

Chemical Coordination and Integration

OBJECTIVE TYPE QUESTIONS

➡ Multiple Choice Questions (MCQs)

1. The current scientific definition of the hormone is

- (a) hormones are a chemical produced by endocrine glands and released into blood and transported to a distantly located target organ.
- (b) hormones are non-nutrient chemicals which acts as intercellular messengers and are produced in trace amount.
- (c) hormones are non-nutrient chemicals which acts as intracellular messengers and are produced in trace amounts.
- (d) none of these.

2. The adrenal cortex can be divided into three layers. The arrangement of these layers from outer to inner side is

- (a) zona glomerulosa, zona fasciculata and zona reticularis
- (b) zona reticularis, zona fasciculata and zona glomerulosa
- (c) zona glomerulosa, zona reticularis and zona fasciculata
- (d) zona fasciculata, zona glomerulosa and zona reticularis

3. Inhibition and stimulation of gastric secretions are controlled by hormones

- (a) enterocrinin and secretin respectively
- (b) enterogastrone and gastrin respectively
- (c) enterogastrone and secretin respectively
- (d) none of these.

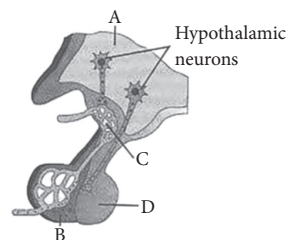
4. What is the function of calcitonin?

- (a) It increases calcium level in blood.
- (b) It decreases calcium level in blood.
- (c) It stimulates steroid synthesis.
- (d) It increases absorption of water in kidney tubules.

5. A tumour in the adrenal zona glomerulosa can cause hypersecretion of hormones produced in that region. Which of the following might you expect to find in a patient with such a tumour?

- (a) Increased blood sodium levels
- (b) Increased blood glucose levels
- (c) Decreased blood calcium levels
- (d) Increased dehydration

6. Which of the following option in given table is correct identification of the structures labelled as A, B, C and D and their corresponding function in the above figure?



	Structure	Function
(a) A.	Hypothalamus	Produces prolactin hormone
(b) B.	Posterior pituitary	Release FSH and LH
(c) C.	Intermediate lobe of pituitary	Release prolactin
(d) D.	Posterior pituitary	Release oxytocin and vasopressin

7. Match column I with column II, and choose the correct combination from the given options.

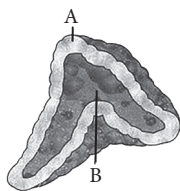
Column I	Column II
A. Goitre	I. Hyperparathyroidism
B. Child birth	II. Hypothyroidism
C. Demineralisation	III. Aldosterone
D. Salt water balance	IV. Oxytocin
(a) A-III, B-I, C-IV, D-II	
(b) A-II, B-I, C-IV, D-III	
(c) A-I, B-II, C-IV, D-III	
(d) A-II, B-IV, C-I, D-III	

8. When the primary sexual organ does not develop, puberty may appear due to

- (a) stimulation of adrenal cortex
- (b) stimulation of adrenal medulla
- (c) excessive secretion from gonads
- (d) none of these.

9. Recognise the given figure and find out the correct matching.

- (a) A-Adrenal gland, B-Kidney
- (b) A-Kidney, B-Adrenal gland
- (c) A-Adrenal medulla, B-Adrenal cortex
- (d) A-Adrenal cortex, B-Adrenal medulla



10. The posterior pituitary gland is not a 'true' endocrine gland because

- (a) it is provided with a duct
- (b) it only stores and releases the hormones secreted by hypothalamus
- (c) it is under the regulation of hypothalamus
- (d) it secretes enzymes.

11. Read the following statements and choose how many statements are incorrect.

- A. Testis performs dual functions as an endocrine gland and as secondary sex organ.
- B. Low pitch voice is induced by testosterone in males.
- C. When blood pressure decreases, ANF is secreted which causes dilation of blood vessels.
- D. Androgenic steroids play a role in growth of axial hair, pubic hair and facial hair during puberty.

- (a) one (b) two
- (c) three (d) four

12. FSH of anterior pituitary acts on

- (a) interstitial cells of testis
- (b) sertoli cells of testis
- (c) parafollicular cells of thyroid
- (d) sustentacular cells of testis.

13. A steroid hormone which regulates glucose metabolism is

- (a) adrenaline (b) corticosterone
- (c) cortisol (d) estradiol.

14. Moon face, buffalo hump, centripetal deposition of fat in belly occurs due to the abnormal functioning of

- (a) adrenal medulla (b) adrenal cortex
- (c) anterior pituitary (d) thyroid gland.

15. α -cells of islet of Langerhans can raise the glucose level by all the following process, except

- (a) accelerate glycogen breakdown in liver
- (b) promoting conversion of amino acid and lactic acid to glucose in liver
- (c) enhancing release of glucose into blood
- (d) promote synthesis of fats from glucose.

16. Which of the following match is correct ?

Hormone	Effect
(a) Oxytocin	Milk ejection hormone
(b) Glucagon	Decreases blood sugar level
(c) Adrenaline	Decreases heart rate
(d) Thyroxine	Decreases BMR

17. Read the following statements and choose the incorrect one.

- (a) Corpus luteum only secretes progesterone.
- (b) GIP inhibits gastric secretions and contractions.
- (c) Cortisol is also considered as stress hormone.
- (d) Glucagon stimulates glycogenolysis in liver.

18. The target cells of hormone always possess

- (a) special channels for hormone movement
- (b) storage sacs for hormones
- (c) special receptors to which hormone binds
- (d) all of these.

19. Which of the following hormones utilises cAMP as a second messenger?

- (a) Aldosterone (b) Estrogen
- (c) Progesterone (d) None of these

20. The hormone receptors complex induces

- (a) release of GDP from G protein
- (b) release of G from GDP
- (c) conversion of cAMP into ATP
- (d) both (a) and (c).

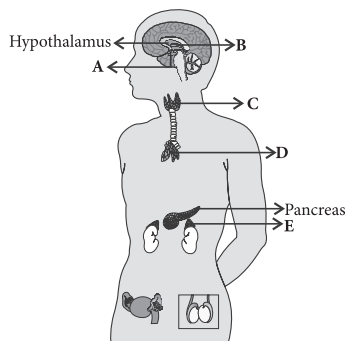
21. Which of the following statement is incorrect with respect to action of FSH hormone?

