



2015 biology solved problems. Cell biology, digestion, breathing, Circulation nervous system and homeostasis

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1. Which of the listed terms is described by: “All the chemical processes that take place in the organelles and cytoplasm the cells of the body”?
- A. Metabolism B. Cellular respiration C. Homeostasis D. Physiology

Answer is A: The quoted statement is a definition of metabolism

2. To which of the following does the “tissue level” of structural organisation refer?
- A. atoms, ions, molecules and electrolytes
B. mitochondria, ribosomes, nucleus, endoplasmic reticulum
C. nephron, alveolus, villus, lobule
D. muscle, nervous, connective, epithelial

Answer is D: the listed structures are the four major tissue types.

3. What does the process known as anabolism refer to?
- A. the use of energy for producing chemical substances.
B. the breaking down phase of metabolism.
C. all the chemical process that take place in the organelles of the cells.
D. the supply of nutrients to the body’s cells.

Answer is A: anabolism refers to the process of constructing/building molecules (think anabolic steroids). B refers to catabolism. C refers to metabolism.

4. Which of the following is the best definition of physiology?
- A. The microscopic study of tissues and cells
B. The study of how the body works.
C. All the chemical processes that take place in the organelles of the body’s cells.
D. The body’s automatic tendency to maintain a relatively constant internal environment.

Answer is B: physiology is indeed the study of how the (healthy) body functions.

5. Which of the following is NOT a component of the cell plasma membrane?
- A. cholesterol C. microfi laments
B. proteins D. phospholipid

Answer is C: microfilaments occur inside the cell.

6. Which of the following is a function of membrane proteins?
- A. to process lipids and proteins for secretion through the plasma membrane
B. to act as receptors for hormones

- C. to synthesise proteins from amino acids
- D. to act as a cytoskeleton to support and shape the cell

Answer is B: One function of membrane proteins is to receive (amino acid based) hormones that cannot pass through the plasma membrane.

7. What are lysosomes, centrosomes and ribosomes example of?

- A. stem cells
- B. organelles within a cell
- C. sensory receptors in the dermis
- D. exocrine glands

Answer is B: the suffix “-some” refers to small body or organelle within a cell.

8. Which cell organelles contain an acidic environment capable of digesting a wide variety of molecules?

- A. Lysosomes
- B. Ribosomes
- C. Centrosomes
- D. Golgi complex

9. Which statement about the plasma membrane is INCORRECT?

- A. It is selectively permeable.
- B. It is composed of two layers of glycoprotein molecules.
- C. It contains receptors for specific signaling molecules.
- D. The plasma membranes of adjacent cells are held together by desmosomes.

Answer is B: The PM is indeed made of two layers, but they are phospholipid (not glycoprotein) molecules.

10. What is the function of phospholipids in the plasma membrane?

- A. to maintain the intracellular fluid at a similar composition to that of the interstitial fluid.
- B. to form channels to selectively allow passage of small molecules.
- C. to act as receptors for signaling chemicals.
- D. to present a barrier to the passage of water-soluble molecules.

Answer is D: molecules that are soluble in water cannot pass through lipid (fat). So the phospholipids are a barrier. The functions described by B. & C. are performed by other molecules in the plasma membrane.

11. What is the name of the mechanism that ensures that there is a higher concentration of sodium ions in the extracellular fluid than in the intracellular fluid?

- A. Facilitated diffusion
- B. Secondary active transport
- C. The sodium-potassium pump
- D. Osmosis

Answer is B: The “pump” (or ATPase) transports Na⁺ out and K⁺ into the cell.

12. Which of the following is NOT part of the plasma membrane of a cell?

- A. integral proteins
- B. glycoproteins
- C. plasma proteins
- D. peripheral proteins

Answer is C: as the name implies, plasma proteins are found in the blood plasma. Not to be confused with the plasma membrane.

13. The plasma membrane of a cell contains molecules that have a hydrophobic end and a hydrophilic end what are they called?

- A. phospholipids
- B. cholesterol
- C. integral proteins
- D. glycoproteins

Answer is A: the phosphate end is hydrophilic (water soluble) while the lipid end is hydrophobic (insoluble in water).

14. Facilitated diffusion refers to the process of

- A. movement along a concentration gradient assisted by protein carrier molecules.
- B. movement of ions and molecules along a concentration gradient.
- C. transport of molecules and ions against their concentration gradient.
- D. water movement through a semi-permeable membrane

Answer is A: facilitated refers to the role of the protein carriers. The other choices refer to diffusion, active transport and osmosis respectively

15. The process of “diffusion” through a membrane may be described by which of the following?

- A. the movement of ions and molecules away from regions where they are in high concentration towards regions where they are in lower concentration.
- B. the use of energy from ATP to move ions and small molecules into regions where they are in lower concentration.
- C. the plasma membrane engulfs the substance and moves it through the membrane.
- D. the use of energy from ATP to move water molecules against their concentration gradient.

Answer is A: the choices with ATP are nonsense. While choice C refers to endocytosis

16. The process of “active transport” through a membrane may be described by which of the following?

- A. the movement of ions and small molecules away from regions where they are in high concentration.
- B. the use of energy from ATP to move ions and small molecules into regions where they are in lower concentration.
- C. the plasma membrane engulfs the substance and moves it through the membrane.

