standard 2

Locate the body cavities and body regions and identify the major organs within each.

- Dorsal cavity
 - Cranial
 - Spinal
- Ventral cavity
 - Thoracic
 - Abdominal
 - Pelvic
- Body regions
 - Right hypochondriac
 - Left hypochondriac
 - Epigastric
 - Right lumbar
 - Left lumbar
 - Umbilical
 - Right inguinal
 - Left inguinal
 - Hypogastric

Standard 3

Identify the following organs and their location.

- Lungs
- Heart
- Diaphragm
- Esophagus
- Trachea
- Stomach
- Spleen
- Pancreas
- Liver
- Gallbladder

- Small Intestine
- Large intestine
- Kidney
- Bladder

Standard 4

Compare and contrast the manner and method of death.

- Define and list manners of death.
- Define and list methods/causes of death.
- Define and list mechanisms of death.

Standard 5

Identify the steps of an autopsy procedure and discuss the role an autopsy report may play in a death investigation.

- List the steps of an external examination.
- Describe the proper technique to perform a Y-shaped incision
- List the steps of an internal examination.

Standard 6

Identify the stages of decomposition to determine the approximate time of death.

- Define taphonomy and describe the stages of decomposition.
 - Fresh
 - Putrefaction
 - Black putrefaction
 - Butyric
 - Dry
- Compare and contrast the following:
 - Algor mortis
 - Rigor mortis
 - Livor mortis
- Identify common insects associated with decomposition (i.e. blow fly, carrion beetle, etc.) and diagram their life cycles.
 - Egg
 - Larva
 - Pupa
 - Adult
- Identify various environmental factors related to time of death (temperature, humidity, cause of death, etc.)

Performance Skills

Identify the steps of an autopsy procedure by animal dissection.

- Steps of an external examination
- Proper Y-shaped incision technique

- Steps of an internal examination

STRAND 8

Students will explore aspects of the criminal mind.

Standard 1

Locate and identify the major organs of the nervous system.

- Brain
 - Cerebral cortex
 - Cerebellum
- Spinal cord

Standard 2

Identify and describe offender profiling procedures.

- Profiling input
- Decision process models
- Crime assessment
- Criminal profile
- Investigation
- Apprehension

Standard 3

Identify psychological testing processes and procedures and other factors that affect the criminal mind.

- Describe the tests used to determine the cognitive and personality types of offenders.
- Discuss the problems with psychometric tests.
- Describe brain abnormalities, genetics, and environmental factors related to the criminal mind.
- Describe the physiological functions measured by a polygraph machine.

Standard 4

Compare and contrast neurobiological brain abnormalities and mental conditions related to abnormal psychology and the criminal brain and technical instrumentation used to diagnose these abnormalities.

- Describe brain abnormalities, genetics, and environmental factors related to the criminal mind.

Standard 5

Explore the psychological aspects of serial killers and mass murderers.

- Define serial killer.
- Define mass murderer.
- Explore the motives of a serial killer.
- Compare and contrast the types of serial killers.

- Explore the motives of a mass murder.

STRAND 9

Students will explore characteristics of physical evidence and remains.

Standard 1

Identify the basic bones of the skeleton and distinguish the differences between long and short bones.

- Cranium
- Vertebrae
- Sternum
- Xiphoid process
- Ribs
- Hyoid
- Humerus
- Radius
- Ulna
- Carpals
- Metacarpals
- Phalanges
- Pelvis
- Femur
- Patella
- Tibia
- Fibula
- Tarsals
- Metatarsals
- Phalanges

Standard 2

Use skeletal remains to determine the physical characteristics of an individual.

- Determine the sex of an individual based on skull, jaw, brow ridge, pelvis, and femur.
- Determine the ancestry of an individual.
- Estimate the age of an individual.
- Estimate the height, build, and handedness of an individual.

Standard 3

Identify injuries, bone diseases, and possible causes/methods of death using bone characteristics.

- Compare and contrast pre and postmortem bone injuries (i.e. fractures).
- Identify bone patterns indicating disease (i.e. arthritis).
- Identify bone markings that could indicate cause of death (i.e. stab wound, bullet hole, blunt force trauma, etc.)

Standard 4

Describe how teeth are used in forensic identification.

- Name and number deciduous (baby) and permanent teeth.
- Employ dentition patterns as a means for bite mark identification.
- Describe the use of forensic dentistry in regard to mass disasters and body identification.

Performance Skills

Identify the sex of an individual based on skeletal markers.

- Skull
- Jaw
- Brow ridge
- Pelvis
- Femur

Performance Skills

Match a bite mark from a victim to the perpetrator.

STRAND 10

Students will develop an understanding of the adverse effects of drugs and be acquainted with the laboratory investigation of the most common poisonings.