- (a) It interacts with membrane bound receptors and normally does not enter the target cell.
- (b) It generates second messengers like cyclic AMP and Ca^{++} .
- (c) It regulates gene expression or chromosome function by the interaction of hormone receptor complex with genome.
- (d) It binds with receptors on the ovarian cell membrane and regulates physiological responses like ovarian growth.

22. Identify the hormone from the given characteristics.

- (i) It is secreted by the mucosa of small intestine.
- (ii) It stimulates gall bladder to release bile juice.
- (a) Enterogastrone
- (b) Pancreatic polypeptide
- (c) Cholecystokinin-pancreozymin
- (d) Vasoactive intestinal peptide

23. The given figure shows main endocrine glands in human body. Identify A to E and select the correct option.



- | A | B | C | D | E |
|---------------|-----------|-------------------------|---------|---------|
| (a) Pineal | Pituitary | Thyroid and parathyroid | Thymus | Adrenal |
| (b) Pituitary | Pineal | Thyroid and parathyroid | Adrenal | Thymus |
| (c) Pituitary | Pineal | Thyroid and parathyroid | Thymus | Kidney |
| (d) Pituitary | Pineal | Thyroid and parathyroid | Thymus | Adrenal |

24. Study the following flow chart that shows calcium regulation by different hormones and identify X, Y and Z.

Anterior lobe of pituitary gland

↓ X

C-cells of thyroid gland

↓ Y

Blood calcium level decreases

↓

Stimulation of chief cells of parathyroid gland

↓ Z

Regulates calcium and phosphate levels in blood

- (a) X-Calcitonin, Y-Thyrotropin, Z-Calcitriol
 (b) X-Thyrotropin, Y-Calcitriol, Z-Parathormone
 (c) X-Thyrotropin, Y-Calcitonin, Z-Parathormone
 (d) X-Thyrotropin releasing hormone, Y-Thyrotropin, Z-Parathormone

25. Read the given statements and state them as true or false.

- A. Cretinism can be treated by an early administration of thyroid hormones.
 B. Conn's syndrome occurs due to insufficient production of aldosterone.
 C. Gigantism affects optic chiasma and vision.
 D. Calcitriol deaccelerates bone formation.
 E. Male hypogonadism is due to hypofunction of Leydig's cells.

- | | A | B | C | D | E |
|-----|---|---|---|---|---|
| (a) | T | F | T | T | F |
| (b) | T | F | T | F | T |
| (c) | T | F | T | T | T |
| (d) | T | F | F | T | T |

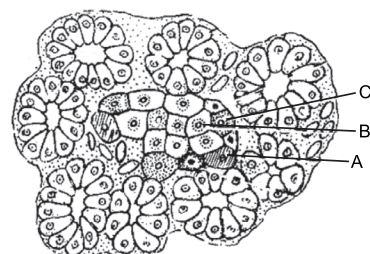
26. Estrogen and testosterone are steroid hormones, it most likely binds to

- (a) membrane ion channels
 (b) enzyme-linked membrane receptors
 (c) G-protein coupled membrane receptors
 (d) cytoplasmic receptors.

27. If baby's anterior lobe of pituitary is damaged due to an accident, then from which of the following disorders is he most likely to suffer?

- (i) Cretinism (ii) Simmonds' disease
 (iii) Acromegaly (iv) Dwarfism
 (a) (i) and (ii) (b) (i), (ii) and (iv)
 (c) Only (iv) (d) (i), (iii) and (iv)

28. Study the given diagram showing the anatomy of pancreas and identify the hormones secreted from labelled parts A, B and C.



- (a) A-Insulin, B-Somatostatin, C-Glucagon
 (b) A-Pancreatic polypeptide, B-Glucagon, C-Insulin
 (c) A-Somatostatin, B-Pancreatic polypeptide, C-Glucagon
 (d) A-Somatostatin, B-Insulin, C-Glucagon

29. Study the given table and identify A, B, C and D.

Disease	Hormone	Secretion
Grave's disease	A	Hypersecretion
Cushing's syndrome	Cortisol	B
C	ADH	Hyposecretion
Osteoporosis	D	Hypersecretion

- (a) A-Melanotrophin, B-Hyposecretion, C-Acromegaly, D-Thyroxine
 (b) A-Cortisone, B-Hyposecretion, C-Gigantism, D-Luteinising hormone
 (c) A-Oxytocin, B-Hypersecretion, C-Diabetes mellitus, D-Glucagon
 (d) A-Thyroid, B-Hypersecretion, C-Diabetes insipidus, D-Parathormone

30. Polydipsia and ketosis are the symptoms of

- (a) hypoglycemia (b) Cushing's syndrome
 (c) diabetes insipidus (d) diabetes mellitus.

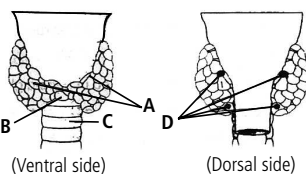
31. Read the given statements and select the correct option.

Statement A: MSH and Melatonin are antagonistic hormones.

Statement B: MSH help in the wide distribution of melanin in melanocytes while melatonin collects the melanin at one place in melanocyte.

- (a) Both statements A and B are true and B is the correct explanation of A.
- (b) Both statements A and B are true but B is not the correct explanation of A.
- (c) Statement A is true but B is false.
- (d) Both statements A and B are false.

32. Observe the given figures and select the option that correctly identifies the labels A, B, C and D.



- | A | B | C | D |
|-----------------------|---------------|---------|-------------------|
| (a) Parathyroid gland | Isthmus | Trachea | Thyroid gland |
| (b) Thyroid gland | Isthmus | Trachea | Parathyroid gland |
| (c) Thyroid gland | Isthmus | Larynx | Parathyroid gland |
| (d) Thyroid gland | Corpus luteum | Trachea | Parathyroid gland |

33. Match the column I with column II and select the correct option from the codes given below.

- | Column I | Column II |
|-------------------|-----------------------------------------------------------------|
| A. Thymosin | (i) Inhibits secretion of glucagon and insulin |
| B. Erythropoietin | (ii) Stimulates development of WBCs |
| C. Melatonin | (iii) Stimulates the bone marrow to increase production of RBCs |
| D. Somatostatin | (iv) Promotes sleep |
- (a) A-(i), B-(ii), C-(iv), D-(iii)
 - (b) A-(ii), B-(iii), C-(iv), D-(i)
 - (c) A-(iii), B-(ii), C-(iv), D-(i)
 - (d) A-(iv), B-(iii), C-(i), D-(ii)

34. The development of enlarged mammary glands in males due to increased levels of estrogen and deficiency of testosterone is called

- (a) acromegaly
- (b) Conn's syndrome
- (c) eunuchoidism
- (d) gynaecomastia.

