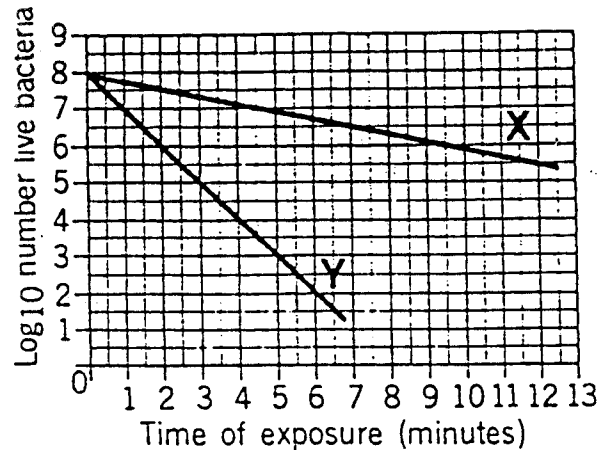




The graph shows the number of live bacteria remaining after exposing a culture for different times to 50 C (curve X) or 70 C (curve Y). To achieve the same degree of killing as at 70 C, the culture should be kept at 50 C for how many times longer?

- (A) 2
- (B) 5
- (C) 10
- (D) 50
- (E) 100

Which of the following is a penicillin-binding protein?

- (A) Alanine racemase
- (B) Glycine pentapeptide
- (C) Peptidoglycan
- (D) Porin protein
- (E) Transpeptidase

10. Sulfonamides inhibit the synthesis of

- (A) dipicolinic acid
- (B) DNA
- (C) folic acid
- (D) PABA
- (E) RNA

11. Molecular cloning of a eukaryotic mRNA would begin with

- (A) alkaline phosphatase
- (B) Bal 31 exonuclease
- (C) DNA ligase
- (D) restriction endonuclease
- (E) reverse transcriptase

12. The effectiveness of immunization with diphtheria toxoid is based on the fact that the

- (A) contained bacterial proteins stimulate a state of hypersensitivity to corynebacteria
- (B) toxoid stimulates production of antibodies that opsonize invading corynebacteria for rapid phagocytosis
- (C) toxoid is converted into immune globulins that are bactericidal
- (D) toxoid stimulates the production of specific antitoxin
- (E) antitoxin prevents invasion of the blood stream by corynebacteria

13. The first globulin to be synthesized by the fetus is

- (A) IgA
- (B) IgD
- (C) IgE
- (D) IgG
- (E) IgM

14. An antibody against the variable region of the Fab fragment is called

- (A) anti-Gm
- (B) anti-hinge
- (C) allotypic
- (D) idiotypic
- (E) isotypic

15. In the classical pathway of activation of complement by immune (antigen-antibody) complexes, the complement cascade is triggered by

- (A) C3 convertase
- (B) direct binding of C1q to the antibody molecules
- (C) direct binding of C3b to the antibody molecules
- (D) direct binding of C5b to the antibody molecules
- (E) properdin

16. Which of the following is NOT a mast cell-derived mediator?

- (A) γ -Interferon
- (B) Histamine
- (C) Leukotriene D₄
- (D) Platelet-activating factor
- (E) Vasoactive intestinal polypeptide

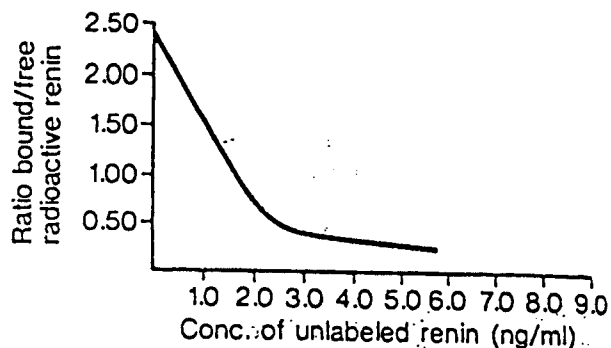
17. Immunization against tetanus is effective because it produces

- (A) activated macrophages that phagocytose bacteria
- (B) antibodies that fix complement and lyse bacteria
- (C) antibodies that prevent *Clostridium tetani* from entering the blood stream
- (D) antibodies that prevent tetanus toxin from entering peripheral nerve cells
- (E) IgA antibodies that prevent colonization of the gastrointestinal tract

18. The observation that proves that immune responses are controlled by the central nervous system is:

- (A) A diminished concentration of norepinephrine is found in the spleen during an immune response
- (B) Immune responses are decreased in stressed animals
- (C) Lymphocytes have receptors for sympathetic mediators
- (D) There are sympathetic nerve fibers in lymphoid organs
- (E) None of the above provides proof

19. A radioimmunoassay consists of mixing a patient's serum with a known amount of radiolabeled renin and then adding insoluble antibody to renin. The resultant supernatant contains 9000 CPM and the precipitate 6000 CPM.



The concentration of renin in the patient's serum (in ng/mL) is

- (A) less than 0.5
- (B) approximately 1.0
- (C) approximately 2.0
- (D) approximately 5.0
- (E) more than 5.0

20. Similar microscopic morphology is shared by

- (A) *Aspergillus fumigatus*, *Coccidioides immitis*, *Mycobacterium kansasii*
- (B) *Bacillus anthracis*, *Clostridium botulinum*, *Bacteroides fragilis*
- (C) *Streptococcus pneumoniae*, *Klebsiella pneumoniae*, *Mycoplasma pneumoniae*
- (D) *Pseudomonas aeruginosa*, *Proteus mirabilis*, *Salmonella typhimurium*
- (E) *Trichomonas vaginalis*, *Herellea vaginicola*, *Hemophilus vaginalis*

21. Among the major causative agents of primary bacterial (nontraumatic) meningitis, the common characteristic is

- (A) an exotoxin
- (B) an endotoxin
- (C) a polysaccharide capsule
- (D) flagella
- (E) penicillin resistance

