LSEP_1_T4_Revision exercise_Ans

MCQ

1. Which of the following indicates the correct order of the tracheobronchial tree?
   A. Trachea → bronchiole → primary bronchus → segmental bronchus → lobar bronchus
   B. Trachea → lobar bronchus → primary bronchus → segmental bronchus → bronchiole
   C. Trachea → primary bronchus → lobar bronchus → segmental bronchus → bronchiole
   D. Trachea → segmental bronchus → primary bronchus → bronchiole → lobar bronchus
   E. Trachea → segmental bronchus → primary bronchus → lobar bronchus → bronchiole

   Refer to Lecture 15: P.11-12

2. How many pair(s) of paranasal sinuses /are there?
   A. 1
   B. 2
   C. 3
   D. 4
   E. 5

   Refer to Lecture 15: P.7

3. Which structure of the tracheobronchial tree is supported by cartilage pieces?
   A. The trachea
   B. The main bronchi
   C. The segmental bronchi
   D. The bronchioles
   E. The terminal bronchioles

   The trachea and main bronchi are supported by C-shaped cartilage and the smaller bronchi are supported with cartilage pieces. The bronchioles and their branches are not supported by cartilage. Smooth muscles can be found in the tracheobronchial tree which is controlled by the autonomic nervous system to control their contraction and relaxation to regulate their diameter – Lecture 15: P.11-12

4. A foreign object that enter the trachea mostly commonly lodges in the:
   A. trachea.
   B. left main bronchus.
   C. left segmental bronchi.
   D. right main bronchus.
   E. right upper lobar bronchus.

   This is because the right primary bronchus is wider and more "vertical" than the left primary bronchus. Also note that there are only 2 lung lobes, upper (superior) and lower (inferior), on the left due to the heart occupying some space in the heart.

5. Which of the following structures connect(s) the nasal cavity and the pharynx?
   A. The conchae
   B. The choanae
   C. The epiglottis
   D. The glottis
   E. The uvula

   Option A: Conchae are located on the lateral wall of the nasal cavity – Lecture 15: P.5
   Option C: Epiglottis is on the larynx – Lecture 15: P.9
   Option D: Glottis is the opening between the vocal cords in the larynx
   Option E: Uvula extends from the soft palate at the back of the roof of the oral cavity

6. Which part of the pharynx is shared by both the respiratory and digestive systems?
   A. The oropharynx only
   B. The nasopharynx and oropharynx
   C. The oropharynx and larygopharynx
   D. The nasopharynx and larygopharynx
   E. The nasopharynx, oropharynx and laryopharynx

Refer to Lecture 15: P.8

7. Visceral pleura lines the
   A. internal surface of the chest wall.
   B. diaphragm.
   C. external surface of the lungs.
   D. internal surface of the lungs.
   E. both internal and external surfaces of the lungs.

The word "viscera" means internal organs. Visceral pleura lines the external surface of the lungs, just like the visceral pericardium (also called epicardium), which lines the external surface of the heart and is the outmost layer of the wall of the heart.

8. The sheet of muscle that divides the thoracic cavity and the abdominal cavity is called the
   A. diaphragm.
   B. internal oblique.
   C. rectus abdominis.
   D. serratus anterior.
   E. transverse abdominis.

Refer to Lecture 15: P.24

9. The central compartment of the thoracic cavity is called
   A. hilum.
   B. pleura.
   C. mediastinum.
   D. thoracic cage.
   E. pleural cavity.

Refer to Lecture 15: P.14

10. How many layers of intercostal muscles are there?
   A. 1
   B. 2
   C. 3
   D. 4
   E. 5

Refer to Lecture 15: P.23

11. Which of the following statements is correct about lung lobes?
   A. Each lung lobe is divided into 10 bronchopulmonary segments.
   B. Each lung lobe is supplied by a primary bronchus.
   C. Each lung lobe is supplied by a segmental bronchus.
   D. There are 3 lung lobes on the right and 2 on the left.
   E. There are 10 lung lobes on the right and 8 on the left.

