

HUMAN BODY: ANATOMY AND PHYSIOLOGY

NAME _____ SCHOOL _____

DATE STARTED _____ DATE COMPLETED _____

PREREQUISITES: Everyday Chemistry course or equivalent abilities; able to use a microscope. Recommended: Circulation of the Blood course.

HOW TO DO THIS COURSE: Do the steps one at a time, in order. When you finish a step, put your initials and the date on the sign-off line on the right. A split line means to get a pass (and an initial) from another student (or your Academic Supervisor if it says that). A * means get a checkout. Essays are turned in to the Academic Supervisor.

PURPOSE: Learn about the human body, its parts, what they do and how they work together.

ESTIMATED TIME: 20 hours.

MATERIALS NEEDED FOR THIS COURSE

Study booklet, *Human Body: Anatomy and Physiology*, with these data sheets (DS):

8029	8030	8031	8032	8033	8034	8035	8036	1729
8037	8038	8039	8040	8041				

Exams: 8042, 8443 (answers), 8043 (review) 8444 (review answers)

Other materials:

human anatomy model (at least 18" for classroom use, smaller permissible for home study), model of human skeleton with flexible joints, stethoscope, bright light bulb, raw chicken wing or drumstick, plastic gloves, sharp scissors, dishwashing detergent, aluminum foil, microscope, slide, cover slip, methylene blue (or another stain), toothpicks, access to water

diaphragm model (commercial or home-made; see DS #8036)

cracker or slice of bread

two stoppered test tubes showing pea-sized portions of meat: one filled with alcohol (before digestion); the other filled with hydrochloric (or muriatic acid) (after digestion)

roll of butcher paper, markers, aluminum foil

access to Internet

A. INTRODUCTION TO THE HUMAN BODY

1. READ: Data Sheet (DS) #8029 The Human Body, to heading "Engines." _____
2. DEMONSTRATE: How the body is like a machine. _____
3. READ: DS #8029, sections "Engines" and "Does your Body Have an Engine?" _____
4. DEMONSTRATE: The two different kinds of "engines" in the human body. _____

5. READ: DS #8029, section “What Makes the Human Body Unique” to the end of the data sheet. _____
6. PRACTICAL APPLICATION: Have another student ask you to define and demonstrate each of the following terms until you can do so without any hesitation. If any confusions or uncertainties come up, restudy DS #8029 to clear up any misunderstood words.

work	_____	machine	_____	engine	_____
structure	_____	function	_____	anatomy	_____
physiology	_____	nutrition	_____	health	_____

7. ESSAY:
 - a) Write down two or three things you think you want to achieve during your lifetime and discuss how having a strong, healthy, well-running body would help you achieve those things. _____
 - b) Describe an imaginary person who doesn’t know anything about how his or her body works and how that might get in the way of the person getting things done, enjoying life or being successful. _____

8. READ: DS #8030 Cells and Groups of Cells. _____
9. PRACTICAL APPLICATION: Do the “Human Cheek Cells Demonstration” at the end of DS #8030. (If you have done this demonstration before, you don’t have to do it again unless you want to.) _____
10. (Optional) PRACTICAL APPLICATION: If a chicken egg is a single cell, what do you think is the largest single cell in the world? Research this using whatever resources you want. _____
11. DEMONSTRATE: Do a quick sketch of each of the following kinds of cells in the human body and with each sketch tell why you think the cell is shaped that way. Turn your work in to your supervisor:

a) cheek cells _____	c) nerve cells _____	e) fat cells _____
b) skin cells _____	d) muscle cell _____	f) cells with little hairs _____

12. DEMONSTRATE: Show how a human body is made up of cells, tissues, organs and systems, showing the relationship of each of these to the next one. _____
13. READ: DS #8031 What a Cell Needs. _____
14. DEMONSTRATE: Write three sentences using each of the two definitions of nutrition given in DS #8031. Show them to your supervisor. _____

15. DEMONSTRATE: Sketch all the different nutrients: carbohydrates, proteins, fats, vitamins, minerals and water and ways that the body uses them.