2. An arthropod vector is the main source of human infection in each of the following EXCEPT
 - (A) scrub typhus
 - (B) Q fever
 - (C) rickettsialpox
 - (D) epidemic typhus
 - (E) Rocky Mountain spotted fever
3. The moiety responsible for the toxicity of endotoxin is
 - (A) teichoic acid
 - (B) "core" polysaccharide
 - (C) peptidoglycan
 - (D) lipid A
 - (E) octanoic acid
24. DNA from which of the following pairs of bacteria would show the greatest degree of DNA-DNA hybridization?
 - (A) *Actinomyces israelii* and *Proteus vulgaris*
 - (B) *Staphylococcus aureus* and *Corynebacterium diphtheriae*
 - (C) *Streptococcus pyogenes* and *Mycobacterium tuberculosis*
 - (D) *Shigella dysenteriae* and *Escherichia coli*
 - (E) *Clostridium perfringens* and *Bacteroides fragilis*
25. Which of the following is caused by an organism that is LEAST likely to be found in the normal microbial flora in humans?
 - (A) Subacute infective (bacterial) endocarditis
 - (B) Uncomplicated infection of the urinary tract
 - (C) Bacillary dysentery
 - (D) Dental caries
 - (E) Pulmonary abscess
26. Which of the following produces a heat-stable enterotoxin while growing in meat, dairy or bakery products?
 - (A) *Clostridium botulinum*
 - (B) *Clostridium tetani*
 - (C) *Pseudomonas aeruginosa*
 - (D) *Staphylococcus aureus*
 - (E) *Vibrio cholerae*
27. Which of the following organisms possesses a surface component, protein A, which interacts nonspecifically with the Fc portion of IgG of virtually all mammalian species?
 - (A) *Escherichia coli*
 - (B) *Listeria monocytogenes*
 - (C) *Staphylococcus albus*
 - (D) *Staphylococcus aureus*
 - (E) *Streptococcus pneumoniae*
28. Which of the following organisms would be most likely to grow and form colonies on nutrient agar containing a high concentration of chloramphenicol (1 mg/mL)?
 - (A) *Bacillus anthracis*
 - (B) *Candida albicans*
 - (C) *Rickettsia prowazekii*
 - (D) *Salmonella typhimurium*
 - (E) *Staphylococcus aureus*
29. Cultured animal cells inoculated with urethral scrapings give rise to cytoplasmic inclusions. This is diagnostic for infection with
 - (A) *Chlamydia trachomatis*
 - (B) herpes simplex virus, type 2
 - (C) *Neisseria gonorrhoeae*
 - (D) *Treponema pallidum*
 - (E) *Ureaplasma urealyticum*
30. During the course of typical infection in humans, which of the following bacteria is LEAST likely to be disseminated via the bloodstream?
 - (A) *Mycobacterium tuberculosis*
 - (B) *Rickettsia rickettsii*
 - (C) *Salmonella typhi*
 - (D) *Shigella flexneri*
 - (E) *Treponema pallidum*
31. Which of the following is the most reliable method for differentiating *Streptococcus pneumoniae* from *Streptococcus mutans*?
 - (A) Catalase test
 - (B) Cellular morphology
 - (C) Gram stain reaction
 - (D) Optochin sensitivity
 - (E) Type of hemolysis

32. The causal agent of subacute sclerosing panencephalitis is

- (A) cytomegalovirus
- (B) influenza virus
- (C) measles virus
- (D) parainfluenza virus
- (E) *Rickettsia rickettsii*

33. Living attenuated vaccines have been licensed for each of the following diseases EXCEPT

- (A) influenza
- (B) measles
- (C) mumps
- (D) poliomyelitis
- (E) rubella

34. Which of the following is most likely to spread from person to person?

- (A) Blastomycosis of the lung
- (B) Coccidioidomycosis of the bone
- (C) Disseminated histoplasmosis
- (D) Oral candidiasis
- (E) Tinea capitis

35. Sporotrichosis is most commonly acquired by

- (A) a mosquito bite
- (B) breathing of spore-laden dust
- (C) eating contaminated food
- (D) sexual contact
- (E) skin puncture by a rose thorn

36. The persistence of pathogenic African trypanosomes in the blood is due to

- (A) antigenic variation
- (B) immunologic paralysis
- (C) reinfection
- (D) a "protective" polysaccharide capsule
- (E) the release of new organisms from the capillary bed

37. Laboratory diagnosis of *Trichomonas* infections is usually made from

- (A) blood
- (B) feces
- (C) tissue obtained by muscle biopsy
- (D) sputum
- (E) vaginal secretions

38. In humans, infection with hepatitis B may persist. This can be determined by detection in the blood of

- (A) complement-fixing antibody to HBs antigen
- (B) defective interfering particles
- (C) high levels of antibody to hepatitis B
- (D) high levels of HBs antigen and Dane particles
- (E) neutralizing antibody to HBs antigen

39. Visceral larva migrans in children is characterized by eosinophilia and involvement of the liver and lungs. The source is usually the larvae of *Taxocara* typically acquired from contact with an environment soiled by feces of

- (A) birds
- (B) other children
- (C) pigs
- (D) dogs
- (E) rodents

40. Genes on the bacterial chromosome have the following linkages in conjugal transfer: x and y, 25% of the time, y and z, 50% of the time. If the gene order is x-y-z, x and z should be transferred together

- (A) 1% of the time
- (B) 5% of the time
- (C) 13% of the time
- (D) 20% of the time
- (E) 40% of the time

1. In contrast to eukaryotic transcription, transcription in prokaryotes

- (A) can be coupled to translation
- (B) is coupled to DNA synthesis
- (C) uses a polyadenylated 3' end of mRNA
- (D) uses mRNAs that characteristically code for one protein each
- (E) uses mRNA with 5' caps

42. The pair of viral diseases that is most commonly responsible for congenital defects in humans is

- (A) cytomegalovirus and herpes simplex
- (B) measles and herpes simplex
- (C) rubella and chickenpox
- (D) rubella and cytomegalovirus
- (E) rubella and measles

DIRECTIONS (ITEMS 43-65): Each group of items in this section consists of lettered options followed by a set of numbered items. For each item, select the ONE lettered option that is most closely associated with it and fill in the circle containing the corresponding letter on the answer sheet. Each lettered option may be selected once, more than once, or not at all.

