MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Which two populations account for the greatest difference in reference intervals? 1) _____
A) Whites and blacks B) Adults and 12-year-olds
C) Newborns and adults D) Newborns and 12-year-olds
Answer: C

2) What component of plasma assists in the transport of bilirubin? 2) _____
A) Enzymes B) Calcium C) Hydrogen D) Albumin
Answer: D

3) When bilirubin is increased above the reference range, what disease process should be suspected if liver disease is ruled out? 3) _____
A) Hormone imbalance B) Increased metabolism of hemoglobin
C) Decreased albumin D) Increased osmotic pressure
Answer: B

4) Which of the following can explain a decrease of erythrocytes? 4) _____
A) Dehydration B) Neutropenia C) Blood loss D) Infection
Answer: C

5) Platelets and coagulation proteins are circulating components responsible for what process? 5) _____
A) Hemostasis B) Hemolysis
C) Immune defense D) Normal cell production
Answer: A

6) The focus of a clinical pathway is on changing structure and processes to achieve what goal? 6) _____
A) Provide better patient outcomes
B) Provide assistance in difficult diagnostic cases
C) Develop better communication among the health care team
D) Decrease laboratory test utilization
Answer: A

7) Under Medicare for laboratory testing, what codes are used for billing purposes? 7) _____
A) Capitated payment plan B) Fee for service
C) Current procedural terminology D) Prospective payment service
Answer: C

8) Under a capitated payment plan, the provider is decided upon by whom? 8) _____
A) Health care organizations B) The consumer or patient
C) Physicians groups D) The insurer
Answer: D

9) Under managed cost plans, laboratory services must be considered as what? 9) _____
A) A reimbursement source B) A cost
C) A managed resource D) A source of revenue
Answer: C

10) The predominant blood leukocyte found in children is the: 10) _____
A) Neutrophil. B) Eosinophil. C) Monocyte. D) Lymphocyte.
Answer: D

11) The cellular component of blood that is involved in hemostasis is: 11) _____

A) Hemoglobin. B) Thrombocyte. C) Leukocyte. D) Erythrocyte.

Answer: B

12) The protein found in erythrocytes that is responsible for oxygen transport is: 12) _____

A) Albumin. B) Oxygen protein.

C) Gamma globulin. D) Hemoglobin.

Answer: D

13) Which of the following is NOT a cellular component of blood? 13) _____

A) Albumin B) Leukocytes C) Erythrocytes D) Platelets

Answer: A

14) The liquid portion of anticoagulated blood is called: 14) _____

A) Whole blood. B) Serum.

C) Plasma. D) None of the above.

Answer: C

15) What percentage of the total blood volume is comprised of formed elements? 15) _____

A) 45 B) 10 C) 100 D) 55

Answer: A

16) An abnormal test result is defined as: 16) _____

A) The opposite of a normal test result.

B) A value that is outside the reference interval for a particular analyte.

C) A value that is above the reference range for a single analyte.

D) A value that is below the reference range for multiple analytes.

Answer: B

17) Payment for health care services under Medicare is based on: 17) _____

A) Fee for services. B) PPS.

C) Capitated pay. D) None of the above.

Answer: B

18) In disease management, the term "practice guidelines" is synonymous with: 18) _____

A) Critical pathway. B) Managed care.

C) Patient-focused approach. D) Clinical pathway.

Answer: D

19) Which of the following is NOT a role of the clinical laboratory professional? 19) _____

A) Correlate lab results with appropriate disease states

B) Order reflex tests

C) Correlate lab results with treatment

D) Correlate lab results with disease pathophysiology

Answer: B

20) Which of the following is an expected finding in a newborn? 20) _____

A) Hemoglobin = 17.0 g/dL B) WBC count = 2×10^9/L

C) PLT count = 100×10^9/L D) RBC count = 3.50×10^9/L

Answer: A

21) Which of the following blood cell components would be most influenced in a patient with ton sillitis?

