# a-g Anatomy and Physiology

## Basic Course Information

Title: a-g Anatomy and Physiology

Transcript abbreviations: a-g Anatomy/Phys B / 6E1008 , a-g Anatomy/Phys A / 6E1001

Length of course: Full Year

Subject area: Laboratory Science ("d") / Biology / Life Sciences

UC honors designation? No

Prerequisites: Biology (Required)

Co-requisites: None

Integrated (Academics / CTE)? No

Grade levels: 10th, 11th, 12th

Course learning environment: Classroom Based

### Course Description

Course Overview:

a-g Anatomy and Physiology is a standards-based course focused on the Next Generation Science Standards. It is an advanced elective science course for the college preparatory student who wishes to acquire a greater breadth and depth of knowledge of the principles of biology as applied to the human body and its functions. This course is designed for students who may be interested in a career in health-related fields. The class consists of in-class discussions that are lab focused, as well as a variety of assignments and projects designed to create greater understanding in students and encourage inquiry and reasoning skills. Students are expected to be critical thinkers; self-directed, productive learners; and be able to analyze problems as well as set learning goals for themselves. Students will select and use the appropriate technology to communicate their research. They will have a workable understanding of the scientific inquiry method that includes asking questions and defining problems, planning and carrying out investigations, analyzing and interpreting data, and communicating results. Students will develop and use models to simulate real-world phenomena, and will select and use the appropriate scientific and medical equipment as well as technology to perform tests and collect and analyze data. Students will effectively communicate their content knowledge through verbal and written methods of communication. Students will have a deeper understanding of six major units, including levels of organization, support and movement, integration and coordination, transport, absorption and excretion, and the human life cycle.

**Course content:**

The shaded background of the following field indicates this course was approved by UC for the 2014-15 school year or earlier. Please refer to the current "a-g" course criteria and guidelines when completing your course submission form.

**Unit 1 - Levels of organization**

**Description:**

This unit is designed to introduce students to the study of body systems, to provide a review of earlier leanings that were developed in previous biology/life science courses, and to extend this understanding as a base to build upon through the year. Students learn about simple anatomy and physiology, levels of body organization, the characteristics of life, maintenance of life, organization of the human body, and an introduction to anatomical terminology. Students go on to review the structure of matter, the chemical constituents of cells, the basic structure of the cell, how materials are transported within the cell as well as in and out of the cell through the cell membrane, the cell cycle, cell metabolic reactions, DNA and protein synthesis, and how cells make up the various tissues of the body and the characteristics of these tissues..

NGSS Core Performance expectations emphasized:

HS-LS1-1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Disciplinary Core Ideas in this Segment: LS1.4 Structure and Function.

**Unit Assignment(s):**

Summary of sample assignment - Body Model

This activity is designed to reinforce the organization of the human body, by having students construct a series of 3- dimensional models of the human body that distinguish different regions and views through a student-developed system of color coding and written labels. Students present and explain their models to the class upon completion of the assignment.

**Unit Lab Activities:**

Summary of sample lab - Distinguishing between Muscle and Nerve Tissue

In this inquiry lab, students take a detailed look at muscle and nerve tissue, looking for the features that help them recognize the different types of muscle tissue, and then compare muscle and nerve tissue, focusing on the features characteristic to each. Students use a compound microscope to observe three prepared slides, one of skeletal muscle, one of smooth muscle, one of cardiac muscle, and observe each tissue. Students make careful diagrams of what they observe about the different tissues, and provide appropriate labeling for the structures they see. They then describe the characteristics of each tissue and how they can be used to identify the tissue. Next students observe a prepared slide of nerve tissue, making a careful diagram of what they observe about the tissue and providing appropriate labeling for the structures they see. They then describe the characteristics of nerve tissue that help identify it. Finally, students develop a chart comparing and contrasting muscle and nerve tissue, and discuss how the structure of the cells that make up each kind of tissue allows for the tissue’s function in the body. Students write a formal report of their investigation.

