

**Course**

Principles of  
Health Science

**Unit V**

Anatomy &  
Physiology

**Essential  
Question**

What are the  
tissues and  
systems of the  
human body?

**TEKS**

130.202 (c) 1C,  
1D, 1E, 1G, ,  
1H, 2D

**Prior Student  
Learning**

n/a

**Estimated time**

1-2 hours

**Rationale**

To pursue a career in health care, proficiency in anatomy and physiology is vital.

**Objectives**

Upon completion of this lesson, the student will be able to:

- describe biological and chemical processes that maintain homeostasis;
- analyze forces and the effects of movement, torque, tension, and elasticity on the human body;
- associate the disease process with changes in homeostasis;
- identify changes in structure and function due to trauma and disease; and
- identify normal and abnormal anatomy and physiology.

**Engage**

Ask the students to discuss the following question:

How do the bones, joints, muscles and ligaments function to permit movement and mobility in the body?

or

Show students pictures of X-rays with different types of fractures - many can be found on the internet.

**Key Points**

- I. Identification of terms
  - A. Abduction – motion away from midline of the body, as raising arm to shelf
  - B. Adduction – motion toward the midline of the body
  - C. Flexion – decrease in the angle between two bones at their joint
  - D. Extension – movement that straightens bones at their joint
  - E. Joint – point of juncture of two or more bones
  - F. Ligament – tissue which connects bones at a joint
  - G. Synovial fluid – lubricating fluid of joints
  - H. Tendon – tissue which connects muscles to bone
- II. Functions of the Skeleton
  - A. Supports and gives shape to the body
  - B. Protects internal organs
  - C. Makes movement possible
  - D. Produces blood cells

- III. Divisions of skeleton
  - A. Axial skeleton
    - 1. Skull
      - a. Cranium
      - b. Face
    - 2. Vertebral column
    - 3. Thorax
      - a. Ribs
      - b. Sternum
  - B. Appendicular skeleton
    - a. Upper extremities – shoulder girdle, arms, hands
    - b. Lower extremities – hip girdle, legs, and feet
  - C. Parts of bones
    - a. Diaphysis- the long shaft of the bone.
    - b. Epiphysis- the end of long bones, proximal and distal
    - c. Periosteum- tough membrane which covers bones
    - d. Endosteum- membrane that lines the medullary canal
    - e. Medullary Canal- a cavity in the diaphysis
    - f. Red Marrow- Found in certain bones and produces bone cells
    - g. Yellow Marrow – found inside the medullary canal and produces fat cells
- IV. Bone injuries and disease
  - A. Fracture
    - 1. Simple fracture – bone is broken, without external Wound, also known as a closed fracture
    - 2. Compound fracture – bone is broken, skin and soft tissue torn, increases chance of infection
    - 3. Greenstick fracture – incomplete break in which the bone is partially broken and partially bent.
    - 4. Spiral fracture – bone twist resulting in one or more breaks
    - 5. Comminuted – bone fragments or splinters into more than two pieces
    - 6. Impacted – broken bones ends jam into each other
  - B. Dislocations – displacement of bone from its normal position in a joint; ligaments may be torn and stretched.
  - C. Bone disorders and disease
    - 1. Arthritis – inflammation of bones at joints
    - 2. Bursitis – inflammation of the bursa (a sac or cavity filled with synovial fluid)

3. Kyphosis – increase in the curvature of the spine resulting in a hunchbacked appearance.
  4. Lordosis – exaggerated inward curvature in the lumbar region of the spinal column
  5. Osteomyelitis – inflammation of the bone
  6. Rickets – failure of bones to calcify sufficiently, hampering growth
  7. Scoliosis – side-to-side curvature of the spine
  8. Sprain – injury to ligaments resulting from wrenching of a joint
  9. Tuberculosis – bone disease caused by tubercle bacillus
- V. Types of muscles
- A. Skeletal or voluntary muscles – provide for voluntary body movement. Examples are chewing, movements of head, or walking.
  - B. Smooth or involuntary muscles – muscles contract independently of the will. Examples are muscles of the blood vessels and digestive tract.
  - C. Cardiac muscle – forms the heart wall and produces heartbeats.
- VI. Muscle disorders
- A. Muscular dystrophy – progressive wasting and weakness of muscles.
  - B. Paralysis – muscles do not contract because nerves controlling them are diseased or injured.
  - C. Muscle atrophy – decrease in muscle size due to disuse.
  - D. Hypertrophy – increase in muscle size resulting from increased use
  - E. Spasm – sudden, violent and involuntary contraction of a muscle

### **Activity**

- I. Color code a diagram of the skeleton then label the structures.
- II. Color and label a diagram of the muscles of the body.
- III. Complete Skeletal/Muscular Systems Questions.
- IV. Participate in the Hokie-Pokie Osteokey.
- V. Participate in Paper Bones Game.
- VI. Participate in Bag o' Bones Game.
- VII. Participate in Skeletonary Game.
- VIII. Participate in Muscle Madness.
- IX. Participate in Muscle Memory.

