

Saladin 7E
Answer Key
Chapter 9, Joints

Testing Your Comprehension

1. Mechanical advantage is the ratio of the length of the effort arm, L_E , to the length of the resistance arm, L_R . In a second-class lever, the components are in the order fulcrum-resistance-effort (FRE), so the effort arm is always longer than the resistance arm and L_E/L_R is always greater than 1. In a third-class lever, the components are in the order FER, so the effort arm is always shorter than the resistance arm and L_E/L_R is always less than 1.
2. (a) Calcaneus–frontal plane; (b) coxal bones–frontal plane; (c) femur–sagittal plane; (d) tibia–frontal plane; (e) proximal phalanx II–frontal plane.
3. (a) Flexion of the hip, knee, and elbow as you sit; (b) pronation of the forearm, extension of the elbow, and flexion of the shoulder as you reach for the apple; (c) depression and protraction followed by elevation of the mandible as you take a bite; and (d) retraction of the mandible and cyclic elevation, depression, and lateral and medial excursion as you chew it.
4. The fulcrum is the head of the humerus. The effort arm is from the middle of the humeral head to the deltoid tuberosity and the resistance arm is from the middle of the head to the weight in the hand. The MA is less than 0.2 because the resistance arm is more than 5 times as long as the effort arm. This is a third class lever.
5. (1) Ball-and socket joint: shoulder (humeroscapular) and hip (coxal) joints. (2) Condylar joint: radiocarpal, metacarpophalangeal, and metatarsophalangeal joints. (3) Saddle joint: trapeziometacarpal joint I of the upper limb, with no example in the lower limb. (4) Plane joint: intercarpal and intertarsal joints. (5) Hinge joint: elbow (humeroulnar), knee, and interphalangeal joints. (6) Pivot joint: Proximal radioulnar joint of the upper limb, with no example in the lower limb.