There are 10 bronchopulmonary segments on the right and 9 on the left. Lung lobes are supplied by secondary bronchi – Lecture 15: P.11 & 16

12. The respiratory zone of the tracheobronchial tree includes all except:
    A. alveolar duct.
    B. alveolar sac.
    C. alveoli.
    D. respiratory bronchioles.
    E. terminal bronchioles.

Respiratory zone is where gas exchange happens as the wall in the respiratory zone is thin enough for exchange of substances. The rest of the tracheobronchial tree is the conduction zone in which air passes through but no gas exchange can happen – Lecture 15: P.12, Lecture 17: P.5

13. The diaphragm is innervated by the:
    A. intercostal nerve.
    B. phrenic nerve.
    C. sympathetic trunk.
    D. thoracic splanchnic nerves.
    E. vagus nerve.

Refer to lecture 15: P.24

14. What is the first step of respiration?
    A. Cellular respiration
    B. External respiration
    C. Gas transport
    D. Internal respiration
    E. Ventilation

Refer to lecture 16: P.3

15. Which of the following changes occurs during quiet inspiration?
    A. The external intercostal muscles relax
    B. The diaphragm lowers
    C. The rib cage depresses
    D. The internal intercostal muscles contract
    E. The sternum is pulled inward

Contraction of diaphragm causes lowering and flattening of the diaphragm to increase the height and volume of the thoracic cavity. It causes a decrease in the intrapleural and intrapulmonary pressures – Lecture 15: P.25, Lecture 16: P.12

16. What is the driving force for a normal quiet exhalation, and is the process active or passive?
    A. Contraction of diaphragm, active
    B. Contraction of external intercostal muscles, active
    C. Contraction of internal intercostal muscles, active
    D. Elastic recoil force, passive
    E. Relaxation of internal intercostal muscles, passive

During normal expiration, there is no muscle contraction. The lungs returns to its original smaller size due to passive recoil of the lungs – Lecture 15: P.25, Lecture 16: P.18

17. Which of the following is/are assessor muscle(s) of inspiration?
    A. Abdominal muscles
    B. Diaphragm
    C. External intercostal muscles
    D. Internal intercostal muscles
    E. Pectoralis

Diaphragm and external intercostal muscles are primary inspiration muscles. Internal intercostal muscles and abdominal muscles are accessory expiration muscles. Lecture 15: P.25-26, Lecture 16: P.25-28

18. Which of the following muscles contract during a forceful expiration?
    A. The external intercostal muscle and rectus abdominis
    B. The external intercostal muscle and sternocleidomastoid muscle
    C. The internal intercostal muscle and pectoralis minor
    D. The internal intercostal muscle and rectus abdominis
    E. The internal intercostal muscle and sternocleidomastoid muscle

    External intercostal muscle is a primary inspiratory muscle that contracts during every inspiration. The ixternal intercostal muscles and rectus abdominis (the six-pack) are accessory muscles of expiration that contract only during forced expiration. The external intercostal muscles contraction causes depression of the rib cage and reduce the size of the thoracic cavity. The abdominal muscles (including rectus abdominis) contraction causes depression of the lower ribs and reduction in the volume of the abdominal cavity which pushes the abdominal organs upward (also downward to pelvic cavity) to further reduce the volume of the thoracic cavity. As a result, the intrapleural and intrathoracic pressures are further increased to aid expiration – Lecture 15: P.27, Lecture 16: P.25-28

19. At the end of normal expiration before the next inspiration, the alveolar pressure is
    A. lower than atmospheric pressure.
    B. lower than intrapleural pressure.
    C. higher than atmospheric pressure.
    D. higher than intrapleural pressure.
    E. the same as intrapleural pressure.

    Alveolar (intrapulmonary) pressure is always higher than intrapleural pressure – Lecture 16: P.24

20. When we exhale,
    A. both intrapulmonary pressure & intrapleural pressure decrease.
    B. both intrapulmonary pressure & intrapleural pressure increase.
    C. both intrapulmonary pressure & intrapleural pressure remain the main
    D. intrapulmonary pressure decreases while intrapleural pressure increases.
    E. intrapulmonary pressure increases while intrapleural pressure decreases.

