

Chemical Coordination and Integration — NEET MCQs with Solutions

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Q1. Thymus undergoes gradual reduction in size after puberty due to:

- (A) Increased thymosin secretion post-puberty
- (B) Age-related involution after puberty
- (C) TSH-mediated suppression
- (D) Cortisol excess from adrenal gland

Q2. Vasopressin (ADH) exerts its antidiuretic effect primarily by acting on:

- (A) Proximal convoluted tubule cells
- (B) Distal convoluted tubule and collecting duct
- (C) Descending loop of Henle only
- (D) Bowman's capsule epithelium

Q3. Thymosin secreted by thymus is essential for:

- (A) Erythropoiesis in red bone marrow
- (B) Activation of B lymphocytes for antibody production
- (C) Platelet aggregation at injury site
- (D) Differentiation and maturation of T lymphocytes

Q4. Zona fasciculata, the middle layer of adrenal cortex, primarily secretes:

- (A) Glucocorticoids like cortisol and corticosterone
- (B) Mineralocorticoids like aldosterone
- (C) Catecholamines like adrenaline
- (D) Androgens like dehydroepiandrosterone

Q5. Which of the following correctly distinguishes prolactin from oxytocin regarding milk?

- (A) Both are released from posterior pituitary
- (B) Oxytocin stimulates milk synthesis in alveolar cells
- (C) Prolactin stimulates milk synthesis; oxytocin drives milk ejection
- (D) Prolactin is released by neurohypophysis under hypothalamic control

Q6. Pancreas is described as a heterocrine gland because it:

- (A) Functions as both exocrine and endocrine gland
- (B) Secretes hormones into intestinal lumen
- (C) Produces only digestive enzymes
- (D) Has dual embryological origin

Q7. Pineal gland is called the 'third eye' in lower vertebrates because:

- (A) It secretes melatonin into CSF directly
- (B) It is photosensitive and influences light-based responses
- (C) It controls visual cortex via optic tract
- (D) It secretes hormones regulating eye pressure

Q8. Which type of endocrine stimulus involves one hormone triggering secretion of another?

- (A) Hormonal stimulus
- (B) Neural stimulus
- (C) Humoral stimulus
- (D) Paracrine stimulus

Q9. Hormonal effects generally last longer than neural effects primarily because hormones:

- (A) Have extended half-lives due to plasma protein binding and slower degradation
- (B) Are larger molecules that diffuse slowly
- (C) Act on more receptor subtypes than neurotransmitters
- (D) Are produced in greater quantities than neurotransmitters

Q10. Which of the following BEST illustrates synergistic hormonal interaction?

- (A) Both GH and cortisol promoting lipolysis together
- (B) Insulin opposing glucagon in glucose regulation
- (C) Calcitonin reducing blood calcium raised by PTH
- (D) Adrenaline inhibiting insulin secretion

Q11. Which of the following correctly explains the slower onset of hormonal responses compared to neural responses?

- (A) Hormones require gene transcription at every step
- (B) Hormones must travel through blood to reach distant targets
- (C) Hormones are larger molecules than neurotransmitters
- (D) Hormones act via electrical conduction

Q12. The opposing actions of insulin and glucagon in blood glucose regulation best exemplify:

- (A) Permissive hormonal interaction
- (B) Synergistic hormone action
- (C) Antagonistic hormonal interaction
- (D) Positive feedback regulation

Q13. Hormones acting via membrane receptors generally produce:

- (A) Rapid but short-lived effects
- (B) Delayed but prolonged effects
- (C) Direct gene activation without intermediates
- (D) Effects requiring nuclear entry

Q14. IP_3 (inositol trisphosphate) primarily causes:

- (A) Increased cAMP synthesis
- (B) Inhibition of protein kinase A
- (C) Direct activation of ribosomes
- (D) Release of Ca^{2+} from endoplasmic reticulum

Q15. Which of the following correctly explains why lipid-soluble hormones can regulate gene expression directly?

- (A) They bind intracellular receptors and the complex acts as a transcription factor on DNA
- (B) They activate adenylate cyclase to produce cAMP in the nucleus
- (C) They bind membrane receptors that send signals to the nucleus
- (D) They phosphorylate RNA polymerase via protein kinase A

Q16. Hormone specificity of action is primarily determined by:

- (A) Circulating hormone concentration
- (B) Type of second messenger produced
- (C) Presence of specific receptors on target cells
- (D) Degree of vascularization of target tissue

Q17. Which molecule serves as the intracellular receptor for steroid hormones before nuclear translocation?

- (A) Ribosomal protein subunit
- (B) Zinc-finger transcription factor
- (C) Cytoplasmic receptor protein
- (D) cAMP-dependent kinase

Q18. Water-soluble hormones primarily act through:

- (A) Direct DNA binding in nucleus
- (B) Second messenger systems
- (C) Cytoplasmic steroid receptors
- (D) Diffusion into nucleus

Q19. Which symptom is more characteristic of hyperthyroidism than hypothyroidism?