16. READ: DS #8032 Organs and Body Systems.

17. DRILL: Have another student ask you to define and demonstrate each of the following terms until you can do so without any hesitation. If any confusions or uncertainties come up, restudy DS #8032 to clear up any misunderstood words.

integumentary system

skeletal system

muscular system

circulatory system

respiratory system

digestive system

nervous system

excretory system

endocrine system

reproductive system

B. INTEGUMENTARY, SKELETAL AND MUSCULAR SYSTEMS

1. READ: DS #8033 The “Skin” or Integumentary System.

2. DEMONSTRATE USING CLAY: The epidermis and dermis, including hair and hair follicles, sweat and oil glands, blood vessels and nerve cells.

3. PRACTICAL APPLICATION: You will need a raw chicken wing or drumstick, plastic gloves, sharp scissors and aluminum foil.

a) Put on the plastic gloves. _____

b) Place the piece of chicken on a table on a large piece of aluminum foil. _____

c) With the scissors cut through the skin along the length of the piece of chicken as best you can. _____

d) Try to pull a flap of skin away from the underlying muscle. Notice the thin whitish connective tissue that connects the skin to the muscle. See if you also notice some white, greasy fat there. _____

e) Dispose of the piece of chicken and aluminum foil as directed by the supervisor. _____

f) Wash the scissors with dishwashing detergent and warm water. Wipe the table too. _____

g) Dispose of the gloves as directed by the supervisor. _____

4. READ: DS #8034 The Skeletal System to heading “The Bones of the Skeleton.” _____
5. DEMONSTRATE: Find pivot joints (head, wrist), on a model of a human skeleton, then on your own body. See how this type of joint moves. (Move the joint on the model or move the joint on your own body.) _____
6. DEMONSTRATE: Find hinged joints (jaw, elbow, knee) on a model of a human skeleton, then on your own body. See how this type of joint moves. _____
7. DEMONSTRATE: Find ball and socket joints (shoulder, hip) on a model of a human skeleton, then on your own body. See how this type of joint moves. _____
8. READ: DS #8034 The Skeletal System, section “The Bones of the Skeleton.” _____
9. DEMONSTRATE: Find all the bones listed in the last section on a model of a human skeleton. _____
10. DRILL:
 - a) Have another student call off the name of a bone or group of bones in the diagram of DS #8034, section “The Bones of the Skeleton.” Show him where it is on your body. Do this with all the bones named in the diagram until you can do it without any hesitation. ____
 - b) Have the other student point to a bone on his body and you tell him the name of the bone. Do this with all the bones named in the diagram until you can do it without any hesitation. _________
11. READ: DS #8035 The Muscular System to heading “Tendons.” _____
12. DEMONSTRATE:
 - a) Bend your right arm in front of you with your hand facing your face. Hold your right wrist with your left hand. Now try to pull your right hand toward your face while holding it back with the left hand. Feel your biceps muscle working in your right arm. Now try to move your right hand away from your face while holding it back with the left hand. Feel your triceps muscle working in your right arm. ____
 - b) Have another student do the above. Feel their biceps and triceps muscles, noticing when they are more tense and more relaxed. _________
13. DEMONSTRATE:
 - a) Pick someone in your class that is about your size and weight. (If nobody in your class is about your size and weight, ask your supervisor for permission to find someone who is.) In a place approved by your

supervisor, arm wrestle this person. (If you don't know how to arm wrestle, ask your supervisor to have someone show you how it is done.)

Before you start, if your arms are covered, both of you should roll up your sleeves so that you can see your arm muscles. When you are wrestling, notice all the areas of your body where you contract muscles in trying to win the arm wrestling match. Try to notice muscles you can see tensing in the person you are arm wrestling. (You will probably see him even tensing up face muscles!) ____

- b) Pick someone in your class (or in another class or a nearby adult) who is much bigger and stronger than you. Arm wrestle with that person—you can ask them to “go easy” on you if you want. Notice how big the person's arm and shoulder muscles are compared to yours. ____

14. PRACTICAL APPLICATION: Go to a place where you can do one or more of the following:

a dance move

kicking, shooting or throwing a ball

jumping or running

some other physical movement you enjoy doing

Repeat the movement over and over, going slowly if needed to notice what muscles contract for each part of the movement. Return to the classroom and write a short essay describing how you think you could become better at the movement by exercising those muscles to make them stronger. ____

15. READ: #8035 The Muscular System, section “Tendons.” ____

16. DEMONSTRATE: Feel the Achilles tendon that connects the muscles of your calf to your heel. Flex your foot back and forth, and feel what happens at the Achilles tendon. ____