35. Choose the incorrect statement.

- (a) The secretion of the posterior lobe of pituitary is known as pituitrin.
- (b) High blood level of ADH is characterised by dilute blood and high plasma sodium.
- (c) Somatostatin is secreted by delta cells of Langerhans.
- (d) Thyrocalcitonin is secreted when calcium level in blood is high.

36. Contraction of smooth muscles of arterioles is influenced by

- (a) PRL
- (b) ACTH
- (c) ADH
- (d) FSH.

37. Which of the following functions are regulated by melatonin/pineal gland?

- A. Defense capability
- B. Pigmentation
- C. Menstrual cycle
- D. Metabolism
- E. Growth and differentiation
- F. Body temperature
- G. Sleep-wake cycle

- (a) A, D, C, F and G
- (b) B, C, D, E, F and G
- (c) A, C, D and E
- (d) A, B, C, D, F and G

38. During stress, besides epinephrine and norepinephrine which other hormones are also released ?

- (a) Thyroxine, cortisol, aldosterone and vasopressin
- (b) Cortisol, aldosterone, vasopressin and glucagon
- (c) Cortisol, vasopressin, insulin and parathormone
- (d) Parathormone, vasopressin, glucagon and thyroxine

39. Which of the following cells does not secrete hormone?

- (a) Kupffer cell
- (b) Leydig cell
- (c) Lutein cell
- (d) Parafollicular cells of thyroid

40. Which one of the following four glands is correctly matched with its description?

- (a) Thyroid - hyperactivity in young children causes cretinism
- (b) Angiotensin - stimulates production of aldosterone

(c) Parathyroid - secretes parathormone which promotes movement of calcium ions from blood into bones during calcification

(d) Pancreas - delta cells of the islets of Langerhans secrete a hormone which stimulates glycolysis in liver.

Case Based MCQs

Case I : Read the following passage and answer the questions from 41 to 45 given below.

Certain hormones in body are secreted by glands X in response to stress during emergency situations. These hormones increase alertness, pupillary dilation, heart beat and rate of respiration. Hormone secreted by Y is the salt retaining hormone and is responsible for regulation of minerals metabolism.

41. Identify the endocrine glands X and Y.

- | X | Y |
|---------------------|----------------|
| (a) Adrenal gland | Pituitary |
| (b) Hypothalamus | Adrenal gland |
| (c) Adrenal medulla | Adrenal cortex |
| (d) Adrenal cortex | Pineal gland |

42. Which of the following hormones are secreted during emergency situations?

- (a) Calcitonin and thymosin
- (b) Adrenaline and nor-adrenaline
- (c) Aldosterone and adrenaline
- (d) Epinephrine only

43. Name the disease caused by deficiency of hormone secreted by Y.

- (a) Addison's disease
- (b) Cushing's syndrome
- (c) Adrenal viruism
- (d) Conn's syndrome

44. Category of hormone secreted Y is

- (a) glucocorticoid
- (b) gonadocorticoid
- (c) mineralocorticoid
- (d) Catecholamine.

45. Catecholamines are derived from which amino acid?

- (a) Tryptophan
- (b) Phenylalanine
- (c) Glutamine
- (d) Tyrosine

Case II : Read the following passage and answer the questions from 46 to 50 given below.

Hormones act as a intercellular messengers and produce their physiological effects on target tissues by binding to its specific receptors. Receptors present on cell membrane of target cells are membrane bound receptors whereas nuclear receptor present inside the target cell are called intracellular receptors. For *e.g.*, steroid hormone being lipid soluble can easily pass through the cell membrane and enters the nucleus with receptor and insulin being water soluble binds with membrane bound receptor.

46. Which of the following is not a second messenger in hormone action ?

- (a) cAMP
- (b) cGMP
- (c) Calcium
- (d) ATP

47. Which set of the hormones are antagonist to each other ?

- (a) Estrogen and progesterone
- (b) Insulin and glucagon
- (c) Thyroxine and parathormone
- (d) Both (b) and (c)

48. Identify the incorrect pair.

- (a) Peptide hormone - Insulin
- (b) Steroid - Oxytocin
- (c) Iodothyronines - Thyroine
- (d) Amino-acid derivatives - Epinephrine

49. Number of cAMP molecules required to activate enzymes protein-kinase A is/are

- (a) 1
- (b) 4
- (c) 2
- (d) 3

50. Action of lipid soluble hormones

- (a) is slow
- (b) is fast
- (c) last long
- (d) both (a) and (c).

Assertion & Reasoning Based MCQs

For question numbers 51-60, two statements are given—one labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

- (a) Both assertion and reason are true and reason is the correct explanation of assertion.
- (b) Both assertion and reason are true but reason is not the correct explanation of assertion.
- (c) Assertion is true but reason is false.
- (d) Assertion is False but reason is true.

51. Assertion : Excessive amounts of calcitonin hormone in the blood causes softening of bones.

Reason : Parathormone causes mobilisation of calcium from the bones to the blood plasma.

52. Assertion : Oxytocin is also known as anti diuretic hormone (ADH).

Reason : Oxytocin is also known as milk ejection hormone.

53. Assertion : Insulin is said to be an anabolic hormone.

Reason : Failure of insulin secretion causes diabetes.

54. Assertion : Glucagon is said to lower down the blood sugar level.

Reason : Insulin increases the utilisation of glucose in the tissues and the synthesis of liver glycogen.

55. Assertion : FSH is also known as interstitial cell stimulating hormone.

Reason : FSH is secreted by anterior lobe of pituitary.

56. Assertion : Prolactin is also known as 'Mammothropin hormone'.

Reason : Prolactin stimulates the growth of mammary glands during Pregnancy.

57. Assertion : The parathyroid glands are said to be under the feedback control of blood calcium levels.

Reason : Parathormone of parathyroids mobilises calcium from the bones to the blood plasma.

58. Assertion : Pituitary gland is located just below the hypothalamus.

Reason : Pituitary is situated in a depression of sphenoid bone of skull called sella turcica.