### **Assessment**

Successful completion of diagram(s)

Key - Skeletal/Muscular Systems Questions

**Materials**

Diagram of skeleton  
Diagram of muscles of the body  
Arts and crafts materials

<http://phs.pedr3.org/science/anatomy/muscular.html>

Utah State Office of Education, (2005). *Medical Anatomy and Physiology Teacher Resource CD*. Utah.

**Accommodations for Learning Differences**

For reinforcement, the student will make flashcards of key terms.

For enrichment, the student will research and report on how forensic scientists use the skeletal system when investigating homicides.

For enrichment, the students will research and report on a neuromuscular disease.

**National and State Education Standards**

National Health Science Cluster Standards

HLC01.01 Academic Foundations

Health care workers will know the academic subject matter required (in addition to state high school graduation requirements) for proficiency within their area. They will use this knowledge as needed in their role.

HLC10.01 Technical Skills

Health care workers will apply technical skills required for all career specialties. They will demonstrate skills and knowledge as appropriate.

**TEKS**

130.202 (c)(1)(C) interpret technical material related to the health science industry;

130.202 (c)(1)(D) organize, compile, and write ideas into reports and summaries;

130.202 (c) (1)(E) plan and prepare effective oral presentations; and

130.202 (c) (1)(G) describe biological and chemical processes that maintain homeostasis.

130.202 (c)(1)(H) identify and analyze principles of body mechanics and movement such as forces and the effects of movement, torque, tension, and elasticity on the human body.

130.202 (c)(2)(D) accurately interpret, transcribe, and communicate medical vocabulary using appropriate technology.

