August 11, 2009 Duration: 3 hours

ANSWER ALL QUESTIONS

1. Elastin is like collagen in each of the following ways except:

A. it is covalently cross-linked to other molecules/structures that are common to both proteins

B. approximately 33 % of its amino acid residues are Gly residues

C. it has a higher than average content of the amino acid Proline.

D. it is found in association with collagen in connective tissue

E. it is initially synthesized as a longer precursor molecule

2. Ascorbic acid plays an important role in which amino acid modification of collagen?

A . Oxidation of certain lysines to active aldehydes via lysine oxidase

B . Hydroxylation of certain proline and lysine residues via specific hydroxylases

C . Disulfide bonds formation to place collagen chains in the proper register for triple helix formation

D . Glycosylation of hydroxylysines on their -OH groups

E . None of the above.

3. The substitution that would most likely cause a change in a protein's tertiary structure is

A. serine to threonine. B. arginine to lysine.

C. valine to leucine. D. glutamate to aspartate.

E. histidine to tryptophan

4. The peptide bond has all of the following attributes except:

A.     a partial double bond character

B.     ability to form an H-bond with the side chain of leucine

C.     cis and trans isomers

D.     partial positive and negative charges on carbonyl oxygen and nitrogen

E.      flat planar character (with substituents).

5. Which of the following would most likely provide information regarding the isoelectric point of a protein?

A. protein quaternary structure B. protein solubility as a function of pH

C. protein size D. protein shape

E. protein tertiary structure

Questions 6 – 11: Match the immunoglobulins (A – E) with statements in 6 – 11 *(one to one matching only)*

A. IgG B. IgA C. IgD D. IgE E. IgM

6. Predominantly secreted as a dimer although monomers exist B

7. Pathogen-specific immunoglobulins of this class indicate a recent infection D

8. First to be secreted in response to an antigenic challenge E

9. Each molecule contains four identical antigen binding sites B

10. Actively secreted into external body fluids B

11. Implicated in allergic reactions D

Questions 12-14: Collagen .. 12 … can be monitored by urinary excretion of ..13… . These amino acids can be detected in urine because they are not …14.. in new collagen synthesis during remodeling of collagen.

12. a. turnover =ANS

b. reversal

c. metabolism

d. shake-up

e. synthesis

13. a. proline, glycine, lysine

b. hydroxproline, hydroxylysine

c. hydroxyproline, proline

d. lysine, hydroxylysine

e. glycine, hydroxyproline

14. a. metabolized

b. hydroxylated

c. modified

d. re-utilized =ANS

e. excreted

15. The function of Plasmin is

A. to control osmotic pressure of the blood

B. to hydrolyze fibrin

C. to activate factor XII

D. not yet known

E. none of the above

16. Which of these have almost nothing to do with blood clotting?

A. Calcium B. Liver C. Platelets D. Vitamin B12 E. Fibrinogen

Questions 17 - 22: Select:

A - for increase/attainable/most probable

B - for decrease/unattainable/least probable

C - for no change

Q. 17 – 22: Shin Okubo a renowned Hematologist developed a blood agent called Shaku-Ji that improved tissue oxygenation by increasing the percentage of oxygen that is released from hemoglobin during its passage through the capillaries of extra-pulmonary tissues.

17. This agent will increase the intracellular pH of RBCs, and subsequently stabilize the R state of Hb. B

18. This agent will increase the intracellular pH of RBCs, subsequently leading to an increase in oxygen affinity B

19. Decrease the intracellular pH of RBCs and subsequently lead to an increase in oxygen affinity and destabilization of the R state of Hb B

20. Decrease the intracellular pH of RBCs and subsequently lead to an decrease in oxygen affinity and stabilization of the T state of Hb A

21. Increases the concentration 2,3-BPG leading to an increase in oxygen affinity B

22. Increase the concentration 2,3-BPG leading to a destabilization of the R state and destabilization of the T state. A

23. The clinical manifestation of sickle cell disease are not present at birth because:

a. the spleen of the neonate filters out sickled cells

b. there are no reliable methods to detect it

c. maternal erythrocytes protect the neonatal erythrocyte from sickling

d. HbF interferes with the sickling phenomenon

e. the concentration of HbS is too low =ANS

24. Elastin is like collagen in each of the following ways except:

a. it is covalently cross-linked to other elastin molecules to structures that are common to both proteins

b. approximately 33 % of its amino acid residues are Gly residues

c. it has a higher than average content of the amino acid Proline.

