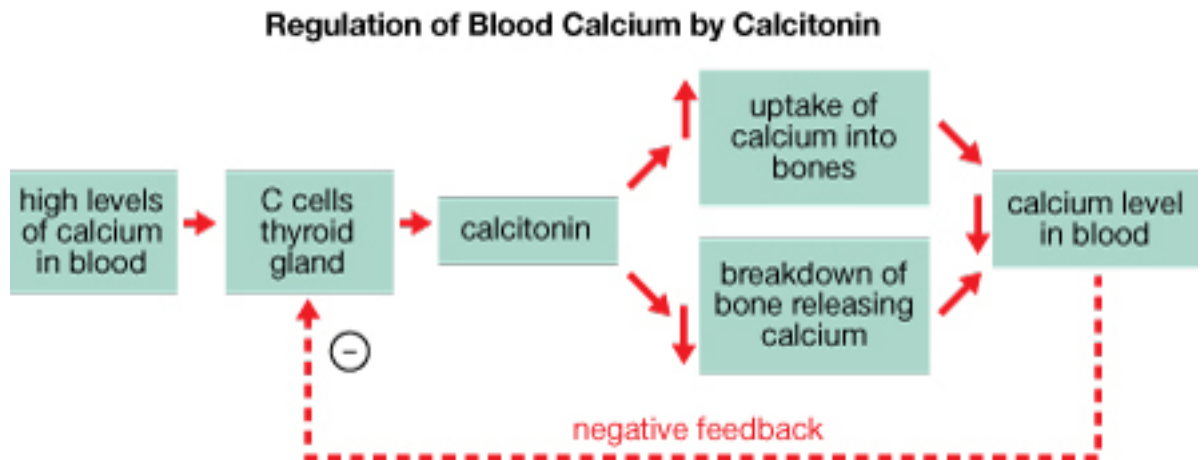


Bio30 1.2.4 page 4 Try this Answers

TR 3.

1. Functions of calcium include:
 - structure of bones in skeleton
 - tooth development
 - blood clotting process
 - synaptic transmission in nerve conduction
 - muscle contraction
2. Calcium homeostasis in the blood (plasma) is regulated by calcitonin, produced by the thyroid gland, and parathyroid hormone (sometimes called parathormone or PTH), produced by the parathyroid glands.
3. Antagonistic hormones oppose or work opposite of each other. Calcitonin **decreases** levels of calcium in the blood, whereas parathyroid hormone **increases** levels of blood calcium.
4. Calcitonin decreases levels of blood calcium by stimulating uptake of calcium into the bones, and by inhibiting certain bone cells (osteoclasts) from breaking down bone in the skeleton to release calcium.
5. High levels of calcium in the blood stimulate the secretion of calcitonin, which increases the uptake of calcium into the bones and inhibits the decomposition of bone, thereby lowering calcium levels in the blood. Low calcium levels in the blood inhibit the secretion of calcitonin, which in turn decreases the uptake of calcium into the bones and allows the decomposition of bone to release more calcium into the blood. A negative feedback loop regulating blood calcium levels by calcitonin would resemble the following:

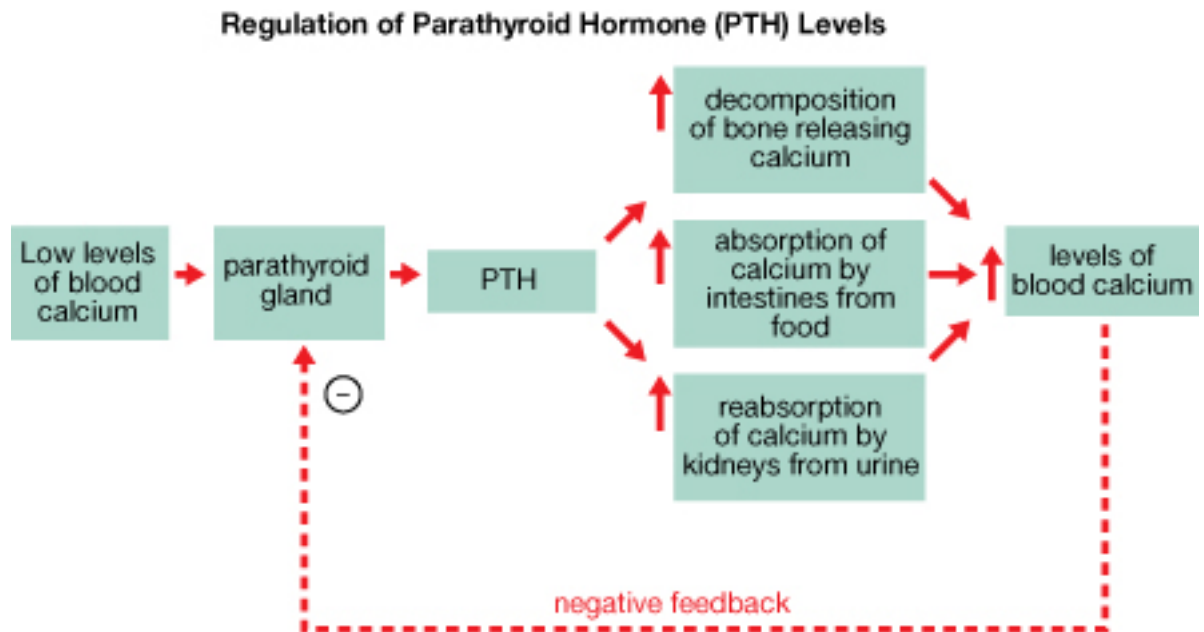


6. The overall effect of PTH is to increase levels of calcium in the blood plasma. It does this by (1) stimulating bone decomposing cells (osteoclasts) to digest bone in the skeleton and release the calcium from this decomposed bone into the bloodstream; (2) stimulating the kidneys to reabsorb more calcium, thereby decreasing the amount of calcium excreted in the urine, which consequently increases the levels of calcium in the blood, and (3) stimulating cells in the intestines to increase the absorption of calcium from food, thereby increasing the levels of calcium in the blood. Vitamin D is required for the absorption of calcium from the intestines, and parathyroid hormone stimulates the activation of Vitamin D to accomplish this.

7. The tumors in Emily's parathyroid glands cause the hyper-secretion of parathyroid hormone. Therefore, calcium is being constantly being released from her bones, making it very difficult for new bone tissue to form. The result is that the bones in her wrist do not heal, and furthermore, it is likely that her already weakened bones may have broken more easily due to the release of too much PTH.

Kidney stones are caused by the precipitation of excess calcium into crystals in the kidney tubules. Your hypothesis should resemble the following: **If** there is excess parathyroid hormone secreted into the blood, **then** excess calcium will be released into the blood **because** PTH stimulates the bones to release calcium, the kidneys to reabsorb more calcium from urine, and the intestines to absorb more calcium from food. Continued release of calcium from the bones will cause the bones to become less dense, more fragile and more prone to breaks. The high levels of blood calcium may crystallize and plug small tubules such as those in the kidneys resulting in kidney stones.

8. A negative feedback loop that illustrates the regulation of blood calcium levels by parathyroid hormone may resemble the following:



A diagram similar to Figure 13.18 on page 449 of your McGraw Hill textbook would also be acceptable.

9. Emily's feedback loop would be different because high levels of parathyroid hormone would not inhibit the bone cells from releasing calcium, the kidneys from reabsorbing the calcium, or the intestines from absorbing the calcium from food. All three actions would continue. A feedback loop may resemble the following:

Positive Feedback with Oversecretion of (PTH)