Texas College and Career Readiness Standards

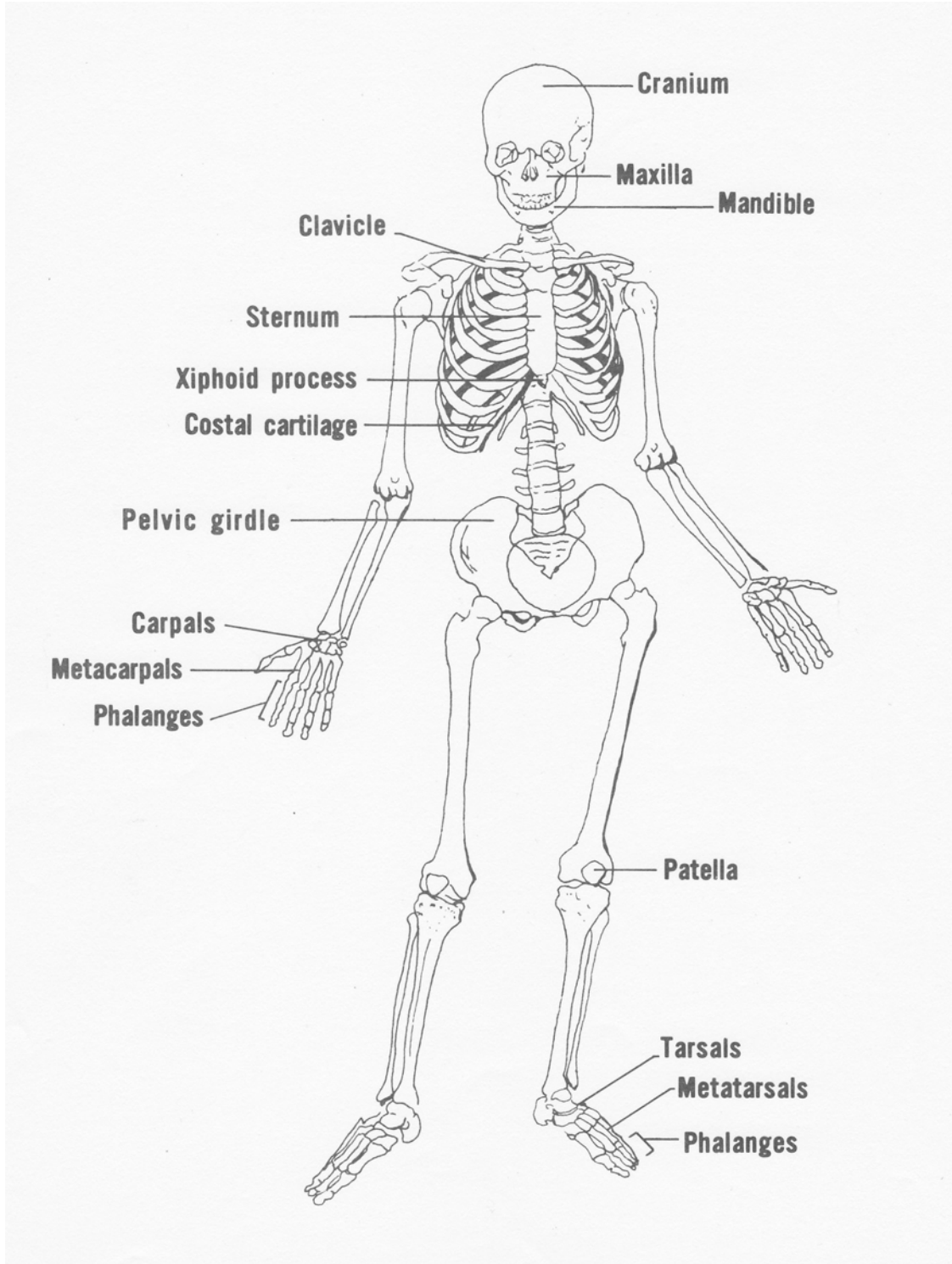
English Language Arts

- II. B. Understand new vocabulary and concepts and use them accurately in reading, writing, and speaking.
- III. B. Develop effective speaking styles for both group and one-on-one situations.
- IV. A. Apply listening skills as an individual and as a member of a group in a variety of settings.
- IV. B. 2. Listen actively and effectively in one-on-one communication situations.

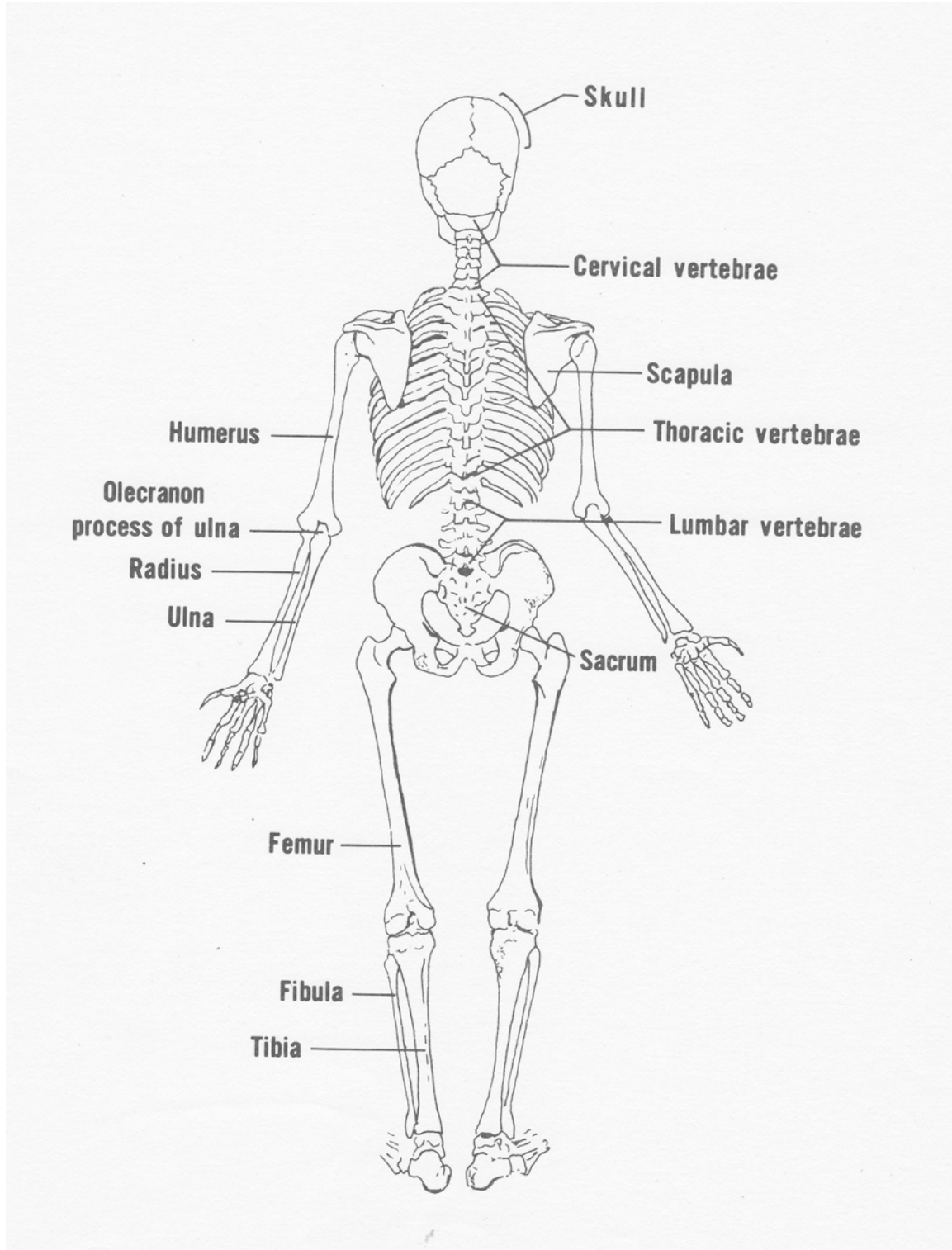
#### Science

- 1.E.1. Use several modes of expression to describe or characterize natural patterns and phenomena. These modes of expression include narrative, numerical, graphical, pictorial, symbolic, and kinesthetic.
- 1.E.2. Use essential vocabulary of the discipline being studied.
- 3.A.1. Use correct applications of writing practices in scientific communication.