- D. the use of energy from ATP to move ions and small molecules against their concentration gradient.

Answer is D: energy (ATP) is required to force molecules against their concentration gradient.

17. The resting membrane potential of a cell is the consequence of which of the following concentrations of ions?
- A. High K^+ and Cl^- outside the cell and high Na^+ and large anions inside the cell.
 - B. High K^+ and Na^+ outside the cell and high Cl^- and large anions inside the cell.
 - C. High Cl^- and Na^+ outside the cell and high K^+ and large cations inside the cell.
 - D. High Ca^{2+} and Na^+ outside the cell and high K^+ and large cations inside the cell.

Answer is C: These ionic species are largely responsible for the membrane potential (cations are positive ions). While there is a higher concentration of Ca^{2+} outside the cell than inside, there are fewer Ca^{2+} than Cl^- ions.

18. Facilitated diffusion differs from active transport because facilitated diffusion:
- A. requires energy from ATP
 - B. moves molecules from where they are in lower concentration to higher concentration
 - C. moves molecules from where they are in higher concentration to lower concentration.
 - D. involves ions & molecules that pass-through membrane channels.

Answer is C: diffusion always refers to movement from high to low concentration (without energy expenditure). Facilitated refers to the assistance provided by a transport molecule that is designed for the purpose.

19. One of the functions of integral proteins in cell membranes is to:
- A. maintain the rigid structure of the cell
 - B. support mechanically the phospholipids
 - C. interact with the cytoplasm
 - D. form channels for transport functions

Answer is D: some proteins form channels which allow molecules and ions to enter the cell.

20. What is the purpose of the “sodium/potassium pump”?
- A. to perform endocytosis.
 - B. to move sodium and potassium by facilitated diffusion.
 - C. to perform bulk transport through the plasma membrane.
 - D. To produce a concentration gradient for sodium ions

Answer is D: a concentration gradient is set up by the use of energy to move Na ions to where they are in greater concentration. This requirement for energy means choice B is wrong.

21. What is the name given to the type of transport where glucose or an amino acid binds to a receptor protein on the plasma membrane, which then moves the molecule into the cell without the expenditure of energy?

- A. facilitated diffusion
- B. bulk transport
- C. secondary active transport
- D. active transport

Answer is A: the membrane protein facilitates the entry into the cell. No energy is expended so it is not active transport

22. What is the name given to the movement of glucose or amino acids from the gut into the cells lining the gut, when they bind to a transport protein that has also bound a sodium ion? The sodium ion is entering the cell along its concentration gradient.

- A. facilitated diffusion
- B. the sodium potassium pump
- C. active transport
- D. secondary active transport

Answer; D the sodium ion was transported out of the cell with the use of energy in order to set up the sodium concentration gradient. This gradient then allows other molecules to enter the cell along with sodium's re-entry. This is active (because energy used), but secondary as it occurs as a result of the previous active transport event.

23. Why does the plasma membrane of a cell present a barrier to the movement of electrolytes through it?

- A. There are no channels in the membrane for the passage of electrolytes.
- B. Electrolytes are not soluble in the lipid of the membrane.
- C. Electrolytes are too large to pass through membrane channels.
- D. Membrane proteins electrically repel charged particles.

Answer is B: electrolytes, being charged particles are not able to dissolve their way through the lipid plasma membrane (which is non-polar). Hence it is a barrier to them.

24. What term is used to describe the movement of dissolved particles along (or down) their concentration gradient?

- A. endocytosis
- B. active transport
- C. osmosis
- D. diffusion

Answer is D: Following the concentration gradient is a passive process. Choice C applies only to water molecules.

25. Which of the following molecules cannot pass through the plasma membrane?

- A. water molecules
- B. non-polar molecules
- C. amino acid based hormones
- D. fat-soluble molecules

Answer is C: These hormones are not lipid soluble and too large to pass through channels.

26. Which of the following is a connective tissue?

- A. Pancreas
- B. spinal cord
- C. muscle
- D. blood

Answer is D: blood contains cells separated by a liquid matrix. Choices A & B are epithelial and nervous tissues.

27. Which of the following is an epithelial tissue?

- A. adipose tissue
- B. the adrenal gland
- C. the heart
- D. blood

Answer is B: the adrenal gland is glandular epithelial tissue.

28. What is the major component of the plasma membrane of a cell?

- A. phospholipid
- B. glycolipid
- C. integral protein
- D. cholesterol

Answer is A: cholesterol and proteins are also present in the plasma membrane but as more minor components.

29. Facilitated diffusion through a membrane involves which of the following scenarios?

- A. the diffusion of water through a selectively permeable membrane along its concentration gradient.
- B. the movement of a molecule against its concentration gradient with the expenditure of energy
- C. the plasma membrane surrounding (engulfi ng) the molecule & the molecule moving into the cell.
- D. a molecule binding to a receptor which moves the molecule through the membrane without the expenditure of energy

Answer is D: facilitation is by binding to a membrane protein.

