

## NCERT Exemplar Solutions of Class 11 Biology – Chapter 22: Chemical Coordination and Integration

### LONG ANSWER TYPE QUESTIONS

**1. A milkman is very upset one morning as his cow refuses to give any milk. The milkman's wife gets the calf from the shed. On fondling by the calf, the cow gave sufficient milk. Describe the role of endocrine gland and pathway associated with this response?**

**Solution: Hormone Involved:** Oxytocin **Gland:** Posterior pituitary (neurohypophysis)

**Enhanced Explanation:**

**Pathway:**

**Stimulus:** Physical stimulation of nipples by calf suckling

**Neural pathway:** Sensory neurons → Spinal cord → Hypothalamus

**Hormone release:** Hypothalamic neurosecretory cells → Oxytocin → Posterior pituitary

**Target action:** Oxytocin → Mammary gland myoepithelial cells

**Response:** Smooth muscle contraction → Milk ejection

**Additional Functions of Oxytocin:**

Uterine contractions during labor

Social bonding and maternal behavior

**Positive feedback mechanism** during milk ejection and parturition

**2. A sample of urine was diagnosed to contain a high content of glucose and ketone bodies. Based on this observation, answer the following:**

a. Which endocrine gland and hormone is related to this condition? **Answer:**

**Pancreas** gland; **Insulin** hormone

b. Name the cells on which this hormone acts. **Answer: Hepatocytes, adipocytes, and muscle cells**

c. What is the condition called and how can it be rectified? **Answer: Diabetes mellitus**

**Enhanced Explanation:**

**Pathophysiology:**

**Glucose in urine (Glycosuria):** Due to hyperglycemia exceeding renal threshold

**Ketone bodies:** Result from fat metabolism when glucose cannot enter cells

**Types:** Type 1 (insulin deficiency) and Type 2 (insulin resistance)

**Treatment:**

**Type 1:** Insulin injections

**Type 2:** Diet control, exercise, oral hypoglycemic drugs

**Monitoring:** Blood glucose levels, HbA1c

**Complications prevention:** Regular check-ups

**3. Calcium plays a very important role in the formation of bones. Write on the role of endocrine glands and hormones responsible for maintaining calcium homeostasis.**

**Solution: Glands Involved:** Thyroid and Parathyroid glands

**Enhanced Explanation:**

**Hormones and Functions:**

**1. Parathyroid Hormone (PTH):**

**Source:** Parathyroid glands (4 small glands)

**Function:** Increases blood calcium

**Mechanisms:**

Stimulates osteoclasts (bone resorption)

Increases calcium reabsorption in kidneys

Activates vitamin D<sub>3</sub> → Calcitriol

Enhances intestinal calcium absorption

**2. Calcitonin:**

**Source:** Thyroid gland (C-cells)

**Function:** Decreases blood calcium

**Mechanisms:**

Inhibits osteoclast activity

Promotes calcium deposition in bones

Reduces calcium reabsorption in kidneys

**3. Calcitriol (Active Vitamin D<sub>3</sub>):**

**Source:** Kidneys (from vitamin D<sub>3</sub>)

**Function:** Enhances calcium absorption from intestine

**Regulatory Mechanism:**

**Low Ca<sup>2+</sup>** → PTH release → Ca<sup>2+</sup> increase

**High Ca<sup>2+</sup>** → Calcitonin release → Ca<sup>2+</sup> decrease

**4. Illustrate the differences between the mechanism of action of a protein and a steroid hormone.**

**Solution:**

Aspect	Protein Hormones	Steroid Hormones
<b>Solubility</b>	Water-soluble	Lipid-soluble
<b>Receptor location</b>	Plasma membrane	Intracellular (cytoplasm/nucleus)
<b>Membrane crossing</b>	Cannot cross lipid bilayer	Can cross cell membrane
<b>Second messenger</b>	Required (cAMP, IP <sub>3</sub> )	Not required
<b>Response time</b>	Rapid (seconds to minutes)	Slow (hours to days)
<b>Response duration</b>	Short-lived	Long-lasting

**Enhanced Explanation:**

**Protein Hormone Mechanism:**

Hormone binds to membrane receptor

Conformational change in receptor

Activation of second messenger system

Cascade amplification

Phosphorylation of enzymes

Rapid cellular response

**Examples:** Insulin, glucagon, adrenaline

**Steroid Hormone Mechanism:**

Hormone diffuses through cell membrane

Binds to intracellular receptor

Hormone-receptor complex formation

Translocation to nucleus

DNA binding and gene transcription

Protein synthesis and cellular changes

**Examples:** Testosterone, estrogen, cortisol

**5. Hypothalamus is a super master endocrine gland. Elaborate.**

**Solution:** Hypothalamus controls the "**master gland**" (pituitary), making it the "**super master**" of the endocrine system.

**Enhanced Explanation:**

**Anatomical Connection:**

**Anterior pituitary:** Connected via hypothalamic-hypophyseal portal system

**Posterior pituitary:** Direct neural connection via hypothalamic-hypophyseal tract

**Hypothalamic Hormones:**

**Releasing Hormones:**

**TRH** (Thyrotropin-releasing hormone) → TSH release

**CRH** (Corticotropin-releasing hormone) → ACTH release

**GHRH** (Growth hormone-releasing hormone) → GH release

**GnRH** (Gonadotropin-releasing hormone) → FSH, LH release

**PRH** (Prolactin-releasing hormone) → Prolactin release

**Inhibiting Hormones:**

**Somatostatin/GHIH** → Inhibits GH and TSH

**PIH/Dopamine** → Inhibits prolactin

**Direct Secretions to Posterior Pituitary:**

**ADH (Vasopressin)** → Water balance, blood pressure

**Oxytocin** → Milk ejection, uterine contractions

**Master Control Functions:**

**Neuroendocrine integration** - links nervous and endocrine systems

**Circadian rhythm regulation** - biological clock control

**Homeostatic regulation** - temperature, hunger, thirst

**Emotional responses** - stress, fear, pleasure

**Clinical Significance:** Hypothalamic dysfunction can affect multiple endocrine glands simultaneously, demonstrating its central regulatory role in maintaining physiological balance.