**Unit 2 - Support and Movement**

**Description:**

In Unit 2, students investigate the mechanisms that support and move the body. In this study, students first examine the integumentary system. Inquiry activities are designed to help students understand the amazing, intricate nature of the skin. Students look at the basic structure of the skin and extend their observations to the many accessory structures of the skin. The expectation is the students take away a good understanding of how the skin's structures allow for the many important functions it carries out for the body, including the regulation of body temperature, its role in waste elimination, and the processes involved in the healing of wounds. From the study of skin, students move on to the study of the skeletal and muscular systems and examine their interrelatedness. As students investigate the skeletal system, they learn how the structure of bone is related to its function, how bone grows and develops, and how the skeleton is organized. Students take an in-depth look at the different regions of the skeleton, including the bones of the skull, vertebral column, thoracic cage, pectoral girdle, the upper limbs, the lower limbs, and the various joints that allow the skeleton to move. Students then proceed to learn about the muscular system. Inquiry activities focus on the detailed structure of skeletal muscle and how muscle contractions take place. In addition, students learn about muscle responses and how skeletal muscle, smooth muscle, and cardiac muscle differ. Finally, students learn the names and locations of common bones and muscles that make up the body.

NGSS Core performance expectations emphasized:

HS-LS1-1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Disciplinary Core Ideas in this segment: LS1.A Structure and Function

**Unit Assignment(s):**

Summary of sample assignment - Skin Project

This assignment is designed is to help students gain a better understanding of the structure and function of the skin. Students use library and online resources to research and gather information about the skin and skin health. Students use this information to write a research report describing the detailed structure of the skin, the many functions skin performs for the body, and what can be done to insure healthy skin. A bibliography is to be included of the sources used. As part of this assignment, students are also given the task to build a 3-D model of the skin, using household materials that shows all structures of the skin discussed in class. All structures must be clearly labeled with name and function. Students present a summary of their report and an explanation of their model to the class.

**Unit Lab Activities:**

Summary of lab assignment-– Chicken Wing Dissection

In this lab, students investigate the skeletal and muscular systems by dissecting a fresh chicken wing and recording observations they make as they examine the wing. Safety note: all students are required to wear safety goggles and disposable gloves throughout the duration of this lab. To begin

the lab, students examine diagrams of chicken and human skeletons, identifying common structures in the forelimbs of chickens and humans (i.e., the humerus, ulna, radius, carpal, metacarpal, and the phalanges), and use a color-coding system to show matching structures in the chicken wing and human arm. Students then proceed by following printed chicken wing dissection directions. First the skin is peeled back to expose the fat and thin fascia (connective tissue) that covers the muscle. Students record observations of what they see as they expose the tissue under the skin. Next they use scissors to remove this thin layer to expose the actual skeletal muscle tissue. Students use dissecting needles to tease and separate the individual muscles and observe that the muscles are arranged in pairs on opposite sides of the bones. Students record what they see. Next they locate the flexors and extensors of the elbow joint. They are directed to straighten the chicken wing and hold it horizontally above the tray, then use forceps to pull on each of the muscles and note the movement that each muscle causes. Students record what they see. Next they are to straighten the joint and observe how the bones fit together. They are to look for the shiny, white covering of the joint surfaces, which is made of cartilage, and describe what they see. Next students are directed to look for several white tendons connecting muscle and bone in upper and lower wing muscle groups, and separate the bones of the wing elbow to see the ligaments that hold bone to bone. They end the dissection by locating blood vessels and nerves positioned between individual muscle bundles and between individual muscle bundles and bone. This will require the use of tweezers and dissecting pins. As a final activity, students perform a series of short investigations relating to muscle fatigue, and an analysis of the bones and muscles that are involved in simple hand movements. Students organize their observations into an appropriate chart, answer several related questions, and write a formal report that summarizes the lab.

**Unit 3 - Integration and Coordination**

**Description:**

Students learn about the interrelatedness of the nervous system, the body's senses, and the endocrine system as they investigate the topics covered in Unit 3. Students begin by learning about the general functions of the nervous system, including the peripheral and autonomic nervous systems, and the parts of the neuron and associated structures, They continue their study by investigating how impulses are transmitted, including concepts of cell membrane potential, impulse conduction, synaptic transmission, and impulse processing. Next, students investigate the types of nerves, nerve pathways, and the function of the meninges. They culminate their study of the nervous system by investigating the brain and its structure and function. In their study of the body's senses, students examine how their senses work in concert with the rest of their nervous system to allow the body to function properly. In this area of study they learn about the body's receptors and how these work to provide sensation and perception. Students learn about the structures and functions of the nose, tongue, ears, eyes, and skin. The study of the endocrine system focuses on the structure and function of the endocrine glands, including the pituitary gland, thyroid gland, parathyroid gland, adrenal gland, and pancreas, and their interrelationship with the nervous system and senses. Additionally, students examine the impact of stress on these systems and overall health.