59. Assertion : Type I diabetes is caused by destruction of β -cells of Islets of Langerhans.

Reason : Insulin can be taken as injections by Type I patients.

60. Assertion : Insulin forms hormone receptor complex which regulates the formation of second messenger.

Reason : Insulin is a peptide hormone which can easily pass through cell membrane to interact with intracellular receptors in cell cytoplasm.

SUBJECTIVE TYPE QUESTIONS

Very Short Answer Type Questions (VSA)

1. What are neurohormones?
2. What do you mean by hypophysis?
3. Name the hormones secreted from the thyroid gland.
4. Fill in the blanks :

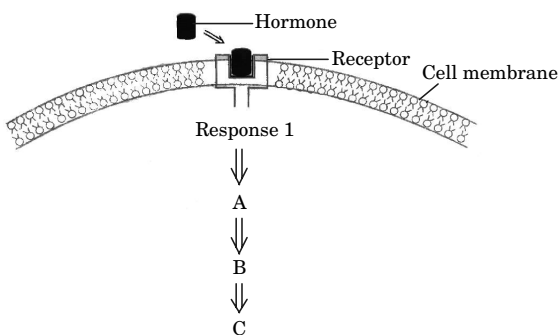
Hormones	Target gland
(a) Corticotrophin (ACTH)
(b) Gonadotrophins (LH, FSH)
(c) Melanotrophin (MSH)
5. Name any two heterocrine glands.
6. Which hormone is secreted in an inactive form?
7. Name any two ovarian hormones.
8. Which disease is caused due to hypo functioning of Sertoli cells?
9. Name any two hormones which produce second messengers to bring physiological effects in the target tissue.
10. What is the source of hormone responsible for darkening of skin colour?

➡ Short Answer Type Questions (SA-I)

11. Mention the chemical nature of animal hormones and give their examples.
12. (a) What is intermedin?
(b) (i) Name the smallest endocrine gland of human body.
(ii) Name the hormone secreted by it.
13. (a) What are catecholamines?
(b) Where they are found?
14. Give example(s) of
(a) Hyperglycemic hormone and hypoglycemic hormone
(b) Hypercalcemic hormone
(c) Gonadotrophic hormones
(d) Progestational hormone
(e) Blood pressure lowering hormone
(f) Androgens and estrogens.
15. Write any four characteristic features of hormones.
16. Which hormone is also called hormone of maternity? What is its source gland? Write its main physiological effect.
17. Name three zones of adrenal cortex. Also mention the types of hormones secreted and their effect.
18. How follicle stimulating hormone is different from luteinising hormone?
19. What is the role of second messenger in hormone action?
20. Differentiate between cretinism and dwarfism.

➡ Short Answer Type Questions (SA-II)

21. Distinguish between exocrine gland and endocrine gland.
22. Briefly mention the mechanism of action of FSH.
23. The given figure shows the diagrammatic representation of the mechanism of protein hormone action.



- (a) Name the steps labelled as 'A', 'B' and 'C'.
- (b) What is the role of second messenger in this process?
- (c) How is this mechanism different from the mechanism of action of steroid hormone?
24. Describe the functions of (a) FSH, (b) LH, (c) LTH.
25. (a) Name the hormone which lowers the blood sugar level.
(b) From where that hormone is secreted?
- (c) Describe functions of insulin.
26. Write short notes on the functions of the following hormones :
(a) Thymosin (b) Androgen
(c) Estrogen
(d) Insulin and Glucagon.
27. Which two hormones regulate blood calcium levels? Briefly describe the feedback mechanism.
28. Explain the endocrine role of placenta.
29. Mention the name and source of the hormone which regulates the following:
(a) Heart beat and blood pressure
(b) Maturation of Graafian follicle
(c) Milk secretion
(d) Secretion of growth hormone
(e) Lowers the level of calcium ion in blood
30. What is exophthalmic goitre? Mention any four symptoms of this disorder.
31. (a) Write the different types of cells of islets of Langerhans and also the hormones produced by them.
(b) How does anti-insulin hormone control glucose level in body?
32. Which cells secrete testosterone? What are its various functions?

Long Answer Type Questions (LA)

33. Hypothalamus is a super master endocrine gland. Elaborate.

34. Describe the mechanism of action of steroid hormones.

35. (a) Which hormone is secreted by β -cells of

pancreas? Also mention the location of β -cells.

(b) How does this hormone affect various processes in the body?

(c) Describe the disorders resulting from its deficient and excessive production.

ANSWERS

OBJECTIVE TYPE QUESTIONS

1. (b) : The current scientific definition of the hormone is as follows: Hormones are non-nutrient chemicals which acts as intercellular messengers and are produced in trace amounts.

2. (a) : The adrenal cortex can be divided into three layers, called zona reticularis (inner layer), zona fasciculata (middle layer) and zona glomerulosa (outer layer).

3. (b) : Inhibition of gastric and stimulation of gastric, secretions are controlled by hormones enterogasterone and gastrin respectively.

4. (b) : Calcitonin is a hormone secreted by the thyroid gland. It lowers the calcium level in the blood by suppressing the release of calcium ions from the bones.

5. (a) : Adrenal zona glomerulosa secrete hormones called mineralocorticoids. Aldosterone (the principal mineralocorticoid) regulates sodium content of the body. Hypersecretion of aldosterone will lead to increased blood sodium levels.

6. (d) 7. (d)

8. (a) : Adrenal cortex secretes sexcorticoids (androgens) which stimulates the development of secondary sexual characters.

9. (d)

10. (b) : Posterior lobe of the pituitary gland does not secrete any hormone. Its hormone are secreted in the hypothalamus.

11. (b) : Testis are primary sex organ in males. Atrial natriuretic factor decreases the blood pressure.

12. (b) 13. (c)

14. (b) : The given symptoms belong to Cushing's syndrome which occurs due to excess of cortisol, a glucocorticoid secreted by adrenal cortex.

15. (d) : α -cells of islet of Langerhans secrete glucagon which is antagonistic to insulin. Glucagon promotes breakdown of fats.

16. (a) : Oxytocin is a hormone that causes both contraction of smooth muscles in the uterus during birth and expulsion of milk from the mammary glands during suckling. Oxytocin is produced by the neurosecretory cells of the hypothalamus but it is stored and released by posterior pituitary gland.

