Chapter 01
What is Biomechanics?

Multiple Choice Questions

1. Which of the following is the most appropriate definition of biomechanics?
A. the study of human movement
B. the study of biological organisms
C. the study of movement mechanics
D. the study of the mechanical aspects of biological organisms

2. Which of the following terms is applied to the study of systems in a constant state of motion?
A. statics
B. dynamics
C. anthropometrics
D. plyometrics

3. What term is given to considerations such as the size, shape, and weight of body segments?
A. cybernetic
B. anthropometric
C. kinematic
D. kinetic

4. Which of the following would not be measured in a kinematic analysis of a tennis serve?
A. angular velocity
B. linear velocity
C. muscular force
D. angular acceleration

5. Which of the following is an example of a kinetic consideration?
A. muscle force producing a vertical jump
B. impact force landing from a jump
C. both A and B
D. neither A nor B

6. Which of the following is an example of a static situation?
A. a cyclist riding at a constant velocity
B. a person balancing motionless on one foot
C. both A and B
D. neither A nor B

7. Which of the following is associated with kinematics?
A. force
B. displacement
C. mass
D. all of the above

8. Which of the following are anthropometric factors?
A. the length of a forearm
B. the shape of a body
C. the weight of the trunk
D. all of the above

9. Which of the following is included in sports medicine?
A. clinical aspects of exercise and sport
B. scientific aspects of exercise and sport
C. both A and B
D. neither A nor B

10. Which of the following topics might be studied by biomechanists?
A. optimal form during the pole vault
B. forces on the spine during lifting
C. the mechanics of the jump shot
D. all of the above

11. Biomechanics has roots in which of the following disciplines?
A. physics
B. biology
C. both A and B
D. neither A nor B

12. Which of the following questions about the long jump should be answered quantitatively?
A. What is the horizontal velocity at take-off?
B. What is the angle at take-off?
C. both A and B
D. neither A nor B

13. Which of the following characterizes a formal problem?
A. a goal or answer
B. a set of given information
C. a set of operations that can be used to arrive at the desired answer from the given information
D. all of the above

14. What does the word qualitative mean?
A. general
B. numerical
C. pertaining to quality
D. all of the above

15. Which of the following statements is true regarding qualitative analysis?
A. It is always of a general nature.
B. It does not involve the use of numbers.
C. Both A and B.
D. Neither A nor B.

16. Which of the following professionals regularly make use of qualitative observations?
A. teachers
B. coaches
C. clinicians
D. all of the above

17. Which of the following are components of a structured approach to problem solving?
A. writing down the given information
B. drawing a diagram representing the problem situation
C. rereading the problem to look for additional information that may be inferred from the problem statement
D. all of the above

18. Which of the following countries uses the metric system?
A. France
B. Germany
C. Japan
D. all of the above

19. In which of the following systems of measurement are units of the same variable related to each other by factors of ten?
A. the English system
B. the metric system
C. both A and B
D. neither A nor B

20. Which of the following conversions is accurate?
A. 2.54 cm = 1 in
B. 2.54 in = 1 cm
C. 4.45 lb = 1 N
D. none of the above

21. Which of the following is true about osteoporosis?
A. it is a disease with acute onset
B. it inevitably accompanies aging
C. it is a lifestyle disease that develops and progresses over a number of years
D. all of the above are true

22. Which of the following is a risk factor for osteoporosis?
A. physical inactivity
B. estrogen deficiency
C. excessive consumption of caffeine
D. all of the above

23. Which of the following is true about carpal tunnel syndrome?
A. it is a neurological impairment
B. it is associated with repetitive keyboard use
C. both A and B
D. none of the above

24. Which of the following is an example of equipment designed to enhance performance?
A. Klapskate
B. aerodynamic helmet
C. both A and B
D. none of the above

25. Biomechanical analysis has revealed which of the following about high velocity pitchers compared to lower velocity pitchers?
A. they have greater internal rotation at the shoulder
B. they have greater upright posture at release
C. they have higher angular velocity of the pelvis and upper torso
D. all of the above

26. Biomechanical research has contributed to which of the following?
A. injury prevention
B. enhanced sport performance
C. equipment design
D. all of the above

27. Why is swimming not the best exercise for prevention of osteoporosis?
A. no weight bearing
B. water resistance is hard on the bones
C. both A and B
D. none of the above

28. Which of the following could be performed by a biomechanist?
A. quantitative analysis of human movement
B. qualitative analysis of human movement
C. both A and B
D. none of the above

29. Which type of analysis involves identifying, analyzing and answering a question of interest?
A. quantitative
B. qualitative
C. both A and B
D. none of the above

30. Choose the term or phrase that is not synonymous with the others.
A. metric system
B. English system
C. International system of units
D. S. I.