    Refer to Lecture 16: P.23

21. The difference between the amount of air you normally inhale with each breath and the amount you can inhale with maximum effort is the
    A. inspiratory capacity.
    B. inspiratory reserve volume.
    C. maximum inspiratory volume.
    D. functional residual capacity.
    E. vital capacity.

22. The volume of air that remains in the lungs after a normal quiet expiration is called
    A. expiratory reserve volume.
    B. functional residual capacity.
    C. inspiratory reserve volume.
    D. residual volume.
    E. tidal volume.

23. Total lung capacity equals
    A. expiratory reserve volume + residual volume.
    B. expiratory reserve volume + vital capacity
    C. inspiratory reserve volume + tidal volume.
    D. inspiratory capacity + functional residual capacity
    E. inspiratory capacity + residual volume.

    Q21-23 – refer to Lecture 16: P.30-41

24. Exchange of blood gases between the alveolar air and blood is called
    A. cellular respiration.
    B. external respiration.
    C. internal respiration.
    D. gas transport.
    E. ventilation.

Refer to Lecture 16: P.3

25. Which of the following statements about external respiration is correct?
    A. **CO_2 moves into the alveoli because PCO_2 is higher in the blood than in the alveoli**
    B. CO_2 moves into the alveoli because PCO_2 is higher in the alveoli than in the blood.
    C. CO_2 moves out of the alveoli because PCO_2 is higher in the blood than in the alveoli.
    D. CO_2 moves out of the alveoli because PCO_2 is higher in the alveoli than in the blood.
    E. CO_2 moves out of the tissues because PCO_2 is higher in the tissues than in the blood.

Refer to Lecture 17: P.4 & 11

26. In the lungs, _____ in the alveoli is _____ that in the blood entering the pulmonary capillaries.
    A. PCO_2, the same as
    B. **PCO_2, lower than**
    C. PCO_2, higher than
    D. PO_2, the same as
    E. PO_2, lower than

Refer to Lecture 17: P.11

27. During internal and external respiration, gases move by
    A. active transport.
    B. endocytosis.
    C. facilitated diffusion.
    D. osmosis.
    E. **simple diffusion.**

Refer to Lecture 17: P.9

28. Internal respiration occurs at the
    A. alveolar membrane.
    B. bronchioles.
    C. systemic capillary membranes.
    D. nasal and oral cavity.
    E. trachea.

Refer to Lecture 17: P.13

29. Carbon dioxide is mainly carried by blood through
    A. binding to plasma proteins.
    B. physically dissolving in plasma as gas.
    C. dissolving in plasma as bicarbonate ions.
    D. binding to haemoglobin as carboxyhaemoglobin.
    E. binding to haemoglobin as carbaminohaemoglobin.

Carbon dioxide is carried by the blood in 3 forms:

1. ***Majority (70%) is in the form of <u>bicarbonate ion</u>*** *(HCO_3^-) due to the action of* ***carbonic anhydrase*** *in the red blood cells, which combines water and CO_2 into carbonic acid. Carbonic acid spontaneously ionize into H^+ and HCO_3^-. The bicarbonate ions diffuse out of the RBC to be carried dissolved in plasma. H^+ binds to Hb which prevents excessive reduction in pH.*
2. ***About 20% of CO_2 is carried by binding to haemoglobin to form <u>carbaminohaemoglobin</u>.***
3. ***Only about 10% of CO_2 is <u>dissolved</u> in plasma.***

** When Hb is bound with H^+ or CO_2, its affinity for O_2 will be reduced, which favours the release of O_2 in tissue → Bohr Effect*

*** Also note the difference between **carboxy**haemoglobin (bound with **carbon monoxide**, which is formed from incomplete combustion [i.e. burning]) and **carbamino**haemoglobin (bound with CO_2).*

Refer to lecture 17: P.26-33

30. Bohr effect
    A. occurs in the lungs to facilitate O_2 loading.
    B. increases the O_2 binding affinity of haemoglobin.
    C. is caused by an elevation in body temperature.
    D. **is caused by an elevation of plasma H^+ concentration.**
    E. causes the haemoglobin-oxygen dissociation curve to shift to the left.