30. If a semi-permeable membrane separates two aqueous solutions with different osmotic pressures, what will be the direction of water flow between solutions? From:

- A. higher osmotic pressure to the solution of lower osmotic pressure.
- B. lower osmotic pressure to the solution of higher osmotic pressure.
- C. higher concentration to the solution of lower concentration.
- D. higher hydrostatic pressure to the solution of lower hydrostatic pressure.

Answer is B: lower osmotic pressure means a lower solution concentration (and a higher concentration of water molecules). Water moves from the dilute solution into the more concentrated one.

31. Osmosis may be defined as which of the following?

- A. The diffusion of water molecules across a semi-permeable membrane from the solution with higher water concentration into the solution of lower water concentration.
- B. The movement of water molecules across a semi-permeable membrane from the solution of higher concentration into the solution of lower concentration.
- C. The diffusion of solute particles across a semi-permeable membrane from the solution of higher concentration into the solution of lower concentration.
- D. The movement of water molecules across a semi-permeable membrane from the solution of lower concentration into the solution of higher concentration.

Answer is D: The definition should include: “water”; movement through an SP membrane; direction of water flow from more dilute solution into the solution of higher concentration.

32. Osmosis involves the movement of:

- A. water molecules through a membrane from a region of higher concentration of water molecules to a region of lower water molecule concentration.
- B. solute particles from a region of higher solution concentration to a region of lower solution concentration.
- C. water molecules from a region of lower concentration of water to a region of higher water molecule concentration.
- D. solute particles through a membrane from a region of lower solute concentration to a region of higher solute concentration.

33. Blood has a slightly higher osmotic pressure than the interstitial fluid that surrounds capillaries. What is the effect of this?

- A. Water will tend to move from the interstitial fluid into the capillaries.
- B. The solution concentration of blood is less than the solution concentration of interstitial fluid.
- C. Water will tend to move from the capillaries into the interstitial fluid.
- D. Capillaries will expand in diameter.

Answer is A: water will move through a membrane into a solution of higher osmotic pressure (the blood) from a solution of lower osmotic pressure.

34. If a red blood cell (rbc) is placed in a solution that has a greater concentration than that inside the rbc, what will happen?

- A. the rbc will crenate
- B. the rbc will haemolyse
- C. there will be a net movement of water out of the rbc into the solution
- D. there will be no net movement of water out of the rbc

Answer is C: water will flow by osmosis from the rbc into the surrounding solution. If the difference in concentration is large enough, the outflow of water will be large, and the rbc will also shrivel (crenate) as a result of this outflow.

35. One of the following is an example of osmosis. Which one?
- A. water moving from the glomerulus of a nephron into the Bowman's capsule
 - B. water leaving a blood capillary from close to its arteriole end, to enter the interstitial fluid
 - C. water entering a red blood cell that is in a 0.8% sodium chloride solution, by passing through its plasma membrane
 - D. water evaporating from perspiration on the skin

Answer is C: Osmosis refers to the movement of water through a membrane in the direction of its concentration gradient. A 0.8% solution is hypotonic to the contents of the rbc, so water would enter the cell. In both choice A & C, the water is moving due to a hydrostatic pressure difference.

36. The Na⁺/K⁺ ATPase pump in the plasma membrane moves Na out of the cell and K into the cell against their concentration gradient. Then Na reenters the cell and K leaks out of the cell, along their concentration gradients through their membrane channels. What is the movement of Na and K along their concentration gradients called?
- A. Active transport
 - B. Diffusion
 - C. Facilitated diffusion
 - D. Osmosis

Answer is B: The movement of these ions down their concentration gradient is diffusion. The concentration gradient is produced by the active transport of the Na⁺/K⁺ ATPase pump.

37. Which of the following statements is FALSE?
- A. Filtration is movement of water caused by a difference in hydrostatic pressure, while diffusion results from a difference in concentration.
 - B. Both diffusion and filtration will tend to continue till there is an equal amount on both sides of the membrane.
 - C. Any hypertonic solution has a concentration lower than that of blood while a hypotonic solution has a concentration greater than the blood.
 - D. Water moves into a red blood cell resulting in haemolysis, and out of a cell by a process called plasmolysis.

Answer is C: Hypertonic solutions have a concentration greater than blood. Plasmolysis is the process in which cells lose water in a hypertonic solution.

38. What term is applied to an intravenous solution that would cause a net movement of water out of red blood cells?
- A. hypertonic
 - B. supertonic
 - C. epitonic
 - D. hypotonic

Answer is A: “hyper-” refers to greater (tonicity) than inside an rbc. Hence water would move from the less concentrated solution (within the rbc) to the exterior.

39. What can be correctly said of an isotonic intravenous solution? An isotonic solution:

- A. causes water to move out of red blood cells.
- B. causes no net movement of water into or out of red blood cells.
- C. has the same solutes in the same solution concentration as blood plasma
- D. causes water to move into red blood cells.