17. READ: #8035 The Muscular System, section “Smooth Muscle” to end. ____

18. DEMONSTRATE: Show how skeletal muscle, smooth muscle and heart muscle are different. ____

C. CIRCULATORY AND RESPIRATORY SYSTEMS

1. READ AND DEMONSTRATE: DS #8036 The Circulatory and Respiratory Systems, to heading “Blood and the Respiratory System.” ____

2. DEMONSTRATE: Lay two fingers against the front side of your neck and feel the throb of your heart through an artery. ____

3. DEMONSTRATE: Find one or more veins on your arm or hand. (When you look at them through the skin they are bluish.) _____
4. DEMONSTRATE: Hold your fingers close to a bright light bulb. Notice that the edges of your fingers are red. They are colored red from the blood circulating through the capillaries in the fingers. _____
5. PRACTICAL APPLICATION:
- a) Listen to the sound of your heart beat with a stethoscope. Use the stethoscope to determine your current heart rate (beats per minute). Write the number here: _____. ____
- b) Run for a minute or climb some stairs rapidly. Then sit down and use the stethoscope to see what your heart rate is now. Write the number here: _____. Also notice if the sound of your heartbeat has changed. ____ _____
6. READ: DS #1729 Pulse. _____
7. PRACTICAL APPLICATION:
- a) Sit down and take your pulse. Write the number here: _____. ____
- b) Run for a minute or climb some stairs rapidly. Then sit down and take your pulse again. Write the number here: _____. ____ _____
8. PRACTICAL APPLICATION:
- a) Take the pulse rates of other people and write down the numbers here. Make sure they are sitting down and are relaxed:
- Someone much younger than you: _____.
 - Someone about your age: _____.
 - Someone much older than you (could be an adult): _____.
- b) Can you tell from this if younger bodies seem to have faster pulse rates than older bodies? Go over your results with your supervisor. _____
9. READ: DS #8036 The Circulatory and Respiratory Systems, section “Blood and the Respiratory System.” _____
10. DEMONSTRATE: How oxygen gets from the lungs to the cells and carbon dioxide gets from the cells to the lungs. _____
11. DEMONSTRATE: Using the diagram of blood circulation on the last page of DS #8036, trace a drop of blood from the lower body to the head and back to the lower body. _____
12. READ: DS #8036 The Circulatory and Respiratory Systems, section “Breathing” to end of data sheet. _____

13. (Optional) DEMONSTRATE: Use a diaphragm model to demonstrate how the diaphragm works to inflate the lungs. _____
14. DEMONSTRATE: Do the breathing demonstrations at the end of DS #8036. _____
15. DEMONSTRATE: Find these parts of the circulatory and respiratory systems on an anatomy model:

heart _____	artery to lungs _____
artery to head and upper body _____	vein from lungs _____
artery to lower body _____	windpipe _____
vein from lower body _____	lungs _____
vein from upper body _____	diaphragm _____
16. DRILL: Have another student ask you to define and demonstrate each of the following terms until you can do so without any hesitation. If any confusions or uncertainties come up, restudy DS #8036 to clear up any misunderstood words.

blood vessel _____	artery _____	vein _____
capillary _____	trachea _____	hemoglobin _____
red blood cell _____	diaphragm _____	plasma _____

D. DIGESTIVE AND EXCRETORY SYSTEMS

1. READ: DS #8037 The Digestive System to heading "From Mouth to Stomach." _____
2. DEMONSTRATE: Show the two ways food is broken down. _____
3. READ: DS #8037, section "From Mouth to Stomach." _____
4. DEMONSTRATE: Find these parts of the digestive system on an anatomy model:

mouth _____	teeth _____	salivary glands _____
esophagus _____	stomach _____	
5. DEMONSTRATE: For a demonstration of how sugar is released in the breakdown of starch, chew a piece of bread or cracker until it begins to taste sweet. _____
6. DEMONSTRATE: Look at test tubes of small pieces of meat before and after they were treated with hydrochloric acid. _____

7. **PRACTICAL APPLICATION:** In this activity (and the others that follow), first draw the digestive system in sections and then do the demonstrations:
- Cut off a sheet of butcher paper 2–3 ft. long to use in drawing a life-size diagram of the digestive system. ____
 - Start at the top and sketch the digestive system from teeth to stomach, and label mouth, teeth, salivary gland, esophagus, stomach. ____
 - Using the diagram, and pieces of clay to represent food and chemicals, demonstrate these actions:
 - The teeth tear up food ____
 - Saliva from the salivary glands breaks down starch ____
 - The esophagus squeezes food into the stomach ____
 - Hydrochloric acid dissolves meat in the stomach ____