- (A) Raised basal metabolic rate
- (B) Weight gain
- (C) Cold intolerance
- (D) Bradycardia

Q20. Excess aldosterone secretion would most directly produce:

- (A) Hypotension and hyperkalemia
- (B) Hypoglycaemia and weakness
- (C) Bone demineralisation
- (D) Hypertension and hypokalemia

Q21. Excess PTH in hyperparathyroidism raises blood calcium primarily by:

- (A) Stimulating osteoclast-mediated bone resorption
- (B) Increasing intestinal calcium secretion
- (C) Decreasing renal calcium reabsorption
- (D) Stimulating calcitonin release

Q22. Which endocrine disorder is most directly associated with a subnormal basal metabolic rate?

- (A) Graves disease
- (B) Myxoedema
- (C) Cushing syndrome
- (D) Conn syndrome

Q23. A child shows stunted growth with normal intelligence and proportionate body. This best indicates:

- (A) Cretinism
- (B) Pituitary dwarfism
- (C) Acromegaly
- (D) Myxoedema

Q24. Hyposecretion of growth hormone during childhood causes:

- (A) Acromegaly
- (B) Gigantism
- (C) Pituitary dwarfism
- (D) Cushing syndrome

Answer key and explanations

Q1. Answer: (B) Age-related involution after puberty

Thymus involutes progressively after puberty — though T cells already educated persist. This is a normal physiological process, not pathological. Increased thymosin would be expected to maintain, not reduce, thymus size.

Q2. Answer: (B) Distal convoluted tubule and collecting duct

ADH increases water permeability of distal convoluted tubule and collecting duct via aquaporin insertion. It does not act on the proximal tubule or loop of Henle — common wrong options in NEET papers.

Q3. Answer: (D) Differentiation and maturation of T lymphocytes

Thymosin promotes T lymphocyte differentiation — critical for cell-mediated immunity. Thymus involutes after puberty, but its early role in establishing T cell repertoire is permanent. B lymphocyte activation is driven by antigen and helper T cells, not thymosin.

Q4. Answer: (A) Glucocorticoids like cortisol and corticosterone

Zona fasciculata (middle) → glucocorticoids. Mineralocorticoids come from glomerulosa (outer); androgens from reticularis (inner); catecholamines from medulla. Remembering GFR from outside-in is the standard mnemonic.

Q5. Answer: (C) Prolactin stimulates milk synthesis; oxytocin drives milk ejection

Prolactin (anterior pituitary) → milk synthesis; oxytocin (posterior pituitary) → milk ejection via myoepithelial contraction. Option B reverses the roles — the highest-frequency wrong answer on this topic.

Q6. Answer: (A) Functions as both exocrine and endocrine gland

Heterocrine means a gland with both exocrine (digestive enzymes via ducts) and endocrine (insulin, glucagon via blood) functions. The islets of Langerhans constitute the endocrine component.

Q7. Answer: (B) It is photosensitive and influences light-based responses

In lower vertebrates, the pineal gland is directly photosensitive and mediates light-dependent responses — analogous to a visual organ. In mammals, it receives photic input via retinohypothalamic tract.

Q8. Answer: (A) Hormonal stimulus

Hormonal stimulus occurs when a tropic hormone (e.g., TSH) stimulates a target endocrine gland (thyroid) to secrete its hormone. Humoral stimulus (Option C) involves changes in blood ion/nutrient levels — not one hormone acting on another gland.

Q9. Answer: (A) Have extended half-lives due to plasma protein binding and slower degradation

Hormones bound to plasma proteins are protected from rapid enzymatic degradation, extending their half-life and effect duration. Option B is incorrect — molecular size does not determine duration; many large peptide hormones have short half-lives.

Q10. Answer: (A) Both GH and cortisol promoting lipolysis together

Synergism occurs when two hormones produce a combined effect greater than either alone — GH and cortisol both promote fat breakdown and together enhance lipolysis synergistically. Option B is antagonism, not synergism.

Q11. Answer: (B) Hormones must travel through blood to reach distant targets

Hormones are released into the bloodstream and must reach target organs via circulation, taking minutes to hours. Option A is a trap — gene transcription is required for steroid hormone action but is not the primary reason for slower onset compared to neural conduction.

Q12. Answer: (C) Antagonistic hormonal interaction

Insulin lowers blood glucose while glucagon raises it; their opposing actions maintain glucose homeostasis. Synergism (Option B) is a trap — synergistic hormones enhance each other's effects, which is the opposite of what insulin-glucagon do.

Q13. Answer: (A) Rapid but short-lived effects

Second messenger cascades are rapidly activated and rapidly degraded, producing fast but transient effects. Steroid hormones (Options B) act via gene transcription with slow onset but prolonged duration.

Q14. Answer: (D) Release of Ca^{2+} from endoplasmic reticulum

IP_3 binds receptors on the endoplasmic reticulum membrane, triggering Ca^{2+} release into the cytosol. This Ca^{2+} then activates calmodulin and other calcium-dependent proteins. Option A (cAMP) belongs to the separate adenylate cyclase pathway.