Refer to lecture 17: P.23

31. Which of the following conditions would cause a left-shift of the haemoglobin-oxygen dissociation curve?
    A. Increase in 2-3-BPG levels in the red blood cells.
    B. Increase in pH.
    C. Increase in PCO_2.
    D. Increase in temperature.
    E. None of the above.

pH is determined by the amount of H^+ ions in a solution. The more the H^+ ions, the lower the pH. Refer to lecture 17: P.23

32. Which of the following conditions will decrease the binding affinity between haemoglobin and oxygen?
    A. Decrease in 2-3-BPG levels in the red blood cells.
    B. Decrease in pH.
    C. Decrease in PCO_2.
    D. Decrease in temperature.
    E. All of the above.

pH is determined by the amount of H^+ ions in a solution. The more the H^+ ions, the lower the pH. Refer to lecture 17: P.23

33. A right shift of the haemoglobin-oxygen dissociation curve indicates that
    A. haemoglobin has a decreased affinity for oxygen.
    B. haemoglobin has an increased affinity for oxygen.
    C. haemoglobin has an increased affinity for carbon dioxide.
    D. oxygen unloading would be less efficient.
    E. the oxygen saturation is increased at a particular PO_2.

Refer to lecture 17: P.22-24

34. Which of the following hormones has intracellular receptors?
    A. Insulin
    B. Glucagon
    C. Cortisol
    D. Gastrin
    E. Adrenaline

Water-soluble hormones have receptors on the cell surface as they cannot pass the plasma membrane. Lipid-soluble hormones (e.g. all steroid hormones and thyroid hormones) have intracellular receptors as they can freely pass through the plasma membrane. Refer to lecture 18: P.7

35. Which of the following pairs of hormones exhibit antagonistic effect?
    A. Cortisol and thyroxine
    B. Epinephrine and glucagon
    C. Estrogen and progesterone
    D. Follicle stimulating hormone and luteinizing hormone
    E. Insulin and glucagon

    Antagonistic means opposing effect.
    Option A: Both cortisol and thyroxine exhibit permissive effect on other hormones' action.
    Option B: Both epinephrine and glucagon elevates glucose and therefore have redundant and synergistic effect.
    Option C: Estrogen has permissive effect on progesterone.
    Option D: FSH and LH has synergistic effect on the growth of ovarian follicle and ovulation.
    Refer to lecture 18: P.8-12

36. Which of the following pairs of hormones exhibit permissive effect?
    A. Epinephrine and insulin
    B. Epinephrine and glucagon
    C. Estrogen and progesterone
    D. Follicle stimulating hormone and luteinizing hormone
    E. Insulin and glucagon

    Option A: Epinephrine and insulin have antagonistic effect on glucose level.
    Option B: Both epinephrine and glucagon elevates glucose and therefore have redundant and synergistic effect.
    Option D: FSH and LH has synergistic effect on the growth of ovarian follicle and ovulation.
    Option E: Insulin and glucagon have antagonistic effect on glucose level.
    Refer to lecture 18: P.8-12

37. Which of the following hormones exhibits cyclical changes in its plasma level?
    A. Cortisol
    B. Estrogen
    C. Epinephrine
    D. Insulin
    E. Thyroxine

    Option A: Cortisol level has a diurnal rhythm (higher in the morning)
    Option C – D, their secretion are mainly pulsatile due to presence of stimulus
    Option E: Thyroid hormones are released in pulses and exhibit diurnal rhythm (higher at night)
    Refer to lecture 18: P.13-14

38. Which of the following is a characteristic of amino acid derivative hormones?
    A. Most of them are synthesized by modifying the amino acids tyrosine and tryptophan.
    B. They are fat-soluble.
    C. They consist of amino acids joined by peptide bonds.
    D. They have relatively long half-lives.
    E. They have relatively short half-lives.