Standard 1

Identify the five schedules of drug types and classify according to the effects that they have on the body.

- Describe the five schedules of drug types.
 - Schedules 1-5
- Classify the Categories of drugs based on the physiological effects on the body and the chemical composition.
 - Stimulants (i.e. Amphetamines, Cocaine, Crack, Methamphetamines, Adderall, other mental disorder medications)
 - Depressants (i.e. Alcohol, Sedatives, Xanax, Marijuana, All narcotics, other mental disorder medication)
 - Narcotics/Opioids (i.e. Heroin, Codeine, Methadone, Oxycodone)
 - Hallucinogens (i.e. Ecstasy (MDMA), Bath salts, Mushrooms, GHB, other “date rape” drugs)

Standard 2

Describe how individual body systems are affected by drug intake.

- Integumentary
- Skeletal
- Muscular
- Nervous

- Cardiovascular
- Respiratory
- Endocrine
- Digestive
- Urinary
- Reproductive

Standard 3

Identify signs and symptoms of an overdose.

- Stimulants
- Depressants
- Narcotics/Opioids
- Hallucinogens

Standard 4

Describe current field and laboratory procedures used for measuring the concentration of alcohol in the bloodstream.

- Describe techniques used to measure the blood alcohol content (BAC).
 - Through blood
 - Through the breath
- Anabolic steroids
- Depressants (including alcohol)
- Bacterial toxins
 - Botulism
 - Tetanus
- Heavy metals and pesticides
 - Lead
 - Mercury
 - Arsenic
 - Cyanide
 - Strychnine

Standard 5

Discuss other chemical and biological agents that have high mortality rates with exposure.

- Bacterial toxins
 - Botulism (clostridium botulinum)
 - Tetanus (clostridium tetani) lockjaw
- Bioterrorism
 - Ricin (castor beans)
 - Anthrax (Bacillus anthracis)

Standard 6

Compare and contrast methods used to collect and package drug evidence.

- Identify procedures used to collect and package plant substances.

- Identify procedures used to collect and package liquids.
- Identify procedures used to collect and package biohazards.

STRAND 11

Students will investigate the importance of DNA evidence.

Standard 1

Identify the structure and function of a DNA molecule.

- Describe the structure of DNA.
- Describe the function of DNA.
- Compare and contrast nuclear DNA and mitochondrial DNA

Standard 2

Describe advancements in technology used to obtain a DNA fingerprint.

- Describe the purpose of PCR.
- Define RFLP and discuss how it relates to forensic identification.
- Define STR and discuss how it relates to forensic identification.
- Describe the CODIS System of DNA identification.
- Processing at the lab.

Skill Certificate Test Points by Strand

Test Name	Test #	Number of Test Points by Standard											Total Points	Total Question
		1	2	3	4	5	6	7	8	9	10	11		
Medical Forensics	730	2	2	4	7	13	13	12	6	8	5	6	78	73

STRANDS AND STANDARDS

BIOTECHNOLOGY



Course Description

Biotechnology is an exploratory course designed to introduce students to methods and technologies that support bioscience research and practice. Students are also introduced to career possibilities in the field of biotechnology.

Intended Grade Level	11-12
Units of Credit	1.0
Core Code	36.01.00.00.080
Concurrent Enrollment Core Code	36.01.00.13.080
Prerequisite	Biology or Chemistry
Skill Certification Test Number	780
Test Weight	1.0
License Type	CTE and/or Secondary Education 6-12
Required Endorsement(s)	
Endorsement 1	Biotechnology
Endorsement 2	N/A
Endorsement 3	N/A

STRAND 1

Students will investigate the past, present, and future applications of Biotechnology as well as relevant careers.

Standard 1

Describe historical applications of Biotechnology:

- Create a timeline of historical biotechnology developments.
- Discuss or replicate a historical application of biotechnology (e.g., yogurt, cheese, sauerkraut, bread).

Standard 2

Describe applications of present technology and theorize future implications:

- Evaluate the ethical, legal, and social implications in biotechnology (e.g., vaccines, genetically modified organisms (GMO), cloning, genetic engineering).
- Describe the technologies that have been developed to identify, diagnose, and treat genetic diseases (e.g., gene therapy, genetic testing, genetic counseling, Human Genome Project, Real-time PCR, Next Gen sequencing).
- Research and present biotechnology concepts and methodologies using effective communication skills (e.g., Pharmacogenomics, Therapeutic cloning, Transgenics).

Performance Skills

Research and present biotechnology concepts using effective communication skills.

Standard 3

Explore the various science and non-science fields and careers associated with biotechnology:

- Use the Internet, field trips, job fairs, interviews, and speakers to explore biotechnology.
- Outline career paths for various occupations in the biotechnology field.