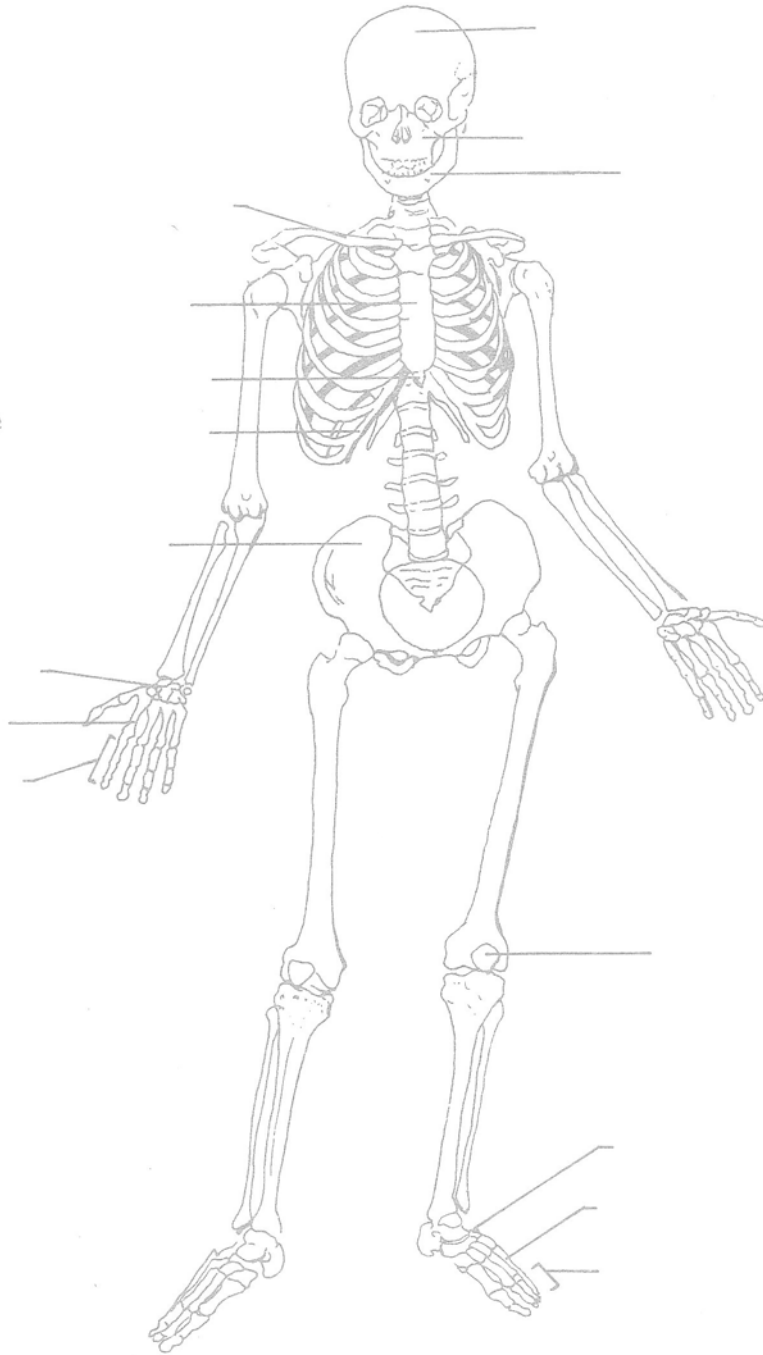
## Skeleton, Anterior View



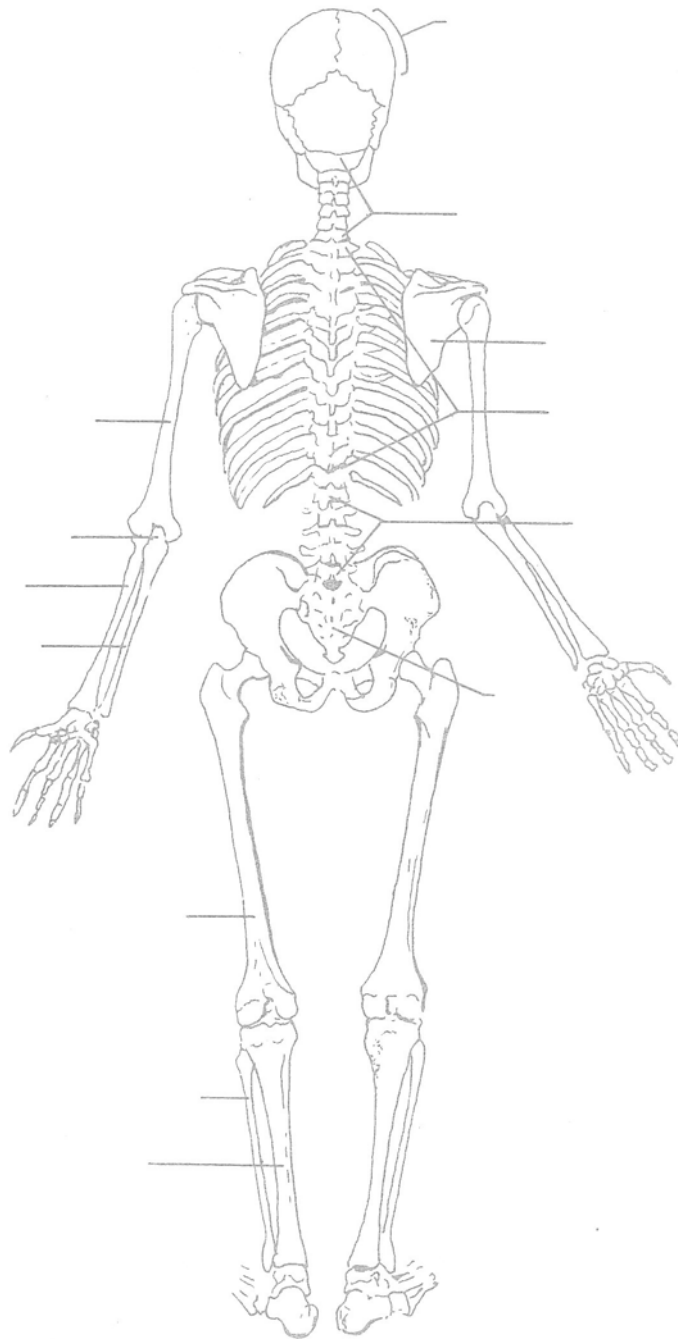
## Skeleton, Posterior View



## Label the Skeleton, Anterior View



## Label the Skeleton, Posterior View



## Questions – Skeletal/Muscular Systems

Directions: Answer the following questions.

1. List four functions of the skeletal system.
  - a.
  - b.
  - c.
  - d.
2. List and describe three types of fractures.
  - a.
  - b.
  - c.
3. List and describe five diseases or disorders of bone.
  - a.
  - b.
  - c.
  - d.
  - e.
4. List three types of muscles.
  - a.
  - b.
  - c.
5. List and describe five muscle disorders.
  - a.
  - b.
  - c.
  - d.
  - e.

adapted from ("Medical anatomy and," 2005)

## KEY - Questions – Skeletal/Muscular Systems

Directions: Answer the following questions.

1. List four functions of the skeletal system.
  - a. Supports and gives shape to body
  - b. Protects internal organs
  - c. Makes movement possible
  - d. Produces blood cells
2. List and describe three types of fractures.
  - a. Simple fracture – bone is broken, but there is no external wound.
  - b. Compound fracture – bone is broken, skin and soft tissue are torn
  - c. Greenstick fracture – incomplete break in which the bone is partially broken and partially bent
3. List and describe five diseases or disorders of bone. Answer should include and 5 of the following:
  - a. Arthritis – inflammation of bones at joints
  - b. Bursitis – inflammation of the bursa. A bursa is a sac or cavity filled with synovial fluid.
  - c. Kyphosis – increase in the curvature of the spine resulting in a hunchbacked appearance
  - d. Lordosis – exaggerated inward curvature in the lumbar region of the spinal column
  - e. Osteomyelitis – inflammation of the bone
  - f. Rickets – failure of bones to calcify sufficiently, hampering growth
  - g. Scoliosis – side-to-side curvature of the spine
  - h. Sprain – injury to ligaments resulting from wrenching of a joint
  - i. Tuberculosis – bone disease caused by tubercle bacillus
4. List three types of muscles.
  - a. Skeletal (voluntary, striated)
