

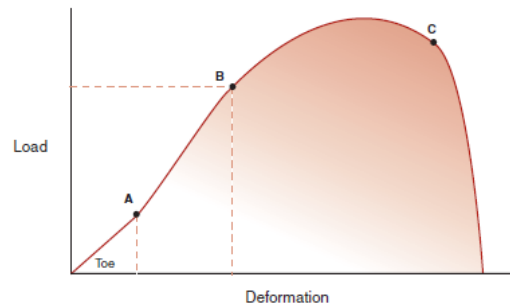
Kinesiology in Action

Recommended Answers to Generation Exercises

Use these answers as a guide for grading your students' responses to the generation exercises.

Lesson 1: Foundational Concepts of Kinesiology

Exercise #1



What is the region between point A and point B called? What happens when you remove the load while you are in this region? *Elastic. The tissue returns to its original length.*

What is the region between points B and C called? What happens when you remove the load while you are in this region? *Plastic. There is a permanent change in the tissue's structure, and it will not return to its previous length.*

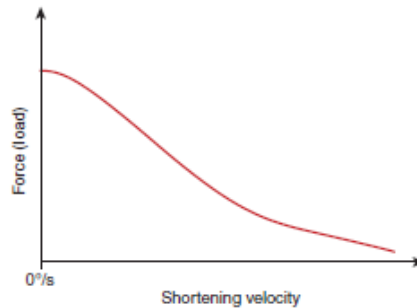
What happens at point C? *The connective tissue has reached its ultimate failure point.*

Exercise #2

Identify whether the movements listed below are classified as roll, spin, or slide.

- Glenohumeral flexion in the scapular plane: *Spin*
- Hip abduction: *Slide*
- Initial phase of knee flexion in standing: *Roll*
- Metacarpophalangeal flexion: *Slide*
- Initial temporomandibular depression: *Roll*
- Radiohumeral supination: *Spin*

Exercise #3



What type of contraction is occurring at the maximum point of force production? *Isometric*

What type of contraction is occurring to the right of the y-axis? *Concentric*

Why does the amount of force produced decrease as the shortening velocity increases? *As the speed of shortening increases, less actin and myosin linkages are made, resulting in decreased force production.*

If the graph included data points to the left of the y-axis (lengthening velocity), would the line incline or decline as it moved further to the left? *It would incline, because eccentric force production increases with increased speed.*

Lesson 2: Axial Skeleton

Exercise #1

Identify whether FLEXION or EXTENSION is occurring in the following situations:

- Intervertebral foramen gets smaller: *Extension*
- Anterior annulus bulges slightly: *Flexion*
- Inferior articular process (superior portion of motion segment) glides superiorly: *Flexion*
- Spinous processes approximate: *Extension*
- Nucleus pulposus migrates posteriorly: *Flexion*
- Posterior annulus becomes taut: *Flexion*
- Superior vertebral body translates anteriorly: *Flexion*
- Ligamentum flavum bulges into spinal canal: *Extension*

Exercise #2

What is the gravitational moment on the thoracic spine? *Extension*

In what direction is the pelvis rotated? *Anteriorly. Note the contour of the lower lumbar spine and lower abdomen.*

Lifting the right arm off the ground while keeping the trunk in the same position would require significant increase in which abdominal muscles? *The left external oblique and right internal oblique as well as the transversus abdominus*

What is the gravitational moment on the cervical spine? *Flexion*

Exercise #3

During flexion, which muscle is active first? *Erector spinae*

Is this concentric or eccentric activity? *Eccentric*

During the return to upright, which muscle is active first? *Biceps femoris*

Is this concentric or eccentric activity? *Concentric*

Describe the sequence of lumbar and hip motion you would expect to see from this individual during forward bending and return to upright. *Forward bend: lumbar flexion then hip flexion. Return to upright: Hip extension then lumbar extension.*

Lesson 3: Chest Wall and Temporomandibular Joint

Exercise #1

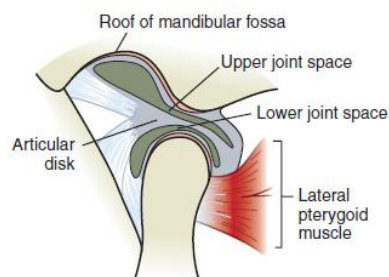
Name the primary muscles of respiration and describe their actions.

Diaphragm. Attachments along the entire lower border of the rib cage form a dome, separating the abdominal contents from the thoracic cavity. Contraction flattens the dome, causing a negative pressure in the lung that results in inspiration.

Internal intercostal muscles. The parasternal portion of these muscles is located anteriorly, starting at the costosternal junction and continuing posteriorly to the angles of the ribs. Deep to the external intercostals, the fibers run posteriorly and caudally from superior rib to inferior rib. Contraction aids in quiet respiration.