Items 43-46

- (A) A patient who has been admitted to the hospital 7 times during the last 5 years with middle ear infections, and 4 times with a bacterial pneumonia
- (B) A patient with urinary Bence Jones protein and an abnormal immunoelectrophoretic serum profile
- (C) A patient who has periodic bouts of eye infections and also has chronic diarrhea
- (D) A patient with severe allergy
- (E) Fourteen days after the administration of horse serum antitetanus toxin, a patient develops serum sickness

Serum profiles:

- 43. IgA three times normal concentration
- 44. Total complement concentration is very low
- 45. IgG concentration is abnormally low
- 46. IgM concentration is normal, but IgA concentration is abnormally low

Items 47-48

- (A) Cessation of synthesis of leucine synthetases by addition of leucine
- (B) Inhibition of lactose utilization by glucose
- (C) Inhibition of leucine synthetase by addition of leucine
- (D) Inhibition of rRNA accumulation after starvation for a required amino acid
- (E) Repair of DNA after ultraviolet irradiation

Involves:

- 47. Decreased concentrations of cyclic AMP
- 48. Increased concentrations of uncharged tRNA

Items 49-50

- (A) Acridine orange
- (B) 5-Bromouracil
- (C) Nitrous acid
- (D) Ultraviolet irradiation
- (E) X irradiation

For each mechanism of mutation described, select the most likely cause.

- 49. Intercalating between bases on a DNA strand
- 50. Free-radical induced breaks

Items 51-52

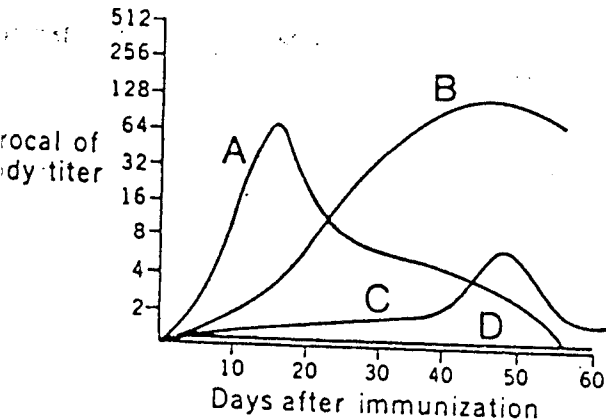
- (A) Bare lymphocyte syndrome
 - (B) Chédiak-Higashi syndrome
 - (C) Chronic granulomatous disease of childhood
 - (D) DiGeorge syndrome
 - (E) Wiskott-Aldrich syndrome
- 51. Microtubular and lysosomal defects of phagocytic cells
 - 52. Deficiency of myeloperoxidase

Items 53-54

- (A) *Staphylococcus aureus*
 - (B) *Streptococcus agalactiae* (group B)
 - (C) *Streptococcus pneumoniae*
 - (D) *Streptococcus pyogenes* (group A)
 - (E) Viridans streptococci
- 53. Subacute bacterial endocarditis
 - 54. Neonatal septicemia

Items 55-56

One group of 3-year-old children was immunized orally with live poliovirus; another similar group of children was immunized subcutaneously with inactivated virus. The antibody responses of the various classes of immune globulins are shown on the graph.



- 55. Serum IgG antibody to the live virus
- 56. Serum IgM antibody to the inactivated virus

Items 57-58

- (A) Creutzfeldt-Jakob agent
 - (B) Herpes simplex virus
 - (C) JC (papovavirus) virus
 - (D) Measles virus
 - (E) Mumps virus
57. Focal encephalitis; agent is present in all types of parenchymal cells of the brain
58. Spongiform encephalopathy; agent is present in all types of parenchymal cells of the brain

Items 59-61

Virion associated:

- (A) DNA-dependent RNA polymerase
- (B) DNA polymerase
- (C) Double-stranded RNA, dependent RNA transcriptase
- (D) Reverse transcriptase
- (E) Single-stranded RNA, RNA-dependent polymerase

- 59. Influenza A virus
- 60. Rotavirus
- 61. Poxviruses

Items 62-63

- (A) Orthomyxovirus
- (B) Picornavirus
- (C) Reovirus
- (D) Rhabdovirus
- (E) Togavirus

- 62. Single transcriptional and translational unit
- 63. Double-stranded RNA

Items 64-65

- (A) *Ascaris lumbricoides*
- (B) *Necator americanus*
- (C) *Trichuris trichiura*
- (D) *Trypanosoma brucei*
- (E) *Trypanosoma cruzi*

- 64. Sleeping sickness
- 65. Chagas disease

DIRECTIONS (ITEMS 66-99): Each group of items in this section consists of lettered headings followed by a set of numbered words or phrases. For each numbered word or phrase, fill in the circle on the answer sheet containing

- A if the item is associated with (A) *only*
- B if the item is associated with (B) *only*
- C if the item is associated with *both* (A) *and* (B)
- D if the item is associated with *neither* (A) *nor* (B)

Items 66-67

- (A) Gram-negative bacteria
- (B) Gram-positive bacteria
- (C) Both
- (D) Neither

66. Peptidoglycan

67. Mitochondria

Items 68-69

- (A) Amphotericin B
- (B) Griseofulvin
- (C) Both
- (D) Neither

68. Deposit(s) in keratin-containing tissues

69. React(s) with sterols in the cell membrane of fungi

Items 70-71

- (A) Chemotaxis
- (B) Motility
- (C) Both
- (D) Neither

70. Require(s) ATP

71. Require(s) pili

Items 72-73

- (A) F' lac cells
- (B) Hfr cells
- (C) Both
- (D) Neither

72. F factor present in plasmid state

73. Produce sex pili

Items 74-75

- (A) DNA polymerase I
- (B) Reverse transcriptase
- (C) Both
- (D) Neither

74. Require(s) a template

75. Involved in bacterial DNA repair

Items 76-77

Component of complement:

