Nasco Education™

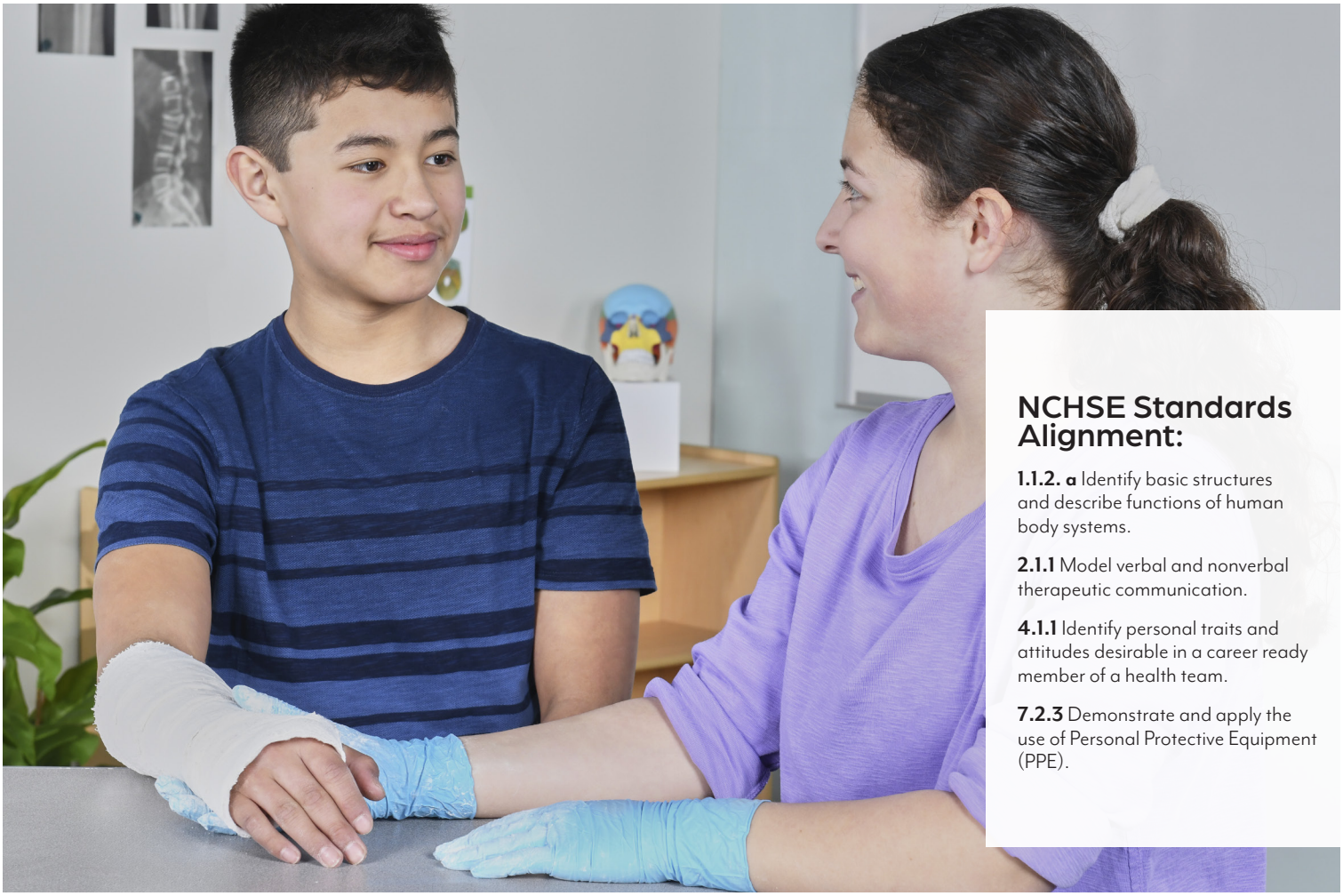
LESSON PLAN

Health Sciences

Breaking down bones: Understanding anatomy and cast application

Volume 13 | Gr. 9–12

Time required: 3–5 class periods



NCHSE Standards Alignment:

1.1.2. a Identify basic structures and describe functions of human body systems.