17. (a) : Corpus luteum secretes estrogen and progesterone.

18. (c)

19. (d) : Aldosterone, progesterone and estrogen are steroid hormones and they interact with intracellular receptors. So, they do not require second messenger.

20. (a) 21. (c)

22. (c) : Enterogastrone is secreted by duodenal mucosa that inhibits gastric secretion and contractions. Vasoactive intestinal peptide dilates peripheral blood vessels of small intestine and inhibits gastric secretion. Pancreatic peptide is secreted by pancreas.

23. (d)

24. (c) : The thyroid gland is the largest endocrine gland located in the neck. The stroma contains small clusters of specialised parafollicular cells or small cells which secretes calcitonin. This gland is stimulated to secrete its hormone by thyroid stimulating hormone (also called thyrotropin) secreted by the anterior lobe of pituitary gland.

25. (b) : Conn's syndrome occurs due to excessive secretion of aldosterone. Calcitriol promotes absorption of calcium and phosphorous in small intestine and accelerates bone formation.

26. (d) : Estrogen and testosterone are steroid hormones are lipid soluble and easily pass through the cell membrane of a target cell into the cytoplasm. In the cytoplasm they binds to specific intracellular receptors.

27. (b) : A baby with damaged anterior lobe of pituitary gland is most likely to suffer the disorders like cretinism (caused by deficiency of thyroid hormone in infants), Simmond's disease (atrophy or degeneration of anterior pituitary) and dwarfism (due to deficiency of growth hormone) as hormone and thyroid stimulating hormone are secreted by anterior lobe of pituitary gland.

28. (d) 29. (d)

30. (d) : Diabetes mellitus occurs due to deficiency of insulin. The blood sugar becomes high and glucose appears in urine. There is high blood cholesterol and ketone body formation (ketosis). Its symptoms are excessive urine production, excessive thirst (polydipsia) and excessive eating.

31. (a) : Melanocyte stimulating hormone (MSH) secreted by intermediate lobe of the pituitary gland, causes dispersal of pigment granules in the pigment cells, thereby darkening the colour in certain animals. Melatonin secreted by pineal gland, lightens the skin colour in certain mammals.

32. (b) 33. (b) 34. (d)

35. (b) : High blood level of ADH is characterised by excessive dilute blood and low plasma sodium.

36. (c) : Antidiuretic hormone (ADH) causes contraction of smooth muscles of arterioles. This increases blood pressure in kidney which facilitates ultrafiltration. The secretion of ADH is regulated by increase or decrease of osmotic pressure of blood in a feedback manner.

37. (d) : Pineal secretes a hormone called melatonin. Melatonin plays a very important role in the regulation of a 24-hour (diurnal) rhythm of our body. For example, it helps in maintaining the normal rhythms of sleep-wake cycle, body temperature. In addition, melatonin also influences metabolism, pigmentation, the menstrual cycle as well as our defense capability.

38. (b) : Cortisol is the next most important hormone secreted during stress after epinephrine and norepinephrine. When an animal or human is exposed to any noxious potential stimuli, there is an increased secretion of ACTH and consequently, a rise in the circulating glucocorticoid level. Glucagon helps to raise the blood glucose level required during stress. Vasopressin and aldosterone helps in the retention of water during stress.

39. (a) : Kupffer's cells are present in the lining of liver sinusoids and help in phagocytosis.

40. (b) : The liver produce a protein angiotensinogen which is changed into angiotensin II by an enzyme renin. Angiotensin stimulates the adrenal cortex to produce aldosterone.

41. (c)

42. (b) : Adrenaline and nor-adrenaline are emergency hormones secreted in response to stress of any kind during emergency situations.

43. (a) : Addison's disease is caused by deficiency of mineralocorticoid (aldosterone) and glucocorticoid (cortisol).

44. (c) : Aldosterone (salt-retaining hormone) is the principal mineralocorticoid.

45. (d) : Norepinephrine and epinephrine are derived from amino acid tyrosine.

46. (d) : ATP

47. (b) : Glucagon and insulin are antagonist as glucagon is hyperglycemic (increases blood glucose level) whereas insulin is hypoglycemic (decreases the blood glucose level).

48. (b) : oxytocin is a peptide hormone.

49. (c) : 2

50. (d) : The action of lipid soluble hormones are slower and last longer.

51. (d) : Excessive amounts of parathormone, not calcitonin in the blood causes softening of bones. Because parathormone, secreted by parathyroid glands is responsible for increasing the concentration of calcium ions in the blood plasma by mobilising more calcium from the bones to the plasma and reducing urinary elimination of calcium. Parathyroid tumors secrete excessive amount of parathormone which causes increased mobilisation of bone minerals into the blood, softening of bones, rise in the concentration of calcium ions in the plasma, and deposition of calcium in kidney tubules and other soft tissues. Calcitonin hormone is a hormone secreted by the thyroid gland when the concentration of calcium ions rises in the blood plasma. Calcitonin then lowers the concentrations of both calcium and phosphate ions in the plasma by reducing their mobilisation from bones. Thus it restores the normal concentration of those ions in the blood. The plasma calcium level is very effectively maintained by a balance between the activities of parathormone and calcitonin in a normal healthy individual.

52. (d) : It is not oxytocin, but the hormone vasopressin also known as antidiuretic hormone (ADH). It reduces the volume of urine by increasing the reabsorption of water from the urine in the distal convoluted tubules, collecting tubules and collecting ducts in the kidney. It does so by rendering the walls of those tubules permeable to water. Failure of secretion of vasopressin leads to a reduced renal reabsorption of water and a consequent elimination of a large volume of very dilute (hypotonic) urine.

Oxytocin is another hormone released by the posterior lobe of pituitary gland. Uterine contractions, stimulated by oxytocin at the end of pregnancy, help in the child-birth or parturition, hence also called birth hormone. The oxytocin induced contractions of the mammary gland muscles help in the flow of stored milk from the mammary glands, hence also called milk ejection hormone.

53. (b) : Insulin hormone, secreted by the β - cells of islets of Langerhans of pancreas, is said to be an anabolic hormone due to the following functions it performs:

(i) Insulin increases the synthesis of fat in the adipose tissue from fatty acids as well as glucose.

(ii) It reduces the breakdown and oxidation of fats.

(iii) Insulin increases the utilisation of glucose in tissues and facilitates the storage of glucose as glycogen in muscles and liver. By these actions, insulin lowers the blood sugar level.