Answer is B: isotonic means that the IV solution has the same concentration of particles (albeit the particles themselves may be different) as in rbc, hence there is no net osmotic flow

Biochemical molecules

40. Denaturation of proteins involves disruption of the

- A. primary structure B. secondary structure C. tertiary structure D. covalent bonding

Answer is C: Protein “tertiary structure” is held together by the relatively weak attraction between different parts of the protein molecule known as “hydrogen bonding”. This structure is the most easily disrupted.

41. One of the following is NOT a function of lipids in the body. Which one?

- A. function as co-enzymes.
- B. used in phospholipids.
- C. used to make prostaglandins.
- D. steroids are produced from them.

Answer is A: co-enzymes are proteins (not lipids)

42. Amino acids are the building blocks of all proteins. As more amino acids are added the protein chain tends to fold upon itself in a characteristic way. This characteristic of a protein is called the:

- A. primary structure
- B. secondary structure
- C. tertiary structure
- D. quaternary structure

Answer is C: The shape produced by folding is the tertiary structure. Primary structure is the sequence in which the amino acids are joined. Secondary structure is any repetition of the primary structure. Quaternary structure does not exist.

43. Which of the following is the correct combination for the nucleic acid DNA?

- A. Phosphate, Ribose, Uracil
- B. Phosphate, Deoxyribose, Uracil
- C. Phosphate, Ribose, Adenine
- D. Phosphate, Deoxyribose, Adenine

Answer is D: “Deoxyribose” supplies the “D” in DNA. The base uracil occurs in RNA (not DNA) where it substitutes for the thymine that occurs in DNA.

44. To which of the following class of biological compounds do all enzymes belong?
A. Hormones B. Proteins C. Carbohydrates D. Lipids

Answer is B: All enzymes are proteins

45. The twisting of a polypeptide chain into a characteristic shape such as a helix is an example of which of the following?
A. Primary structure B. Secondary structure C. Tertiary structure D. Quaternary structure
Answer is C: Shape of the protein molecule is the tertiary structure of the protein.

46. Which one of the following is NOT a steroid compound?

- A. stearic acid C. cholesterol
B. oestrogen D. testosterone

Answer is A: Stearic acid is a fatty acid. The sex hormones oestrogen and testosterone are derived from cholesterol.

47. Which of the following carbohydrates are able to pass through the plasma membrane?

- A. disaccharides C. glycogen
B. sucrose D. monosaccharides

Answer is D: For example glucose may be absorbed from the gut by passing through the plasma membrane of the cells lining the gut. Glucose is also absorbed by cells for respiration inside mitochondria.

48. Which of the following foods when catabolised in the body produces the highest yield of energy?

- A. 100 gram of fat B. 100 gram of chocolate C. 100 gram of carbohydrate D. 100 gram of protein

49. Which of the following formulae would be most likely to represent a lipid?

- A. $C_{2936}H_{4624}N_{786}O_{889}S_{41}$ C. $C_6H_{12}O_6$
B. $C_{57}H_{110}O_6$ D. $Ca_{10}(PO_4)_6(OH)_2$

Answer is B: Lipids consist of carbon, hydrogen and oxygen, with relatively few O compared to C. Choice C is a monosaccharide, Choice A is a protein (note the nitrogen). No-one should have chosen D (=calcium hydroxyapatite).

50. Some of the body's homeostatic responses rely on "negative feedback". Which of the following happens in negative feedback?

- A. The body ignores changes in a physiological variable that are directed towards the set point for that variable.

- B. The body ignores changes in a physiological variable that are directed away from the set point for that variable
- C. The body's response acts to oppose the change in the physiological variable.
- D. The body's response acts to enhance the change in the physiological variable

Answer is C: "Negative" refers to the response being in the opposite direction to the stimulus. Thus if a variable is increasing, then the body's response is to produce a change that causes the variable to decrease. The body does not "ignore" stimuli.

51. Homeostasis usually returns the body to a healthy state after stressful stimuli by

- A. negative feedback
- B. positive feedback
- C. means of the immune system
- D. means of the nervous system

Answer is A: Negative feedback is far more common in maintaining homeostasis than is positive feedback.

52. Which of the following is a correct definition of "negative feedback"?

- A. The process by which the body maintains homeostasis.
- B. A mechanism in which the body's response opposes the stimulus.
- C. A mechanism whereby the body responds to a stimulus by acting to enhance the stimulus.
- D. The dynamic equilibrium maintained by an integrating centre which causes an effector to respond to the stimulus received by the receptor.

Answer is B: When an action is taken to cause the stimulus to be reduced, the feedback is termed "negative".

53. Homeostasis refers to maintaining:

- A. a constant internal body environment through negative feedback.
- B. body conditions relatively constant within a narrow range through negative and positive feedback.
- C. adequate concentrations of respiratory gases.
- D. blood glucose level within the healthy range.

Answer is B: The maintenance of body conditions through feedback which is usually negative but is positive in some rare situations.

54. What does the term "homeostasis" refer to?

- A. the chemical processes that take place in the organelles of the cells.
- B. the body's tendency to maintain a relatively constant internal environment.
- C. the body's use of energy to produce chemical substances and parts for growth.
- D. any body response that opposes the stimulus that initiated the response.

Answer is B: This is the best definition of homeostasis. Choice D refers to negative feedback.