2.1.1 Model verbal and nonverbal therapeutic communication.

4.1.1 Identify personal traits and attitudes desirable in a career ready member of a health team.

7.2.3 Demonstrate and apply the use of Personal Protective Equipment (PPE).

Materials

- Nasco's Cast Making Kit (**NE40752**)
- Scissors
- Water and basin
- Large, labeled diagram of the human skeleton

Objectives

- Understand skeletal anatomy and recognize common fractures
- Demonstrate professional/patient interaction
- Properly use PPE in a clinical setting
- Apply skeletal structure knowledge to practical skills through hands-on activities

Directions

Introduction

1. Start with a class discussion to activate prior knowledge. Ask: "What do you think happens when someone breaks a bone?"
2. Then, show examples of broken bones using the Roylco® Broken Bones X-Rays.
3. Have students Think-Pair-Share to discuss why understanding bone anatomy is crucial in healthcare.

Studying the bones of the body

1. Begin by displaying a large, labeled diagram of the human skeleton on the board or projector. Briefly review major bone groups, such as the skull, spine, ribcage, arms, and legs.
2. Then, distribute the "Bones of the human body" handout to students on **p. 5**. Have students work in pairs or small groups to study the diagram and discuss key bones and their functions. Encourage students to use highlighters or colored pencils to categorize bones by type (e.g., axial vs. appendicular).
3. Then, distribute the blank "Bones of the human body" handout on **p. 6** and have students label the major bones from memory.

Identifying common fractures

4. Use X-rays and the handout on **p. 7** to discuss the characteristics of common fractures, including greenstick, simple, compound, comminuted, spiral, transverse, and oblique displaced and nondisplaced. Discuss how to identify each fracture type based on shape, severity, and bone displacement.
5. Test students' recall with the "Fracture identification" handout on **pp. 8-9**.

Reviewing soft skills when working with patients

1. Explain that while technical skills are essential when treating a fracture, how students interact with patients during procedures like casting is just as important.
2. Ask students: "What makes a healthcare provider trustworthy and approachable?" Emphasize that patients are often in pain or anxious, and healthcare workers must provide reassurance.
3. Discuss and define the following key soft skills as a class on the board:
   - **Active listening:** Listening without interrupting, acknowledging patient concerns
   - **Empathy:** Showing understanding and concern for the patient's feelings
   - **Clear communication:** Using simple language, explaining procedures
   - **Patience:** Giving time for patients to ask questions, not rushing them
   - **Confidence:** Demonstrating expertise while offering reassurance
   - **Respect:** Treating every patient with dignity, regardless of background or condition
   - **Adaptability:** Adjusting communication to meet different patients' needs
   - **Compassion:** Showing kindness and concern for the patient's overall well-being
   - **Reassurance:** Offering comfort to reduce anxiety
   - **Non-verbal communication:** Using body language to reinforce trust, e.g., eye contact, posture

Learning the steps to applying a cast

1. Before you begin the hands-on part of the lesson, make sure you have signed permission slips from parents/caregivers. See template on **p. 15**.
2. Begin by asking: "Why do healthcare professionals follow a specific order when performing medical procedures?" Briefly discuss the risks of incorrect cast application (e.g., pressure sores, poor circulation, improper healing).
3. Demonstrate the steps of applying a cast on a manikin, discussing each step. Then, show a short clip from The process of putting on a cast - Dr. Hilton Gottschalk or UofU Dept of Orthopaedics: short-arm cast application.
4. Then hand out the "Steps for applying a cast" worksheet on **p. 10** and challenge students to put the steps in the correct order. Review each step as a class, discussing what each one accomplishes.