(iv) It promotes protein synthesis in tissues from amino - acids.

(v) It reduces catabolism of proteins in the body.

Failure of insulin secretion causes a disease called diabetes mellitus. In this disease, blood sugar is abnormally high and exceeds the renal threshold for glucose. Consequently, glucose appears in the urine. The utilisation of glucose is decreased, instead, catabolism of fats and proteins are enhanced. Increased oxidation of fats produces ketone bodies such as acetoacetate, β -hydroxy butyrate and acetone. Also

the blood cholesterol rises. The osmotic effect of glucose in the urine considerably increases the volume of urine, and therefore thirst is enhanced. Injuries take a long time to heal and may turn into gangrene. In extreme cases, the patient suffers from coma and may die.

54. (d) : It is not glucagon but the hormone insulin secreted from the β - cells of islets of Langerhans of pancreas, which lowers down the blood sugar level by increasing the utilisation of glucose in tissues and facilitating the storage of glucose as glycogen in muscles and liver. A rise in blood glucose level stimulates the synthesis and the secretion of insulin. Glucagon is a hormone, secreted by α -cells of pancreatic islets. It increases the breakdown of liver glycogen to blood glucose and the formation of glucose from amino acids. So, it raises the blood sugar level and tends to cause the elimination of sugar in the urine.

55. (d) : It is not FSH (follicle stimulating hormone), but the LH (luteinizing hormone) which is also known as interstitial cell stimulating hormone (ICSH). It stimulates the interstitial cells of Leydig, of testis to secrete the male sex hormone testosterone and other androgen to regulate the secondary sexual characteristics.

The follicle stimulating hormone (FSH) is secreted by anterior pituitary. It stimulates the testes in the males to produce sperms and the ovaries in the female to produce ova. It also stimulates ovaries to secrete female sex hormones called estrogens.

56. (a)

57. (b) : Parathyroids are four small glands situated in the neck region, very close to the thyroid gland. Parathyroids secrete a hormone called parathormone. They are said to be under the feedback control of blood calcium level, because, a fall in blood calcium stimulates them to secrete parathormone and a rise in blood calcium inhibits parathormone secretion from them.

Parathormone increases the concentration of calcium ions in the blood plasma, because it mobilises more calcium from the bones to the plasma and reduces urinary elimination of calcium. It is secreted whenever the plasma calcium ion concentration falls and restores the calcium ion concentration to normal in the plasma.

58. (b)

59. (b) : Type I diabetes is an autoimmune disease wherein immune system destroys cells in pancreas called beta cells which make insulin. Insulin is a hormone that helps move sugar from blood into body tissues where cells use it as fuel. Damage to beta cells leads to build up of sugar in blood as cell are not able to utilise it which leads to high blood sugar. Patients having type I diabetes take insulin injections to control blood sugar.

60. (c) : Insulin is a peptide hormone produced in the islets of Langerhans in the pancreas. Insulin interacts with membrane bound receptors and does not enter target cell

but generates second messenger. Insulin receptors for most cells are less than 100. Insulin binds to receptors located on plasma membrane to form hormone receptor complex which induces release of GDP from G protein which activates adenyl cyclase that in turn catalyses the formation of cyclic adenosine monophosphate (cAMP) from ATP. The hormone is called first messenger and cAMP is termed as second messenger.

SUBJECTIVE TYPE QUESTIONS

1. Higher animals with well developed nervous system produce special type of hormones, called neurohormones, secreted by some modified nerve cells, and possessing functional characteristics of both nerve and endocrine cells. e.g. oxytocin, ADH, etc.

2. Pituitary gland is also called hypophysis and it lies in the sella turcica of the sphenoid bone.

3. (c) The hormones secreted from the thyroid gland are: Thyroxine (T_4), Tri-iodothyronine (T_3) and Calcitonin.

4. (a) Adrenal cortex

(b) Gonads –Testes in male and ovaries in female

(c) Skin

5. (i) Testes

(ii) Pancreas

6. Insulin

7. Estrogen and relaxin

8. Male hypogonadism occurs due to the deficiency of androgens-male sex hormones (hypofunction of leydig's cells), deficiency of sperm formation (hypofunction of Sertoli cells) or both, before puberty. As a result male secondary sexual characters and musculature do not develop.

9. Insulin and follicle stimulating hormone.

10. Pars intermedia or intermediate lobe of pituitary gland.

11. Chemical nature of animal hormones –

(i) Protein nature – TSH, ACTH, FSH

(ii) Steroid nature – Testosterone, estrogen

(iii) Amino nature – Thyroxine, Epinephrine

(iv) Polypeptide nature – ADH, Oxytocin

12. (a) Intermedin is a substance secreted by the pars intermedia of pituitary gland.

(b) (i) Pituitary is the smallest endocrine gland of human body.

(ii) Hormones of pituitary gland are growth hormone (GH), prolactin, TSH, ACTH, oxytocin, antidiuretic hormone, FSH, and LH.

13. (a) Catecholamines are a group of chemicals which acting as neurotransmitters. It is a amine derivative catechol and include adrenaline, noradrenaline and dopamine.

(b) Catecholamines are found within the adrenal medulla of adrenal gland.

14. (a) Glucagon, insulin

(b) Parathormone (PTH)

- (c) Follicle stimulating hormone (FSH) and luteinizing hormone (LH)
 (d) Progesterone
 (e) Atrial natriuretic hormone
 (f) Testosterone and estradiol

- 15.** (i) Hormones are intercellular chemical messengers.
 (ii) They have low molecular weight.
 (iii) They are effective in low concentration.
 (iv) They may accelerate or retard the specific reactions.

16. Prolactin is also called as hormone of maternity. It is secreted by anterior lobe of pituitary gland. It activates growth of breasts during pregnancy and secretion of mammary glands after child birth.

17. The adrenal cortex is sub-divided into three zones :

- (i) Zona glomerulosa - secretes mineralocorticoids that affect mineral homeostasis.
 (ii) Zona fasciculata - secretes glucocorticoids, that affect glucose homeostasis.
 (iii) Zona reticularis - secretes gonadocorticoids (*e.g.*, androgens having masculinising effect).