Save your diagram so that you can continue adding to it. _____

8. **READ:** DS #8037, sections “The Small Intestine” and “Other Organs Contribute to Digestion.” _____

9. **DEMONSTRATE:** Find these parts of the digestive system on an anatomy model: small intestine, villi, liver, gall bladder, pancreas. (Refer to the pictures at the beginning and end of DS #8037, if needed.) _____

10. **PRACTICAL APPLICATION:**

- Continue sketching in the digestive system on your diagram by adding the small intestine, liver, gall bladder and pancreas. ____
- Using the diagram, and pieces of clay to represent food and chemicals, demonstrate these actions:
 - The stomach squeezes the partially-digested food mixture into the small intestine. ____
 - The pancreas pours digestive juices into the small intestine. ____
 - The small intestine mixes food with digestive juices. ____
 - Stomach acid is neutralized in the small intestine. ____
 - The liver makes bile, which is stored in the gall bladder. ____
 - Bile pours into the small intestine and dissolves fats and oils. ____
 - Digestion is completed in the small intestine. ____
 - Digested food is absorbed into the blood. ____

Save your diagram so that you can add to it a final time. _____

11. **READ:** DS #8037, section “The Large Intestine.” _____

12. DEMONSTRATE: Find these parts of the digestive system on an anatomy model: large intestine, rectum, anus. _____
13. PRACTICAL APPLICATION:
- Finish sketching the digestive system by adding the large intestine, rectum and anus to your diagram. ____
 - Using the diagram, and objects to represent food and chemicals, demonstrate these actions:
 - Blood with food nutrients goes to the liver. ____
 - The large intestine removes water from digested waste and puts it into the blood. ____
 - Solid waste (feces) leaves the digestive system through the rectum. ____
14. DEMONSTRATE USING CLAY: How the organs of the digestive system are connected. (Save for next step.) _____
15. DEMONSTRATE USING CLAY: How the digestive and circulatory systems are connected. (Save this for use again at step D.22.) _____
16. DRILL: Have another student ask you to define and demonstrate each of the following terms until you can do so without any hesitation. If any confusions or uncertainties come up, restudy DS #8037 to clear up any misunderstood words.
- | | | | |
|------------------------|----------------------|----------------------|-------|
| digest ____ | tract ____ | digestive tract ____ | |
| gland ____ | secrete ____ | esophagus ____ | |
| hydrochloric acid ____ | small intestine ____ | large intestine ____ | _____ |
17. READ: DS #8038 The Excretory System.” _____
18. DEMONSTRATE: The two main jobs of the excretory system. _____
19. DEMONSTRATE: On an anatomy model, find the parts of the excretory system that were mentioned in last reading. _____
20. DEMONSTRATE: The function of the kidneys. Show where urine comes from and where it goes. _____
21. DRILL: Have another student ask you to define and demonstrate each of the following terms until you can do so without any hesitation. If any confusions or uncertainties come up, restudy DS #8038 to clear up any misunderstood words.
- | | | | |
|--------------|------------|--------------|-------|
| excrete ____ | urine ____ | urethra ____ | |
| kidneys ____ | | | _____ |

22. DEMONSTRATE USING CLAY: How the digestive, circulatory and excretory systems are connected. _____

E. THE NERVOUS AND ENDOCRINE SYSTEMS

1. READ: DS #8039 The Nervous System. _____
2. DEMONSTRATE: On an anatomy model find the brain, spinal cord and some nerves. _____
3. DEMONSTRATE: Nerves carry electrical messages. _____
4. DEMONSTRATE: The brain serves to coordinate and relay nerve messages, and acts as a “surge protector” for the nervous system. _____
5. DRILL: Have another student ask you to define and demonstrate each of the following terms until you can do so without any hesitation. If any confusions or uncertainties come up, restudy DS #8039 to clear up any misunderstood words.
nerves _____ impulse _____ brain _____
nervous _____ transmit _____ spinal cord _____ _____
6. READ: DS #8040 Endocrine System—A Special System of Glands, to heading “How the Endocrine System Is Controlled.” _____
7. DEMONSTRATE: What hormones are used for. _____
8. DEMONSTRATE: On an anatomy model find the adrenal glands and the pituitary gland. _____
9. DEMONSTRATE: Show at least three different things that adrenaline makes the body do. _____
10. READ: DS #8040, section “How the Endocrine System Is Controlled” to end of data sheet. _____
11. DRILL: Have another student ask you to define and demonstrate each of the following terms until you can do so without any hesitation. If any confusions or uncertainties come up, restudy DS #8040 to clear up any misunderstood words.
endocrine glands _____ hormones _____ adrenaline _____ _____
12. DEMONSTRATE: How you can control your body through your nervous and endocrine systems. _____