55. The body returns to a healthy state after stressful stimuli thanks to which of the following?

- A. positive feedback B. metabolism C. anabolism D. negative feedback

Answer is D: Negative feedback is more common than positive feedback.

56. How would the hypothalamus respond if its osmoreceptors noticed an increase in plasma osmotic pressure? It would send a message to:

- | | |
|--|---|
| A. the posterior pituitary to release more ADH | C. the adrenal cortex to release less aldosterone |
| B. the posterior pituitary to release less ADH | D. the atria to release more ANP |

Answer is A: The hypothalamus would respond in a way that opposed the rise in osmotic pressure. Releasing more ADH would make the distal convoluted tubules of the nephrons to become more permeable to water. This would allow more water to be reclaimed from the filtrate which would act against the osmotic pressure of the plasma from rising further. It would also stimulate thirst.

57. During the delivery of a baby the baby's head is pushing against the cervix causing the cervix wall to stretch. This stretching causes nerve impulses to be sent to the hypothalamus which directs the posterior pituitary to release oxytocin in the blood. Oxytocin stimulates the uterus to contract which pushes the baby's head deeper into the cervix, stretching it further. This situation is a description of which of the following?

- | | |
|----------------------|---|
| A. negative feedback | D. an afferent pathway to an integrating centre |
| B. positive feedback | |
| C. homeostasis | |

Answer is B: The stimulus (cervical stretching) causes the integrating centre (the hypothalamus) to respond by enhancing the stimulus – releasing oxytocin so that the uterus contracts. Enhancing the stimulus is an example of positive feedback. The feedback stops when the cervix is no longer being stretched, that is when the baby is delivered.

58. Which of the following statements about positive feedback and homeostasis is correct?

- A. They are regulation mechanisms that control most fluctuations in the internal environment of the body.
B. The response to the stimulus serves to exaggerate the feedback effect.
C. This type of feedback response only involves an effector not a specific stimulus receptor site.

- D. This feedback mechanism involves adjustments at the organ level but not at the cellular level.

Answer is B: Positive feedback causes the stimulus to increase in magnitude which in turn elicits a more exaggerated response.

59. Which of the following statements is WRONG? The end products of:
- A. protein digestion is transported to the liver via the hepatic portal vein
 - B. triglyceride digestion is transported to the liver via the lymphatic system
 - C. carbohydrate digestion is transported to the liver in the blood
 - D. triglyceride digestion is transported via the lymphatic system

Answer is B: The products of fat digestion are transported by the lymphatic system but do not pass through the liver.

60. One of the following processes is NOT part of mechanical digestion. Which One?

- A. hydrolysis
- B. peristalsis
- C. segmentation
- D. mastication

Answer is A: Hydrolysis is a chemical process that converts large food molecules into smaller ones (i.e. performs digestion)

61. Which type of cell produces hydrochloric acid?

- A. Zymogenic cells
- B. Parietal cells
- C. Chief cells
- D. Enteroendocrine cells

Answer is B: The parietal cells of gastric glands produce hydrochloric acid. (Zymogenic cells are the same as Chief cells, they produce pepsinogen).

62. Which of the following glands are accessory organs of the digestive system?
- A. adrenal glands
 - B. pancreatic islets
 - C. gastric glands
 - D. salivary glands

Answer is D: Salivary glands produce a secretion (saliva) that empties into the digestive tract via a tube. (Pancreatic islets are in the pancreas, but are themselves not a gland)

63. What is the role of gastrin in the digestive system?
- A. to stimulate release of bile and pancreatic juice
 - B. to stimulate gastric secretion
 - C. to activate pepsinogen
 - D. to hydrolyse proteins to polypeptides

64. After ejaculation, sperm travel through the structures of the female reproductive tract in which order?

- | | |
|--|--|
| A. Vagina, uterus, fallopian tube, ovary. | C. Vagina, cervix, uterus, fallopian tube. |
| B. Cervix, vagina, uterus, fallopian tube. | D. Cervix, urethra, uterus, fallopian tube |

65. What is the chromosome complement of a sperm?

- A. 46 chromosomes (23 pairs including a pair of Y chromosomes).
- B. 46 chromosomes (22 pairs plus one X chromosome and one Y).
- C. 23 chromosomes including one X chromosome OR one Y.
- D. 23 chromosomes including one X chromosome AND one Y

Answer is C: Sperm are haploid (have 23 chromosomes) so that when they fuse with the egg (also with 23 chromosomes), the zygote has 46 chromosomes. The X or Y chromosome of the sperm, in conjunction the X of the egg, then determine the sex of the baby.

66. What is the role of progesterone?

- | | |
|--|--|
| A. to stimulate follicle development | C. to stimulate the oocyte to complete meiosis I |
| B. to stimulate the maturation of the uterine lining | D. to stimulate the release of FSH |

Answer is B: Progesterone stimulates the maturation of the uterine lining, and the secretions of the uterine glands.