- (A) C3b
- (B) C5a
- (C) Both
- (D) Neither

76. Lytic activity

77. Chemotaxis

Items 78-80

- (A) Interleukin-1
- (B) Interleukin-2
- (C) Both
- (D) Neither

78. Act(s) on T lymphocytes

79. Secreted by macrophages

80. Secreted by T lymphocytes

Items 81-82

- (A) Lymph node
- (B) Thymus
- (C) Both
- (D) Neither

81. Lymphocytes with surface IgD

82. Antigen-dependent differentiation of lymphocytes

Items 83-84

- (A) T-dependent antigens
- (B) T-independent antigens
- (C) Both
- (D) Neither

83. Large molecules with repeating antigenic determinants

84. Induce high affinity IgG antibodies

Items 85-86

Mediated by:

- (A) IgE
- (B) IgG
- (C) Both
- (D) Neither

85. Arthus reaction

86. Tuberculin reaction

Items 87-88

- (A) Binds to macrophages
- (B) Crosses the placenta
- (C) Both
- (D) Neither

87. IgG

88. IgA

Items 89-91

- (A) Class I MHC
- (B) Class II MHC
- (C) Both
- (D) Neither

89. Present on all nucleated cells

90. Recognized by helper T cells

91. Made up of pairs of polypeptide chains

Items 92-93

- (A) Cellular immune deficiency
- (B) Humoral immune deficiency
- (C) Both
- (D) Neither

92. Chronic mucocutaneous candidiasis

93. Lepromatous leprosy

Items 94-95

- (A) Attenuated oral poliovirus vaccine
- (B) Inactivated poliovirus vaccine
- (C) Both
- (D) Neither

94. Specific humoral antibodies

95. Specific secretory antibodies

Items 96-97

- (A) Avian retroviruses (RNA)
- (B) Simian virus 40 (DNA)
- (C) Both
- (D) Neither

96. DNA synthesis is required for transformation

97. Contact inhibition of transformed cells is increased

Items 98-99

- (A) Reading frame-shift mutations
- (B) Transition mutations
- (C) Both
- (D) Neither

98. Induced by agents that intercalate with DNA

99. Induced by base analogs

DIRECTIONS (ITEMS 100-140): For each of the items in this section, ONE or MORE of the numbered options is correct. On the answer sheet fill in the circle containing

- A if only 1, 2, and 3 are correct,
 B if only 1 and 3 are correct,
 C if only 2 and 4 are correct,
 D if only 4 is correct,
 E if all are correct.

FOR EACH ITEM FILL IN ONLY ONE CIRCLE ON YOUR ANSWER SHEET

DIRECTIONS SUMMARIZED

A	B	C	D	E
1, 2, 3 only	1, 3 only	2, 4 only	4 only	All are correct

100. The lipopolysaccharide of *Escherichia coli* contains

- (1) wax D
- (2) core polysaccharide
- (3) trehalose-6,6'-dimycolate
- (4) lipid A

101. Components that are found in the cell wall of gram-positive bacteria but not gram-negative bacteria include

- (1) lipopolysaccharide
- (2) peptidoglycan
- (3) porin
- (4) teichoic acid

102. Penicillin would be expected to be ineffective against

- (1) mycoplasmas
- (2) gram-positive cocci
- (3) L forms
- (4) gram-negative cocci

103. Addition of a high concentration of chloramphenicol to a bacterial culture growing in a medium containing radioactive thymidine, uracil and leucine causes an immediate cessation of

- (1) respiration
- (2) incorporation of thymidine
- (3) incorporation of uracil
- (4) incorporation of leucine

104. Protoplasts can be induced by treatment of gram-positive bacteria with

- (1) lysozyme
- (2) chloramphenicol
- (3) ampicillin
- (4) capsular antibody and complement

105. Intracellular pathogens include

- (1) *Mycobacterium leprae*
- (2) *Legionella pneumophila*
- (3) *Listeria monocytogenes*
- (4) *Staphylococcus aureus*

106. Bacterial structures that impede phagocytosis include

- (1) polysaccharide capsules
- (2) polyglutamic acid capsules
- (3) pili
- (4) ribosomes

107. Complement is required as an accessory factor for the action of antibody in

- (1) bacterial agglutination
- (2) bacteriolysis
- (3) precipitation reactions
- (4) hemolysis

FOR EACH ITEM FILL IN ONLY ONE CIRCLE ON YOUR ANSWER SHEET

DIRECTIONS SUMMARIZED

A
1, 2, 3
only

B
1, 3
only

C
2, 4
only

D
4
only

E
All are
correct

108. Activation of complement by antigen-antibody interaction may result in

- (1) promotion of opsonization
- (2) release of peptides that are chemotactic for neutrophils
- (3) release of anaphylatoxin
- (4) generation of macrophage migration-inhibition factor

109. Advantages of passive immunization by a single injection of high-titer antiserum as opposed to active immunization include:

- (1) Antibody synthesis of host cells is stimulated
- (2) A uniformly high level of antibody is maintained for months
- (3) Serum sickness is avoided
- (4) A high level of antibody of desired specificity is rapidly provided

110. The structural units that confer immunologic specificity to major blood group substances

- (1) contain no galactose
- (2) are oligosaccharides
- (3) are small peptides attached to a polysaccharide backbone
- (4) contain fucose and N-acetylhexosamine

111. Complement is required for

- (1) the Arthus reaction
- (2) killing by cytotoxic T lymphocytes
- (3) the development of glomerulonephritis caused by antigen-antibody complexes
- (4) antibody-dependent cell-mediated cytotoxicity

112. Tumors may avoid immune surveillance by

- (1) changing expression of cell-surface antigen
- (2) producing immunosuppressive factors
- (3) inducing an immune response that does not inhibit tumor growth
- (4) not expressing tumor-specific transplantation antigen