Scalenes. The anterior, middle, and posterior scalenes attach to the upper two ribs. Contraction from superior attachments on the cervical transverse processes of C3 to C7 elevates the two ribs, causing the manubrium to elevate. This is known as the pump handle motion.

Exercise #2



In the image shown, is the mandible elevated or depressed? How do you know? *Depressed. The mandibular condyle has glided anteriorly to the mandibular fossa.*

What tissue is stretched in this position? *Superior lamina (retrodiscal tissue).*

If you are looking at the right side and the left side appears to be in a position where the mandibular condyle is in the mandibular fossa, what is the position of the mandible? *Deviated to the left.*

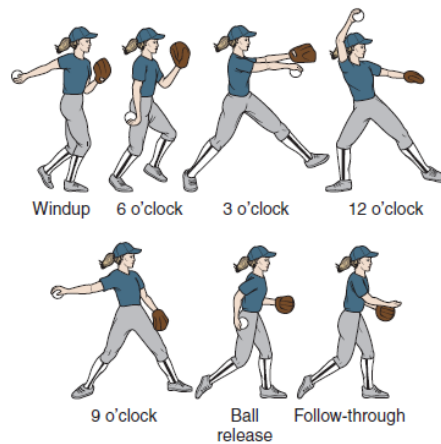
Exercise #3

Name the mandibular motion resulting from the following combinations of muscle contractions:

- B Masseter, B Temporalis, B Medial Pterygoid: *Elevation*
- L Lateral Pterygoid, R Masseter: *R lateral deviation*
- B Lateral Pterygoid, B Medial Pterygoid: *Protrusion*
- B Lateral Pterygoid, B Digastric: *Depression*

Lesson 4: The Shoulder Complex

Exercise #1



Given the windmill softball pitching motion identified in the image shown, list the activity level (peak, high, moderate, minimal, or none) of the supraspinatus muscle at each phase (windup, 6 o'clock, 3 o'clock, 12 o'clock, 9 o'clock, ball release, and follow-through). *Answers should reflect the information in the table shown.*

	Wind-up	6:00-3:00	3:00-12:00	12:00-9:00
Peak				
High		X		
Moderate	X		X	
Minimal				X
None				

Exercise #2



Identify two muscles that are failing to appropriately stabilize the scapula in this patient. Identify an exercise for each of those muscles. *1.) Rhomboids—scapular adduction via rowing; 2.) Serratus anterior—scapular retraction.*

Lesson 5: The Elbow Complex

Exercise #1

Identify the attachments of the triceps muscle. *Proximal attachments = long head—infraglenoid tubercle of the scapula, lateral head—posterior surface of proximal humerus, medial head—posterior surface of distal half humerus; distal attachments = olecranon process of the ulna.*

Identify the three motions of the triceps muscle. *1.) Extension of the shoulder; 2.) Extension of the elbow; 3.) The long head also adducts the shoulder.*

What is the position of maximal force generating capacity? Why? *Neutral shoulder with mid-range elbow flexion; this is the optimal length-tension relationship for maximal triceps force production.*

What is the position of active insufficiency? *Position in which the triceps is maximally shortened = full shoulder and elbow extension.*

What is the position of passive insufficiency? *Position in which the triceps is maximal lengthened = full shoulder and elbow flexion.*

Exercise #2

Identify the surfaces of the elbow articulations. *Capitulum and trochlea are convex, and the olecranon fossa is concave.*

Why is the carrying angle of the elbow a valgus position? *The medial epicondyle (trochlea) extends further distally than the lateral epicondyle (capitulum).*

When moving into flexion in open chain, what are the directions of the elbow arthrokinematics? *Concave ulna rolls and glides anteriorly on the convex humerus.*

Does this change with closed chain motions? If so, how? If not why? *Yes. In closed chain, the proximal segment (humerus) moves on the distal segment (ulna), which means that the convex surface of the humerus rolls anteriorly and glides posteriorly on the ulna.*

Lesson 6: The Wrist and Hand Complex

Exercise #1

Using a blood pressure cuff rolled up and inflated to 30 mm Hg, explore the strength of gripping with the wrist in varying degrees of flexion and extension. In what wrist position is the grip the greatest? Why? *Grip is greatest with wrist extension with ulnar deviation because of the length-tension relationship of the multi-articulate muscles of the wrist and hand. Wrist extension helps to take up the slack of the finger flexors to prevent active insufficiency.*

Exercise #2

If an individual is lacking wrist extension after a radial fracture, which direction should a clinician glide the proximal carpals on the distal radius to enhance motion? Why? *Glide anteriorly because convex proximal carpals will glide posteriorly and roll anteriorly on a concave distal radius.*

Lesson 7: The Hip Complex

Exercise #1

When lowering a box to the floor, what type of muscle action is being performed at the hips? *Eccentric hip extension*

What muscles are responsible for this motion? *Gluteus maximus, biceps femoris, semitendinosus, and semimembranosus*