18. Differences between follicle stimulating hormone and luteinising hormone are:

	Follicle stimulating hormone	Luteinising hormone
(i)	It controls the development of tissues in ovary and testis and also controls gametogenesis.	It controls the secretion of sex hormones testosterone in males and progesterone in females.
(ii)	It stimulates secretion of estrogen and controls the first half of menstrual cycle in females.	It controls the ovulation and the second half of menstrual cycle in females.

19. Hormones which interact with membrane - bound receptors normally do not enter the target cell, but generate second messenger (*e.g.*, cAMP) which acts as intracellular hormonal mediator, delivering information inside the target cells. This activates appropriate cellular enzyme system by cascade effect which stimulates the cell machinery to perform its specialised function.

20. Differences between cretinism and dwarfism are :

	Cretinism	Dwarfism
(i)	A disorder caused in children due to deficiency or hyposecretion of thyroid hormone.	A disorder caused in children due to hyposecretion of growth hormones during growth period.
(ii)	The rate of metabolism, heart rate and blood pressure are low.	Growth of body cells, bones and muscles is retarded and there is less ATP formation.

21.

	Exocrine glands	Endocrine glands
(i)	Exocrine glands are referred as glands with ducts	Endocrine glands are referred as the ductless glands.
(ii)	The secretion acts locally from the site of its formation and is carried through ducts.	The secretion is known as hormone and passes directly into the blood or extracellular fluid. The hormone exerts its effect on target organ.
(iii)	It helps in the process of digestion, absorption, and metabolism.	It influences not only the metabolic process but also regulates body growth, sexual activities, etc.

22. FSH being glycoprotein is insoluble in lipids, therefore, cannot enter the target cells. It binds to the specific receptor molecules located on the surface of the cell membrane to form hormone – receptor complex. This complex causes the release of an enzyme adenylate cyclase from the receptor site. This enzyme forms cyclic adenosine monophosphate (cAMP) from ATP in the cytoplasm. The cAMP activates the existing enzyme system of the cell. This accelerates the metabolic reactions in the cell. The hormone is called the first messenger and the cAMP is termed the second messenger. The hormone-receptor complex changes the permeability of the cell membrane to facilitate the passage of materials through it. This increases the activities of the cell as it receives the desired materials.

23. (a) 'A' – Generation of second messenger

'B' – Biochemical responses

'C' – Physiological responses.

(b) Second messenger like cAMP activates the enzyme system of the cell and thus accelerates the metabolic reactions in the cell.

(c) Protein hormones interact with membrane bound receptors and generate second messengers which in turn regulate cellular metabolism. Steroid hormones enter the cell and interact with intracellular receptors and regulate gene expression or chromosome function by the interaction of hormone – receptor complex with the genome.

24. (a) FSH – In females it stimulates the development of ovarian follicle. In males it induces the development of seminiferous tubules and production of sperms.

(b) LH – In females it regulates the formation of corpus luteum after ovulation and stimulates it to secrete progesterone. But in male it stimulates the interstitial cells of the testes to secrete testosterone hormone.

(c) LTH – It promotes breast development to initiate the secretion of milk and also controls the secretion of progesterone by the corpus luteum.

25. (a) Insulin is the hormone which lowers the blood sugar level.

(b) Insulin is secreted from the β -cells of islets of Langerhans of pancreas.

(c) (i) It lowers blood glucose levels by stimulating the deposition of glycogen granules in the liver and muscles.

(ii) It increases the glucose entry through the plasma membrane.

(iii) Insulin increases protein synthesis by incorporation of amino acids into peptides.

(iv) It helps in the deposition of fat in adipose tissue from glucose.

26. (a) Thymosin is secreted by thymus. It accelerates cell division, stimulates the development and differentiation of T-lymphocytes and also hastens attainment of sexual maturity.

(b) Androgens are secreted by testis. They stimulate the development of male reproductive system, formation of sperms, development of male accessory sex characters and also determines the male sexual behaviour and the sex urge.

(c) Estrogens are secreted by ovaries. It stimulates the female reproductive tract to grow to full size and become functional, differentiation of ova and development of accessory sex characters.

(d) Insulin is secreted by the β -cells of the pancreas. It lowers blood glucose level, and promotes synthesis of proteins and fats. Glycogen is secreted by the α -cells of the pancreas. It increases the level of glucose in the blood.

27. Calcitonin and parathormone regulate blood calcium levels. Calcitonin is secreted when blood calcium levels are high. It lowers the calcium levels by decreasing mobilisation of Ca^{2+} from bones and prevents Ca^{2+} reabsorption in nephrons. Parathormone (PTH) is secreted in response to fall in blood calcium level. The release of parathormone increases blood calcium to normal by drawing calcium from bones into the plasma, by increasing calcium absorption in the digestive tract and by reducing loss of calcium in the urine.

PTH has an effect that opposes the effect of calcitonin.

28. Placenta is an intimate connection between the fetus and the uterine wall of the mother to exchange the materials. It is temporarily an endocrine gland. It secretes some hormones like estrogen, progesterone, human chorionic gonadotropin (hCG), human chorionic somatomammotropin – hCS (formerly known as human placental lactogen), chorionic thyrotropin, chorionic corticotropin and relaxin. Estrogen and progesterone have the same roles as in the nonpregnant state. However, the placental progesterone also checks contraction of uterine muscles and thus helps to maintain pregnancy. hCG stimulates progesterone release from the corpus luteum and maintains it. Presence of hCG in urine indicates pregnancy. Human chorionic somatomammotropin stimulates the growth of mammary glands. Placental relaxin causes relaxation of the ligaments of pubic symphysis and towards the termination of pregnancy it softens and widens the opening of the cervix for easy child birth.

29. The name and source of the hormones are given in the table:

	Hormones	Source
(a)	Adrenaline and nor-adrenaline	Adrenal medulla
(b)	Follicle stimulating hormone	Anterior pituitary
(c)	Prolactin	Anterior pituitary
(d)	Growth hormone releasing hormone (GHRH)	Hypothalamus
(e)	Thyrocalcitonin	Parafollicular cells of thyroid gland

30. Exophthalmic goitre or Grave's disease is caused due to hypersecretion of thyroid hormones. It is an autoimmune disease in which a person produces antibodies that mimic the action of TSH but are not regulated by normal negative feedback control. Its symptoms include protrusion of eye balls, loss of weight, rise in body temperature, rapid heart beat, nervousness and restlessness.

31. (a) Islets of Langerhans of pancreas has four different kinds of cells:

(i) α -cells - Produce glucagon

(ii) β -cells - Produce insulin

(iii) δ -cells - Produce somatostatin

(iv) Pancreatic polypeptide cells - Produce pancreatic polypeptide.