Applying a cast

5. Before you begin, hand out the steps on **p. 4** to each pair of students. Explain to students that they will be working in pairs to create their own casts. Set expectations that students must work quietly and respectfully with their partners, practicing therapeutic communication. Remind them to follow proper PPE procedures.
6. Then, assign each student a scenario from the "Bone fracture scenarios" sheet on **pp. 12–13**. Have them take turn role-playing both the doctor and then the patient from their assigned scenarios.
7. Each student must wash hands for 20 seconds, dry hands, and put on gloves before beginning the cast application, follow the correct steps for applying a cast, and demonstrate proper communication throughout the process.
8. Monitor student performance by circulating around the room and providing feedback. Use the rubric on **p. 14** to assess student performance.
9. Before casts have fully set, use the scissors in your kit to remove them to avoid skin irritation. Be sure to supervise removal.

Steps for applying a cast

Steps 1–3

1. Explain the procedure to the patient and ensure proper positioning. Wash and dry hands with soap/water for 20 seconds (both medical professional and patient). **2.** Put on gloves and prepare materials, including water and casting supplies. **3.** Slide the stockinette over the arm, ensuring it extends beyond both ends of the cast. Cut a hole for the thumb if needed.

Steps 4–5

4. Apply cotton padding, ensuring it is smooth, wrinkle-free, and covers bony areas for comfort and protection. **5.** Check circulation (capillary refill, pulse, and skin color) before proceeding.

Step 6

Immerse the casting tape in water to activate it, then gently squeeze out excess water.

Step 7

Wrap the casting material around the limb, starting below the bottom of the fracture, working upwards and overlapping each layer by half. Use moderate tension to avoid pressure points.