31. What is the base unit for mass in the metric system?
A. Newton
B. kilogram
C. meter
D. slug

32. A 200 lb. man weighs approximately what in metric units?
A. 890 N
B. 45 N
C. 440 kg
D. none of the above

33. Which of the following is true regarding mechanics?
A. branch of physics
B. analyzes the actions of forces on particles
C. both A and B
D. none of the above

34. Which of the following defines inference?
A. the process of elimination
B. the process of forming deductions from available information
C. the process of observation in a qualitative analysis
D. none of the above

35. Which of the following is true?
A. No particular biomechanical factors have been associated with running economy.
B. 3-year olds walking fast can use 70% more energy than adults.
C. both A and B
D. none of the above

36. Astronauts who travel out of the earth's gravitational field have experienced which of the following?
A. increased bone density
B. reduced strength
C. both A and B
D. none of the above

37. Exercise walking can have which of the following effects?
A. improved balance in older adults
B. decreased likelihood of falls in older adults
C. decreased risk of osteoporosis for women
D. all of the above

38. Which of the following affects the flight of a discus?
A. speed at release
B. projection angle
C. orientation angle relative to the wind
D. all of the above

39. The high incidence of knee injuries among snow skiers is partially due to which of the following?
A. rigid boot which limit ankle motion
B. bindings which release during a fall
C. both A and B
D. none of the above

40. Possible detrimental effects of knee braces include(s) which of the following?
A. changes muscle activity during gait
B. reduces sprinting speed
C. increases onset of fatigue
D. all of the above

Fill in the Blank Questions

41. _____ refers to an excessive loss of bone mineral mass and strength resulting in one or more fractures.
Osteoporosis

42. An overuse condition caused by compression of the median nerve, involving numbness, tingling and pain in the hand is called _____.
carpal tunnel syndrome

43. The branch of biomechanics which studies the actions of forces is called _____.
kinetics

44. A field that focuses on the prevention of work-related injuries and the improvement of working conditions and worker performance is known as _____ biomechanics.
occupational

45. Sport shoes are designed to prevent _____ and enhance _____.
excessive loading; performance

Short Answer Questions

46. What are the two key strategies for preventing osteoporotic fractures?

Answers will vary

47. List four innovations in sport equipment developed by biomechanists.

Answers will vary

48. Explain how equipment innovation has improved performance and/or prevented injury.

Answers will vary

49. Name three professions related to kinesiology and explain how each will benefit from a knowledge of biomechanics.

Answers will vary

50. Explain the difference between qualitative and quantitative problems and give an example of each one that is related to a kinesiology topic.

Answers will vary

True / False Questions

51. Within the fields of kinesiology and exercise science, the living organism most commonly of interest to the biomechanist is the human body.
TRUE

52. The kinetics of an exercise or sport skill execution is commonly known as form or technique.
FALSE

53. Force can be thought of as a push or a pull acting on a body.
TRUE

54. More than half of all sport injuries are to the knee.
TRUE

55. Promising work in the development of intervention strategies has shown that the key to preventing falls may be the ability to limit trunk motion.
TRUE

Short Answer Questions

56. Application of mechanical principles in the study of living organisms

Branch of mechanics dealing with systems in a constant state of motion

Branch of mechanics dealing with systems subject to acceleration

Study of the description of motion, including considerations of space and time

Study of the action of forces

Study of human movement

Overuse condition caused by compression of the median nerve

Involving the use of numbers

Involving nonnumeric description of quality

System of weights and measures used internationally in scientific applications

A. Biomechanics
B. Carpal tunnel syndrome
C. Dynamics
D. English system
E. Kinematics
F. Kinesiology
G. Kinetics
H. Mechanics
I. Metric system
J. Qualitative
K. Quantitative
L. Sports medicine
M. Statics
N. Tennis elbow

Application of mechanical principles in the study of living organisms (A)
Branch of mechanics dealing with systems in a constant state of motion (M)
Branch of mechanics dealing with systems subject to acceleration (C)
Study of the description of motion, including considerations of space and time (E)
Study of the action of forces (G)
Study of human movement (F)
Overuse condition caused by compression of the median nerve (B)
Involving the use of numbers (K)
Involving nonnumeric description of quality (J)
System of weights and measures used internationally in scientific applications (I)