NGSS core performance expectations emphasized:

HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Disciplinary Core Ideas in this segment: LS1.A: Structure and Function

**Unit Assignment(s):**

Summary of sample assignment - **Stroop Effect**

From the earliest years of school, reading is a task that people practice every day. We become so good at it that we read words automatically. When we are asked to name the color of the word instead of reading the word, somehow the automatic reading of the word interferes with naming the color of the word. This interference effect provides scientists with a measurable means to investigate how the brain works. Students investigate this phenomenon, called the Stroop Effect, by first researching information relating to how the brain works. Students use library and internet sources to research and gain a better understanding of how the brain filters and processes information it receives via the senses. Students make sets of Stroop cards that they can use as they administer the Stroop Effect tests with several volunteers, measuring how well their brains deal with interference. Students record the time it takes for each subject to read the words on the card correctly, and record the level of accuracy, i.e., saying the right word based on the directions given. Once the basic Stroop test has been given to a subject, students are encouraged to try different variables, i.e., have the volunteers look at the cards so the words are upside down, and have volunteers stand on one leg, etc., while doing the Stroop test. Students compare the performance of different age groups and the performance of men versus women. Students develop the necessary data tables in which to record the data, and develop the appropriate graphs to allow for analysis of their results. Students write a formal research report on the Stroop Effect, incorporating their data and analysis into the report.

**Unit Lab Activities:**

Summary of a sample lab: **Give Me Some Feedback**

In this inquiry lab, students work with a partner to construct a model of the pancreas and investigate through simulation the process by which the pancreas maintains blood sugar levels. In this model, sand represents the two hormones that come from the pancreas: insulin and glucagon. The goal is to maintain a balance in blood sugar. The students learn that when blood sugar is high, the pancreas releases insulin and glucagon is inhibited. When blood sugar is low, the pancreas releases glucagon and inhibits insulin. To set up their models of the pancreas, students use sand, a lever, and a stop watch. In the simulation, students use a graduated cylinder filled with sand as their supply of the hormones that are released from the pancreas. They begin the model simulation by laying out a piece of newspaper, placing a short section of plastic pipe on the newspaper, and taping the tube down so it does not move. Next, they place a strip of foam core board (the lever) across the plastic pipe until it balances. Students label one side of the model “Low Blood Sugar” and label the other side “Insulin,” then label the other card “High Blood Sugar” and “Glucagon.” Once the lever is balanced and the two sides are labeled, they add sand to one side or the other of the lever. Placing sand on one side of the lever is like adding insulin, while placing sand on the other side is like adding glucagon.

Students begin the simulation by eating a small piece of candy (provided). This increases the sugar in the blood stream. They start the stop watch and use a teaspoon to add sand (insulin) to the insulin side of the lever until it the end hits the table. At this point the students should understand that the body has used the sugar and the level of sugar in the blood is low. Now sand (glucagon) needs to be added to the glucagon side of the lever until the balance of the lever is restored. If two much glucagon is added then more insulin will need to be added. Students time how long it takes to get the lever back into balance. Students record the time in the Data section, record the time it takes to balance the lever. This process is repeated a total of 5 times. Students calculate and record the average time it takes to reach balance. Students write a formal lab report of that explains and summarize their investigation.

**Unit 4 - Transport**

**Description:**

Unit 4 is designed to help students learn how the blood, cardiovascular system, and lymphatic system, and their related mechanisms, structures, and processes, and how these work together to transport oxygen and vital nutrients throughout the body, as well as remove metabolic waste and regulate body temperature. A deep understanding of this transportation system aids in the overall understanding of the physiology of the body. Students begin the unit by focusing on the blood and its components, along with its many important functions, including its role in maintaining homeostasis. The study continues by investigating blood groups, blood typing, and transfusions. Students study the heart next. They examine the structures of the heart and learn their functions. Also included are the heart's actions, the types and characteristics of blood vessels, blood pressure, and the arterial and venous systems. The lymphatic system is the third part the body's transportation system. Here students focus on lymphatic pathways, tissue fluid and lymph, lymph movement, and lymphatic tissue and organs. The unit ends with investigating the important relationship between the lymphatic system and the body's immunity. Specific types of immunity are included in this study.