Genu valgus is an undesirable component of a squat. What muscles of the hip are important to prevent genu valgus? *Hip external rotation (ER) is an effective way to control genu valgus. The muscles responsible for hip ER are the gluteus maximus, superior fibers of the piriformis, obturator internus and externus, gemellus superior and inferior, and posterior fibers of gluteus medius.*

When performing a squat, how can you prevent excessive stress on the knees with increasing knee flexion? *Keep the knees behind the toes; if you are more concerned about reducing stress on the hip, allowing the knees to pass anterior to the toes is acceptable.*

Exercise #2



What muscle is passively insufficient during the motion shown? *Hamstrings*

Why is this muscle passively insufficient? *It is elongated over both the hip and knee joints.*

If this individual is limited in hip flexion due to posterior muscle tension, what could be done to increase hip flexion? *Flex the knee.*

Exercise #3



Discuss the coupled motions of the pelvis and lumbar spine. When the hip is abducted in closed kinetic chain motion, what is the associated lumbar motion? *Hip abduction is associated with hip hiking and lumbar lateral flexion.*

What class lever is open kinetic chain hip abduction? *First class*

Exercise #4

Describe the surfaces of the hip joint. Based on relationship of these surfaces, what are the arthrokinematics of the hip joint when the osteokinematic motion is open-chain hip flexion? *With hip flexion, the convex femoral head rolls anteriorly and glides posteriorly in the acetabulum.*

What are the muscles performing this motion? *Iliacus, psoas major, tensor fasciae latae, sartorius, rectus femoris*

Lesson 8: The Knee

Exercise #1

An athlete had an ACL reconstruction. The athlete has decreased knee flexion. Given the structure of the joint surfaces, in what direction should you glide the tibia to facilitate knee flexion? *In open kinetic chain, the concave tibia will roll and glide posteriorly on the femur for knee flexion. Gliding the tibia posteriorly will enhance knee flexion.*

Does this change if the femur is mobilized on the tibia? *Yes. If the femur is moved on the tibia, the arthrokinematics are now convex on concave. That means the femur will roll posteriorly and glide anteriorly during closed kinetic chain knee flexion.*

Lesson 9: The Ankle and Foot Complex

Exercise #1

An individual experienced an Achilles tendon injury and now presents with limited ankle dorsiflexion. What are the arthrokinematics that would be helpful to restore this motion? *The convex talus roll anteriorly and slide posteriorly on the concave tibial mortise.*

Exercise #2

Given the common nature of lateral ankle sprains:

What is the common motion that would stress the lateral ligaments? *Talocrural inversion*

What additional motions would isolate the following ligaments?

- Anterior talofibular: *Is most often injured with inversion and plantarflexion (e.g., stepping in a hole or on someone's foot)*
- Calcaneofibular: *Stabilizes the talus in the mortise; prevents inversion and dorsiflexion*
- Posterior talofibular: *Prevents inversion and dorsiflexion*

Palpate each of these ligaments and perform the appropriate motions to stress each ligament.

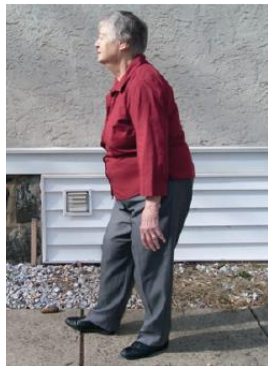
Lesson 10: Integrated Function: Posture and Walking

Exercise #1



Given the line of gravity in the figure above, give the gravitational moment at the ankle, knee, hip, lumbar spine, and cervical spine. *Ankle = dorsiflexion, knee = flexion, hip = extension, lumbar spine = extension, and cervical spine = extension*

Exercise #2



Describe some of the changes in posture you see in the figure shown. What are these changes often characteristic of? *Knees and hips are flexed. The trunk leans forward. Increased kyphosis and forward head position.*

Is the cervical lordosis increased or decreased? *Aging*

Where is the line of gravity relative to a more normal posture? *Anterior to the normal line of gravity*

Exercise #3



Name the phase of gait for the left lower extremity in the figure shown. *Heel strike, or initial contact*

Do you think the person above is walking quickly, slowly, or at a normal speed? Why? *Slowly. The right heel is still on the ground as the opposite leg makes its initial contact.*

Is her time in double support increased or decreased compared to normal? *Increased. Time of double support decreases as speed increases. Running begins at the time there is no longer any double support.*

Exercise #4



Notice the brace on the person in the illustration shown. How might the brace help with gait at the ankle? *It can prevent plantarflexion of the ankle during swing phase, stopping the foot from dragging.*

How might the brace help with gait at the knee? *It can prevent the knee from snapping into hyperextension during stance phase.*

What kind of gait might this person demonstrate if he was not wearing the brace? *Steppage gait. Circumduction may also occur.*