113. Anti-idiotypic antibodies may react with

- (1) the paratope of an antibody
- (2) part of the paratope of an antibody
- (3) nonparatopic segments of the hypervariable region
- (4) Fc region sequences

114. Serum IgE (reaginic) antibody activity is measured by

- (1) quantitative immunoprecipitation with antigen
- (2) radioimmunoassay using anti-IgE
- (3) C1q binding and transfer test
- (4) histamine release from mast cells exposed to antigen

115. Characteristic features of tuberculosis include:

- (1) The causative organisms are resistant to drying
- (2) Primary infection usually heals in the form of a small, often calcified lesion
- (3) The source of reinfection or reactivation infection usually is endogenous
- (4) Passive immunity may be achieved with specific antibody

16. Factors involved in the process of phagocytosis and consequent microbial killing can include
 - (1) formation of phagolysosomes
 - (2) degranulation of neutrophils
 - (3) activation of the H_2O_2 -myeloperoxidase system
 - (4) antibody directed against the microorganism
17. Properties that generally can be used to differentiate *Salmonella* from *Escherichia coli* include
 - (1) a Gram stain
 - (2) the presence of R plasmid-mediated drug resistance
 - (3) the presence of flagella
 - (4) an inability to ferment lactose
18. In tissue and exudates, the Gram stain is useful for identifying
 - (1) *Mycobacterium tuberculosis*
 - (2) *Mycoplasma pneumoniae*
 - (3) *Treponema pallidum*
 - (4) *Hemophilus influenzae*
19. Antiphagocytic surface antigens associated with virulence are found in
 - (1) *Streptococcus pneumoniae*
 - (2) β -hemolytic streptococci, group A
 - (3) *Hemophilus influenzae*
 - (4) *Corynebacterium diphtheriae*
20. Bacteria that have a polysaccharide capsule that resists phagocytosis include
 - (1) *Neisseria meningitidis*
 - (2) *Klebsiella pneumoniae*
 - (3) *Streptococcus pneumoniae*
 - (4) *Hemophilus influenzae*
21. Substances of phagocytic cells that kill intracellular bacteria include
 - (1) hydrogen peroxide
 - (2) superoxide radicals
 - (3) singlet oxygen
 - (4) myeloperoxidase
122. The epidemiology of *Listeria monocytogenes* infection characteristically involves transmission from
 - (1) animal to human via milk and milk products
 - (2) animal to human via arthropod vectors
 - (3) human to human in utero
 - (4) human to human via respiratory secretions
123. Insect vectors are important in the transmission of agents causing
 - (1) Lyme disease
 - (2) tularemia
 - (3) plague
 - (4) leprosy
124. Blood cultures are useful for the diagnosis of systemic infections caused by
 - (1) *Neisseria meningitidis*
 - (2) *Staphylococcus aureus*
 - (3) *Streptococcus pneumoniae*
 - (4) *Mycoplasma pneumoniae*
125. Extracellular products produced by group A streptococci include
 - (1) fibrinolysin
 - (2) hyaluronidase
 - (3) erythrogenic toxin
 - (4) hemolysin
126. Viruses that would be unable to replicate in tissue culture with a medium containing 2-iodo-5'-deoxyuridine include
 - (1) herpesviruses
 - (2) reoviruses
 - (3) adenoviruses
 - (4) enteroviruses
127. Before viral mRNA is synthesized in infected cells, retrovirus genetic information must be
 - (1) circularized
 - (2) translated
 - (3) integrated into cellular DNA
 - (4) encapsidated

FOR EACH ITEM FILL IN ONLY ONE CIRCLE ON YOUR ANSWER SHEET

DIRECTIONS SUMMARIZED

A
1, 2, 3
only

B
1, 3
only

C
2, 4
only

D
4
only

E
All are
correct

128. Likely causes of fever lasting several weeks include

- (1) cytomegalovirus
- (2) EB (Epstein-Barr) virus
- (3) *Toxoplasma gondii*
- (4) influenza virus

129. Diseases that may be caused by organisms from the normal microbial flora include

- (1) candidiasis
- (2) cryptococcosis
- (3) actinomycosis
- (4) blastomycosis

130. Diseases caused by *Candida albicans* include

- (1) thrush
- (2) vaginitis
- (3) nail infections
- (4) disseminated infections

131. Humans acquire, via direct penetration of skin by larvae,

- (1) hookworm disease
- (2) ascariasis
- (3) cutaneous larva migrans
- (4) trichinosis

132. In humans, passive immunization is one method used to avert clinical disease in

- (1) measles
- (2) rabies
- (3) infectious mononucleosis
- (4) hepatitis B

133. In the USA, ulcerative genital lesions are characteristic of infection with

- (1) herpes simplex
- (2) *Haemophilus ducreyi*
- (3) *Treponema pallidum*
- (4) *Gardnerella vaginalis*

134. The biosynthesis of cell wall components in gram-negative bacteria requires

- (1) D-alanine
- (2) N-acetylglucosamine
- (3) diaminopimelic acid
- (4) ribitol teichoic acid

135. The involvement of oncogenes in tumorigenesis or transformation has been deduced from

- (1) analysis of chromosome translocations
- (2) DNA-mediated transfer of the transformed phenotype in tissue culture cells
- (3) a study of the structure of acute transforming retrovirus genomes
- (4) integration sites in tumor-derived cells

136. Resistance to antibiotics may be plasmid-mediated in

- (1) *Staphylococcus aureus*
- (2) *Neisseria gonorrhoeae*
- (3) *Salmonella typhimurium*
- (4) *Haemophilus influenzae*

37. ATC TAG GGG GCA GGA TGA

Suppression of the mutated codon, TAG, could result from

- (1) mutation in RNA polymerase
- (2) mutation in an elongation factor
- (3) deletion of the ensuing four codons
- (4) mutation of the anticodon loop of tRNA tyr to AUC