d. it is found in association collagen in connective tissue

e. it is synthesiszed as a longer precursor molecule

25. A new form of insulin has been produced which gives a more rapid response. To produce this new form of insulin, one amino acid in the original molecule was replaced. Which of the following is the replacement scheme?

a. Asp replacing a Pro

b. Gly repacing a Pro

c. Glu replacing Asp

d. Lys replacing Arg

e. Phe replacing Ala

26. Enzymes increase reaction rates by:

a. Altering the change in free energy of the reaction

b. Inhibiting the rate of reverse reactions

c. Changing the equilibrium constant of the reaction

d. Decreasing the energy of activation =ANS

e. Selectively enhancing the rate of  the forward reaction

27. The Michaelis constant (Km) is:

a. Not changed by the presence of a noncompetitive inhibitor

b. The substrate concentration at v = ½ Vmax. =ANS

c. The intercept on the 1/v axis of  Lineweaver-Burk plot.

d. Equal to ½ Vmax.

e. The equilibrium constant for the dissociation of ES to E + P

28. Captopril, a competitive inhibitor for angiotensin converting enzyme, can be used as a therapeutic agent for hypertension. Competitive inhibitors change:

a. The Vmax  of the reaction

b. The Km of the reaction

c. Both the Vmax and the Km of the reaction

d. The substrate specificity of the enzyme

e. None of the above

29. Choose the correct description of an enzyme catalyzed reaction.

a. An enzyme that catalyzes A + B → C + D accelerates the reaction velocity  of the forward reaction, but does not accelerate the reaction velocity  of reverse reaction.

b. Enzymes decrease the activation energy of reactions, but do not affect the free-energy change  ΔG. =ANS

c. Enzymes can change the reaction velocity  without directly interacting with substrates

d. Enzymes mainly consist of proteins. Coenzymes are small compounds that support the structure of the enzymes, but are not involved in the reaction

e. Since enzymes catalyze chemical reactions in much the same manner as inorganic catalysts the higher the reaction temperature the higher the reaction velocity becomes

30. Which of the following statement is not True about the transition state analog?

a. It fits in the active site than the natural substrate

b. It increases the rate of product formation =ANS

c. It can be used as a hapten to produce catalytic antibodies

d. It is usually a distorted or strained molecule

e. It is a potent inhibitor of the enzyme

31. The following statements are general properties of enzymes *Execept*

a. Enzymes are almost exclusively proteins

b. Enzymes have great catalytic power

c. Enzymes bind substrates specifically

d. Enzymes use only hydrophobic interactions in binding substrates =ANS

e. The catalytic activity of enzymes can be regulated

32. In a eukaryotic cell,

a. metabolism is by anaerobic and aerobic means:

b. the DNA is found in the cytoplasm

c. there is a nuclear envelope =ANS

d. there is no cytoskeletal metabolism

e. none of the above apply

33. These lipids predominate in the plasma membrane except:

a. phosphatidylcholine b. cholesterol

c. triacylglycerol d. phosphatidylinositol

e. garri =ANS

34. Which of the following is not true about functions of the membrane protein?

a. they transport ions

b. they are a source of energy for the cell =ANS

c. they bind hormones

d. they take part in signal transduction

e. all of the above are true

Questions 35 & 36: Mrs. Mendes reported at the Mamprobi polyclinic with a 2-year old child who had a fever which did respond to malaria therapy. Blood samples were taken for bacteria cultures and rod shaped bacteria were isolated from blood. After staining the bacteria with gram stain, it could not be decolorized with alcohol.

35. The sub-cellular structure which took up the gram stain is:

a. cell envelope b. nucleoid c. cytoplasm

d. cytoskeleton e. all of the above

36. The bacteria cells isolated probably lack

a. ribosomes b. outer plasma membrane

c. nucleiod d. pili e. none of the above

Questions 37 & 38: During clinical trials of a new drug, Appiah Stadium was accidentally injected with oubain. Within 30 minutes, Appiah Stadium became extremely dizzy and weak, and fell into coma.

