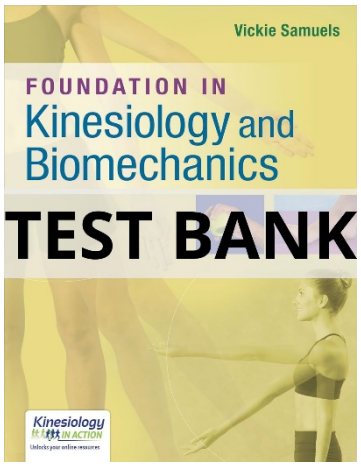
Chapter 1. Principles of Kinesiology and Biomechanics



Multiple Choice

1. In which of the following planes and around which axis does abduction and adduction occur?
A. Transverse plane around a sagittal axis
B. Sagittal plane around a frontal axis
C. Frontal plane around a sagittal axis
D. Horizontal plane around a vertical axis

ANS: C
REF: 4–9
OBJ: 1.2
KEY: planes, axis

2. In which of the following planes and around which axis does flexion and extension occur?
A. Transverse plane around a sagittal axis
B. Sagittal plane around a frontal axis
C. Frontal plane around a sagittal axis
D. Horizontal plane around a vertical axis

ANS: B
REF: 4–9
OBJ: 1.2
KEY: planes, axis

3. In which of the following planes and around which axis does rotation occur?
A. Transverse plane around a sagittal axis
B. Sagittal plane around a frontal axis
C. Frontal plane around a sagittal axis
D. Horizontal plane around a vertical axis

ANS: D
REF: 4–9
OBJ: 1.2
KEY: planes, axis

4. A person is bringing an eating utensil to the mouth using elbow flexion. In which plane and around which axis does this elbow motion primarily occur?

A. Transverse plane around a sagittal axis
B. Sagittal plane around a frontal axis
C. Frontal plane around a sagittal axis
D. Horizontal plane around a vertical axis

ANS: B
REF: 4–9
OBJ: 1.2
KEY: planes, axis

5. A person is using a screwdriver to tighten a screw. In which plane and around which axis does movement of the forearm primarily occur when turning the screwdriver?
A. Transverse plane around a sagittal axis
B. Sagittal plane around a frontal axis
C. Frontal plane around a sagittal axis
D. Horizontal plane around a vertical axis

ANS: D
REF: 4–9
OBJ: 1.2
KEY: planes, axis

6. A person is moving from a sitting to a standing position. In which plane and around which axis is the movement at the knee primarily occurring?
A. Transverse plane around a sagittal axis
B. Sagittal plane around a frontal axis
C. Frontal plane around a sagittal axis
D. Horizontal plane around a vertical axis

ANS: B
REF: 4–9
OBJ: 1.2
KEY: planes, axis

7. In the anatomical position, which directional term BEST describes the position of the radius in relation to the ulna?
A. Lateral
B. Anterior
C. Medial
D. Posterior

ANS: A
REF: 4–5
OBJ: 1.1

KEY: directional terms

8. In the anatomical position, which directional term BEST describes the position of the knee in relation to the hip?
A. Proximal
B. Superior
C. Medial
D. Distal

ANS: D
REF: 4–5
OBJ: 1.1
KEY: directional terms

9. Which definition BEST describes the anatomical position?
A. Lying down, face up, arms at the side of the body
B. Standing, facing forward, arms at the side of the body
C. Sitting, facing forward, legs crossed
D. Any position assumed by the patient

ANS: B
REF: 4–5
OBJ: 1.1
KEY: directional terms

10. Which of the following movement terms BEST describes segments moving away and toward the midline?

A. Flexion and extension
B. Circumduction
C. Rotation
D. Abduction and adduction

ANS: D
REF: 7–9
OBJ: 1.3
KEY: movement directions

11. Which of the following movement terms BEST describes the motion that occurs when the angle between two bones decreases?
A. Flexion

B. Extension
C. Abduction
D. Rotation

ANS: A
REF: 7–9
OBJ: 1.3
KEY: movement directions

12. Which of the following activities is an example of reversal of action at the elbow?
A. Bringing the hand to the mouth during eating
B. Holding to a bar during a chin-up activity and moving the body toward the bar
C. Throwing a ball
D. Brushing hair