38. IgM and IgG molecules that share the same idio-type

- (1) have similar complement-fixing capacity
- (2) have similar, if not identical, antigen-binding regions
- (3) have shared Gm allotypes
- (4) may be synthesized by cells derived from the same B lymphocyte precursor clone

139. In *Escherichia coli* growing under anaerobic conditions in minimal medium with glucose as the carbon source,

- (1) the reactions of the tricarboxylic acid cycle function in a biosynthetic capacity
- (2) glucose is metabolized via the Embden-Meyerhof glycolytic pathway
- (3) substances typical of a "mixed acid" fermentation are produced
- (4) growth ceases when oxygen is admitted to the culture

140. The porin channels of the outer membrane of gram-negative bacteria

- (1) permit small hydrophilic compounds to cross the membrane
- (2) function by the use of energy from ATP
- (3) do not permit the passage of proteins or nucleic acids
- (4) are bound to the cytoplasmic membrane

PHARMACOLOGY

DIRECTIONS (ITEMS 1-47): Each of the numbered items or incomplete statements in this section is followed by answers or by completions of the statement. Select the ONE lettered answer or completion that is BEST in each case and fill in the circle containing the corresponding letter on the answer sheet.

1. If, following first-order kinetics, 50% of a drug is absorbed from an intramuscular site of injection in 12 minutes, then 75% would be absorbed in
 - (A) 18 minutes
 - (B) 24 minutes
 - (C) 30 minutes
 - (D) 36 minutes
 - (E) 48 minutes
2. In studies of bioavailability, it is common practice to compare plasma concentration time curves obtained after intravenous and oral administrations of the same dose of drug. Assuming the drug is eliminated according to first-order kinetics, the best indicator of the fraction of drug reaching the systemic circulation after oral administration is the
 - (A) amount of the drug in the feces
 - (B) area under the plasma concentration time curve
 - (C) fraction of the drug bound to plasma protein
 - (D) peak plasma concentration of the drug
 - (E) time to reach peak plasma concentration of the drug
3. What is the approximate clearance rate of a drug that is infused at a rate of 2 mg/min and achieves a steady-state plasma concentration of 3 mg/L?
 - (A) 67 mL/min
 - (B) 120 mL/min
 - (C) 150 mL/min
 - (D) 667 mL/min
 - (E) 1500 mL/min
4. Assume that, in a given isolated system, drug X has an EC_{50} of 10^{-6} M and drug Y has an EC_{50} of 10^{-8} M. The most likely explanation is that:
 - (A) Drugs X and Y act at the same pharmacologic receptor
 - (B) Drugs X and Y are agonists
 - (C) The apparent affinity for drug Y's receptor is 100 times greater than that of drug X for its receptor
 - (D) The efficacy of drug Y is greater than that of drug X
 - (E) There are more spare receptors for drug X than for drug Y
5. A patient on medication complains of severe dizziness. His blood pressure in a supine position is 132/84 mm Hg; while standing, it is 82/54 mm Hg. Which of the following drugs is most likely responsible?
 - (A) Chlorpromazine
 - (B) Lithium carbonate
 - (C) Prednisone
 - (D) Diazepam
 - (E) Indomethacin
6. Of the following drugs that affect mood and behavior, which has the LEAST effect on the function of the autonomic nervous system?
 - (A) Chlorpromazine
 - (B) Diazepam
 - (C) Imipramine
 - (D) Reserpine
 - (E) Tranlylcypromine

7. Which of the following is LEAST likely to be associated with the actions of tricyclic antidepressants?

- (A) Bradycardia
- (B) Confusion in elderly patients
- (C) Interference with presynaptic reuptake of neurotransmitter monoamines
- (D) Slow onset of antidepressant effects
- (E) Urinary retention

8. Which of the following is a heparin antagonist?

- (A) Aspirin
- (B) Clofibrate
- (C) Dicumarol
- (D) Protamine
- (E) Warfarin

9. Preparations of cocaine used as a topical anesthetic will cause local vasoconstriction

- (A) because they inhibit catechol-O-methyltransferase
- (B) because they inhibit monoamine oxidase
- (C) because they inhibit neuronal uptake of catecholamines
- (D) only if they contain a sympathomimetic amine (e.g., norepinephrine)
- (E) primarily as a result of increased sympathetic discharge

10. Which of the following drugs decreases peripheral vascular resistance, increases cardiac output, has little effect on the heart rate and increases renal blood flow?

- (A) Dopamine
- (B) Epinephrine
- (C) Isoproterenol
- (D) Norepinephrine
- (E) Phenylephrine

11. The most useful drug for the treatment of malignant hyperthermia is

- (A) acetaminophen
- (B) aspirin
- (C) dantrolene
- (D) succinylcholine
- (E) tubocurarine

12. Which of the following agents does NOT cause drug-induced parkinsonism?

- (A) Chlorpromazine
- (B) Desipramine
- (C) Diazepam
- (D) Haloperidol
- (E) Reserpine

13. Phenylephrine can be used to convert paroxysmal atrial tachycardia to normal sinus rhythm by

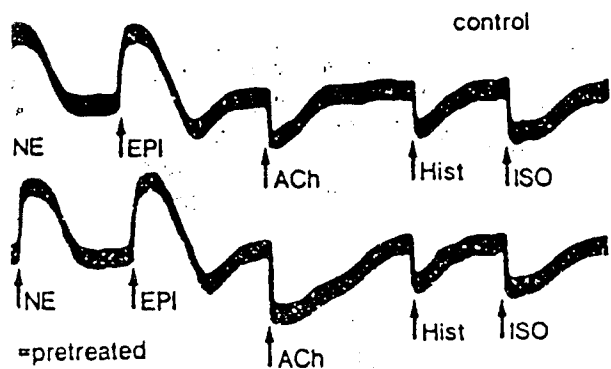
- (A) a direct action on cardiac sympathetic nerve terminals to inhibit the release of norepinephrine
- (B) a direct antagonism of β -adrenergic receptors
- (C) a direct depressant action on conduction in the atrioventricular node
- (D) a direct inhibition of myocardial adenylylate cyclase
- (E) reflex activation of the vagus (X) nerve

