Anatomy/Physiology Study Guide part 2- UNIT 3: SKELETAL SYSTEM

**WORDS TO KNOW: Define these terms.**

**Hematopoiesis**: process of making red blood cells

**Osteon**: structural/functional unit of compact bones (cylindrical)

**Canaliculi**: microscopic canals that supply osteocytes with oxygen and nutrients

**Lacunae**: space that the osteocytes occupy

**Haversian Canal**: central canal in the middle of an Osteon that blood vessels travel through

**Lamellae**: rings of compact bone that surround the Haversian canal (make up the osteon)

**Arthroscopy**: surgery where small openings are made at the joint so that surgeon can insert a small camera (scope) and their instruments

**Complete the following on a separate piece of paper:**

1. **How is spongy bone different than compact bone?**

   *Spongy bone has more spaces and is found in the middle of flat bones (i.e. skull) and in the epiphysis of long bones. Spongy bone contains red bone marrow. Compact bone is solid bone comprised of many osteons running the length of the diaphysis of long bones and is found on the top and bottom portion of flat bones.*

2. **a) List the two types of bone growth and then state the type of bone that is formed by that type of growth.**

   **Intramembranous: flat bones**

   (ossification begins in the middle of the membrane model. Spongy bone is formed in the middle with compact bone formed on either side)

   **Endochondral: long bones**

   (ossification begins in the center of the hyaline cartilage model. Osteoclasts carve out the medullary cavity and blood vessels begin to grow into the area. Osteoblasts form a little bit of spongy bone and then compact bone for the diaphysis of the long bone. A secondary ossification center forms in each epiphysis which extends to meet the primary ossification center in the diaphysis. Where these 2 areas meet is the epiphyseal plate and growth during childhood occurs here.

   **b) What type of bone growth is shown in the diagram and how do you know?** **Intramembranous; spongy bone in the middle and compact on either side**

   **c) Hyaline cartilage** is the template that will go through ossification to become bone.

   **d) The small amount of that (from “b”) that remains after ossification is called** **articular cartilage**.

   **e) The cartilage that remains where the primary and secondary ossification centers meet is called the epiphyseal plate.**

   **f) Genetics and nutrition play a role in bone growth. However, list the four specific factors that affect bone growth.**

   1. Growth hormone (GH: stimulate cartilage cells at epiphyseal plate)
   2. Thyroid hormone (TH: replace cartilage at plate; needed for GH)
   3. Sex hormones (estrogens & androgens promote bone formation)
   4. Vitamins A & C
      - Vit. A: osteoclast/osteoblast activity
      - Vit. C: collagen synthesis
3. Draw and label an osteon (include: Central/Haversian canal, lamellae, lacunae, caniculi, osteocytes, Volkmann's canal)

4. Discuss the negative feedback loop involving calcitonin and parathyroid hormone. Include the cells they act on & what happens as a result. If blood calcium levels are too low (or remodeling needs to occur), parathyroid hormone will cause osteoclasts to become active and break down (thin out) bone. This adds calcium back into the blood and blood calcium levels increase. If blood calcium levels are too high (or new bone needs to be formed), calcitonin will cause osteoblasts to become active and lay done/build new bone.

5. When would a bone go through the processes involved in bone remodeling (provide more than 1 answer)?
   - as bones change shape with growth
   - during and after the healing of fractures
   - as bones adjust to varying patterns of stress (how you use your skeleton)

6. a) List the three structural kinds of joints and describe the functional movement for each (use the anatomical term with a brief description).
   - Fibrous structure leads to synarthroses (no movement in a joint) i.e. skull sutures
   - Cartilaginous structure leads to amphiarthroses (limited movement in a joint) i.e. costal cartilage or intervertebral discs
   - Synovial structure leads to diarthroses (free movement in a joint) i.e. shoulder and fingers
b) List the six types of synovial joints and describe the type of movement each type of synovial joint allows. Give an example of each in your description.

1) Ball and socket: free range of movement in all directions; Example: head of femur in acetabulum

2) Condyloid: These joints form where the head of one or more bones (hill like shape) fits in an elliptical cavity of another. Example: phalanx to phalanx, occipital condyle to atlas, or where the distal radius fits to the carpal bones.