21) _____
A) Erythrocyte B) Leukocyte C) Thrombocyte D) Hemoglobin
Answer: B

22) Which of the following formed elements could result in hypoxia if decreased? 22) _____
A) Platelets B) Erythrocytes
C) Leukocytes D) None of the above
Answer: B

23) Which component of blood passes through blood vessel walls into surrounding tissues to defend the body against invading foreign antigens? 23) _____
A) Leukocytes B) Platelets
C) Red blood cells D) Gamma globulin
Answer: A

24) Which of the following blood constituents is associated with increased red blood cell destruction? 24) _____
A) Blood urea nitrogen B) Albumin
C) Immunoglobulins D) Bilirubin
Answer: D

25) All of the following must be taken into consideration when establishing a reference interval for a group of individuals except: 25) _____
A) Occupations of the population. B) The geographic area.
C) Age of the population. D) Sex of the population.
Answer: A

26) What is the main difference between capitated pay and fee-for-service pay? 26) _____
A) Amount of reimbursement
B) Type of health care providers who can participate
C) Entity controlling the service and fees
D) The selection of beneficiaries by the insurer
Answer: C

27) What is the main difference between the clinical pathway and the critical pathway? 27) _____
A) Nothing; they are the same thing.
B) Critical pathways are developed by the physicians and clinical pathways are developed by the laboratory team.
C) Physicians are reimbursed for services based on the clinical pathway used while the laboratory is reimbursed based on a critical pathway.
D) The clinical pathway helps determine a method of diagnosis and treatment, whereas a critical pathway occurs after treatment has begun.
Answer: D

28) Which of the following tests could be reflexed from an abnormal prothrombin time? 28) _____
A) Hemoglobin analysis B) Measurement of albumin
C) Complete blood count D) Molecular analysis of clotting factors
Answer: D

29) Which of the following could be reflexed from an abnormal RBC count? 29) _____
A) WBC count B) Prothrombin time
C) Reticulocyte count D) Blood urea nitrogen

Answer: C

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

30) Explain how a reference interval is determined. 30) _____

Answer: A reference interval for a given region is determined by calculating the mean for a group of "normal healthy" individuals. Conditions that must be considered include physiologic differences in a given population as well as the geographic area. Once the mean has been determined, a calculation to determine the standard deviation must be done. The range is calculated by taking the mean and 2 standard deviations above and below the mean value.

31) Name three blood analytes that show significantly different results in adults, children, and infants. 31) _____

Answer: Hemoglobin is higher in infants and children than in adults. WBC counts are higher in infants than in children and adults. Differential results are different in children (inverted ratio of lymphs: neutrophils) than in infants and adults.

32) Explain how the hemostatic pathway is activated in times of need. 32) _____

Answer: Traumatic events to body tissue stimulate the activation of repair mechanisms. As a result of both external and internal stimuli, the hemostatic pathway becomes activated in stages called primary, secondary hemostasis and fibrinolysis

33) List five ways to optimize laboratory test utilization to improve patient outcomes. 33) _____

Answer: Five ways to optimize laboratory test utilization include: Development of critical pathways, managing the test ordering system, instituting sequential testing protocols, eliminating incorrect use of tests, and designing wellness panels.

34) Give two reasons for transfusing leukoreduced, irradiated, packed red blood cells. 34) _____

Answer: Reasons for transfusing leukoreduced packed red blood cells are: to decrease the risk of febrile nonhemolytic transfusion reactions, to decrease risk of HLA sensitization, and to decrease the risk of CMV transmission. Irradiation is used to reduce the risk of graft-versus-host disease.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

35) Protein synthesis occurs predominantly in the: 35) _____

A) Lysosome. B) Cell membrane. C) Nucleus. D) Cytosol.

Answer: D

36) The plasma membrane of blood cells is characterized by which of the following? 36) _____

A) The hydrophilic ends of the phospholipids directed toward the inside of the lipid bilayer
B) The absence of peripheral proteins
C) Carbohydrate components (of glycolipids, glycoproteins) embeded in the lipid bilayer
D) The asymmetric distribution of the phospholipids

Answer: D

37) Which phospholipids are found predominantly in the outer layer of the lipid bilayer? 37) _____

A) Phosphatidylethanolamine and phosphatidylserine
B) Phosphatidylserine and sphingomyelin
C) Phosphatidylcholine and sphingomyelin
D) Phosphatidylethanolamine and phosphatidylcholine

Answer: C

38) In which phase of the cell cycle is a cell quiescent? 38) _____
A) The S phase B) The R phase C) The G0 phase D) The G1 phase
Answer: C

39) The point in the cell cycle after which cell division is complete but before the next round of DNA synthesis is: 39) _____
A) The G0 phase. B) The G1 phase. C) The G2 phase. D) The R phase.
Answer: B

40) In order to maintain _____, terminally differentiated blood cells undergo _____. 40) _____
A) Tumor suppression; apoptosis B) Cell regeneration; necrosis
C) Homeostasis; apoptosis D) Cell cycle division; necrosis
Answer: C

41) All of the following are promoters of apoptosis except: 41) _____
A) TNF-alpha. B) BCL-2. C) Fas Ligand. D) Caspases.
Answer: B