67. Which list of structures in the male reproductive tract has them in correct sequence?

- A. seminiferous tubules, epididymis, vas deferens, urethra, ejaculatory duct
- B. epididymis, seminiferous tubules, vas deferens, ejaculatory duct, urethra
- C. seminiferous tubules, epididymis, vas deferens, ejaculatory duct, urethra
- D. epididymis, seminiferous tubules, vas deferens, urethra, ejaculatory duct

Answer is C: Seminiferous tubules must precede the epididymis; and the ejaculatory duct must precede the urethra.

68. Below is a list of structures and (in brackets) a hormone that they might produce. Which list is correct?

- A. hypothalamus (FSH); pituitary (GnRH); follicle (estrogens); corpus luteum (LH)
- B. hypothalamus (GnRH); pituitary (estradiol); follicle (LH); corpus luteum (progesterone)
- C. hypothalamus (estrogens); pituitary (FSH); follicle (progesterone); corpus luteum (estrogens)
- D. hypothalamus (GnRH); pituitary (FSH & LH); follicle (estrogens); corpus luteum (progesterone)

Answer is D: The anterior pituitary produces and releases FSH & LH.

69. By which of the following pathways does sound entering the ear reach the organ of Corti?

- A. basilar membrane, middle ear, oval window, endolymph,
- B. tympanic membrane, ossicles, oval window, cochlear fluid
- C. tectorial membrane, Eustachian tube, ossicles, cochlear fluid
- D. oval window, ear canal, auditory tube, endolymph

Answer is B: Sound impinges on the tympanic membrane first. The Eustachian tube and the auditory tube are the same thing and do not conduct sound – they connect the middle ear to the mouth.

70. Which part of the ear contains the apparatus that we use to distinguish between different frequencies of sound?

- A. The cochlea
- B. The Eustachian (or auditory) tube
- C. The tensor tympani
- D. The auditory meatus

Answer is A: The cochlea contains the organ of Corti (the spiral organ) and its basilar membrane.

71. In which colour ranges do the three pigments in the retina have their major sensitivities?

- A. red, green and blue.
- B. red, blue and yellow.
- C. green, yellow and red.
- D. green, yellow and blue.

72. As part of the normal ageing process, our eyes deteriorate because

- A. the ciliary muscles gradually lose their tone.
- B. the lens loses its flexibility.
- C. parts of the retina detach from the underlying blood vessels.
- D. the distance between the lens and the retina gradually changes.

Answer is B: The lens needs to be elastic in order to become thin (to view distant objects) and to become thick (to view objects that are within one metre).

73. Glaucoma is an eye disease which affects vision. It is caused by:

- A. blockage of the flow of aqueous humor through the canal of Schlemm and loss of intraocular pressure in the vitreous humor.
- B. detachment of the retina and subsequent loss of vision in this part of the eye.
- C. cataracts that form in the eye's lens which prevent light from reaching the retina.
- D. increased intraocular pressure which collapses the blood capillaries that perfuse the retina so part of it dies.

Answer is D: Glaucoma results from higher than healthy intraocular pressure in the eyeball.

74. What is meant by the term “accommodation” when referring to our vision? It refers to the ability of our eye to:
- A. alter the thickness of the lens to focus on objects whatever their distance from us.
 - B. alter the amount of refraction occurring in the cornea.
 - C. alter the diameter of the pupil to cope with situations of different light intensity.
 - D. use either rods or cones for vision depending on whether we are viewing during daylight or at night.

Answer is A: Accommodation refers to the ability of our eye’s lens to alter its shape – its thickness, or roundness or convexity – to enable it to bring light from objects at any distance to a focus on the retina.

75. People over 45 years of age eventually require reading glasses. This condition (known as presbyopia) is the result of which of the following conditions?
- A. the loss of elasticity in the lens
 - B. the development of cataracts in the lens
 - C. the decrease in the refractive index of the cornea
 - D. the degeneration of the cone cells of the retina.

Answer is A: The elastic lens loses some of its elasticity with age so is not able to focus light from nearby objects such as books. Hence “reading” glasses – which have convex lenses – become necessary

76. Which of the following is NOT indicative of the stimulation of the parasympathetic system?
- A. constriction of skeletal muscle blood vessels and vasodilation of renal blood vessels
 - B. excitation of the blood flow to the kidneys and smooth muscles of the GI tract
 - C. inhibition of heart rate and smooth muscles of the urinary bladder
 - D. excitation of the smooth muscles of the urinary bladder and GI tract

Answer is A: The parasympathetic division is not involved in vasoconstriction or dilation of skeletal muscle blood vessels.

77. If the pO_2 of oxygen in the alveoli is 104 mmHg and in the blood in alveolar capillaries is 40 mmHg, while the pCO_2 in the alveoli 40 mmHg and in the blood is 46 mmHg, which of the following will happen?
- A. carbon dioxide will diffuse from the alveoli to the blood.
 - B. oxygen will diffuse from the blood to the alveoli.
 - C. oxygen will diffuse from the red blood cells to the plasma.
 - D. carbon dioxide will diffuse from the blood into the alveoli.

Answer is D: Dissolved gases will diffuse from where they are in high concentration to where they are in low concentration. Hence CO₂ can go from 46 mmHg to 40 mmHg and pO₂ can move from where it is at 104 mmHg to where it is at 40 mmHg. D is the only choice consistent with this.