STRAND 2

Students will demonstrate appropriate safety procedures and equipment use in the laboratory.

Standard 1

Demonstrate appropriate use of personal protective equipment (PPE):

- Describe how personal protective equipment (PPE) protect the experiment and the lab worker.
- Wear personal protective equipment (PPE) when appropriate (e.g., lab coats, gloves, eye protection).
- Demonstrate safe removal of gloves.

Standard 2

Maintain a sanitary laboratory environment:

- Explain the appropriate sterilization methods (e.g., autoclave/steam, chemical-ethanol and bleach).
- Demonstrate proper aseptic/sterilizing procedures.

Standard 3

Exhibit appropriate behavior to protect coworkers and self:

- Explain the dangers of contamination via food, drink, electronics, cosmetics, lotion, eye drops, and contact lenses.
- Follow proper disposal and clean-up procedures with respect to chemicals and laboratory equipment as indicated by SOP and SDS guidelines (e.g., broken glass, sharps, spills).
- Show locations of emergency exits and equipment (e.g., fire extinguishers, blankets, eye washes, showers).

Performance Skills

Demonstrate appropriate use of personal protective devices.

Standard 4

Use biotechnology laboratory equipment correctly and safely:

- Identify equipment and describe when to use it.
- Demonstrate the proper use of biotechnology equipment.
 - Micropipette
 - Centrifuge
 - Spectrophotometer
 - pH meter
 - Electrophoresis apparatus-protein & DNA
 - Thermocycler
 - Microscope
 - Autoclave
 - Balance
 - Water baths
 - Demonstrate proper use and handling of Micropipettes.

Performance Skills

Demonstrate proper use and handling of micropipettes.

STRAND 3

Students will follow laboratory procedures properly.

Standard 1

Follow laboratory protocols:

- Understand the purpose of individual steps within a protocol.
- Perform the steps of laboratory protocols accurately and in sequence.

Standard 2

Comply with policies and requirements for documentation and record keeping:

- Follow standard operating procedures.
- Maintain accurate records and documentation according to minimum good documentation practices (GDP).

Performance Skills

Maintain accurate records and documentation according to minimum good documentation practices (GDP).

Standard 3

Demonstrate proper handling of chemicals:

- Communicate the rationale for various laboratory-labeling procedures.
- Recognize and comply with the labeling of chemicals used in a laboratory setting for safe handling and storage.
 - Flammable
 - Corrosive
 - Toxic
 - Environmental Hazard
 - Biohazard
 - Electrical Shock Hazard
 - NFPA 704
 - White
 - Yellow
 - Red
 - Blue
- Reference and interpret the guidelines in Safety Data Sheets (SDS).

STRAND 4

Students will describe the properties of atoms and molecules and prepare lab reagents.

Standard 1

Explain chemical concepts relevant to biotechnology:

- Atomic and Molecular mass
 - Molecular weight/formula weight
- Bonding
 - Ionic
 - Covalent
 - Hydrogen
- Characteristics of the four types of bio-molecules
 - Carbohydrates
 - Lipids
 - Proteins

- Nucleic Acids
- Characteristics of molecules in water
 - Hydrophobic vs. hydrophilic
 - Polar vs. nonpolar
- Acid base chemistry, pH scale, and buffer properties

Performance Skills

Research and present biotechnology concepts using effective communication skills.

Standard 2

Demonstrate accurate and correct solution preparation:

- Use the metric system, common conversions, and proper units of scientific measurement.
- Calculate concentrations of solutions
 - Moles
 - Molarity
 - % volume per volume
 - % weight per volume
 - Concentration
 - mg/ml
 - ug/ul
 - x concentration
- Calculate how to dilute a stock solution to make the following:
 - Working solution ($C_1V_1=C_2V_2$)
 - Serial dilutions
- Measure and adjust the pH of specific solutions with commonly used acids and bases.
- Correctly label reagents with the following:
 - Chemical
 - Concentration and pH
 - Initials
 - Date
- Prepare solutions of defined concentrations and ph.

Performance Skills

Prepare solutions of defined concentrations and ph.

Standard 3

Relate dilution to solution preparation:

- Explain dilution principles.
- Prepare serial dilutions of specific solutions.
- Measure absorbance and determine concentration of solutions (e.g., spectrophotometer, fluorometry).

STRAND 5

Students will describe the structure and function of cells and their components.

Standard 1

Identify key cellular components and correlate with function:

- Describe the structure of the following and explain the major function of each.
 - Nucleus
 - Ribosomes
 - Mitochondria
 - Cell wall
 - Cell membrane

Standard 2

Compare and contrast the Three-domain system.