37. Biochemical analysis of Appiah Stadium’s serum is expected to show:

a. hyponatremia b. hypokalemia c. hypercalcemia

d. hyperchloremia e. all of the above

38. Appiah Stadium’s ill-health has arisen from defective:

a. ATP synthesis b. ATP hydrolysis c. enzyme phosphorylation

d. membrane transport e. none of the above

Questions 39 – 41: A child was found to be susceptible to bacteria infection. Detailed tests revealed defective phagocytosis by the white blood cells.

39. What cytoskeletal structure is most likely defective?

a. actin b. intermediate fibers c. dyein

d. cytosol e. microtubules

40. What other cellular function may also be altered?

a. mitotic chromatid separation

b. flagellar movement

c. cytokinensis =ANS

d. secretion of proteins

e. glucuronidation

41. This child mother later admitted that her child had ingested an unknown chemical. This chemical is most likely to be:

a. cyanide b. cytochalasin c. colchicines

d. oubain e. paracetamol

42. Analysis of a group of cells showed extreme damage to the lipid component of the plasma membrane by free radicals. Which sub-cellular structure is most likely defective?

a. lysosomes b. Peroxisomes

c. mitochondria d. endoplasmic reticulum

e. liver

43. Post-translational modification of proteins occurs in Golgi apparatus. In the cis-golgi, proteins, destined for the lysosomes are attached with:

a. glucose-6-phospahte b. sialic acid

c. Mannose-6-phosphate d. glyceraldehyde-3-phosphate

e. fructose

44. Defective degradation of worn out organelles within the cells would likely be due to:

a. higher than normal organelle turnover

b. excessive cell proliferation resulting from growth factors

c. Defective ATP-dependent pump in lysosomal membrane

d. modified proteins and lipids found in the sub-cellular structures

e. creatine kinase

45. Erythrocytes suspended in solution for 15 minutes were centrifuged at 2500 g for 10 minutes. The supernatant was deep red. The process that explains the color of the supernatant is:

a. active transport b. simple diffusion

c. facilitated diffusion d. membrane dissolution

e. Osmosis

46. A new species of *Streptococcus aureus* (bacteria) was found to be resistant to the antibiotic Penicillin. What sub-cellular structure is most likely responsible for its resistance?

a. nucleoid b. ribosome c. plasmid

d. phage (virus inhibiting bacteria) e. nannose

47. A characteristic of heterochromatin is that it is:

a. basic b. relatively extended and dispersed

c. transcriptionally inactive d. not attached to any protein

e. rich in arachidonic acid

48. After incubating a group of cells with drug B, it was found that they had lost their ciliary motion. Drug B is most likely:

a. colchicines b. ouabain c. salicyclate

d. fodrine e. celebrex

Questions 49 & 50: Jayzee homogenized a piece of liver in 0.2 M sucrose solution and subjected the mixture to centrifugation at 1000 g for 10 minutes.

49. Jayzee carried out the homogenization in solution because it:

a. creates an osmotic pressure within the organelles

b. dissolves plasma membranes, facilitating organelle isolation

c. prevents organelles from adhering to each other

d. maintains the osmolarity of the homogenizing solution

e. facilitates homogenization

50. after 10 minutes initial centrifugation, the supernatant most likely contains:

a. cytoskeleton b. nuclei

c. plasma membrane d. mitochondria

e. all of the above…….(THE SUPERNATANT NOT THE PELLET)

