

## Chapter 02

# Kinematic Concepts for Analyzing Human Motion

### Multiple Choice Questions

1. Which of the following is not an example of a sagittal plane movement?  
A. flexion  
B. hyperextension  
**C. lateral flexion**  
D. plantar flexion
  
2. The cardinal frontal plane divides the body into equal \_\_\_\_\_.  
A. right and left halves.  
**B. front and back halves.**  
C. top and bottom halves.  
D. medial and lateral halves.
  
3. Movements in the transverse plane occur around which axis?  
A. mediolateral  
B. anteroposterior  
**C. longitudinal**  
D. horizontal
  
4. Elbow extension takes place in what plane?  
**A. sagittal**  
B. frontal  
C. transverse  
D. longitudinal

5. Abduction takes place around which axis?

- A. anteroposterior
- B. mediolateral
- C. longitudinal
- D. horizontal

6. A dancer performs a pirouette in which plane?

- A. sagittal
- B. frontal
- C. transverse
- D. longitudinal

7. Which of the following statements is false?

- A. the hip is distal to the knee
- B. the shoulder is superior to the hip
- C. superficial muscles are closer to the skin than deep muscles
- D. the triceps are posterior to the biceps

8. Nodding the head "yes" occurs in which plane?

- A. sagittal
- B. frontal
- C. transverse
- D. oblique

9. Most human movement falls into which category?

- A. rectilinear
- B. curvilinear
- C. angular or rotational
- D. general

10. Which of the following terms best describes translational motion along a curved line?

- A. rectilinear
- B. curvilinear**
- C. rotational
- D. general

11. Which of the following categories of motion is mutually exclusive with each of the others?

- A. translational motion
- B. rectilinear motion
- C. curvilinear motion
- D. rotational motion**

12. Which of the following motions occurs primarily in the sagittal plane?

- A. running**
- B. a cartwheel
- C. a pirouette
- D. all of the above

13. Which of the following motions occurs primarily in the frontal plane?

- A. running
- B. cartwheel**
- C. pirouette
- D. all of the above

14. Abduction occurs in which plane?

- A. sagittal
- B. frontal**
- C. transverse
- D. it depends on the action being performed

15. Primarily in which plane does the swinging of a baseball bat occur?

- A. sagittal
- B. frontal
- C. transverse**
- D. obtuse

16. Which of the following limb movements occur during "jumping jacks"?

- A. flexion and abduction
- B. extension and adduction
- C. flexion and extension
- D. adduction and abduction**

17. Which imaginary cardinal plane bisects the body into right and left halves?

- A. sagittal**
- B. frontal
- C. transverse
- D. none of the above

18. During the preparatory phase for an underhand softball pitch, the hand holding the ball is drawn behind the body prior to the forward swing of the arm. When the hand is drawn behind the body, which of the following movements occurs at the shoulder?

- A. flexion
- B. extension
- C. hyperextension**
- D. circumduction

19. In which of the following planes does a forward roll occur?

- A. sagittal**
- B. frontal
- C. transverse
- D. oblique

20. Which of the following are transverse plane movements at the shoulder?

- A. horizontal abduction
- B. medial rotation
- C.** both A and B above
- D. none of the above

21. Which of the following terms means "farther from the head"?

- A. distal
- B. proximal
- C. superior
- D.** inferior

22. Which of the following is/are examples of superficial muscle(s)?

- A. biceps
- B. triceps
- C. gastrocnemius
- D.** all of the above

23. Which of the following describes the knee joint relative to the ankle joint?

- A. distal
- B.** proximal
- C. medial
- D. lateral

24. Which of the following terms would accurately describe the biceps muscle?

- A.** anterior
- B. posterior
- C. medial
- D. lateral

25. Which of the following is/are true regarding anatomical reference position?

- A. palms face forward
- B. erect posture
- C. starting position for describing motion
- D.** all of the above

26. In anatomical position what is the position of the elbow?

- A. 180°
- B.** 0°
- C. need more information
- D. none of the above

27. Foot pronation occurs at which joint?

- A. ankle
- B.** subtalar
- C. both A and B
- D. pronation does not occur in the foot

28. Internal rotation is synonymous with which of the following?

- A.** medial rotation
- B. lateral rotation
- C. external rotation
- D. none of the above

29. In anatomical position, the forearm is in what position?

- A. pronated
- B.** supinated
- C. flexed
- D. abducted

30. Which of the following is true regarding horizontal adduction?

A. also called horizontal flexion

B. occurs in the transverse plane

**C.** both A and B

D. none of the above

31. Which of the following is true regarding circumduction?

**A.** combines flexion, extension, adduction, and abduction

B. synonymous with rotation

C. both A and B

D. none of the above

32. Which is true about the Cartesian coordinate system?

A. It is a special reference system used by biomechanists.

B. It can be used to describe two-dimensional *or* three-dimensional motion.

**C.** both A and B

D. none of the above

33. In two-dimensional Cartesian coordinate systems, what unit is used for the vertical axis?

A. x

**B.** y

C. z

D. any of the above can describe the vertical axis

34. Which of the following units is unique to three-dimensional Cartesian coordinate systems (i.e. do not exist in 2-D systems)?

