ANSWERS TO REVIEW QUESTIONS

1. If the activity of oseoclasts exceeds the activity of osteoblasts, how will the mass of the bone be affected?
   **Because osteoclasts break down or demineralize bone, the bone would have a reduced mineral content (less mass); as a result it would also be weaker.**

2. How could x-rays of the femur be used to determine whether a person has reached full height?
   **Long bones of the body, such as the femur, have an epiphyseal cartilage, a plate of cartilage that separates the epiphysis from the diaphysis as long as the bone is still growing lengthwise. An x-ray would indicate whether the epiphyseal cartilage is still present. If it is, growth is still occurring; if it is not, the bone has reached its adult length.**

3. Why would you expect that the arms of a weightlifter to be thicker and heavier than those of a jogger? What about the leg bones?
   **The larger arm muscles of the weight lifter would apply more mechanical stress to the bones of the upper limbs. In response to that stress, the bones would grow thicker. For similar reasons, we would expect the jogger to have heavier and thicker thigh bones.**

4. A child who enters puberty several years later than the average age is generally taller than average as an adult. Why?
   **Growth continues throughout childhood. At puberty, a growth spurt occurs and is followed by the closure of the epiphyseal cartilages. The later puberty begins, the taller the child will be when the growth spurt begins, so the taller the individual will be when growth is completed.**

5. What effect would increased PTH secretion have on blood calcium levels?
   **PTH stimulates osteoclasts to release calcium ions from the bone. Increased PTH secretion would result in an increase in the level of calcium ions in the blood.**

6. How does calcitonin help lower the calcium ion concentration of the blood?
   **Calcitonin lowers blood calcium levels by (1) inhibiting osteoclast activity and (2) increasing the rate of calcium excretion at the kidneys.**

7. Why are stresses or impacts to the side of the shaft in a long bone more dangerous than stress applied to the long axis of the shaft?
   **The osteons are parallel to the long axis of the shaft, which does not bend when forces are applied to either end. Stresses on impacts to the side of the shaft can lead to a fracture.**
8. Why do extended periods of inactivity cause degenerative changes in the skeleton?
Inactivity in unstressed bones leads to the removal of calcium salts from bone matrix since the osteoblasts are not being stimulated. Up to one-third of the bone mass can be lost in this manner, causing the bones to become thin and brittle.

9. How might damage to the thyroid gland influence calcium regulation in the body?
The thyroid gland secretes calcitonin, which stimulates calcium excretion and inhibits osteoclast activity and calcium absorption into the blood. Without calcitonin, blood calcium levels might become abnormally high.

10. Would you expect to see changes in blood levels of the hormones calcitonin and PTH as a result of vitamin D3 deficiency? Explain?
A person deficient in vitamin D3 would not be able to absorb calcium effectively from the digestive tract, leading to a shortage of calcium in the blood. To maintain homeostasis, the decrease in blood calcium would trigger the release of PTH. The PTH, in turn, would stimulate osteoclasts to release enough calcium from the bones to maintain proper calcium levels in the blood. Levels of calcitonin would probably decrease, because this hormone lowers blood calcium levels and would aggravate the situation caused by the vitamin D3 deficiency. You would expect to see weakened bones that become flexible e.g. Rickets disease, typically as a result of inadequate exposure to sunlight & inadequate dietary supply.

11. Why would improper circulation of synovial fluid lead to the degeneration of articular cartilages in the affected joint?
Articular cartilages lack a blood supply; they rely on synovial fluid to supply nutrients and eliminate wastes. Impairing the circulation of synovial fluid would have the same effect as impairing a tissue’s blood supply. Nutrients would not be delivered to meet the tissue’s needs and wastes would accumulate. Damage to and ultimately death of the cells in the tissue would occur.

12. The greater the range of motion at a joint, the weaker the joint becomes. Why?
A joint cannot be both highly mobile and very strong. The shoulder joint demonstrates this principle that strength and stability must be sacrificed to obtain mobility; it permits the greatest range of motion of any joint in the body. The relatively loose oversized, poorly reinforced articular capsule lessens the stability of the joint but allows a great range of movement.
13. When you do jumping jacks, which lower limb movements are necessary? When you do jumping jacks and move your lower limbs away from the midline of the body, the movement is abduction. When you bring the lower limbs back together towards the midline, the movement is adduction.

14. During a basketball game, Bob injured his right knee when he jumped to retrieve the ball and then landed off-balance on his right knee. Since then he has pain and limited mobility of his right knee. What type of injury did Bob sustain? Bob has probably damaged his menisci, which act as cushions to absorb the force of movements such as jumping. When Bob landed off-balance on his right knee, the excessive force could have pushed the menisci out of place. In turn the synovial membranes and/or the ligaments were damaged, resulting in swelling.

15. How would you explain to your grandmother the characteristic decrease in height with advancing age? Height decreases during adulthood in part as a result of osteoporosis in the vertebra and in part as a result of the decline in water content of the nucleus pulposus region of the intervertebral discs.

16. While playing tennis, Dave “overturns” his ankle. He experiences swelling and pain. After being examined, he is told that he has no torn ligaments and that the structure of the ankle is not affected. On the basis of the symptoms and the examination results, what happened to Dave’s ankle? Dave sprained his ankle. This condition occurs when ligaments are stretched to the point at which some of the collagen fibers are torn. Stretched ligaments in joints can cause the release of synovial fluid, which results in swelling and pain.

17. What two factors interact to determine the effects of muscle contraction? (1) The anatomical arrangement of the muscle fibers; and (2) the type of muscle attachment to the skeleton.

18. List the four fascicle organizations that produce the difference patterns of skeletal muscles. (1) parallel; (2) convergent; (3) pinnate; (4) circular

19. How do first-, second-, and third-class levers differ? In first-class levers, the fulcrum lies between the applied force and the resistance. In second-class levers, the resistance lies between the applied force and the fulcrum. In third-class levers, the force is applied between the resistance and the fulcrum.
20. Why is it difficult to lift a heavy object when the elbow is at full extension? Lifting heavy objects becomes easier as the elbow approaches a 90 degree angle. As you decrease the angle at or near full flexion, tension production declines, so movement becomes more difficult.