(b) Glucagon is an anti-insulin hormone that stimulates the liver to convert stored glycogen into glucose in the blood. Low level of blood glucose stimulates secretion of glucagon and it signals the liver to release glucose into the blood. High blood glucose level suppresses release of glucagon and stimulates release of insulin.

32. Testosterone is secreted from endocrine cells called interstitial cells or Leydig's cells, situated in connective tissue present between the seminiferous tubules in testis. Various functions of testosterone are :

(i) It stimulates growth and development of male secondary sex organs like the seminal vesicles, prostate and penis. It also helps to maintain their normal functions.

(ii) This hormone also stimulates the development of the male secondary sexual characters like beard, moustache and low-pitch male voice in man.

(iii) It also stimulates the formation of sperms in the seminiferous tubules of the testes.

(iv) This hormone promotes growth of many body tissues such as bones and muscles. It is due to this fact that male has a higher stature than the female.

33. Hypothalamus is a super master endocrine gland as it secretes hormones that regulate the synthesis and secretion of pituitary gland which is a master gland. The hypothalamus is connected to the anterior lobe of pituitary gland by hypophyseal portal veins, however, it is connected to the posterior lobe of pituitary gland mainly by axons of

neurosecretory cells. The hormones produced by hypothalamus are of two types, the releasing hormones (which stimulate the secretion of pituitary hormones) and the inhibiting hormones (which inhibit secretions of pituitary hormones).

The hormones secreted by hypothalamus are summarised below:

(i) Adrenocorticotrophic Releasing Hormone (ARH) or Corticotropin Releasing Hormone – It stimulates the anterior lobe of pituitary gland to secrete its adrenocorticotrophic hormone (ACTH).

(ii) Thyrotropin Releasing Hormone (TRH) – It stimulates the anterior lobe of pituitary gland to secrete its thyroid stimulating hormone (TSH) or thyrotropin.

(iii) Growth Hormone-Releasing Hormone (GHRH) – It stimulates the anterior lobe of pituitary gland to release its growth hormone (GH) or somatotrophin.

(iv) Growth Hormone-Inhibitory Hormone (GHIH) – This hormone is also called somatostatin (SS). It inhibits the secretion of growth hormone from the anterior lobe of pituitary gland.

(v) Gonadotropin Releasing Hormone (GnRH)- It stimulates the anterior lobe of pituitary gland to secrete two gonadotropic hormones : Follicle Stimulating Hormone (FSH) and Luteinising Hormone (LH)).

(vi) Prolactin Releasing hormone (PRH) – It stimulates the anterior lobe of the pituitary gland to secrete its prolactin hormone.

(vii) Prolactin Inhibitory Hormone (PIH) – It inhibits the secretion of prolactin from the anterior lobe of pituitary gland.

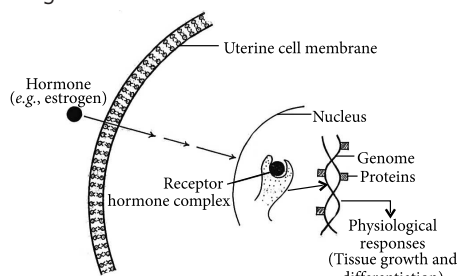
(viii) MSH Releasing Hormone (MSHRH) – It stimulates the intermediate lobe of pituitary gland to secrete its melanocyte stimulating hormone (MSH).

(ix) MSH Inhibitory Hormone (MSHIH) – It inhibits the secretion of melanocyte stimulating hormone from the intermediate lobe of pituitary gland.

34. Steroid hormones are lipid-soluble and easily pass through the cell membrane of a target cell into the cytoplasm. In the cytoplasm, they bind to specific intracellular receptors (proteins) to form a hormone receptor complex that enters the nucleus. In the nucleus, hormones which interact with intracellular receptors (*e.g.*, steroid hormones, iodothyronines, etc.) mostly regulate gene expression or chromosome function by the interaction of hormone-receptor complex with the genome. Biochemical actions result in physiological and development effect (tissue growth and differentiation, etc.). Infact, the hormone receptor complex binds to a specific regulatory site on the chromosome and activates certain genes (DNA). The activated gene transcribes *mRNA* which directs the synthesis of proteins and usually enzymes in the cytoplasm. These enzymes promote the metabolic reactions in the cell. The actions of lipid soluble hormones are slower

and last longer than the action of water-soluble hormones.

The diagrammatic representation of the mechanism of steroid hormone is given below :



35. (a) β -cells of pancreas secrete insulin hormone. These cells are usually found towards the middle of the islets of Langerhans.

(b) Insulin converts glucose into glycogen in the liver and muscles. Insulin affects various processes in the body, such as :

- (i) It promotes protein synthesis in tissue from amino acids.
- (ii) It reduces catabolism of proteins. It is an anabolic hormone.
- (iii) It increases the synthesis of fat in the adipose tissue from fatty acids.
- (iv) Insulin reduces the breakdown and oxidation of fat.

(c) Disorders of pancreas due to deficient and excessive production of insulin are :

- (i) Hyperglycemia or Diabetes mellitus : It is due to deficiency of insulin. It is of 2 types –

The insulin-dependent diabetes mellitus (IDDM) is caused by a failure of the β -cells to produce adequate amount of insulin while the non-insulin-dependent diabetes mellitus (NIDDM) appears to involve failure of insulin to facilitate the movement of glucose into cells. In both disorders, the blood glucose concentration is elevated above the normal range. Some of the glucose is excreted in the urine and water follows the glucose, causing excessive urination and dehydration of body tissues. This causes excessive thirst (polydipsia). The cells are unable to utilise glucose and other carbohydrates for energy production and due to this reason they utilise their proteins for it. The person becomes very weak. Degradation of fats increases, producing ketone bodies (ketosis) that are acidic and poisonous. Blood cholesterol level rises and healing power is impaired.

- (ii) Hypoglycemia : It is due to excess of insulin or deficiency of glucagon, or a failure of the secretion of two hormones to completely regulate the blood glucose. The presence of excess insulin is more correctly referred to as hyperinsulinism. Its symptoms include weakness, profuse sweating, irritability, confusion, unconsciousness and convulsions, low blood glucose level, hunger. It needs urgent intake of sugar or glucose.