42) Apoptosis plays a role in human development in all of the following except: 42) _____
A) Removal of interdigital webs of the hands and feet.
B) Selection of appropriate T and B lymphocyte clones.
C) Differentiation (divergence) of mast cells and basophils.
D) Formation of the blood vessels and the gastrointestinal tract.
Answer: C

43) All of the following are mechanisms of apoptosis in hematopoiesis except: 43) _____
A) Final stages of RBC maturation.
B) Elimination of PMNs and eosinophils after an inflammatory response.
C) Progression of acute leukemias.
D) Elimination of B cell clonal populations after infection responses.
Answer: C

44) Which cytoplasmic organelle's function is lipid synthesis? 44) _____
A) Ribosomes B) Golgi apparatus
C) Smooth endoplasmic reticulum D) Mitochondria
Answer: C

45) Which phospholipids are predominantly found in the inner layer of the lipid bilayer? 45) _____
A) PS and SM B) PE and PS C) PE and PC D) PC and SM
Answer: B

46) In which phase of mitosis do the chromosomes align on opposite poles of the cell? 46) _____
A) Prophase B) Metaphase
C) Interphase D) Anaphase and telophase
Answer: D

47) The (R) restriction point occurs during what phase in the cell cycle? 47) _____
A) G_1 B) G_2 C) S D) M
Answer: A

48) If an organism fails to regulate apoptosis, resulting in excessive apoptosis, which of the foll owing

processes might result? 48) ___ ___

A) Carcinoma B) Lymphoma
C) Neurodegenerative disorder D) Autoimmune disorder
Answer: C

49) The sections of a gene which contain the coding sequences for the final protein product are: 49) _____
A) UTRs. B) Nucleosomes. C) Introns. D) Exons.
Answer: D

50) Which of the following influences the stability of the mRNA and the efficiency of translation? 50) _____
A) Introns B) Exons
C) Single-nucleotide polymorphisms D) Untranslated regions
Answer: D

51) To be considered a true polymorphism, a SNP must occur with a frequency of: 51) _____
A) >5% B) >1% C) >10% D) >25%
Answer: B

52) Structurally abnormal proteins can be eliminated from the body by tagging them with _____ and sending them to the _____. 52) _____
A) Cyclins; necrosis pathway B) CDKs; apoptosis pathway
C) Ubiquitin; proteosome D) Caspase; apoptosis pathway
Answer: C

53) Which cyclin component is predominant in the G1 phase of the cell cycle? 53) _____
A) Cyclin B1 B) Cyclin A C) Cyclin D D) Cyclin E
Answer: C

54) What protein is responsible for activating phosphorylation of all kinases involved in the cell cycle? 54) _____
A) Cdk inhibitor B) CAK C) Cdk D) Cyclin
Answer: B

55) Predict the effect of p16 on the cell cycle of dividing cells. 55) _____
A) No change in the cell cycle progression B) Decreased cell cycle progression
C) Initiate apoptosis D) Increased cell cycle progression
Answer: B

56) At which checkpoint would detection of unreplicated DNA strands occur? 56) _____
A) G1 checkpoint B) Metaphase checkpoint
C) S phase checkpoint D) G2/M checkpoint
Answer: D

57) Which regulatory protein is present in all stages of the cell cycle but has varying degrees of phosphorylation (activation) from phase to phase? 57) _____
A) p53 B) Rb protein C) Cyclin D D) p21
Answer: B

58) Initiation of apoptosis occurs primarily with: 58) _____
A) Activation of BCL-2.

B) Activation of p53.
C) Stimulus from an inflammatory response.
D) Cleavage of appropriate caspases at timely intervals.
Answer: D

59) Exposure to radiation would lead to activation of which caspase pathway? 59) _____
A) Common pathway B) Extrinsic pathway
C) Intrinsic pathway D) None of the above
Answer: C

60) Predict the effect of the Bax:Bcl-2 complex on the apoptotic pathway. 60) _____
A) The pathway will be activated and then inhibited by Bax:Bcl-2.
B) The pathway is activated by Bax: Bcl-2.
C) The pathway is not affected by Bax: Bcl-2.
D) The pathway is inhibited by Bax: Bcl-2.
Answer: D

61) Which of the following are apoptosis activators? 61) _____
A) Bak B) Bcl-X_L C) BCL-2 D) Mcl-1
Answer: A

62) Malignancies can result from which of the following? 62) _____
A) Normal occurrence of apoptosis B) Accelerated apoptosis
C) Inhibited apoptosis D) None of the above
Answer: C