  - b. Smooth (involuntary)
  - c. Cardiac
5. List and describe five muscle disorders.
  - a. Muscular dystrophy – progressive wasting and weakness of muscles.
  - b. Paralysis – muscles do not contract because nerves controlling them are diseased or injured.
  - c. Muscle atrophy – decrease in muscle size due to disuse
  - d. Hypertrophy – increase in muscle size resulting from increased use
  - e. Spasm – sudden, violent and involuntary contraction of a muscle

## Activity: Hokie-Pokie Osteokey

### Objective:

Help students practice location of bones.

### Instructions:

1. Write the following anatomical terms on the board:

Phalanges (hands)  
Left patella  
Right humeral head  
Olecranon  
Coccyx  
Left ulna  
Right tarsals  
Left innominate  
Cranium  
Right tibia  
Left calcaneus  
Mandible  
Right radius  
Left great toe  
Right parietal  
Right carpals  
skeleton

2. Ask students to stand. (It's fun to get everyone in a circle.)
3. Have everyone sing Hokey-pokey song and substitute bones on board for usual body parts.

“Put your phalanges in. Take your phalanges out.  
Put your phalanges in and shake them all about.  
Do the hokey-pokey and turn yourself around. That's what it's all about!”

Clap, Clap.

adapted from ("Medical anatomy and," 2005)

# Paper Bones

Objective: Label bones on a cardboard “Halloween-type” skeleton

Materials: Each group of students will need the following:

1. Cardboard Halloween skeleton about four feet long
2. Post-it stickers (1/2” x 2”) – 25
3. List of bones and labeled atlas (from text)

## Warm-up

1. Break the class into groups of 3 or 4 (no more).
2. Give each group the materials above and tell them to choose a place to work together (table top or floor).
3. Give them ten minutes to correctly label all the bones they can find on the list.
4. Have each group present their labeled skeleton while the class critiques and gives feedback. The students are encouraged to defend their choices using the reference atlas. The instructor is the referee.
5. Repetition of this process for each group reinforces the learning.