	RIGHT EYE	LEFT EYE
Without treatment		
Treatment with tyramine		
Treatment with epinephrine		

14. The circles represent the size of the pupils of a patient's right and left eyes, both without treatment and with two different treatments. The responses are compatible with the conclusion that the left eye has had

- (A) β -adrenergic receptors blocked
- (B) α -adrenergic receptors blocked
- (C) cholinesterase inhibited
- (D) muscarinic receptors blocked
- (E) sympathetic denervation

15. The blood pressure-lowering effect of bradykinin is
- (A) associated with a decreased plasma concentration of catecholamines
 - (B) caused by a reduction in cardiac output
 - (C) decreased by propranolol
 - (D) increased by aspirin
 - (E) increased by captopril
16. In patients with bronchial asthma, cromolyn sodium is used as
- (A) a bronchodilator
 - (B) an anti-inflammatory agent
 - (C) an antihistaminic (H_1 receptor blockade)
 - (D) a blocker of the response of bronchiolar smooth muscle to slow-reacting substance of anaphylaxis (SRS-A)
 - (E) a blocker of IgE-mediated release of histamine and SRS-A
17. Prazosin decreases blood pressure by
- (A) acting centrally to decrease peripheral sympathetic nerve activity
 - (B) decreasing cardiac output
 - (C) directly acting on myofibrils of vascular smooth muscle
 - (D) inhibiting the release of renin from the kidney
 - (E) preventing the vasoconstrictor effects of neuronally released norepinephrine on vascular smooth muscle
18. When isoproterenol or metaproterenol is used for the treatment of bronchial asthma, the adverse effect most likely to occur is
- (A) anginal pain
 - (B) excessive sweating
 - (C) postural hypotension
 - (D) sinus tachycardia
 - (E) ventricular arrhythmias
19. A patient seen in the emergency room does not know which "heart drug" he is taking. His heart rate is greater than 80/minute, and the P-R and QRS intervals on an electrocardiogram are prolonged. The patient notes ringing of the ears. He most likely is taking
- (A) digoxin
 - (B) lidocaine
 - (C) phenytoin
 - (D) propranolol
 - (E) quinidine
20. Sympathomimetic bronchodilators produce their therapeutic effects by
- (A) blocking bronchial smooth muscle adenosine receptors
 - (B) blocking calcium channels in bronchial smooth muscle
 - (C) blocking histamine receptors on bronchial smooth muscle
 - (D) increasing cyclic AMP in bronchial smooth muscle cells
 - (E) reducing reflex bronchoconstriction
21. Which of the following describes the probable mechanism of action of colchicine in alleviating an acute attack of gout?
- (A) Stabilization of lysosomal membranes
 - (B) Inhibition at some point of the phagocytosis of monosodium urate crystals by leukocytes
 - (C) Inhibition of the formation and subsequent accumulation of monosodium urate crystals in the joints
 - (D) Competitive inhibition with histamine at a receptor site
 - (E) Dissolution of existing monosodium urate crystals in the joints



25. Each of the following is a result of administration of ethinyl estradiol EXCEPT

- (A) augmented excretion of sodium
- (B) increased vascularity of the endometrium
- (C) increased plasma concentrations of cortisol and thyroid-binding proteins
- (D) increased plasma concentration of triglycerides
- (E) induction of progesterone receptors in the mammary glands

26. The most potent drug for suppression of ACTH secretion is

- (A) corticosterone
- (B) dexamethasone
- (C) hydrocortisone
- (D) prednisone

Norepinephrine (NE), epinephrine (EPI), acetylcholine (ACh), histamine (Hist) and isoproterenol (ISO) are injected into an anesthetized dog before (control) and after treatment with an unknown drug (X=pretreatment). From the arterial blood pressure tracings shown, the unknown drug could be

30. The therapeutic efficacy of sodium nitrite in the treatment of patients with cyanide poisoning depends upon

- (A) the formation of methemoglobin
- (B) an increase in oxidative phosphorylation
- (C) an increase in coronary arterial blood flow
- (D) a decrease in intracranial pressure
- (E) relaxation of the nonvascular smooth muscle

31. Carboxyhemoglobin may result from inhaling

- (A) arsine gas
- (B) sewer gas
- (C) cigarette smoke
- (D) natural gas
- (E) none of the above

32. A child who has ingested an organophosphate insecticide would most likely have each of the following symptoms EXCEPT

- (A) convulsions
- (B) defecation
- (C) dry skin
- (D) increased salivation
- (E) miosis

33. The Occupational Safety and Health Administration (OSHA) imposes severe restrictions on the use of benzene because it

- (A) can produce anesthesia
- (B) causes neutropenia
- (C) is flammable
- (D) is teratogenic
- (E) is leukemogenic

34. Which of the following is most directly responsible for the most serious effects of methanol?

- (A) Acetaldehyde
- (B) Formic acid
- (C) Methanol
- (D) Renal failure
- (E) Respiratory failure

35. A farmer has gradual onset of respiratory distress over the past few weeks. Among the following, he was most likely exposed to

- (A) chlordecone
- (B) dimethyldithiocarbamate
- (C) methoxychlor
- (D) paraquat
- (E) 2,4,5-T (2,4,5-trichlorophenoxyacetic acid)

36. The principal therapeutic effect of calcitonin is to

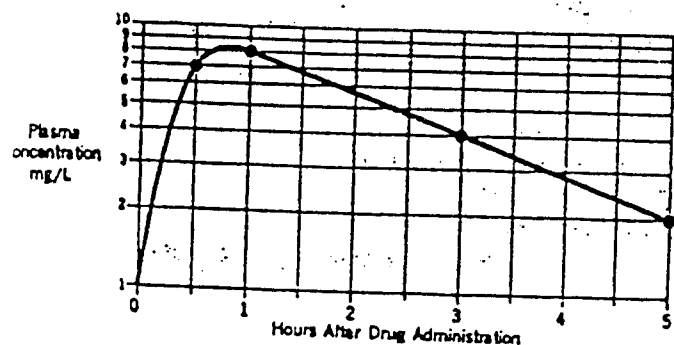
- (A) decrease the conversion of cholecalciferol (vitamin D₃) to an active metabolite
- (B) decrease the urinary excretion of calcium
- (C) decrease the active transport of calcium from the gut
- (D) increase the urinary excretion of phosphate
- (E) inhibit the active resorption of bone