63) Clearance of cytotoxic T cells after an immune response results from: 63) _____
A) Inhibited apoptosis. B) Normal occurrence of apoptosis.
C) Accelerated apoptosis. D) None of the above.
Answer: C

64) All of the following are potential proto-oncogenes except: 64) _____
A) Proteins that neutralize growth factor receptors.
B) Proteins that bind DNA.
C) Growth factors.
D) Proteins that function as growth factor receptors.
Answer: A

65) UTRs constitute which segments of mRNA? 65) _____
A) Heteronuclear RNA B) Exons
C) 3' and 5' ends D) Introns
Answer: C

66) Disposal of damaged or misfolded proteins is carried out by which cell component? 66) _____
A) Lysosome B) Ubiquitin/proteosome system
C) Molecular chaperones D) Caspase/apoptosis system
Answer: B

67) Cdk or kinase must be complexed with what molecule to drive one cell to the next cell-cycle stage? 67) _____
A) DNA B) Cyclin
C) Phosphorylating enzymes D) mRNA

Answer: B

68) Which two proteins are critical for the effective function of the G1 checkpoint? 68) _____
A) P53 and Rb B) Cyclin E C) P21 and p57 D) Cdk4 and Cdk6
Answer: A

69) What feature distinguishes necrosis from apoptosis? 69) _____
A) Necrosis induces inflammation.
B) Necrosis results in nuclear fragments of 185 base pairs.
C) Necrosis requires ATP.
D) Necrosis is characterized by cellular shrinkage and chromatin condensation.
Answer: A

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

70) Explain in detail how p53 and Rb can contribute to the onset of malignancy. 70) _____
Answer: Rb is the protein product of the retinoblastoma susceptibility gene, which predisposes individuals to retinoblastomas and other tumors when only one functional copy is present. Rb is present all throughout the cell cycle. Phosphorylations vary with each cell-cycle phase. In its hypophosphorylated (active) state, Rb has antiproliferative effects, inhibiting cell cycling. It does this by inhibiting transcription factors required for the transcription of genes needed for cell proliferation, rendering them nonfunctional. Hyperphosphorylation, on the other hand, neutralizes (inactivates) the Rb protein, thus promoting cell cycle division.
P53 acts as a molecular policeman; it monitors the integrity of the genome. It can activate and inhibit gene expression depending on the target gene. It is activated in response to DNA breakage, and slows cell-cycle division to initiate DNA repair or apoptosis. It functions as a tumor suppressor gene, and it is the most common mutated gene in tumors.

71) List three ways in which the caspase pathway can be activated. Explain the role of each, and also indicate which arm of the caspase pathway will be activated. 71) _____
Answer: The extrinsic pathway of apoptosis is triggered by extracellular "death" signals (TNF, Fas Ligand, and CD95). The intrinsic pathway of apoptosis is triggered by intracellular signals in response to stress, exposure to cytotoxic agents, and radiation.

72) Describe the apoptotic pathway. 72) _____
Answer: Death receptor binding of death receptor to cell receptor → caspase recruitment → activation of initiator caspases → activation of effector caspases → cleavage of crucial cellular proteins → cell death.

73) Explain the role of epigenetic alterations in cancer development. 73) _____
Answer: The most common epigenetic change in the development of cancer involves a methylation/demethylation of CpG dinucleotide bases. Cancer may involve demethylation of promoter regions of genes making them transcriptionally ready. Methylation may result in transcriptional silencing of the gene and loss of function of tumor suppressor genes. Deacetylation of key histones may result in gene silencing, which may favor growth over differentiation.

74) List the four major phospholipids found in the plasma membrane of hematopoietic cells, and explain their unique distribution. 74) _____

Answer: The four major phospholipids that are found in the plasma membrane are phosphatidylethanolamine (PE), phosphatidylserine (PS), phosphatidylcholine (PC), and sphingomyelin (SM). Most blood cells have an asymmetric distribution of these phospholipids, with PE and PS occurring in the inner layer and PC and SM occurring in the outer layer.

1) C
2) D
3) B
4) C
5) A
6) A
7) C
8) D
9) C
10) D
11) B
12) D
13) A
14) C
15) A
16) B
17) B
18) D
19) B
20) A
21) B
22) B
23) A
24) D
25) A
26) C
27) D
28) D
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35) D
36) D
37) C
38) C
39) B
40) C

41) B
42) C
43) C
44) C
45) B
46) D
47) A
48) C
49) D
50) D
51) B
52) C
53) C
54) B
55) B
56) D
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