51. Identify the option that ranks amino acids in order of increasing polarity at physiological pH.

a. Val, Asn, Met, Tyr b. Met, Tyr, Val, Asn

c. Met, Val, Asn, Tyr d. Tyr, Val, Met, Asn

e. Val, Met, Tyr, Asn

52. Binding of the first molecule of oxygen to sickle-cell hemoglobin produces all of the following except:

a. a conformational change in the quaternary structure

b. a cooperative effect comparable to that of normal hemoglobin

c. a decrease in the probability of sickling

d. an enhancement of carbamate formation

e. release of protons

53. Proteins are effective buffers because they contain:

a. a large number of amino acids

b. amino acid residues with different pKs

c. peptide bonds that can readily hydrolyze, consuming OH- and H+ ions

d. a large number of hydrogen bonds in helices

e. amino acid residues with different pKs

54. All of the following about immunoglobulins are true except:

a. IgA is the major immunoglobulin found in external secretions

b. the light chains are similar in each class of immunoglobulins

c. IgG is the dominant immunoglobulin in serum

d. the constant regions of the heavy chain are the same in each class of Ig

e. Ig M is the first Ig secreted in response to an antigen

55. The clinical manifestation of sickle cell disease is not present at birth because:

a. the spleen of the neonate filters out sickled cells

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c. maternal erythrocytes protect the neonatal erythrocyte from sickling

d. HbF interferes with the sickling phenomenon

e. the concentration of HbS is too low

56. Which of the following statements is true?

A. the formation of carbamates decreases the proton concentration

B. on binding oxygen, the iron atom in the heme is oxidized to the ferric state.

C. a high concentration of 2,3-BPG in the erythrocyte enhances the binding of oxygen by hemoglobin.

D. lowering the pH accelerates the release of oxygen from oxyhemoglobin.

E. oxygen binding by any one of the four heme groups occurs independently of the other three.

57. All of the following are true about the pK(s) of an amino acid except:

A. are unique for the α-amino group and α-carboxyl group, i.e., have at least two buffering regions.  
B. exist for all side chains or R-groups.  
C. are the pH value(s) at which 50% of that amino acid functional group is ionized and 50% is not ionized.  
D. ionizable side chains determine the charge of the protein at physiological pH of 7.4.  
E. any amino acid must have at least three different protonation states.

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59. A new form of insulin has been produced which gives a more rapid response. To produce this new form of insulin, one amino acid in the original molecule was replaced. Which of the following is the most likely replacement scheme?

a. Asp replacing a Pro b. Gly repacing a Pro c. Glu replacing Asp

d. Lys replacing Arg e. Phe replacing Ala

60. Which of the following statements about amino acids is INCORRECT? Amino acids may be categorized according to their:

A. polar and non-polar nature.  
B. chemical properties of the side chains.  
C. functional groups attached to the side chains.  
D. ability to form covalent bonds in secondary structures after being incorporated into proteins.  
E. ability to form disulfide bonds in multimeric proteins

61. Mexina at age three could not stand, and only crawled. She had a long history of long-bone

fractures. Radiography revealed long bone abnormalities. Susan’s collagen was examined. Why?

A. collagen is not related to long bone

B. Collagen is a secondary component of bone

C. collagen is intimately involved in bone formation

D. A and B

E. B and C

62. Blood was sampled from two suspected cardiac patients and analyzed

for their isoenzymes of creatine kinase and lactate dehydrogenase in a



quest to determine whether either patient had just experienced a

myocardial infarction. One of the patients showed this profile of

isoenzymes of lactate dehydrogenase, as analyzed by electrophoresis on

cellulose acetate. Which statement below is correct?

A. This indicates necrosis of heart tissue.

B. There are 5 different subunits of lactate dehydrogenase.

C. Only one of these isoenzymes is enzymatically active.

D. Lactate dehydrogenase is positively charged protein at the pH of the electrophoresis.

E. None of the above

63. The peptide bond:  
A. of a polypeptide chain is involved in the strong covalent bonds of the primary structure, as well as the weak, noncovalent hydrogen bonding interactions of any secondary structure.  
B. results from the condensation reaction between the alpha carboxyl group of one amino acid with the alpha amino group of a second amino acid.  
C. is the fundamental linking unit of amino acids that results in the primary structure of a polypeptide chain.  
D. results from condensation of any R-groups or side chains of different amino acids with each other.  
E. results in a somewhat rigid and planar structure.