Q15. Answer: (A) They bind intracellular receptors and the complex acts as a transcription factor on DNA

Lipid-soluble hormones diffuse through the membrane, bind cytoplasmic/nuclear receptors, and the complex binds HREs on DNA to modulate transcription. Option B incorrectly places cAMP in the nucleus. Option C describes peptide hormone indirect nuclear signaling.

Q16. Answer: (C) Presence of specific receptors on target cells

Only cells expressing the specific receptor for a hormone will respond to it — this is the molecular basis of target organ specificity. High hormone concentration (Option A) can increase effect magnitude but does not confer specificity.

Q17. Answer: (C) Cytoplasmic receptor protein

Steroid hormones bind specific cytoplasmic receptor proteins; the hormone-receptor complex then translocates to the nucleus. Option B (zinc-finger protein) is a tempting trap — zinc fingers ARE found in steroid receptor DNA-binding domains, but the receptor itself is a cytoplasmic protein.

Q18. Answer: (B) Second messenger systems

Hydrophilic hormones cannot cross the lipid bilayer; they bind membrane receptors and activate second messengers like cAMP or IP_3 . Option A and D describe steroid hormone action. Option C is the steroid receptor location.

Q19. Answer: (A) Raised basal metabolic rate

Excess T3/T4 increases mitochondrial uncoupling and metabolic rate, producing heat intolerance, tachycardia, and weight loss. Options B, C, D are all hypothyroid features — the question tests directional knowledge of thyroid hormone effects. Cold intolerance (Option C) is a particularly effective trap as students confuse heat vs cold intolerance direction.

Q20. Answer: (D) Hypertension and hypokalemia

Aldosterone increases Na^+ /water reabsorption (raising BP) and promotes K^+ excretion — producing hypertension with hypokalemia (Conn syndrome). Option A is the inversion trap: hypotension and hyperkalemia are features of Addison disease (aldosterone deficiency). Options B and C involve unrelated systems.

Q21. Answer: (A) Stimulating osteoclast-mediated bone resorption

PTH activates osteoclasts to resorb bone matrix, releasing Ca^{2+} into circulation; it also increases renal Ca^{2+} reabsorption and activates vitamin D for intestinal Ca^{2+} absorption. Option C is the trap — PTH actually increases (not decreases) renal Ca^{2+} reabsorption. Calcitonin is antagonistic to PTH.

Q22. Answer: (B) Myxoedema

Thyroid hormones are the primary regulators of BMR; adult hypothyroidism (myxoedema) lowers BMR causing lethargy, weight gain, and cold intolerance. Graves disease is the trap — also thyroid-related but causes elevated BMR. Cushing raises glucose metabolism but not BMR in the classical sense.

Q23. Answer: (B) Pituitary dwarfism

Pituitary dwarfism (GH deficiency) causes proportionate stunting with normal mental development. Cretinism is the elite trap: also shows stunted growth but additionally causes mental retardation and disproportionate features due to thyroid hormone deficiency. Normal intelligence rules out cretinism.

Q24. Answer: (C) Pituitary dwarfism

GH deficiency during growth years stunts linear growth, producing pituitary dwarfism. Gigantism and acromegaly are both hypersecretion disorders — opposite aetiology. Cushing syndrome involves adrenal cortex excess, not GH.

Gland, hormone and disorder

Gland	Hormones and key facts
Hypothalamus	Releasing hormones (e.g. GnRH) and inhibiting hormones (e.g. somatostatin) reach the pituitary through the portal system

Anterior pituitary	GH, prolactin, TSH, ACTH, LH, FSH; excess GH → gigantism (child) or acromegaly (adult); deficiency → pituitary dwarfism
Posterior pituitary	Stores and releases oxytocin and vasopressin (ADH), which are made in the hypothalamus
Pineal gland	Melatonin — diurnal (24-hour) rhythm
Thyroid	T ₄ and T ₃ (need iodine), thyrocalcitonin; hypothyroidism in pregnancy → cretinism; in adults → myxoedema; iodine deficiency → goitre; Graves' disease → exophthalmic goitre
Parathyroid	PTH raises blood Ca ²⁺ (hypercalcaemic); thyrocalcitonin lowers it
Thymus	Thymosins — differentiation of T-lymphocytes; the gland shrinks with age
Adrenal medulla	Adrenaline and noradrenaline — emergency (fight or flight) hormones
Adrenal cortex	Glucocorticoids (cortisol) from zona fasciculata; mineralocorticoids (aldosterone) from zona glomerulosa; androgens from zona reticularis; underproduction → Addison's disease
Pancreas (islets of Langerhans)	α cells: glucagon (raises blood sugar); β cells: insulin (lowers blood sugar); lack of insulin → diabetes mellitus
Gonads	Testis: Leydig cells make androgens (testosterone); ovary: oestrogen from follicles, progesterone from corpus luteum
Other organs	Heart: ANF lowers blood pressure; kidney: erythropoietin; gut: gastrin, secretin, CCK, GIP
Mechanism of action	Protein hormones use membrane receptors and second messengers (cAMP, IP ₃ , Ca ²⁺); steroid and thyroid hormones use intracellular receptors and change gene expression