    Option B: Not all of amino acid derivatives are fat-soluble. Indeed, most are water-soluble.
    Option C: These are peptide hormones
    Option D & E: Amino acid derivatives have variable half-lives, from min (e.g. adrenaline) to days (e.g. thyroid hormones)
    Refer to lecture 18: P.5

39. Which of the following is a characteristic of peptide hormones?
    A. They are often synthesized as precursor and then processed into the active hormone.
    B. They are synthesized on demand.
    C. They are insoluble in plasma.
    D. They have relatively long half-lives.
    E. They require carrier proteins for transport in the circulation.

Option B: Peptide hormones are premade and stored in secretory vesicles and release on demand.
Option C: Peptide hormones are soluble as they are peptides.
Option & E: Peptide hormones' half-lives are relatively short as they are not bound and protected from degradation/excretion like water-insoluble hormones do.
Refer to lecture 18: P.5

40. Which of the following is a characteristic of steroid hormones?
    A. They are often synthesized as precursor.
    B. They are soluble in plasma.
    C. They are synthesized in advance and stored in secretory vesicles.
    D. They are synthesized in rough endoplasmic reticulum.
    E. They have relatively long half-lives.

Option A: They are synthesized as the active hormone instead of a precursor inactive hormone.
Option B: Steriod hormones are fat-soluble and require carrier protein for transport.
Option C: They are synthesized on demand.
Option D: Fats are made in the smooth ER while proteins are made in the rough ER.
Refer to lecture 18: P.5

41. Which of the following chemicals mediates non-shivering thermogenesis in brown adipose tissue?
    A. Acetylcholine
    B. Norepinephrine
    C. Prostaglandins E_2
    D. TNF-α
    E. IL-6

Refer to lecture 19: P.22

42. Which of the following is correct about brown adipose tissue?
    A. Breakdown of brown adipose tissue produces more ATP than normal adipose tissue.
    B. Breakdown of brown adipose tissue requires a lot of ATP.
    C. Brown adipose tissue contains numerous mitochondria.
    D. Infants have less amount of brown adipose tissue than adults do.
    E. The older people has the highest amount of brown adipose tissue.

Refer to lecture 19: P.22

43. Activation of which of the following neurons causes sweating?
    A. Parasympathetic adrenergic neurons
    B. Parasympathetic cholinergic neurons
    C. Sympathetic adrenergic neurons
    D. Sympathetic cholinergic neurons
    E. Sympathetic dopaminergic neurons

Refer to lecture 19: P.24

44. Which of the following events happens at the onset of fever?
    A. Cutaneous vasodilation
    B. Increased blood flow to the skin
    C. Increased heat production by adipose tissue
    D. Increased sweating
    E. Shivering

At the onset of fever, the core body temperature is lower than the new higher set point and therefore heat gain mechanisms are in place to increase the temp to the set point. – Lecture 19: P.35

45. Which of the following chemicals act on the hypothalamus to reset the core temperature set point during fever?
    A. Cytokines
    B. Lipopolysaccharide
    C. Prostaglandins E_2
    D. Endogenous pyrogens
    E. Exogenous pyrogens

Pyrogens are substances that cause fever. Exogenous pyrogens are substances that originate from outside the body which can cause fever, these include substances produced by pathogens like bacteria (e.g. lipopolysaccharide – LPS). Endogenous pyrogens are substances that produced inside the body – i.e. from the immune cells upon activation in events like infection and inflammation. Cytokines are endogenous pyrogens produced by activated immune cells. The presence of pyrogens stimulates production of PGE_2 in the hypothalamus which act to elevate the set point. Refer to lecture 19: P.34

SAQ

1. The thoracic cage protects the heart and the lungs and provide sites for muscle attachment.
   (a) List the component of the skeleton that forms the thoracic cage?
   (b) Define true ribs, false ribs and floating ribs and state which ribs are true, false and floating ribs.

   Suggested Ans
   (a) The sternum, the 12 thoracic vertebrae and the associated intervertebral discs, 12 pairs of ribs and the costal cartilage
   (b) The 1^{st} – 7^{th} ribs are true ribs. They attach to the sternum directly through their own costal cartilage. The 8^{th} – 10^{th} ribs are false ribs. They attach to the sternum indirectly through the costal cartilage of the ribs above them. The 11^{th} – 12 ribs are floating ribs which do not attach to the sternum.