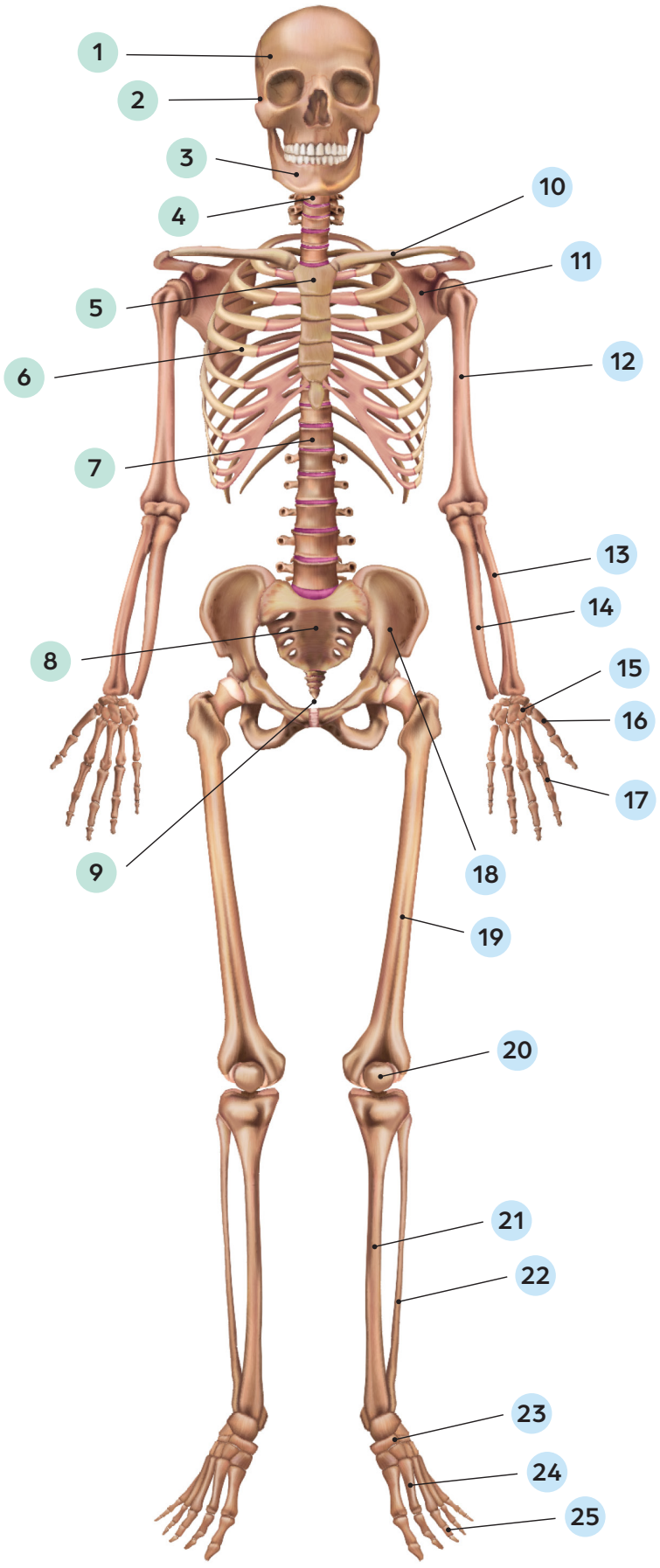
Step 8

Smooth and mold the cast to ensure proper fit and even pressure, preventing wrinkles or sharp edges.

Steps 9–11

9. Check circulation again to confirm the cast is not too tight (assess capillary refill, finger movement, and sensation). **10.** Allow the cast to dry completely before allowing movement. **11.** Provide patient care instructions, including how to protect the cast, signs of complications, and when to seek medical help.

Bones of the human body



Axial skeleton (80)

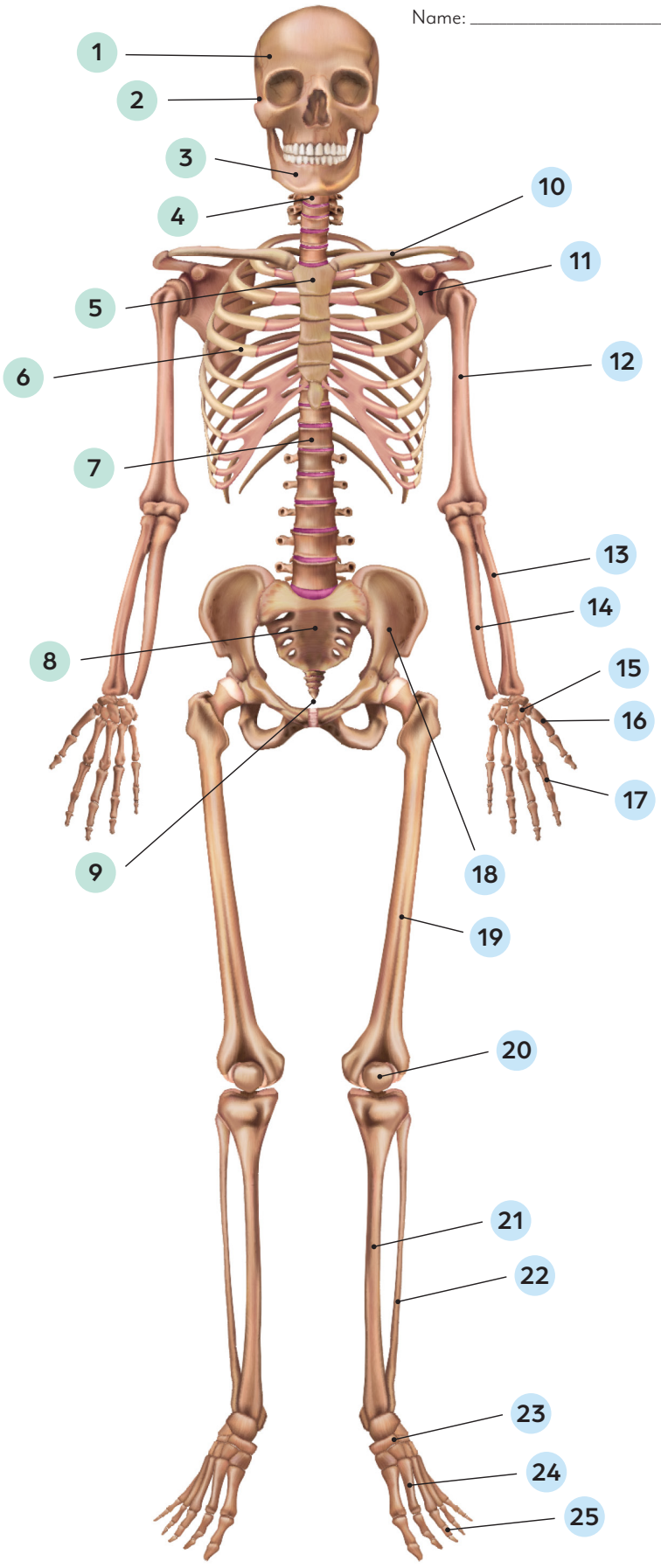
1. Cranium (8)
2. Ear bones (6)
3. Face (14)
4. Hyoid (1)
5. Sternum (1)
6. Ribs (24)
7. Vertebrae (24)
8. Sacrum (1)
9. Coccyx (1)

