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

VERY SHORT ANSWER TYPE QUESTIONS

1. There are many endocrine glands in the human body. Name the glands which are absent in male and the one absent in the female.

Solution:

Absent in males: Ovaries

Absent in females: Testes

Enhanced Explanation: Both are **gonads** (sex glands) that secrete sex hormones:

Ovaries secrete estrogen and progesterone

Testes secrete testosterone and other androgens These glands are responsible for secondary sexual characteristics and reproductive functions.

2. Which of the two adrenocortical layers, zona glomerulosa and zona reticularis lies outside enveloping the other?

Solution: Zona glomerulosa is the outermost layer that envelops the zona reticularis.

Enhanced Explanation: Adrenal cortex has three zones (outer to inner):

Zona glomerulosa - secretes mineralocorticoids (aldosterone)

Zona fasciculata - secretes glucocorticoids (cortisol)

Zona reticularis - secretes androgens (DHEA)

3. What is erythropoiesis? Which hormone stimulates it?

Solution: Erythropoiesis is the formation of red blood cells (RBCs). **Erythropoietin** hormone stimulates erythropoiesis.

Enhanced Explanation:

Process: Formation of RBCs in bone marrow

Hormone: Erythropoietin (EPO) - produced by kidneys

Stimulus: Low oxygen levels (hypoxia)

Target: Bone marrow stem cells

Duration: About 7 days for complete RBC maturation

4. Name the only hormone secreted by pars intermedia of the pituitary gland.

Solution: Melanocyte-stimulating hormone (MSH) is the only hormone secreted by pars intermedia.

Enhanced Explanation:

Location: Middle lobe of pituitary (rudimentary in humans)

Function: Stimulates melanocytes to produce melanin

Effect: Skin pigmentation

Regulation: Controlled by hypothalamic MSH-releasing and inhibiting factors

5. Name the endocrine gland that produces calcitonin and mention the role played by this hormone.

Solution: Thyroid gland produces calcitonin hormone.

Role of Calcitonin:

Decreases blood calcium concentration
Inhibits calcium mobilization from bones
Promotes calcium deposition in bones
Acts as antagonist to parathyroid hormone
Enhanced Explanation:
Cell type: Parafollicular cells (C-cells) of thyroid
Chemical nature: Polypeptide hormone (32 amino acids)
Mechanism: Inhibits osteoclast activity
Clinical significance: Used in treating osteoporosis
6. Name the hormone that helps in cell-mediated immunity.
Solution: Thymosin helps in cell-mediated immunity.
Enhanced Explanation: Functions of Thymosin:
Maturation of T-lymphocytes
Differentiation of T-helper and T-cytotoxic cells
Development of immunocompetence
Regulation of immune responses
Source: Thymus gland (most active during childhood)
7. What is the role of the second messenger in the mechanism of protein hormone action?
Solution: cAMP acts as an intracellular secondary messenger that delivers information to target cells.
Enhanced Explanation: Mechanism:
Hormone binds to membrane receptor
Receptor activates G-protein
G-protein activates adenylyl cyclase
ATP → cAMP (second messenger)
cAMP activates protein kinase A
Phosphorylation of target proteins
Cellular response
Other second messengers: cGMP, IP_3, DAG, Ca^{2+}
8. State whether true or false:
a. **The gastrointestinal tract, kidney and heart also produce hormones. Answer: True**
Enhanced Explanation:
GI tract: Gastrin, secretin, cholecystokinin (CCK)
Kidney: Erythropoietin, renin, calcitriol
Heart: Atrial natriuretic peptide (ANP)
b. **Pars distalis produces six trophic hormones. Answer: True**
Enhanced Explanation: Six hormones from anterior pituitary:
Growth hormone (GH)

Thyroid-stimulating hormone (TSH)
Adrenocorticotrophic hormone (ACTH)
Follicle-stimulating hormone (FSH)
Luteinizing hormone (LH)
Prolactin

c. **B-lymphocytes provide cell-mediated immunity. Answer: False**
Enhanced Explanation:
T-lymphocytes provide **cell-mediated immunity**
B-lymphocytes provide **humoral immunity** (antibody-mediated)

d. **Insulin resistance results in a disease called diabetes mellitus. Answer: True**
Enhanced Explanation:
Type 2 diabetes is characterized by insulin resistance
Cells become less responsive to insulin
Results in hyperglycemia

9. A patient complains of constant thirst, excessive passing of urine and low blood pressure. When the doctor checked the patient's blood glucose and blood insulin level, the level was normal or slightly low. The doctor diagnosed the condition as diabetes insipidus. But he decided to measure one more hormone in patient's blood. Which hormone does the doctor intend to measure?

Solution: The doctor intends to measure **vasopressin (ADH - Antidiuretic hormone)**.
Enhanced Explanation: Diabetes Insipidus is caused by:
Deficiency of ADH (central DI)
Kidney resistance to ADH (nephrogenic DI)
ADH functions:
Increases water reabsorption in kidneys
Prevents excessive water loss
Maintains blood pressure and volume
Deficiency symptoms: Polyuria, polydipsia, low BP

10. Correct the following statements by replacing the term underlined.

a. **Insulin is a steroid hormone. Correction:** Insulin is a **protein** hormone.

b. **TSH is secreted from the corpus luteum. Correction:** TSH is secreted from the **anterior pituitary**.

c. **Tetraiodothyronine is an emergency hormone. Correction: Adrenaline** is an emergency hormone.

d. **The pineal gland is located on the anterior part of the kidney. Correction:** The **adrenal** gland is located on the anterior part of the kidney.