78. Inhalation of air into the lungs is correctly described by which of the following?

- A. the action of the diaphragm and the ribs create a positive pressure in the thoracic cavity which causes air to move into the lungs.
- B. the volume of the thoracic cavity is increased as muscles relax, thus increasing the pressure and air is forced into the lungs.
- C. the thoracic cavity decreases in volume as muscles relax and pressure decreases so external air is forced into the lungs.
- D. the lungs expand as muscles contract, this creates a negative pressure so air is forced into the lungs.

Answer is D: Inhalation is an active process that requires muscles to contract. Their contraction increases lung volume which produces a pressure in the lungs that is lower than atmospheric pressure (a negative pressure).

79. When the diaphragm contracts which of the following will happen in the lungs?

- A. air pressure will increase, volume will decrease and exhalation will occur.
- B. air pressure will decrease, volume will increase and exhalation will occur.
- C. air pressure will decrease, volume will increase and inhalation will occur.
- D. air pressure will increase, volume will increase and inhalation will occur.

Answer is C: Contracting the diaphragm will increase the volume of the lungs, which will decrease the pressure of the contained air. Consequently, air from the room will be pushed into the lungs (inhalation occurs).

80. What are the membranes that surround each lung called? The

- A. parietal and visceral membranes.
- B. parietal and visceral meninges
- C. pleura
- D. peritoneum

Answer is C: The pleura surround each lung. There is an outer (parietal) layer and an inner layer, the visceral pleura.

81. A man runs up a flight of stairs. His respiratory rate rose from 18 breaths per minute (resting) to 36 bpm (at the top of stairs). The increase was probably a result of:

- A. increased blood pH
- B. increased concentration of CO₂ in the blood
- C. decreased concentration of O₂ in the blood

D. decreased concentration of CO₂ in the blood

Answer is B: Muscular activity would have increased the rate of oxygen consumption and carbon dioxide production by cells. A higher breathing rate is required to take in the needed oxygen and to excrete the produced carbon dioxide. It is increased CO₂ rather than decreased O₂ that stimulates respiratory rate.

82. The volume of air which moves in and out of the lungs during a normal quiet respiratory cycle is called the:

A. tidal volume

C. ventilatory volume

B. vital capacity

D. pulmonary capacity

Answer is A: Tidal volume is the volume of air that is inhaled and exhaled while “at rest”.

83. What are the main muscles involved in normal inspiration?

A. muscles of the neck

D. intercostals and the diaphragm

B. abdominal muscles

C. intercostal muscles

Answer is D: Normal inspiration is achieved by contraction of the external intercostal muscles and the diaphragm. The neck and abdominal muscles are used for deep inspiration and forced exhalation respectively.

84. In a healthy person, which of these lung volumes should be the largest?

A. tidal volume

C. expiratory reserve volume

B. vital capacity

D. residual volume

Answer is B: Vital capacity = expiratory reserve volume + tidal volume + inspiratory reserve capacity. So VC is the largest (RV is ~1.2 L).

85. In which of the following situations would blood pressure be increased?

A. antidiuretic hormone (ADH) secretion is inhibited.

B. the kidneys absorb less water before it is excreted as urine.

C. the extracellular fluid volume decreases.

D. the extracellular fluid volume increases.

Answer is D: Extracellular volume includes the blood. If its volume increases, that means blood volume increases and this will increase BP.

86. What is the consequence when ADH is released?

A. blood osmolarity increases

B. the permeability of the collecting ducts to water is increased

C. peripheral vasodilation increases

D. blood pressure decreases

Answer is B: Anti-diuretic hormone decreases the volume of urine formed by causing water to be reclaimed from the DCT and collecting duct. Hence blood osmolarity will not increase and BP will not decrease.

87. If dietary salt intake is excessive, which of the following will NOT occur?

- | | |
|---|---|
| A. Less ADH will be secreted | C. The thirst centre will be stimulated |
| B. The osmolarity of extracellular fluids will increase | D. The extracellular fluid volume increases |

Answer is A: If a greater than recommended amount of salt is in the diet, more ADH will be secreted so that additional water is reclaimed from the nephron filtrate. This will tend to decrease blood osmolarity. Hence it will not occur that “less ADH will be secreted”

88. Which of the following is the best definition of hypertension?

- A. a systolic pressure of more than 140 mmHg and a diastolic pressure of more than 90 mmHg
- B. a diastolic pressure of more than 140 mmHg and a systolic pressure of more than 90 mmHg
- C. a blood pressure of more than 140/90 mmHg measured after 5 minutes of inactivity
- D. a blood pressure of less than 110/70 mmHg measured after 5 minutes of inactivity

Answer is C: Hypertension refers to a resting BP of more than 140/90. Choice A is correct except that there is no reference to being “at rest”.