Appendicular skeleton (126)

10. Clavicle (2)
11. Scapula (2)
12. Humerus (2)
13. Radius (2)
14. Ulna (2)
15. Carpal bones (16)
16. Metacarpal bones (10)
17. Phalanges (28)
18. Hip bone (2)
19. Femur (2)
20. Patella (2)
21. Tibia (2)
22. Fibula (2)
23. Tarsal bone (14)
24. Metatarsal bone (10)
25. Phalanges (28)

Bones of the human body quiz

Name: _____ Date: _____



Axial skeleton (80)

1 _____ (8)

2 _____ (6)

3 _____ (14)

4 _____ (1)

5 _____ (1)

6 _____ (24)

7 _____ (24)

8 _____ (1)

9 _____ (1)

Appendicular skeleton (126)

10 _____ (2)

11 _____ (2)

12 _____ (2)

13 _____ (2)

14 _____ (2)

15 _____ (16)

16 _____ (10)

17 _____ (28)

18 _____ (2)

19 _____ (2)

20 _____ (2)

21 _____ (2)

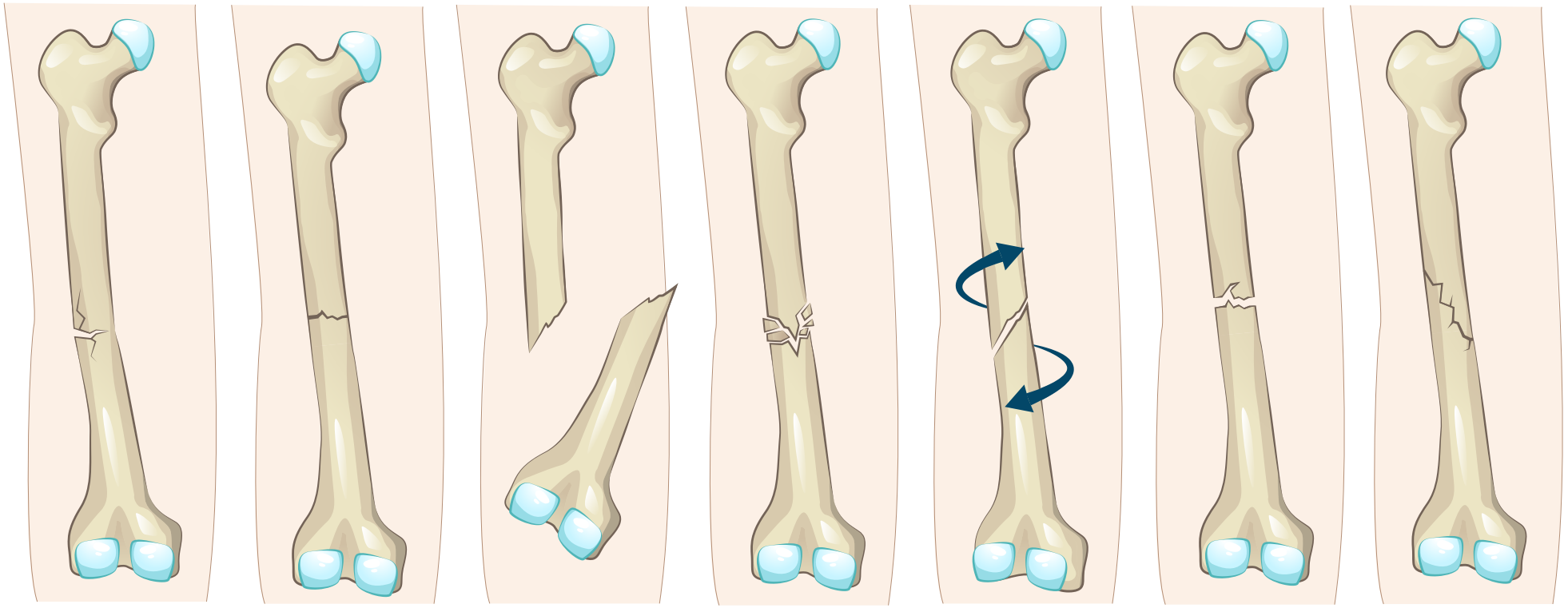
22 _____ (2)