A. x

B. y

**C.** z

D. all of the above are unique to 3-D systems

35. Which view is best for observing normal human gait?

- A.** side view
- B. front view
- C. back view
- D. does not matter

36. Which of the following could be defined by a movement analyst as a mechanical system?

- A. entire human body
- B. right arm
- C. projected ball
- D.** all of the above

37. In anatomical position, what term describes the radius relative to the ulna?

- A. medial
- B.** lateral
- C. posterior
- D. anterior

38. What term is used to describe the motion of bringing the foot closer to the lower leg?

- A. flexion
- B. extension
- C.** dorsiflexion
- D. plantar flexion

39. Which of the following is a *linear* movement in the frontal plane?

- A. shoulder adduction
- B.** shoulder girdle elevation
- C. shoulder flexion
- D. both A and B

40. Shaking the head "no" involves which of the following movements?

- A. lateral and medial rotation
- B. left and right rotation**
- C. internal and external rotation
- D. all of the above are correct

### **Fill in the Blank Questions**

41. The word \_\_\_\_\_ refers to a description of quality without the use of numbers.  
**qualitative**

42. Translation is a synonym for \_\_\_\_\_ motion.  
**linear**

43. \_\_\_\_\_ describes motion along a straight line, whereas \_\_\_\_\_ describes motion along a curved line.  
**Rectilinear; curvilinear**

44. Ventral is a synonym for \_\_\_\_\_, which means toward the front of the body.  
**anterior**

45. The \_\_\_\_\_ axis is the imaginary line around which sagittal plane motion occurs.  
**mediolateral**

### Short Answer Questions

46. What are the two main sources of information for the analyst diagnosing a motor skill?

Answers will vary

47. Name two ways an analyst can increase his/her knowledge about the mechanics of a motor skill and describe the advantages and disadvantages of each.

Answers will vary

48. Describe the steps that should be taken when planning a qualitative analysis.

Answers will vary

49. To supplement visual observations, the analyst can often use non-visual information. Describe two examples of auditory information that could be used during a qualitative analysis.

Answers will vary

50. Describe three different tools used to collect and analyze kinematic data and provide the strengths and weaknesses of each tool. Include both high tech and low tech examples.

Answers will vary

### **True / False Questions**

51. In anatomical position, the radius is medial to the ulna.

**FALSE**

52. The center of mass is located at the intersection of the three cardinal planes.

**TRUE**

53. Researchers only perform quantitative analyses and practitioners only perform qualitative analyses.

**FALSE**

54. Sagittal view is the same as side view.

**TRUE**

55. Translation is synonymous with general motion.

**FALSE**

### **Short Answer Questions**

56. Involving translation and rotation simultaneously

Involving rotation around a central line or point

Along a straight line

Erect standing position with all body parts, including the palms of the hands, facing forward

Toward the back of the body

Toward the midline of the body

Further from the trunk

Toward the surface of the body

Plane in which lateral movements of the body and body segments occur

Imaginary line passing from top to bottom through the body and around which transverse plane rotations occur

- A. Anatomical position
- B. Angular
- C. Anterior
- D. Axis
- E. Cardinal planes
- F. Curvilinear
- G. Deep
- H. Distal
- I. Frontal axis
- J. Frontal plane
- K. General motion
- L. Inferior
- M. Lateral
- N. Linear
- O. Longitudinal axis
- P. Medial
- Q. Posterior
- R. Proximal
- S. Rectilinear
- T. Sagittal axis
- U. Sagittal plane
- V. Superficial
- W. Superior
- X. System
- Y. Translation
- Z. Transverse plane

Involving translation and rotation simultaneously (K)

Involving rotation around a central line or point (B)

Along a straight line (S)

Erect standing position with all body parts, including the palms of the hands, facing forward (A)

Toward the back of the body (Q)

Toward the midline of the body (P)

Further from the trunk (H)

Toward the surface of the body (V)

Plane in which lateral movements of the body and body segments occur (J)

Imaginary line passing from top to bottom through the body and around which transverse plane rotations occur (O)