ANS: B
REF: 7–9
OBJ: 1.3
KEY: movement directions

13. How many degrees of freedom occur at the shoulder joint?
A. 1
B. 2
C. 3
D. 4

ANS: C
REF: 7–9
OBJ: 1.3
KEY: movement directions

14. How many degrees of freedom occur at the hip joint?
A. 1
B. 2
C. 3
D. 4

ANS: C
REF: 7–9
OBJ: 1.3
KEY: movement directions

15. How many degrees of freedom occur at the elbow joint?
A. 1
B. 2
C. 3
D. 4

ANS: B
REF: 7–9
OBJ: 1.3
KEY: movement directions

16. Which of the following examples BEST describes linear motion?
A. Lower limb moving around knee joint axis during knee extension
B. Displacement of the center of mass during walking
C. Hand bringing food to the mouth during eating
D. Gliding motion between the surfaces of two joints

ANS: D
REF: 10–13
OBJ: 1.4
KEY: linear, angular, and general motion

17. Which of the following movements is an example of passive movement?
A. Therapist guarding a patient as patient stands up
B. Therapist rolling a patient in bed
C. Patient transferring out of bed
D. Patient brushing teeth

ANS: B
REF: 10–13
OBJ: 1.4
KEY: linear, angular, and general motion

18. Which activity BEST represents open kinematic chain movement?
A. Kicking a ball
B. Standing up from sitting
C. Squatting
D. Performing a push-up

ANS: A
REF: 13–15
OBJ: 1.5
KEY: open and closed kinematic chain movement

19. Which of the following types of forces is MOST LIKELY occurring at the knee joints in a person who has a body mass greater than ideal body weight when walking?

A. Tension
B. Compression
C. Bending
D. Torsion

ANS: B
REF: 14–16
OBJ: 1.6
KEY: forces

20.What is the approximate location of the center of mass in the anatomical position?
A. L4-L5 vertebra
B. Anterior to S2
C. T10-T11 vertebra
D. Posterior to S1

ANS: B
REF: 14–16
OBJ: 1.6
KEY: forces

21. Which of the following positions has the smallest base of support?
A. Standing with feet together
B. Sitting with legs crossed
C. Standing with feet apart
D. Sitting on a high stool

ANS: A
REF: 17–18
OBJ: 1.6
KEY: base of support

22. A person is unstable in a sitting position. Which position would provide increased stability?
A. Standing with feet together
B. Sitting with legs crossed
C. Standing with feet apart
D. Lying

ANS: D
REF: 17–18
OBJ: 1.6
KEY: base of support

23. Which of the following situations is an example of stable equilibrium?
A. A person riding in a car
B. A person sitting in a bus loses balance as the bus turns a corner
C. A person riding a bicycle
D. A person standing on a bus maintains balance as the bus turns a corner

ANS: D
REF: 17–18
OBJ: 1.6
KEY: equilibrium

24. Which of the following areas on the stress-strain curve represents tissue that is under minimal tension and is on slack?
A. Toe region
B. Yield point
C. Plastic region
D. Mechanical failure

ANS: A
REF: 18–19
OBJ: 1.6
KEY: forces

25. Which of the following areas on the stress-strain curve represents muscle tissue that has been stretched and maintains its new length even after the stretch is stopped?
A. Toe region
B. Elastic region
C. Plastic region
D. Mechanical failure

ANS: C
REF: 18–19
OBJ: 1.6
KEY: forces

26. Which of the following areas on the stress-strain curve represents muscle tissue that has been stretched but returns to its original length after the stretch is stopped?