23 _____ (14)

24 _____ (10)

25 _____ (28)

Types of bone fractures



Fracture identification

Name: _____ Date: _____

Directions:

1. Match the fracture types to their correct descriptions:

_____ Greenstick fracture

_____ Simple fracture

_____ Compound fracture

_____ Comminuted fracture

_____ Spiral fracture

_____ Transverse fracture

_____ Oblique fracture

a. A fracture that breaks cleanly without piercing the skin.

b. A break with multiple bone fragments.

c. A diagonal break across the bone.

d. A bone break that twists due to excessive rotational force.

e. A bone break where one side bends and the other side cracks.

f. A straight horizontal break across the bone.

g. A fracture where the bone pierces the skin.

2. Explain in 2–3 sentences why correctly identifying fractures is important in healthcare.

_____

_____

_____

_____

_____

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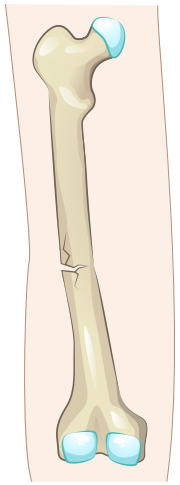
_____

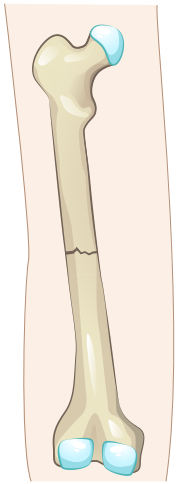
_____

Fracture identification (cont.)

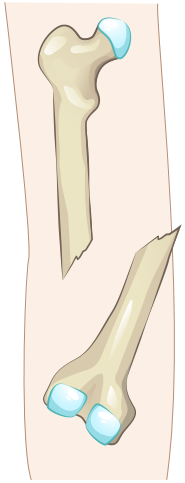
3. Label the images below with the correct fracture type.



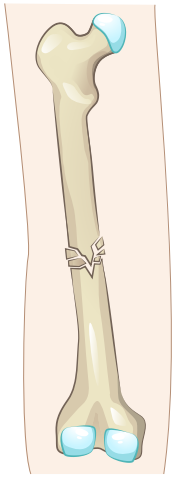
_____ fracture



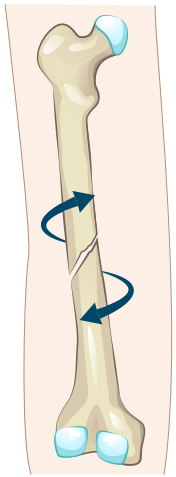
_____ fracture



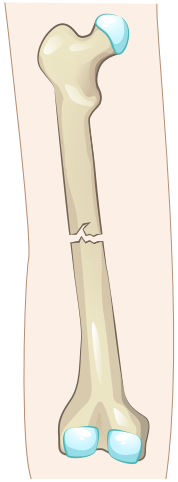
_____ fracture



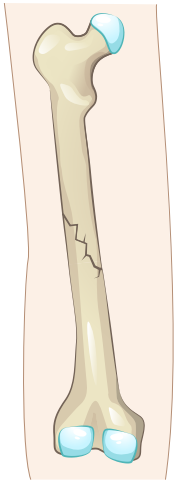
_____ fracture



_____ fracture



_____ fracture



_____ fracture

Steps for applying a cast

Name: _____ Date: _____

Directions: Below are the steps for applying a short-arm cast, but they are out of order! Number them in the correct sequence.

