

Chemical Coordination and Integration — Assignment 2

Class 11 Biology · Higher-difficulty challenge set + integrated problems · Answer key included · Narayan Gurukul Academy

Instructions: (1) Attempt all questions; start with the topic-wise challenge set, then attempt the integrated (multi-topic) problems.
(2) Give all answers with correct SI units. $g = 10 \text{ m/s}^2$ unless stated.
(3) A final answer key is provided at the end — try the full set before checking it.

Part A — Topic-wise challenge questions

Endocrine System and Hormones

1. Distinguish between endocrine and exocrine glands.
2. State two characteristics of hormones.
3. Describe the endocrine system and its functions.

Hormones of the Pituitary and Hypothalamus

1. Name two hormones of the anterior pituitary.
2. State the function of antidiuretic hormone.
3. Describe the hormones of the pituitary and hypothalamus.

Thyroid, Parathyroid, Adrenal and Pancreas

1. Distinguish between insulin and glucagon.
2. State the function of parathormone.
3. Describe the hormones of the thyroid, parathyroid, adrenal and pancreas.

Other Endocrine Glands

1. Name two endocrine tissues other than the major glands.
2. State the function of melatonin.
3. Describe the other endocrine glands and their hormones.

Mechanism of Hormone Action

1. Distinguish between protein and steroid hormone action.
2. Explain the role of cyclic AMP as a second messenger.
3. Describe the mechanism of hormone action.

Feedback Control and Diagnosis

1. Explain negative feedback with one example.
2. Name one technique for measuring hormone levels.
3. Describe the feedback control of hormone secretion.

Disorders of the Endocrine System

1. Distinguish between diabetes mellitus and diabetes insipidus.
2. Name two disorders of the thyroid gland.
3. Describe the disorders of the endocrine system.

Part B — Integrated problems (multi-topic)

1. Distinguish between endocrine and exocrine glands and state the characteristics of hormones.
2. Describe the hormones of the pituitary and hypothalamus.
3. Describe the hormones of the thyroid, parathyroid, adrenal and pancreas.
4. Explain the two mechanisms of hormone action.
5. Explain feedback control of hormone secretion with an example.
6. Describe any three disorders of the endocrine system.

Answer Key

Endocrine System and Hormones

Endocrine glands are ductless and secrete hormones into the blood; exocrine glands have ducts and secrete into a surface. Hormones are chemical messengers secreted in trace amounts, transported by blood, acting on specific target cells. The endocrine system, with the nervous system, coordinates and regulates body functions through hormones that control metabolism, growth, reproduction and homeostasis.

Hormones of the Pituitary and Hypothalamus

Anterior pituitary secretes growth hormone and TSH (also ACTH, FSH, LH, prolactin). Antidiuretic hormone (from the posterior pituitary) promotes water reabsorption in the kidney. The hypothalamus secretes releasing and inhibiting hormones that control pituitary secretion; the pituitary, in turn, controls other endocrine glands, making the hypothalamus the master regulator.

Thyroid, Parathyroid, Adrenal and Pancreas

Insulin lowers blood glucose by promoting cell uptake and glycogenesis; glucagon raises it by promoting glycogenolysis. Parathormone raises blood calcium by acting on bone, kidney and gut. Thyroid secretes thyroxine (metabolism, growth); parathyroid secretes parathormone (calcium balance); adrenal medulla secretes adrenaline and noradrenaline, adrenal cortex secretes corticosteroids; pancreas secretes insulin and glucagon.

Other Endocrine Glands

Two others: the pineal gland and the gastrointestinal tract (also thymus and gonads). Melatonin regulates the sleep-wake cycle and biological rhythms. The thymus secretes thymosins for immune function; the pineal secretes melatonin; the gastrointestinal tract secretes gastrin, secretin and CCK; the gonads secrete sex hormones.

Mechanism of Hormone Action

Protein hormones bind surface receptors and act through second messengers; steroid hormones enter the cell and regulate gene expression. Cyclic AMP is produced from ATP when a protein hormone binds its receptor, and it relays the signal inside the cell. Two mechanisms: (i) membrane-bound receptor hormones (proteins/peptides) generate a second messenger such as cyclic AMP; (ii) intracellular receptor hormones (steroids, thyroid hormones) enter the cell and activate genes.

Feedback Control and Diagnosis

A rise in blood glucose increases insulin secretion, which lowers glucose, reducing further insulin release — a negative feedback loop. Hormone levels can be measured by radioimmunoassay (RIA) and ELISA. Secretion is controlled by feedback: negative feedback maintains homeostasis (e.g. thyroid hormones inhibit TRH/TSH; insulin and glucose), while positive feedback amplifies a response. Diagnosis uses RIA/ELISA and clinical signs.

Disorders of the Endocrine System

Diabetes mellitus is due to insulin deficiency (high blood glucose, glucose in urine); diabetes insipidus is due to ADH deficiency (excess dilute urine). Thyroid disorders: goitre (iodine deficiency/hypothyroidism) and exophthalmic goitre (hyperthyroidism). Disorders: cretinism (thyroxine deficiency in children), dwarfism (GH deficiency), acromegaly/gigantism (GH excess), diabetes mellitus (insulin deficiency), diabetes insipidus (ADH deficiency), and goitre.

Integrated problems

1: Endocrine — ductless, hormones into blood; exocrine — ducts; hormones act in trace amounts on target cells. 2: Anterior pituitary (GH, TSH, ACTH, FSH, LH, prolactin) and posterior pituitary (ADH, oxytocin); hypothalamus controls the pituitary. 3: Thyroxine (metabolism); parathormone (Ca^{2+}); adrenaline (fight or flight); insulin (lowers glucose) and glucagon (raises glucose). 4: Protein hormones — surface receptor + second messenger; steroid hormones — intracellular receptor + gene expression. 5: Negative feedback, e.g. insulin–glucose and thyroid hormone–TRH/TSH loops. 6: Cretinism, dwarfism, acromegaly, diabetes (mellitus/insipidus), goitre.