3) Gliding: bones slide along beside one another in 1 plane. This allows for movement in many directions, hence the flexibility of your wrists. Example: carpals and tarsals

4) Hinge: Hinge joints operate just like the hinges on a door. They allow for a swinging motion, where bones can either flex toward one another, or extend apart. Example: humerus to ulna and femur to tibia

5) Pivot: a rotating motion. Example: atlas rotating around dens of axis bone; head of radius rotating next to ulna

6) Saddle: the bone sitting on the saddle can move in an oval shape relative to the other bone. Our thumb is a classic example of a saddle joint in action. Thumbs can move using a hinge-like motion, but can also rock side to side.

c) What is the purpose of synovial fluid? Lubricate the joint and reduce friction

7. a) How can you differentiate between abduction/adduction and extension/flexion? In abduction & adduction, the arms and legs are moving in a lateral to medial direction whereas in extension/flexion, the arms could be moving along a sagittal plane or transverse plane.

b) Describe circumduction. Conical (cone-like) movement of a limb extending from the joint (e.g. shoulder or hip)
8. Create a table to discuss the following problems associated with the skeletal system: osteoporosis, herniated disc, three types of spinal curvatures, spina bifida, gigantism, dwarfism, acromegaly, TMJ, Osgood-Schlatter, arthritis, rickets, sprains, dislocations, and cartilage injuries.

<table>
<thead>
<tr>
<th>Problems</th>
<th>Info</th>
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<tbody>
<tr>
<td>osteoporosis</td>
<td>bone resorption outpaces bone deposit</td>
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<tr>
<td>herniated disc</td>
<td>Involves rupture of the annulus fibrosus followed by protrusion of the spongy nucleus pulposus</td>
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<tr>
<td>scoliosis</td>
<td>spinous processes are not in line; the vertebral column is in an “s” shape</td>
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<tr>
<td>lordosis</td>
<td>abnormal accentuated arch in the lower back (lumbar curve)</td>
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<tr>
<td>kyphosis</td>
<td>abnormal curvature of the upper spine (hunched shoulders/“hunchback”).</td>
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<tr>
<td>spina bifida</td>
<td>The bones of the spine do not completely form, and the spinal canal is incomplete which allows the spinal cord and meninges (the membranes covering the spinal cord) to protrude out the child’s back</td>
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<tr>
<td>gigantism</td>
<td>hypersecretion of growth hormone in early childhood (before plate ossify/harden)</td>
</tr>
<tr>
<td>dwarfism</td>
<td>pituitary dwarfism: low levels of pituitary growth hormone; whole body is smaller but proportional *different than achondroplastic dwarfism: inherited defect in endochondral bone-forming tissue which is characterized by abnormal short limbs, a normal-sized trunk, large head with a depressed nasal bridge and small face</td>
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<tr>
<td>acromegaly</td>
<td>hypersecretion of growth hormone; excessive growth of connective tissue and bone after the epiphyseal plates have closed</td>
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<td>TMJ</td>
<td>where the mandible articulates with the temporal bone—temporomandibular joint; if not articulated correctly can result in inflammation, pain, popping noise as open/close the mouth</td>
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<tr>
<td>Osgood-Schlatter</td>
<td>an inflammation or partial separation of the quadriceps tendon from the tibial tuberosity (caused by chronic irritation—usually from overuse of the Quadriceps muscle.)</td>
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<td>arthritis</td>
<td>damage to the joints which results in inflammation</td>
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<td>rickets</td>
<td>insufficient calcium and Vitamin D; Osteoid is produced but calcium salts are not deposited</td>
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<td>sprains</td>
<td>Occurs when the ligaments reinforcing a joint are stretched or torn</td>
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<td>dislocations</td>
<td>Occurs when bones are forced out of their normal position at a joint</td>
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<tr>
<td>cartilage injuries</td>
<td>Usually involves tearing of the knee menisci, growth plate fissures, and overuse damage to articular surfaces in other joints</td>
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9. If a person is diagnosed with osteoporosis, what are 3 things they can do to help build up their bone mass?
   1) consume more calcium and Vitamin D (either in food or through supplements)
   2) perform weight bearing exercises
   3) HRT (hormone replacement therapy which includes estrogen)

For the test, you will also need to know:
- all the skeletal structures on the bone list
- long bone anatomy
- microscopic bone anatomy
- body movement terms