## Competition

1. Have each group choose a team name (related to anatomy, e.g., Patellas).
2. Each group prepares to start the exercise over but without the atlas.
3. This time they must label the skeleton as quickly as possible while they are being timed. Give them a few minutes to organize task assignments before starting. Be sure they do not fill out the label beforehand.
4. Give the starting signal and keep track of the time.
5. Instruct them that when finished they should signal completion by standing up and holding up the labeled skeleton.
6. Note times and finishing order on the board.
7. Have the groups re-present their labeling results in order with group critique.
8. Score by adding 10-15 seconds per error to their elapsed time.
9. The team with the fastest resulting time wins.
10. Present an award.

## Comment

Be certain that most of the bones are accurately portrayed on the cardboard skeleton. If there is an error, point it out before play starts and agree to call it something.

# Bag o' Bones

Objective: Identify a bone in a bag by touch only

Materials: 1. A set of disarticulated bones  
2. Pillowcase

1. Divide the students randomly into two teams and decide on team names (anatomy names).
2. The instructor places a bone into the pillowcase in such a manner that the students cannot see it (students can be asked to put their heads down, or the instructor can select the bone behind a cabinet door).
3. Flip a coin to determine which team starts. That team puts forth the first player to represent them.
4. The student player is given the choice of feeling the bone inside the bag or feeling the bone from the outside (which is more difficult through the cloth). Award one point for inside and two points for outside examination.
5. Give the student only 10 seconds (you can vary this according to the skill of your students) to feel the bone, counting during the examination.
6. After withdrawing his hand, the student is given another 10 seconds to announce the name of the bone.
7. If the student chooses to examine the bone from outside the bag, he is given only 5 seconds and then 5 seconds to announce the bone name.
8. If correct, the instructor takes the bone out of the bag and awards the points accordingly (1 point for in-bag exam or 2 points for external exam).
9. Ask the student to point out what features caused them to decide on the bone name.
10. If the bone named is incorrect, the instructor give an opportunity to a student on the other team and that team may now reap the points. The process continues to alternate from one team to the other until it is correctly identified. Obviously the chance for success becomes greater with each wrong answer put forth. Eventually someone will identify the bone.
11. The instructor (or a designated student) keeps track of the team scores.
12. After every student has had at least one turn, the game is finished and a winner declared.

## Comments

This game should only be played when the class is fairly familiar with the bones and their surface features. It is a good opportunity to point out features like the hinge-like joint on the proximal end of the ulna that help differentiate this bone from the radius. The process also reinforces some of the anatomic features like the tibia is much thicker than fibula. It is best to use the long bones and the irregular bones. Small bones (carpals, tarsals, and phalanges) are difficult to exactly identify. Vertebrae can be a challenge, but it is possible to state from what region on the spine the bone comes from (cervical, thoracic).

# Skeletonary

Objective: Make clay images of the bones

Materials:

1. Modeling clay (2 sticks)
2. Deck of cards (1 set) with the name of a bone on each
3. Desk and chair in front of room
4. List of bones and atlas

## Competition

1. Divide the class into two equal groups and have them sit on opposing sides.
2. Have each team choose a name.
3. Flip a coin to decide which team will go first and then have the team choose one member to start. This person comes to the front of the class.
4. The student randomly chooses a card from the deck of bones and shows it to the teacher.
5. For one point, the student must identify the bone on the atlas (unseen by the class).
6. Sitting at the desk, in front of the room, the student has 30-40 seconds to mold the clay into a suitable representation of the selected bone.
7. The team members then have 30 seconds to make three guesses. If correct, the team gets one more point.
8. If not guessed correctly, the other team has an opportunity to guess once and get the point.
9. Then the student-sculptor is given an additional question by the teacher related to the selected bone. If answered correctly, the team gets one more point. Maximum points are three per turn.
10. The other team then takes a turn.
11. The team with the highest score wins and each team member gets an award.

## Additional Rules

1. The sculptor may not speak during their clay rendition. Speaking nullifies the point.
2. The sculptor may hold the clay model to their body to show its location.
3. Any sculpted form is allowable to give the hint. More than one bone may be made and the sculptor can then point to the unknown bone.

## Comments

This game develops psychomotor skills and encourages creativity in remembering features of the bones. For instance, the sculptor with the task of communicating the metacarpal may take all five of them with the attached phalanges or carpal bones and then point to the metacarpals. Kids get creative.

# Muscle Madness

Developed by Dr. J. Stephen Robinson

**Objective:** To identify muscles on an atlas

## Materials

Overhead

Transparencies of muscle views

Paper sheets (8" x 5 ½ ) with names of muscles

## Preparation

1. Prepare transparencies of muscle locations from an atlas (easily found on Internet).
2. Color in 4-5 muscles using a different color for each muscle.
3. Cut 8 ½ x 11 sheets of paper in half (width-wise) for as many muscles as are being studied.
4. Write the name of a muscle on each sheet: write one set in red and the other in black.
5. Stack the muscle name-sheets in two piles (red and black) on a table in the front of the room.