NGSS core performance expectations emphasized:

HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

HS-ETS1-3 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Disciplinary Core Ideas in this segment: LS1.A Structure and Function

**Unit Assignment(s):**

Summary of sample assignment - **Design a Model Artificial Heart Valve**

Biomedical engineers design devices, such as artificial heart valves, to help save people's lives. Following the steps of the engineering design process is critical, especially when the health and safety of humans are involved. Biomedical engineers must understand the challenge, then test their designs and revise as necessary to develop a safe and reliable solution. In this project, students design a model artificial heart valve. The project is divided into three parts. In Part 1, each student group needs access to a computer with internet access to research artificial heart valve ideas. Group members should take notes describing how the valves they see work, and make simple sketches that can be referred to later with the group as they work together to design their own group prototype heart valve. Each student group will need a pitcher of colored water (red), a bucket or large dishpan, a selection of supplies from which to construct their heart valve (pieces of rubber, of various sizes and shapes; paper clips; ping pong balls; rubber bands; plastic sheets, of varying thicknesses; wire coat hangers; metal scraps; cardboard, miscellaneous pieces; cardboard rolls, from paper towel or toilet paper rolls; dental floss; and other miscellaneous household supplies. Other materials include scissors, masking tape, duct tape, hot glue guns and glue sticks, and rulers. Finally, each group needs a notebook to use as an engineering journal.

In Part 2 of the project it is explained to the students that the engineering challenge is to design a

prototype functioning artificial heart valve. Direct them to research current artificial heart valves to get ideas before they begin to brainstorm their own designs. Explain to students that there is a constraint, which is that only the materials in the boxes they are given can be used in the construction of their models. Explain further that once they design a heart valve on paper, they must create a detailed diagram of the valve they have designed. Once they have created a suitable blueprint drawing, remind students that the function of the heart valve they build is to allow “blood” to pass through or prevent “blood” from passing through. Once students have built their prototypes they are ready to test them. The testing is conducted in two phases by positioning the prototype heart valve over a bucket or sink. With the heart valve facing upward, have one student pour half the water in the pitcher on the model heart valve. In this direction, the valve should be open and should allow water to flow through. Students will then flip over the heart valve (or turn it upside down), and pour the remaining pitcher water on the heart valve. The valve should close and prevent any water from passing through. As they test, students should collect data in the form of observations and notes, and then continually redesign (iterate) until the valve functions as a true one-way valve. Instruct students to retest their iterated designs. Remind them to make careful notes in their engineering journals to document design changes and results.

In Part 3 of the project, student teams design informational pamphlets or brochures that describe their prototype design, how it works, and why it is should be bought and used as a prosthetic for patients. Suggest that the marketing pieces include photographs and labeled diagrams showing parts and materials. Have each group present their artificial heart valve designs to the teacher and the rest of the class. Require presentations to include a water (blood) test and brochure explanation. A Heart Valve Model and Brochure Rubric are used to assess each group’s artificial heart valve, checking whether it functions correctly by opening and closing (assuming blood would be pumping around it), as well as whether it and the brochure meet the other challenge requirements.

**Unit Lab Activities:**

Summary of a sample lab: **Heart Dissection**

Before starting this lab, students put on safety goggles, disposable gloves and aprons. Once the protective lab gear is on, students begin the dissection by looking closely at the external structures of the heart, including the system of coronary arteries, and determining the right and left sides of the heart based on the position of the apex and the difference in firmness between the two sides. It is expected that students understand that the larger and more muscular left side of the heart is able to produce the pressure to pump the blood throughout the body, while the smaller and less firm right side only pumps the blood to the lungs. Students continue their examination of the external structures of the heart and identify the left and right atria and the left and right ventricles. Students also locate the primary blood vessels that are visible externally, including the superior and inferior vena cava, the pulmonary vein through which the blood passes on its way to the lungs, the pulmonary artery that brings the oxygenated blood back into the heart, and the large aorta that the blood passes as through it leaves the heart to travel to the rest of the body. Students are directed to connect the structures of these features to their functions.