A. Toe region
B. Elastic region
C. Plastic region
D. Mechanical failure

ANS: B
REF: 18–19
OBJ: 1.6
KEY: forces

27. What are the two components that represent vector measurements of forces?
A. Time and volume
B. Magnitude and direction
C. Direction and time
D. Volume and magnitude

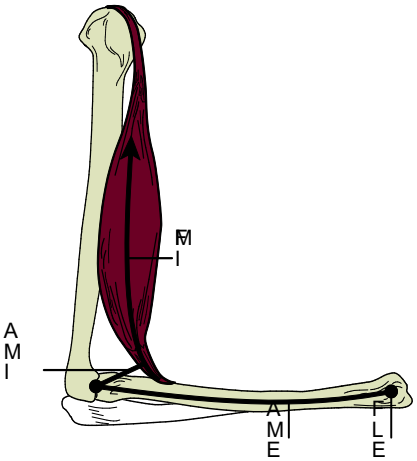
ANS: B
REF: 19–21
OBJ: 1.7
KEY: vectors

28. Which statement is MOST CORRECT when measuring two forces that are parallel, in the same plane, and in opposite directions?
A. The two forces are added together.
B. The negative direction is added to the positive direction force.
C. One force is divided by the second force.
D. One force is multiplied by the second force.

ANS: B
REF: 19–21
OBJ: 1.7
KEY: vectors

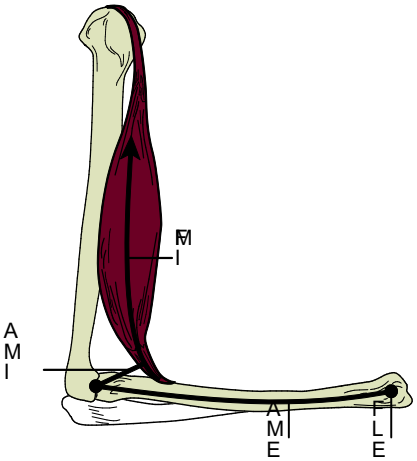
29. When the quadriceps muscles extend the knee, which component of the vector force produced by the muscle tends to produce movement?
A. All components of the vector force
B. Perpendicular force component of the vector
C. Total vector force minus the perpendicular component
D. Parallel force component of the vector

ANS: B
REF: 19–21
OBJ: 1.7
KEY: vectors



30. Referring to the image, what would be the torque force being produced by the muscle if internal muscle force (IMF) is 5 lb and internal moment arm (IMA) is 0.25 ft?
A. 5.55 ft/lb
B. 10 ft/lb
C. 1.25 ft/lb
D. 3 ft/lb

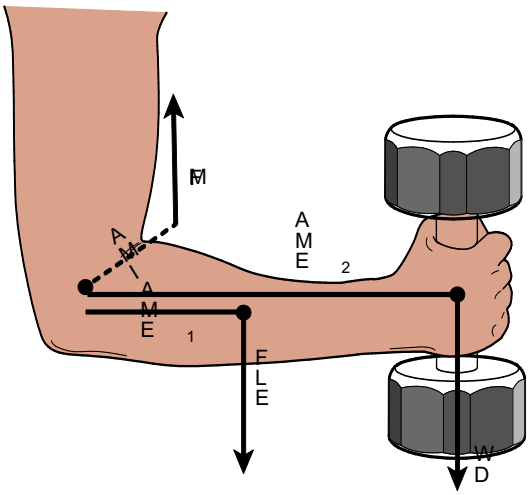
ANS: C
REF: 19–23
OBJ: 1.7, 1.8
KEY: vector forces



31. Referring to the image, what would the movement at the joint be if the internal muscle force (IMF) × internal moment arm (IMA) = external limb force (ELF) × external moment arm (EMA)?
A. Joint angle decreases as joint flexes
B. Joint rotates
C. Joint angle increases as joint extends
D. Joint does not move

ANS: D
REF: 19–23
OBJ: 1.7, 1.8
KEY: vector forces

32.



- Internal moment arm (IMA) = 0.33 ft
- External limb force (ELF) = arm weight = 5 lb
- External moment arm (EMA) 1 = 0.7 ft
- Dumbbell weight (DW) = 10 lb
- EMA2 of DW = 1.5 ft

Referring to the image, how much ft/lb of force will the biceps need to generate to begin to lift the weight?
A. 33
B. 16
C. 56
D. 40

ANS: C
REF: 19–23
OBJ: 1.7, 1.8
KEY: vector forces

33. What type of movement is produced by force couples?
A. Curvilinear
B. Linear