## Competition

1. Divide the class into two equally skilled teams and have them choose team names.
2. Make a scoreboard on the whiteboard to tally the points.
3. Have each team select a player to go on the first turn.
4. The instructor places a covered transparency on the Overhead and announces a color; uncover the transparency for about 5 seconds.
5. The designated player for each team rushes to the front table and searches in the stack of muscles for the correct name.
6. When found, the player raises it over his/her head and immediately calls out the name of the muscle.
7. If correct, the instructor states "correct." If wrong the instructor says nothing.
8. The team that identifies the muscle correctly first gets a point for their team.
9. The team with the most points wins.

## Comments

Four of five transparencies with 4-5 muscles each should suffice. It is important that teammates do not shout out the name of the muscle or in any other way assist the player designated to go to the stacks. Penalty points can be assessed for breaking this rule. A variation is to let the students use their notes the first time, and play by memory only on the second round.

# Muscle Memory

Developed by Dr. J. Stephen Robinson

**Objective:** To match muscles with their actions using a “Sticky Cloth”

## Materials

Satin or sateen cloth (4' x 8') of dark color

White board or display board large enough for the cloth

Can of Dry Mount spray

Paper sheets (8 x 5 ½) with names of muscles

Paper sheets (8 x 5 ½) with actions above muscles

## Preparation

1. Hang the sateen cloth on whiteboard or on wall.
2. Spray the cloth with Dry Mount spray (preferably the night before).
3. Cut 8 ½ x 11 sheets of paper in half -- width-wise-- for as many muscles as are being studied.
4. Write the name of a muscle on one sheet and its corresponding action on another sheet of paper; use large, clearly legible lettering (black marker for muscles and red marker for actions. Be certain the ink does not bleed through the paper.
5. Suspend a string dividing the cloth into left and right halves.
6. Stick the muscle name-sheets face in (toward the wall) on the left side of the cloth in random order
7. Stick the muscle action sheets similarly face in on the right side.

## Competition

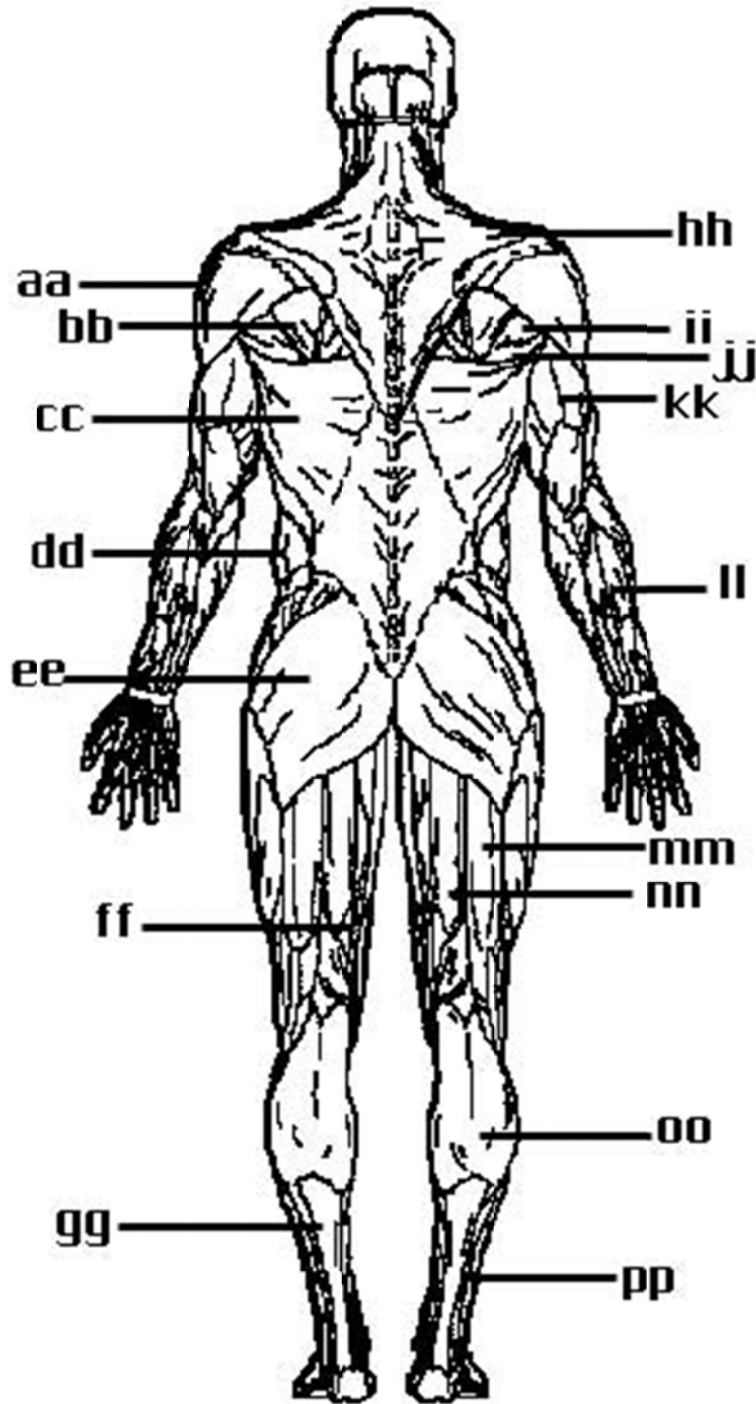
1. Divide the class into two equally skilled teams, and have them choose team names.
2. Make a scoreboard on the whiteboard to tally the points.
3. Flip a coin to decide which team goes first.
4. The first team selects a player to go first.
5. The player goes to the cloth and chooses a muscle sheet from the left side, and attempts to choose a matching sheet from the action (right) side.
6. If they do not match, the sheets are turned over again, and the player returns to his team. Usually the first several players will not be successful because they are working with the most unknowns.
7. The other team sends a player to the board to repeat the matching game.
8. If a match is made, the sheets are left face out for the rest of the game, and the team gets one point.
9. This continues, alternating teams, until all the muscles have been matched.
10. The team with the most points wins.