Once the external features of the heart have been thoroughly examined, students proceed to use a scalpel and surgical scissors to open up the heart so the interior structures of the heart can be seen. Students use laminated diagrams to locate and identify the interior structures of the heart. Structures identified include the major blood vessels that lead in and out of the heart; the right and left atria; the right and left ventricles; the tricuspid, mitral, and semilunar valves; the chordae tendinae; and the septum which separates the right and left sides of the heart. The lab finishes by having students draw detailed cross-section diagrams of the heart, labeling all of the structures identified through the dissection process. Students use blue and red arrows to show the flow of deoxygenated and

oxygenated blood through the heart. Students answer a set of lab-related questions and write a formal lab report.

**Unit 5 - Absorption and Excretion**

**Description:**

Unit 5 has students examine the body's systems that are involved in absorption and secretion. The structures, functions, and processes at work in the digestive system, respiratory system, and urinary system, and the interrelatedness of these systems are the topics of study. The unit begins with students investigating the digestive system, including the general characteristics of the alimentary canal, the mouth, the pharynx and esophagus, the stomach, pancreas, liver, and the small and large intestines. A study of nutrition and nutrients is also included in this section. Next, students study the organs and associated structures of the respiratory system. The breathing mechanism, control of breathing, alveolar gas exchange, and gas transport are included in this study. Students then focus on the structures and functions of the urinary system. In the final section of the unit, students focus on the water, electrolyte, and acid-base balance, and how it is maintained in the body to insure homeostasis.

NGSS core performance expectations emphasized:

HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Disciplinary Core Ideas in this segment: LS1.A Structure and Function

**Unit Assignment(s):**

Summary of sample assignment - **Three-day Diet Analysis**

This assignment is designed to have students analyze their personal diet. To begin, students use internet resources to gather information about overall nutrition, nutrient requirements for optimum health and nutrient sources. Students use this information as they proceed through the project. Students design an Excel spread sheet in which they can record everything they eat over a 72-hour period (3 days). They are instructed to record the specific food eaten (divided into component parts if necessary) and the amount of each food eaten. Once this data is collected, students use library resources and/or the internet to find nutrients present in each food eaten and record the amount of calories, protein, fat, carbohydrate, vitamins, and minerals present in each food, adding this data to their spread sheet. Once all nutrients are recorded, the total amount of each nutrient is totaled for the 3-day period. They use this total to determine the average amount of each nutrient per day they took in. They are instructed to compare these amounts to the RDA (recommended daily allowance) established for each nutrient and record the percent RDA of each nutrient on their spreadsheet. Students present their findings in a formal report that analyzes their diet, and use the evidence they gathered to discuss how well their diet supplied their nutritional needs. They are to include the following points in their reports: the nutrients that were sufficiently and not sufficiently supplied by their diets, and potential problems that could result from current nutritional deficiencies. Then students will offer suggestions of how to improve their current dietary habits.

**Unit Lab Activities:**

Summary of a sample lab - **Respiratory Volume**

In this inquiry lab, students work with a partner and use a spirometer to measure different lung volumes. They use the data they collect to provide evidence of normal lung function. To begin, students design an appropriate data table on which they can record data. Next, one of the students has his/her partner count the number of times he or she inhales in 30 seconds and record this number in the data table. Students repeat this step three more times to increase the validity of the data. The student then calculates his or her average breaths per minute. The entire process is repeated, only this time students exercise vigorously for 3 minutes before counting their breaths. Next, students determine their tidal lung volume (TV). To do this, they are instructed to take a regular breath, exhale normally into a spirometer, and record the volume shown on the gauge. This process is repeated three more times. Students then calculate and record their average tidal lung volume. To determine their average expiratory reserve volume (ERV), they follow a similar procedure, this time breathing normally for a few minutes. Then, at the end of an ordinary expiration, they place the end of the spirometer into their mouth and exhale all of the air that can forced from the lungs. They repeat this process three more times, recording the data. They calculate and record the average expiratory reserve volume. The final lung volume they examine is the lungs' vital capacity (VC). To do this, students breathe normally for 2 or 3 minutes. Then they breathe in and out deeply a couple of times, and finally take the deepest breath possible and exhale all the air they can into the spirometer. They record this measurement in the data table. This process is repeated three more times to find an average vital capacity. Students use the average volume measurements they have collected, with the appropriate equations, to determine their inspiratory reserve volume (RV), inspiratory capacity (IC), and functional residual capacity (FRC), other data used to assess lung function. Students develop a graph that clearly shows their lung function, comparing their data to lung function data they can find on the internet, and develop an assessment of their lung function. Students write a formal report and present an oral summary of their findings.