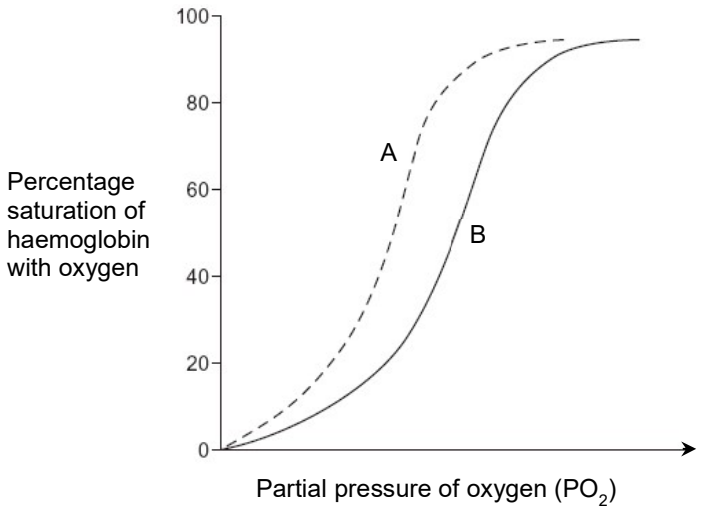
2. Breathing requires contraction and relaxation of respiratory muscles.
   (a) List the TWO primary muscles of inspiration.
   (b) Explain the mechanism of quiet inspiration.
   (c) List one accessory muscle of inspiration that assists forced inspiration and state the action of the muscle during force inspiration.
   (d) List one accessory muscles of expiration that assists forced expiration.

   Suggested Ans
   (a) Diaphragm and external intercostal muscles
   (b) During quiet inspiration, the diaphragm and external intercostal muscles contract to expand the thoracic cavity. Contraction of diaphragm increases the vertical diameter of the thoracic cavity. Contraction of external intercostal muscles causes elevation of the ribs (bucket-handle movement) and the sternum (pump-handle movement). This increases the transverse and anterior-posterior diameters of the thoracic cavity. Such increase in volume of the thoracic cavity creates a negative intrathoracic pressure, which in turn creates a negative intrapulmonary pressure, which lower than the atmospheric pressure. The difference in air pressure causes air to flow into the lungs as air flows from area of higher pressure to area of lower pressure.
   (c) Anterior and middle scalene muscles/sternocleidomastoid/pectoralis major/pectoralis minor. The accessory muscles of inspiration contract to further raise the rib cage, which allows additional increase in the transverse and anteroposterior diameters of the thoracic cavity.
   (d) Internal intercostal muscles/rectus abdominis/transverse abdominis/internal oblique muscles/external oblique muscle.

3. Blood gases diffusion occurs at the respiratory membrane in the conducting zone of the airways.
   (a) Name the THREE layers that make up the respiratory membrane.
   (b) Describe the direction of blood gas movement at the respiratory membrane.
   (c) What is the driving force for gas diffusion?
   (d) List the FOUR factors that affects gas diffusion across the respiratory membrane.

   Suggested Ans
   (a) Alveolar epithelium, capillary endothelium and their joined basement membrane
   (b) O_2 diffuses from alveoli air into the blood in the pulmonary capillaries, CO_2 diffuses from the blood in the pulmonary capillaries into the alveolar air.
   (c) Partial pressure difference of the blood gases across the respiratory membrane
   (d) Partial pressure gradient
   Gas solubility
   Structural characteristics of the diffusion membrane (surface area and thickness)
   Matching of alveolar ventilation with pulmonary blood perfusion

4. The following figure shows two haemoglobin-oxygen ($Hb\text{-}O_2$) dissociation curves at pH 7.2 and pH 7.4.



(a) State the correct pH for each of the curves.
(b) What is the relationship between the position of $Hb\text{-}O_2$ dissociation curve and the affinity of haemoglobin for oxygen?
(c) Name the phenomenon that the position of $Hb\text{-}O_2$ dissociation curve changes when pH is lowered.
(d) Explain how a change in pH from 7.4 to 7.2 affects the supply of oxygen to the tissue.
(e) What are the possible causes for pH to be reduced from 7.4 to 7.2 in a tissue?