64. Amino acid side chains:  
A. are expected to be mostly hydrophobic, if they face the interior of the native conformation.  
B. of glutamine and asparagine categorize these as acidic amino acids.  
C. of leucine, isoleucine, tryptophan and phenylalanine are hydrophobic.  
D. of serine and threonine are considered to be hydrophilic.  
E. of the basic and acidic amino acids are normally expected to be ionized or charged at physiological pH

65. The pI of a protein is the:  
A. pK value of the functional groups attached to the a-carbon.  
B. pH value at which it has no charge.  
C. pH value at which the protein is generally most soluble.  
D. pH value at which its net charge is zero.  
E. net pK value of all the ionizable side chains and R-groups.

66. The enzyme form (isozyme) of creatine phosphokinase which is specifically elevated in serum following a heart attack (myocardial infarction) consists of

A. two M subunits.

B. one M and one B subunit.

C. two B subunits.

D. one B and two M subunits.

E. two B and one M subunit

67. Which of the following statements about Hb S is correct?

A. It is a normal hemoglobin found in adults.

B. It is a form of hemoglobin modified by the addition of a cysteine at the C-terminus.

C. It is a mutant form of hemoglobin in which a glutamic acid of each beta chain has been replaced by a valine.

D. The molecule does not aggregate in red cells as well as does HbA.

E. Aggregation of molecules of this form of hemoglobin is promoted by high oxygen concentration

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D. The molecule does not aggregate in red cells as well as does HbA.

E. Aggregation of molecules of this form of hemoglobin is promoted by high oxygen concentration

69. A noncompetitive inhibitor

A. leads to both an increase in the Vmax of a reaction and an increase in the Km.

B. leads to a decrease in the observed Vmax.

C. leads to a decrease in Km and Vmax.

D. leads to a increase in Km without affecting Vmax.

E. increases the steady-state concentration of ES.

70. All of the following statements about allosteric enzymes are true EXCEPT:

A. Positive cooperativity sensitizes the enzyme to small changes in substrate concentration.

B. They frequently catalyze the slowest step in a metabolic pathway.

C. The allosteric site can be located on a subunit different from that containing the catalytic site.

D. The binding of a ligand to the allosteric site induces a conformational change in the active site.

E. They have substrate saturation curves that frequently show first-order kinetics.

71. All of the following may characterize sickle cell anemia EXCEPT that

A. sickling occurs when there is a high concentration of the deoxygenated form of Hb S.

B. Hb S is altered by the change of a single amino acid in the b chain.

C. Hb S has an unchanged electrophoretic mobility relative to normal hemoglobin.

D. the disease can be diagnosed in fetal DNA by restriction enzyme digestion.

E. the solubility of deoxygenated Hb S is abnormally low.

72. Inactive precursors of some enzymes that are activated through hydrolysis reactions are called:

 A. allosteric enzymes B. apoenzymes

C. holloenzymes D. prosthetic groups

E. zymogens

73. These enzymes have different structure but the same catalytic function. Frequently they are oligomers made from different polypeptide chains. These enzymes are called:

A. allosteric enzymes B. isozymes

C. lyases D. proenzymes

E. zymogens

74. which of the following states binds oxygen with the greatest affinity?

A. Hb(O2)2 B. Hb C. Hb(O2)4

D. HbO2 E. Hb(O)3

75. Analysis of electrophoretic patterns of hemoglobin isolated from blood of patients heterozygous for the sickle cell gene would show \_\_\_\_ bands.

A. one B. five C. four D. two E. three

76. Deoxygenated sickle hemoglobin differs from deoxygenated normal hemoglobin in:

A. Quaternary structure B. secondary and tertiary structure

C. primary and tertiary structure D. Quaternary and tertiary structure

E. primary structure

Questions 77 and 78: Your patient is a professional football player who had a rough game against local city rivals, Enugu Rangers over the weekend. Today, your patient complains of chest pain and is worried about it. As part of his checkup, you assay creatine kinase (CK) isozymes. Results of this assay are:

*Isozymes activity*

BB not present

MB normal

MM elevated

77. CK isozyme is elevated in which of the following tissues?

A. heart B. muscle C. brain

D. none E. brain, muscle and heart

78. What do you tell your patient about his chest pain?

A. he has a myocardial infarction

B. he should take a break from football and play golf

C. it is not real; he is just imaging it

D. he is being tackled often, and taking too many falls.

E. he getting too many heartbreaks from unfaithful women

79. Enzymes increase reaction rates by:

A. Altering the change in free energy of the reaction

B. Inhibiting the rate of reverse reactions

C. Changing the equilibrium constant of the reaction

D. Decreasing the energy of activation

E. Selectively enhancing the rate of  the forward reaction

80. The Michaelis constant (Km) is:

A. Not changed by the presence of a noncompetitive inhibitor

B. The substrate concentration at v = ½ Vmax.

C. The intercept on the 1/v axis of  Lineweaver-Burk plot.

D. Equal to ½ Vmax.

E. The equilibrium constant for the dissociation of ES to E + P.

81. Captopril, a competitive inhibitor for angiotensin converting enzyme, can be used as a therapeutic agent for hypertension. Competitive inhibitors change:

A. The Vmax  of the reaction

B. The Km of the reaction

C. Both the Vmax and the Km of the reaction

D. The substrate specificity of the enzyme

E. None of the above

82. Choose the correct description of an enzyme catalyzed reaction.

A. An enzyme that catalyzes A + B → C + D accelerates the reaction velocity  of the forward reaction, but does not accelerate the reaction velocity  of reverse reaction.

B. Enzymes decrease the activation energy of reactions, but do not affect the free-energy change  ΔG.

C. Enzymes can change the reaction velocity  without directly interacting with substrates

D. Enzymes mainly consist of proteins. Coenzymes are small compounds that support the structure of the enzymes, but are not involved in the reaction

E. Since enzymes catalyze chemical reactions in much the same manner as inorganic catalysts the higher the reaction temperature the higher the reaction velocity becomes.

83. Which of the following statement is not True about the transition state analog?

A. It fits in the active site than the natural substrate

B. It increases the rate of product formation

C. It can be used as a hapten to produce catalytic antibodies

D. It is usually a distorted or strained molecule

E. It is a potent inhibitor of the enzyme

84. The following statements are general properties of enzymes *except:*

A. Enzymes are almost exclusively proteins

B. Enzymes have great catalytic power

C. Enzymes bind substrates specifically

D. Enzymes use only hydrophobic interactions in binding substrates

E. The catalytic activity of enzymes can be regulated

85. Which of the following statements is true?

A. the formation of carbamates decreases the the proton concentration

B. on binding oxygen, the iron atom in the heme is oxidized to the ferric state.

C. a high concentration of 2,3-BPG in the erythrocyte enhances the binding of oxygen by hemoglobin.

D. lowering the pH accelerates the release of of oxygen from oxyhemoglobin.

E. oxygen binding by any one of the four heme groups occurs independently of the other three.

86. All of the following about immunoglobulins are true except:

a. IgA is the major immunoglobulin found in external secretions

b. the light chains are similar in each class of immunoglobulins

c. IgG is the dominant immunoglobulin in serum

d. the constant regions of the heavy are the same in each class of Ig

e. Ig M is the first Ig secreted in response to an antigen

87. The answer that ranks amino acids in order of increasing polarity at physiological pH is:

a. Val, Asn, Met, Tyr

b. Met, Tyr, Val, Asn

c. Met, Val, Asn, Tyr

d. Tyr, Val, Met, Asn

e. Val, Met, Tyr, Asn

88. Binding of the first molecule of oxygen to sickle-cell hemoglobin produces all of the following except:

a. a conformational change in the quaternary structure

b. a cooperative effect comparable to that of normal hemoglobin

c. a decrease in the probability of sickling

d. an enhancement of carbamate formation

e. release of protons

89. Proteins are effective buffers because they contain

a. a large number of amino acids

b. amino acid residues with different pKs

c. peptide bonds that can readily hydrolyze, consuming OH- and H+ ions

d. a large number of hydrogen bonds in helices

e. amino acid residues with different pKs

Questions 90 – 93: SELECT:

A if your answer is INCREASE, B if your answer is DECREASE, C if your answer is NO CHANGE

Questions 90 – 93: As part of your medical internship in a new laboratory, you have been asked to perform detailed analysis of human tissue (skin, aortic tissue) from a copper-deficient patient. Indicate (*by circling the best answer*) how you would expect the following to vary:

90. Lysyl oxidase activity in skin tissue: increase decrease no change

91. Lysine cross-linking in aortic tissue: increase decrease no change

92. hydroxylation of lysine resideues in aortic tissue: increase decrease no change

93. Hydroxylation of Proline in aortic tissue: increase decrease no change

94. What functional advantage (s) might there be to a red blood cell lacking mitochondria?

A. Red blood cells contain hemoglobin so the lack of mitochondria may give the cell more room for hemoglobin.

B. RBCs cannot use up the oxygen they are carrying for their own energy needs.

C. Red blood cells do not creep around like the white blood cells do so they don not need much energy.

D. A and B

E. B and C.

95. A red marrow biopsy is ordered for two patients -- one a child and the other an adult. The specimen is taken from the tibia of the child but from the iliac crest of the adult. Explain why different sites are used to obtain marrow samples in adults and children.

A. In adults, red marrow is found chiefly in the flat bones of the skull and ribs, sternum and proximal epiphyses of the humerus and femur.

B. In children, red marrow is found in the bone marrow cavities of all the bones.

C. Both A and B

D. Neither A nor B

E. None of the above

96. Which sequence is CORRECT concerning homeostasis?

1. Fibrinogen ---> fibrin 2. Clot retraction

3. Release of platelet activating factors 4. Prothrombin ---> thrombin

A. 3, 4, 1, 2 B. 1, 2, 3, 4 C. 4, 3, 1, 2

D. 3, 2, 1, 4 E. 3, 4, 2, 1

97. If you add anti-A agglutinin to a blood sample and agglutination, or clumping occurs, the presence of which antigen or agglutinogen is indicated?

A. Antigen A B. Antigen B C. Antigen O

D. Antigen D E. None of the above

98. All the following choices are compatible pairs of donor & recipients, respectively, except:

A. A & AB B. B & O C. B and AB

D. O & O E. None of the above

99. If a father is Rh- and a mother is Rh+, and both father and mother are homozygous for the Rh factor, what will their offspring be as far as Rh factor is concerned?

A. All will be Rh+

B. None of the children will have the Rh factor

C. All the girls will be Rh+ and all the boys will be Rh-

D. All will be Rh-

E. None of the above

100. Which of the following blood groups has no agglutinogens in its red blood cells?

A. Type O- B. Type A+ C. Type B-

D. Type AB+ E. Type AB-

102. These are events in clotting of blood:

1. Severing of a vessel 2. Clot retraction

3. Fibrin formation 4. Agglutination of platelets

Put the answers in CORRECT order.

A. 1,2,3,4 B. 2,3,4,1 C. 3,4,1,2

D. 4,1,2,3 E. 1,4,3,2

103. Which of the following is not a formed element of the blood?

A. Erythrocyte B. Thrombocyte C. Leukocyte

D. Albumin E. Neutrophil

104. The only formed elements that possess a nucleus when mature are

A. thrombocytes B. erythrocytes C. leukocytes

D. platelets E. All of the above

105. Erythrocytes:

A. are the least numerous of the formed elements

B. are cylindrically shaped cells

C. are produced in yellow bone marrow

D. do not have a nucleus when mature

E. All of the above

106. Which of the following cell types is incorrectly matched with its description?

A. Neutrophils -- polymorphonuclear

B. Basophils – release histamine

C. Lymphocytes -- contain bright orange granules

D. Eosinophils – increase in an allergic reaction

E. Monocytes -- phagocytize bacteria

107. Serotonin and thromboxane, when released from platelets,

A. stimulate prostaglandin formation

B. activate other platelets

C. increase the sticky surface of the platelets

D. stimulate local vascular spasms

E. active fibrinogen

108. Formation of extrinsic thromboplastin requires

A. tissue thromboplastin

B. calcium ion

C. activated factor V

D. factor VII

E. All of these

109. Which of the following events is not one of the three main stages of coagulation?

A. Conversion of fibrin to fibrinogen

B. Production of prothrombin activator

C. Conversion of prothrombin to thrombin

D. All of the above

E. None of the above

110. Heparin

A. is a potent anticoagulant

B. is produced by basophils

C. blocks the action of thrombin

D. Both A and C

E. A, B, and C