**Unit 6 - The Human Life Cycle**

**Description:**

This unit will cover a variety of topics related to human reproduction and the human life cycle. In the first part of the unit, students will investigate the organs of the male and female reproductive system, the hormonal control of these two systems, the mammary glands, birth control, and sexually transmitted infections (STIs). In the second part of the unit, students will learn about fertilization, pregnancy, growth and development, aging, and human genetics, with a focus on genetic diseases and the technology being used and developed to treat and/or prevent these diseases.

NGSS core performance expectations emphasized:

HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Disciplinary Core Ideas in this segment: LS1.A Structure and Function

**Unit Assignment(s):**

Summary of sample assignment: **Reproductive Technologies**

In this activity, students discuss several human reproductive technologies available today, including pregnancy ultrasound, amniocentesis, in-vitro fertilization, and labor anesthetics. They learn how and why each technology was developed and how each technology works, and that these are examples of ways engineers have worked to improve the health of expecting mothers and babies. Students

summarize what they learn by developing an informational brochure or poster that explains each technology and presents the pros and cons of each technology. The activity closes with the discussion of several related questions, including, “Were engineers involved in helping to invent these technologies?”; “How do you think mothers were involved in developing these technologies and advances?”; “Why are these implemented reproductive technologies important to society, to you?”; and finally, “What reproductive technologies do you think still need to be developed?

**Unit Lab Activities:**

Summary of a sample lab - **Modeling STI Transmission**

Students first read information that provides a general description of various STIs and current statistics regarding the incidence rate and infection rate of STIs in the United States. The goal of this lab is to help students understand how STIs are spread and why it is difficult to halt their spread, and decisions they make that increase or decrease the risk of STI infection. Begin the lab by filling all the students’ cups half full with water, except for 2-3 cups (depending on class size). Fill these cups with sodium hydroxide (NaOH) solution instead of water. Both are clear solutions so students will not be able to tell them apart. Note which 2 or 3 students pick up the cups with the NaOH in them. Do not tell students who have what cup. Remind students of the statistic that one in four sexually active teenagers become infected with an STI each year, and that the CDC (Centers for Disease Control) states that the average number of sexual partners for sexually activity teens is 3 partners. Tell your students that they will exchange fluids with three other students only. Have them mingle and exchange with students from all over the room (not just their neighbors). One person will pour their cup of water into another student’s (their partner’s) cup, then that student will pour half back into their partner’s cup. They will do this again two more times with different students (partners). Tell them that they need to remember who they exchanged with and in what order. This should be recorded in the data table provided. When students are done, have them go back to their desks or tables and sit down. Tell them that you are going to place a few drops of an STD indicator to their cup to determine whether or not they have been infected. Take a bottle of phenolphthalein and a dropper and add a few drops to each person’s cup. A “positive test” will turn pink. A “negative test” will remain clear. Have the students write their names on the board with a positive or negative sign indicating whether or not they are infected. Have them answer the questions at the end of the lab. Discuss whether or not they can determine who the originally infected students were.

| Title | Author | Publisher | Edition | Website | Primary |
|---|---|---|---|---|---|
| CA Standards-based textbook (This course is aligned to the 2015 edition of Hole’s Essentials of Human Anatomy and Physiology, Twelfth Edition. textbook but it will work with any CA standards aligned textbook) | David Shier, Jackie Butler, Ricki Lewis | McGraw Hill | 2015 | www.mheducation.com | Yes |

Manuals

| Title | Author | Publisher | Edition | Website | Primary |
|---|---|---|---|---|---|
| Laboratory Manual for Human | Terry R. Martin | McGraw Hill | 2015 | www.mheducation.com | Yes |

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| Anatomy and Physiology, 1st | | | | | |