Suggested Ans

(a) Curve A = pH 7.4; Curve B = pH 7.2
(b) The curve will be positioned towards the left as $Hb\text{-}O_2$ affinity increases / the curve will be positioned towards the right as $Hb\text{-}O_2$ affinity decreases
(c) Bohr effect
(d) When pH drop from 7.4 to 7.2, the affinity of haemoglobin for oxygen is lowered so that more oxygen will be unloaded/released to tissues
(e) 1. Cellular/aerobic respiration (occurs in presence of O_2 and mitochondria is working) generates CO_2. Carbonic anhydrase catalyses the reaction between CO_2 and water to form carbonic acid (H_2CO_3), which spontaneously dissociates in water to increase hydrogen ion concentration. More H^+ means more acidic.
$CO_2 + H_2O \rightarrow H_2CO_3 \rightarrow H^+ + HCO_3^-$
2. Anaerobic respiration (occurs in absence of O_2 and mitochondria are NOT working) produces lactic acid.

4. Hormones regulates various bodily function.
(a) What are the THREE modes of actions of hormones?
(b) What are the THREE classes of hormones as classified by their structure? Give one example for each class.
(c) How does a hormone trigger a reaction in the target cells?
(d) Where are hormone receptors found in a cell?
(e) What are the possible interactions of hormones in the body? Give an example for each possible interaction.
(f) What are the THREE patterns of hormone secretion? Give an example for each pattern of secretion.
(g) How can the activity of a hormone be regulated?
(h) What are the possible causes of hormonal imbalance?

Suggested Ans

(a) Autocrine, paracrine and endocrine
(b) Peptide hormones – e.g. insulin, glucagon
Steroid hormones – e.g. oestrogen, progesterone, cortisol
Amino acid derivatives – e.g. adrenaline (epinephrine), thyroid hormones
(c) By binding to specific hormone receptors on the target cells
(d) On cell surface on the plasma membrane

- *For water-soluble hormones as they cannot pass through the plasma membrane and enter the cells Inside the cell (intracellular receptors) – in cytoplasm or nucleus*
- *For lipid soluble hormones as they can diffuse across the plasma membrane (e.g. cortisol, oestrogen, progesterone, thyroid hormones)*

(e) *Redundant effect – e.g. glucagon, adrenaline and cortisol acts synergistically to elevate blood glucose level*
Reinforcement effect – e.g. cortisol produces different effects on different target tissues to elevate blood glucose level
Antagonistic effect – e.g. insulin and glucagon produces opposite effect to regulate glucose level
Permissive effect – e.g. oestrogen has permissive effect on progesterone to act on the endometrium during the luteal phase of the menstrual cycle as it stimulates the expression (production) of progesterone receptors on the endometrial cells

(f) *Pulsatile secretion – hormone is released in response to a stimulus (e.g. insulin is secreted when glucose level is increased)*
Diurnal secretion – hormone secretion follows a daily rhythm (e.g. cortisol level is higher in the morning while melatonin level is higher at night)
Cyclical secretion – hormone level fluctuates through cycles (e.g. LH/FSH/oestrogen/progesterone levels fluctuates throughout the menstrual cycle)

(g) *By regulating the number of receptor on the target cells*
By regulating the amount hormone secreted

(h) *Problems in the endocrine glands – secrete too much or too little hormone*
Problems in the endocrine feedback system – secretion of certain hormones are controlled by the hormone secreted from the hypothalamus and pituitary glands (e.g. thyroid hormones secretion is stimulated by TSH from the pituitary glands. If the pituitary gland is diseased and cannot secrete TSH, thyroid hormone level will decrease)
Auto-immune disorders (the immune system of the body attack and damage the endocrine gland so that the gland cannot secrete hormone, e.g. in type 1 diabetes mellitus, the beta cells in the pancreas are destroyed by the immune system so that it cannot produce insulin)
Genetic disorders (e.g. mutations in hormone receptors so that the receptors become non-functional)