**Comments**

The sticky cloth is a good tool to use for teaching as it can be used to stick up all sorts of messages and does not require tape or tacks or staples. Additionally, the sheets can be changed or removed quickly and thus re-arranged easily. It is a great tool with which to do concept webs (mind mapping) or to plan a program. This tool has an advantage over the flannel board as any type of thin paper can be used for the drawings.

Once the cloth is prepared, it need only be sprayed once every 40-50 uses. I have gone for a whole year without needing to re-spray the cloth. When not in use, roll it up (sticky side in) and secure it above the whiteboard until needed again.

# Label the Muscles – Posterior View



## KEY - Label the Muscles – Posterior View

aa. deltoid

bb. rhomboid major

cc. latissimus dorsi

dd. external oblique

ee. gluteus maximus

ff. semimembranosus

gg. Achilles tendon

hh. trapezius

ii. teres minor

jj. teres major

kk. triceps

ll. "extensors"

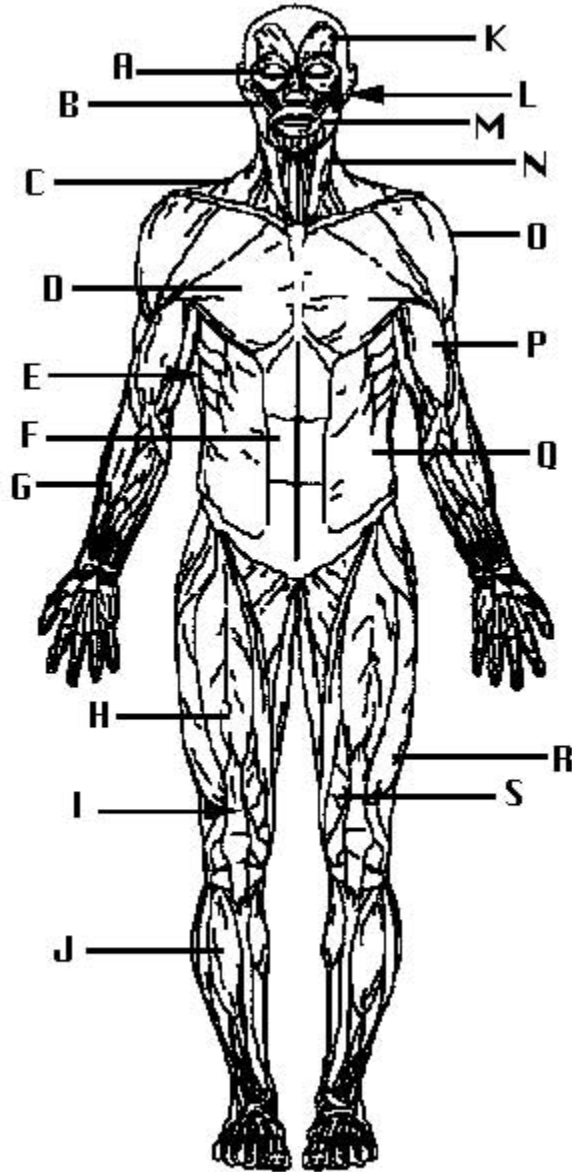
mm. biceps femoris

nn. semitendinosus

oo. gastrocnemius

pp. soleus

Label the Muscles – Anterior View



<http://phs.psd3.org/science/anatomy/muscular.html>

## KEY - Label the Muscles – Anterior View

- A. orbicularis oculi
- B. zygomaticus
- C. trapezius
- D. pectoralis major
- E. serratus anterior
- F. rectus abdominis
- G. "flexors"
- H. rectus femoris
- I. patellar ligament
- J. tibialis anterior
- K. frontalis
- L. masseter
- M. orbicularis oris
- N. sternomastoid
- O. deltoid
- P. biceps brachii
- Q. external oblique
- R. vastus lateralis
- S. vastus medialis