F. THE REPRODUCTIVE SYSTEM

1. READ: DS #8041 The Reproductive System, to heading “The Female Reproductive System.” _____
2. (Optional) DEMONSTRATE: Look at additional illustrations of the sperm and egg. Use an encyclopedia at the level of *The New Book of Knowledge* (subject *Body Human*), a biology text or other reference. (On Google (Internet), click on Images, then type in *sperm egg*.) _____
3. READ: DS #8041, section “The Female Reproductive System,” to heading “The Male Reproductive System.” _____
4. DEMONSTRATE: On an anatomy model, find the parts of the female reproductive system mentioned in the last step. _____
5. DRILL:
 - a) Make two large unlabeled drawings of the female reproductive system on a sheet of butcher paper, one front view and one side view. Show the ovaries, oviduct, uterus or womb, vagina or birth canal, plus bladder and urethra. _____
 - b) Write out the names and functions of each organ listed in a) above on a piece of paper. _____
 - c) Have another student read the names of the organs from your list. Using your drawings, point out each organ and tell what its functions are. If any confusions or uncertainties come up, restudy what you have read in DS #8041 to clear up any misunderstood words. You pass when you can point out each organ and can explain its functions without hesitation. _____
6. READ: DS #8041, section “The Male Reproductive System.” _____
7. DEMONSTRATE: On an anatomy model, find the parts of the male reproductive system mentioned in the last reading on an anatomy model. _____
8. DRILL:
 - a) Make two large unlabeled drawings of the male reproductive system on a sheet of butcher paper, one front view and one side view. Show the testicles, prostate, semen pouches, penis and urethra, plus bladder. _____
 - b) Write out the names and functions of each organ listed in a) above on a piece of paper. _____
 - c) Have another student read the names of the organs from your list. Using your drawings, point out each organ and tell what its functions are. If any confusions or uncertainties come up, restudy DS #8041 to

clear up any misunderstood words. You pass when you can point out each organ and can explain its functions without hesitation. ____

9. READ: DS #8041, section “Pregnancy and Childbirth” to the end of the data sheet. ____
10. (Optional) DEMONSTRATE: Look at additional color illustrations of development of the unborn child. Use a biology text or other reference. On Google (Internet), go to Images, *fetal development*. ____
11. DRILL:
- a) Draw a picture to show how a fetus in the womb gets food, water and oxygen, and gets rid of its wastes. Show the uterus, fetus, placenta and umbilical cord. ____
 - b) Write out the names and functions of each organ listed in a) above on a piece of paper. ____
 - c) Have another student read the names of the organs from your list. Using your drawings, point out each organ and tell what its functions are. If any confusions or uncertainties come up, restudy DS #8041 to clear up any misunderstood words. You pass when you can point out each organ and can explain its functions without hesitation. ____
12. ESSAY: Explain why a woman should be especially careful about what she eats or drinks or takes into her body during pregnancy. ____

G. FINAL SECTION

- *1. REREAD: Data Sheet (DS) #8029 The Human Body.” ____
2. DRILL: Choose one of the body systems below and deliberately do something with it. (It can be a simple action or complex, and it can involve more than one body system. For instance, how many body systems can you think of would have to be involved in lifting a hand?)

Repeat this until you have used all nine body systems listed and write what you did.

circulatory system ____	digestive system ____	integumentary system ____
skeletal system ____	respiratory system ____	nervous system ____
muscular system ____	excretory system ____	endocrine system ____

Supervisor pass. ____

3. ESSAY: Suppose you wanted to improve the health of your body. Discuss which body system or systems you think it would be easiest to begin with and why you think so. Tell something you think you could do to improve that body system or systems. ____

I have completed the steps of this course. I understand what I studied and can use it.

Student _____ Date _____

The student has completed the steps of this course and knows and can apply what was studied.

Academic Supervisor _____ Date _____

The student has passed the exam for this course.

Examiner _____ Date _____