- Describe a prokaryotic cell including the following:
 - Cell structure
 - Reproduction
 - Applications in biotechnology
- Describe an eukaryotic cell including the following:
 - Cell structure
 - Reproduction
 - Applications in biotechnology

STRAND 6

Students will demonstrate proper bacterial identification and maintenance of cultures.

Standard 1

Prepare bacterial growth media:

- Identify growth requirements for common microorganisms.
- Utilize appropriate media preparation techniques and use appropriate conditions for specific experiments (e.g., avoid inactivation in media).
 - Antibiotics
 - Temperatures
 - Selective media

Performance Skills

Prepare bacterial growth media.

Standard 2

Inoculate agar and broth media:

- Explain the different methods of inoculation.
- Select the appropriate media and methods of inoculation.
- Inoculate media using various techniques.

- Streak
- Spread
- Demonstrate the ability to culture and maintain microorganisms.
- Correctly label specimen samples (e.g., bacterial strain, antibiotic, date, media).

Performance Skills

Demonstrate the ability to culture and maintain microorganisms.

Standard 3

Identify common categories of bacteria:

- Explain and identify bacterial properties useful for classification.
 - Cell wall composition
 - Morphology
 - Metabolism
- Perform gram stain tests to identify bacteria.

STRAND 7

Students will compare and contrast different types of nucleic acids and proteins and illustrate the flow of genetic information within the cell.

Standard 1

Describe the structure of nucleic acids:

- Identify the components of nucleotides.
- Compare and contrast the structure and function of DNA and RNA.
- Explain how the chemical structure of DNA applies to gel electrophoresis.
- Perform a restriction digest and analyze the results with gel electrophoresis.

Standard 2

Describe how DNA functions as a template for DNA replication:

- Identify the major components and outline the process of DNA replication.
- Explain the process of DNA replication and how it applies to the amplification of nucleic acids in PCR and DNA sequencing.
- Demonstrate the ability to use PCR technology by amplifying and analyzing DNA using PCR and gel electrophoresis.

Performance Skills

Demonstrate the ability to use PCR technology.

Standard 3

Describe the structure and function of proteins:

- Describe and illustrate the four levels of protein structure.
 - Primary
 - Secondary
 - Tertiary

- Quaternary
- Explain the relationship between the structure and function of proteins.
- Identify functional classes of proteins (e.g., structural, regulatory, enzymes, transport).
- Discuss ways proteins are used in biotechnology.
- Use computer resources to visualize the three dimensional structure of proteins (e.g., Protein data bank, Cn3D).
- Explain proper separation techniques to differentiate between proteins based on size and structure (e.g., chromatography, SDS-PAGE).
- Discuss the effects of environment on the function of enzymes.
 - Temperature
 - pH
 - Salt concentration

Standard 4

Outline the process of protein synthesis as related to the Central Dogma of Molecular Biology:

- Explain the progression of information from DNA to traits.
- Identify the major components, outline the process, and describe the products of transcription.
- Distinguish between transcription in prokaryotic and eukaryotic systems.
 - Introns
 - Exons
 - Post transcriptional modifications
- Identify the major components, outline the process, and describe the product of translation.
- Describe the uses of recombinant proteins in biotechnology (e.g., medicine, agriculture, etc.).
- Manipulate the production of recombinant protein in bacteria (e.g., GFP).

Standard 5

Describe how DNA mutations affect the organism:

- Characterize the different types of mutations.
 - Silent
 - Missense
 - Frame shift
 - Nonsense
- Explore the consequences of mutations on the organism (e.g., cancer, genetic disease).
 - Identify single nucleotide polymorphisms (SNP).
 - Describe the role of single nucleotide polymorphisms (SNP) in biotechnology applications (e.g., paternity, forensics, pharmacogenomics, evolutionary origins).

STRAND 8

Students will explain recombinant DNA techniques in bacteria.

Standard 1

Describe the use of plasmids in bacterial transformation:

- Describe the elements of a functional plasmid vector.
 - Origin of replication
 - Selection gene
 - Multiple cloning sites
 - Promoter
- Explain the role of restriction enzymes in generating recombinant plasmids.
- Describe competent cells, transformation, and selection methods.
- Perform a bacterial transformation and analyze results.

Standard 2

Describe the process of plasmid DNA isolation:

- Analyze the protocol for isolating plasmid DNA.
- Understand how to quantify the amount of DNA purified.

Performance Skills

Demonstrate proper aseptic/sterilizing procedures.

Performance Skills

Perform a restriction digest and analyze the results with gel electrophoresis.

Performance Skills

Demonstrate the ability to use proper separation techniques to differentiate between proteins based on size and structure (chromatography and SDS-PAGE).

Skill Certificate Test Points by Strand

Test Name	Test #	Number of Test Points by Standard															Total Points	Total Questions
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Biotechnology	708	1	11	6	13	3	12	22	3								71	71