89. Which of the following readings (in mm Hg) would be considered within a healthy resting blood pressure range?

- | | | | |
|-----------|-----------|-----------|-----------|
| A. 115/70 | B. 120/30 | C. 100/90 | D. 145/90 |
|-----------|-----------|-----------|-----------|

Answer is A: A reading above 140/90 is considered hypertensive. A diastolic reading of 30 is too low; a systolic reading of 100 is low-ish; a systolic reading of 145 is too high

90. Which of the following definitions best describes veins?

- A. a vessel that carries blood towards the heart.
- B. a vessel that carries oxygenated blood.
- C. vessels that carry blood away from the heart.
- D. vessels whose walls are composed of three tunics.

Answer is A: Veins carry blood towards the heart

91. Arteries may be characterized as:

- A. elastic tubes that carry oxygenated blood.

- B. elastic tubes that carry blood away from the heart.
- C. muscular tubes that have valves.
- D. muscular tubes with a larger diameter than veins.

Answer is B: Arteries are both elastic, and carry blood away from the heart. They do not have valves and they are smaller in diameter than veins.

92. Which of the following parts of the cardiovascular system contain the greatest volume of blood? A. heart B. systemic arteries C. pulmonary circulation D. systemic veins

Answer is D: Systemic veins contain about 64 % of the blood volume, while systemic arteries contain about 13 %.

93. What is meant by the “pulmonary circulation”? The flow of blood:
- A. out the aorta and back through the vena cavae.
 - B. from the heart through the lungs and back to the heart.
 - C. into the coronary arteries and back through the coronary sinus.
 - D. into the vena cavae and out to the pulmonary trunk via the right ventricle.

Answer is B: The pulmonary circulation refers to the flow of blood from the heart (via the pulmonary trunk) through the lungs and back to the heart.

94. The usefulness of having elastic arteries is in:
- A. their ability to regulate blood pressure.
 - B. their ability to expand as the heart pumps blood into them
 - C. the assistance they give to venous return.
 - D. their ability to produce vasoconstriction and vasodilation

Answer is B: The expansion of arteries as blood is pumped into them limits resistance to flow and blood pressure. Smooth muscle in the wall produces vasoconstriction and vasodilation.

95. Which of the following does NOT assist in returning the blood to the heart through the veins?
- A. valves in the veins
 - B. the “respiratory pump”
 - C. the effect of gravity
 - D. the pumping action of the heart

Answer is D: The heart’s contractions do not affect blood movement after blood passes through the capillaries. The contraction of the diaphragm, increases pressure in the abdomen and this creates a pressure gradient that pushes blood towards the heart against gravity. Gravity assists blood to return from the head and neck.

96. What is the advantage of having a wide lumen in veins?
- A. It provides less resistance to the blood on its way to heart

- B. It controls the opening and closing of the valves
- C. It produces high pressure on the blood on its way to heart
- D. It helps the pre-capillary sphincters to stay open for a longer time.

Answer is A: The larger is the vessel diameter, the less will be the resistance to blood flow. The other choices are nonsense.

97. What causes venous blood to return to the heart?

- A. The pumping action of the heart.
- B. The squashing action of muscles, and valves in the veins.
- C. Rhythmic vasoconstriction and valves in the veins.
- D. Gravity, valves and the negative pressure generated by the atria emptying.

Answer is B: Valves prevent blood in veins from flowing away from the heart, while contracting skeletal muscle compresses the veins and this pushes blood through them towards the heart (as the valves prevent blood from being pushed in the other direction).

98. Why does the lumen of a large vein have a larger diameter than the lumen of a large artery?

- A. They need to withstand higher pressure than arteries.
- B. Veins contain the majority of the blood volume.
- C. This allows blood to return to the heart rapidly.
- D. So that vasoconstriction can produce a greater change in diameter than for arteries.

Answer is B: Veins contain about 60 % of the blood volume (and because they have thinner walls, they are also more distensible than arteries).

99. The tricuspid valve separates which two structures?

- A. right ventricle and pulmonary trunk
- B. right ventricle and right atrium
- C. left ventricle and aorta
- D. left ventricle and left atrium

Answer is B: The tricuspid valve is also known as the right atrio-ventricular valve, so it lies between the right atrium and right ventricle.

100. Why is the myocardium of the right ventricle thinner than that of the left ventricle?

- A. the left ventricle has to pump a greater volume of blood than the right ventricle.
- B. it results from left ventricular hypertrophy due to increased peripheral resistance.
- C. it pumps blood into the low resistance pulmonary circulation.

- D. it pumps blood into the high resistance systemic circulation.
101. What supplies blood to the myocardium?
- A. the coronary circulation.
 - B. the vena cavae.
 - C. the vasa recta.
 - D. the pulmonary circulation.

Answer is A: The left and right coronary arteries supply the myocardium.

102. Blood flow through the heart follows which of the sequences listed below?

- A. from left atrium, then mitral valve, right ventricle, aorta, left ventricle
- B. from right atrium, then mitral valve, right ventricle, pulmonary trunk, left ventricle.
- C. from pulmonary trunk, then tricuspid valve, left atrium, aortic valve, aorta
- D. .from vena cava, then right ventricle, pulmonary trunk, left ventricle, aorta.

Answer is D: The mitral valve (bicuspid valve) comes after the right ventricle; the tricuspid valve comes before the pulmonary tr