Steps:

	Smooth and mold the cast to ensure proper fit and even pressure, preventing wrinkles or sharp edges.
	Slide the stockinette over the arm, ensuring it extends beyond both ends of the cast. Cut a hole for the thumb if needed.
	Provide patient care instructions, including how to protect the cast, signs of complications, and when to seek medical help.
	Apply cotton padding, ensuring it is smooth, wrinkle-free, and covers bony areas for comfort and protection.
	Wrap the casting material around the limb, starting below the bottom of the fracture, working upwards and overlapping each layer by half. Use moderate tension to avoid pressure points.
	Immerse the casting tape in water to activate it, then gently squeeze out excess water.
	Allow the cast to dry completely before allowing movement.
	Explain the procedure to the patient and ensure proper positioning.
	Check circulation (capillary refill, pulse, and skin color) before proceeding.
	Wash and dry hands with soap/water for 20 seconds (both medical professional and patient). Put on gloves and prepare materials, including water and casting supplies.
	Check circulation again to confirm the cast is not too tight (assess capillary refill, finger movement, and sensation).

Reflection:

Why is it important to follow the correct steps when applying a cast? How could skipping a step impact patient care? (Answer in 3–5 sentences)

_____

_____

_____

_____

_____

_____

_____

_____

Answer key: Steps for applying a cast (correct order)

Steps for applying a short–arm cast

8	Smooth and mold the cast to ensure proper fit and even pressure, preventing wrinkles or sharp edges.
3	Slide the stockinette over the arm, ensuring it extends beyond both ends of the cast. Cut a hole for the thumb if needed.
11	Provide patient care instructions, including how to protect the cast, signs of complications, and when to seek medical help.
4	Apply cotton padding, ensuring it is smooth, wrinkle-free, and covers bony areas for comfort and protection.
7	Wrap the casting material around the limb, starting below the bottom of the fracture, working upwards and overlapping each layer by half. Use moderate tension to avoid pressure points.
6	Immerse the casting tape in water to activate it, then gently squeeze out excess water.
10	Allow the cast to dry completely before allowing movement.
1	Explain the procedure to the patient and ensure proper positioning.
5	Check circulation (capillary refill, pulse, and skin color) before proceeding.
2	Wash and dry hands with soap/water for 20 seconds (both medical professional and patient). Put on gloves and prepare materials, including water and casting supplies.
9	Check circulation again to confirm the cast is not too tight (assess capillary refill, finger movement, and sensation).

Bone fracture scenarios

Scenario 1: Nervous child getting a cast

- **Patient:** A 6-year-old child who has broken their arm and is nervous about getting a cast.
- **Role-play task:** The student playing the healthcare provider should use reassuring language, speak at the child's level, and offer comfort. The student playing the child should demonstrate fear or confusion about the cast and the procedure.
- **Focus:** Empathy, clear communication, and active listening.

Scenario 2: Elderly patient with broken wrist

- **Patient:** An elderly person who has fractured their wrist and is having trouble understanding the need for surgery and recovery.
- **Role-play task:** The healthcare provider should speak clearly and slowly, offering reassurance about the recovery process and addressing the patient's concerns. The elderly patient should show signs of confusion and frustration, especially due to pain.
- **Focus:** Patience, clear communication, and empathy.

Scenario 3: First–time patient with broken arm

- **Patient:** A new patient who has broken their arm and is unsure of what to expect during their visit to the clinic.
- **Role-play task:** The healthcare provider should explain the procedure for casting, offer reassurance, and answer questions. The patient should express uncertainty or worry about the process.
- **Focus:** Active listening, clear communication, and empathy.

Scenario 4: Teenager with broken arm

- **Patient:** A teenager who has broken their arm while playing sports and is upset about missing practices and games.
- **Role-play task:** The healthcare provider should acknowledge the teenager's frustration and explain the treatment plan, including the expected recovery time, physical therapy, and how they can stay involved in their sport after healing.
- **Focus:** Empathy, clear communication, and active listening.