11. Rearrange the following hormones in Column I to match with their chemical nature in Column II

Column I	Column II	Answer
a. Oxytocin	i. Amino acid derivative	a - iv
b. Epinephrine	ii. Steroid	b - i
c. Progesterone	iii. Protein	c - ii
d. Growth hormone	iv. Peptide	d - iii

Enhanced Explanation:
Oxytocin: 9 amino acid peptide hormone
Epinephrine: Derived from tyrosine (amino acid)
Progesterone: Steroid hormone (derived from cholesterol)
Growth hormone: 191 amino acid protein hormone

SHORT ANSWER TYPE QUESTIONS

1. What is the role played by luteinizing hormone in males and females respectively?
Solution:
In Males:
Stimulates **Leydig cells** to secrete testosterone
Testosterone promotes spermatogenesis
Maintains male accessory sex organs
Develops male secondary sexual characteristics
In Females:
Induces **ovulation** (LH surge)
Causes follicle rupture and release of secondary oocyte
Promotes formation of **corpus luteum**
Stimulates progesterone secretion from corpus luteum
Enhanced Explanation: LH is a **gonadotropin** secreted by anterior pituitary under GnRH control. It works in coordination with FSH to regulate reproductive functions in both sexes.

2. What is the role of the second messenger in hormone action?
Solution: Secondary messengers like **cAMP** act as intracellular mediators that deliver hormonal information inside target cells.
Enhanced Explanation:
Types of Second Messengers:
cAMP, cGMP - cyclic nucleotides
IP_3, DAG - phospholipid derivatives
Ca^{2+} - calcium ions
Functions:
Amplify hormonal signals
Activate protein kinases

Regulate gene expression
Modify enzyme activities
Bridge hormone-receptor binding to cellular response

3. On an educational trip to Uttaranchal, Ketki and her friends observe that many local people were having swollen necks. Please help Ketki and her friends to find out the solutions to the following questions.

a. **Which probable disease are these people suffering from? Answer: Goitre**

b. **How is it caused? Answer:** Caused by **iodine deficiency** in diet, leading to thyroid gland enlargement.

c. **What effect does this condition have on pregnancy? Answer:** Causes **cretinism** - defective development and stunted growth in the growing baby.

Enhanced Explanation:

Endemic goitre common in mountainous regions with iodine-deficient soil
Mechanism: Low iodine → Low T_3/T_4 → High TSH → Thyroid enlargement
Prevention: Iodized salt, marine food consumption
Treatment: Iodine supplementation, thyroid hormone replacement

4. George comes on a vacation to India from the US. The long journey disturbs his biological system and he suffers from jet lag. What is the cause of his discomfort?

Solution: Melatonin hormone disruption causes jet lag - a temporary sleep disorder.

Enhanced Explanation: Jet Lag Mechanism:

Circadian rhythm disruption due to rapid time zone changes
Melatonin secretion remains synchronized to original time zone
Light exposure patterns change suddenly
Symptoms: Insomnia, fatigue, cognitive impairment
Recovery: Gradual resetting of biological clock through light therapy and melatonin regulation.

5. Inflammatory responses can be controlled by a certain steroid. Name the steroid, its source and also its other important functions.

Solution: Steroid: Cortisol **Source:** Adrenal cortex (zona fasciculata)

Functions:

Anti-inflammatory responses
Immune response suppression
Carbohydrate metabolism regulation
Protein catabolism
Stress response

Enhanced Explanation: Cortisol Mechanism:

Inhibits phospholipase A_2 enzyme
Reduces prostaglandin and leukotriene synthesis
Stabilizes cell membranes
Clinical use: Corticosteroid drugs for inflammatory diseases

6. Old people have a weak immune system. What could be the reason?

Solution: Thymosin deficiency due to **thymus gland degeneration** with age causes weak immunity in elderly.

Enhanced Explanation: Age-related Changes:

Thymic involution - thymus shrinks after puberty

Reduced T-cell production and maturation

Decreased immunocompetence

Consequence: Increased susceptibility to infections, cancers, autoimmune diseases

7. What are the effects of hypothyroidism (observed during pregnancy) on the development and maturation of a growing baby?

Solution: Hypothyroidism during pregnancy causes:

Cretinism - defective development and stunted growth

Mental retardation

Low intelligence quotient

Enhanced Explanation: Critical Effects:

Neurological development impairment

Skeletal growth retardation

Metabolic dysfunction

Prevention: Thyroid screening during pregnancy, iodine supplementation

Treatment: Thyroid hormone replacement therapy

8. Mention the difference between hypothyroidism and hyperthyroidism.

Solution:

Aspect	Hypothyroidism	Hyperthyroidism
Cause	Decreased thyroid hormone	Excessive thyroid hormone
Weight	Weight gain	Weight loss
Appetite	Loss of appetite	Increased appetite
Skin	Dry and coarse skin	Moist skin
Metabolism	Slow metabolism	Increased metabolism
Heart rate	Bradycardia	Tachycardia

Enhanced Explanation: Common Conditions:

Hypothyroidism: Hashimoto's thyroiditis, iodine deficiency

Hyperthyroidism: Graves' disease, toxic nodular goitre