Bone fracture scenarios (cont.)

Scenario 5: Pregnant patient with broken arm

- **Patient:** A pregnant woman who has broken her ankle and is concerned about how the injury will affect her pregnancy and ability to care for her toddler.
- **Role-play task:** The healthcare provider should offer reassurance, explain how the injury will be treated, and address any concerns about the safety of the baby. The patient should express anxiety about her ability to care for her children and the injury.
- **Focus:** Empathy, active listening, and patience.

Scenario 6: Patient with broken wrist and limited English proficiency

- **Patient:** A patient with limited English proficiency who has broken their wrist and is unable to fully understand the treatment instructions.
- **Role-play task:** The healthcare provider should make use of translation services or visual aids to help the patient understand the next steps in the treatment process. The patient should demonstrate confusion and frustration due to the language barrier.
- **Focus:** Patience, clear communication, and empathy.

Scenario 7: Patient with broken wrist and chronic pain

- **Patient:** A patient suffering from a broken wrist and dealing with ongoing chronic pain from previous injuries.
- **Role-play task:** The healthcare provider should listen attentively to the patient's concerns, explain the treatment for the broken wrist, and offer strategies to manage both the pain from the fracture and any underlying chronic pain.
- **Focus:** Active listening, empathy, and patience.

Scenario 8: Child with broken arm and sensory issues

- **Patient:** A 7-year-old child with sensory sensitivities (such as autism or sensory processing disorder) who has broken their arm and is overwhelmed by the hospital environment.
- **Role-play task:** The healthcare provider should use a calm, gentle approach, minimize sensory triggers (bright lights, loud noises), and offer choices to help the child feel in control. The provider should communicate with the caregiver on care instructions and allow the caregiver to assist in communication with the child. The child should display signs of distress, such as covering their ears, avoiding eye contact, or resisting touch.
- **Focus:** Sensory-friendly communication, patience, and empathy.

Applying a cast rubric

Criteria	1 - Needs improvement	2 - Proficient	3 - Exemplary
PPE & infection control	Did not use proper PPE or needed multiple reminders. Contaminated materials or patient area.	Used PPE correctly but needed minor reminders. Maintained a mostly clean work area.	Used PPE correctly and independently. Maintained a clean, professional work environment.
Step–by–step procedure	Missed several steps or applied the cast incorrectly, affecting function.	Followed most steps correctly but had minor errors that did not compromise function.	Followed all steps correctly, ensuring proper application and patient safety.
Therapeutic communication	Communication was unclear or lacked professionalism. Did not engage with the "patient."	Communicated clearly and respectfully, but with minor inconsistencies.	Used professional, empathetic, and clear communication throughout the procedure.
Teamwork & role–playing	Did not cooperate well with a partner or struggled to stay in role.	Worked well with a partner, with only minor lapses in role-playing.	Collaborated effectively, stayed in character, and provided realistic patient-caregiver interaction.
Problem–solving & critical thinking	Struggled to address issues (e.g., adjusting cast for comfort). Needed significant instructor intervention.	Identified and addressed minor issues with some guidance.	Independently adjusted and corrected issues, ensuring patient safety and comfort.

Cast Making Permission Form

Dear Parent/Guardian,

As part of our hands-on learning in _____, students will be participating in a Castmaking Unit, where they will work with a partner to apply a simulated cast using safe, classroom-approved materials. This activity is designed to help students understand the process of immobilizing a limb, similar to how medical professionals treat broken bones.

Please review the information below and sign to grant permission for your child to participate.

Student Name: _____

I, the parent/legal guardian of the above-named student, grant permission for my child to participate in the Castmaking Unit. I understand that this activity involves working closely with a partner to apply and remove a simulated cast under teacher supervision.

☐ I give permission for my child to participate.

☐ I do not give permission for my child to participate.

Parent/Guardian Name: _____

Parent/Guardian Signature: _____

Date: _____

If you have any questions or concerns, please contact _____

at _____ or _____.

Thank you,