37. The drug of choice for treatment of patients with microcytic hypochromic anemia is

- (A) cyanocobalamin (vitamin B₁₂)
- (B) erythropoietin
- (C) ferric sulfate
- (D) ferrous sulfate
- (E) folic acid

38. Humans rapidly recover consciousness after receiving an intravenous injection of thiopental because:

- (A) Thiopental is rapidly metabolized
- (B) Thiopental is rapidly cleared by the kidneys
- (C) Humans rapidly develop tolerance to thiopental
- (D) Thiopental is too poorly soluble in lipid to enter the brain
- (E) The injected thiopental rapidly redistributes from brain to muscle and other organs



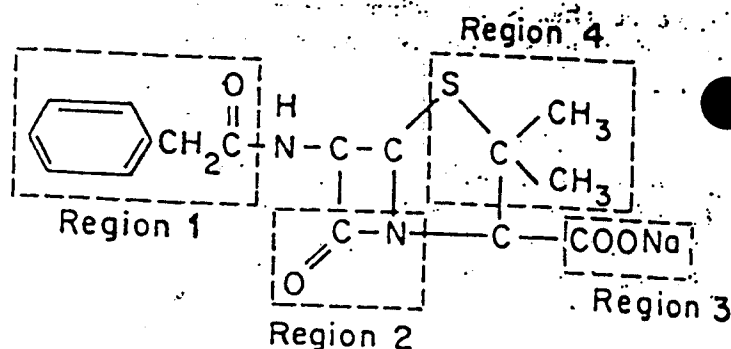
39. The diagram is a plot of the plasma concentration of a drug after oral ingestion of a 400-mg dose. If the drug is administered repeatedly at the same dosage at intervals equal to its elimination half-time, approximately how long will it take to approach steady-state concentration (96% theoretical maximum)?

- (A) 6 hours
- (B) 10 hours
- (C) 15 hours
- (D) 20 hours
- (E) 24 hours

40. Atropine is most useful as a bronchodilator when

- (A) airway obstruction is caused by infection
- (B) an expectorant is indicated
- (C) bronchoconstriction is accompanied by thick mucous plugs in the bronchioles
- (D) bronchoconstriction is caused by an allergic attack
- (E) bronchoconstriction is caused by reflexes initiated by irritants in the pulmonary system

41. The structure of penicillin G sodium is as follows:



Differences in the bactericidal spectrum of the semi-synthetic as well as other penicillins are associated with differences in structure in region(s)

- (A) 1 only
- (B) 2 only
- (C) 3 only
- (D) 4 only
- (E) 2 and 3

42. Benzodiazepines are known to

- (A) bind to GABA receptors and act as GABA agonists
- (B) bind to a benzodiazepine receptor, thereby increasing the binding of GABA to its receptor
- (C) bind to serotonin (5-hydroxytryptamine) receptors and act as serotonin antagonists
- (D) enter and block chloride channels
- (E) enter the lipid portion of the cell membrane and enhance conductance of sodium channels

Items 43-44

A young woman is brought to the emergency room having taken 50 capsules of acetaminophen approximately six hours previously. She does not appear critically ill.

3. At this point, the most serious concern would be the development of

- (A) metabolic acidosis
- (B) hepatic necrosis
- (C) renal failure
- (D) methemoglobinemia
- (E) acute hemolytic anemia

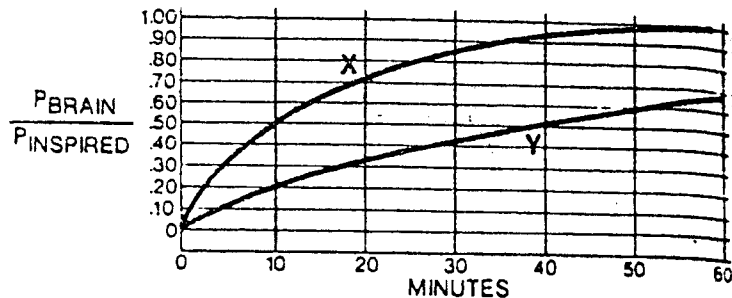
4. At this time, this patient is best managed by the prompt and continued administration of

- (A) acetylcysteine
- (B) methylene blue
- (C) vitamin C
- (D) syrup of ipecac
- (E) sodium bicarbonate

5. A patient is admitted to the hospital with a systemic infection that requires treatment with gentamicin. If it is decided that the initially calculated steady-state concentration will be only one-half that needed to control the infection, the desired concentration may be achieved and maintained by

- (A) continuing the infusion at the same rate as before, but doubling the loading dose
- (B) doubling the rate of infusion
- (C) increasing the infusion rate by a factor of 2.5
- (D) tripling the rate of infusion
- (E) quadrupling the rate of infusion

Items 46-47



Given the following data:

Atmospheric pressure = 760 mm Hg

Anesthetic	Concentration of anesthetic in inspired air	Anesthetic tension in brain required to produce loss of consciousness
X	10%	72 mm Hg
Y	50%	76 mm Hg

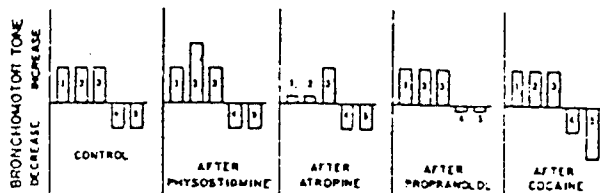
46. Anesthetic X will first produce loss of consciousness in

- (A) less than 5 minutes
- (B) 10 minutes
- (C) 20 minutes
- (D) 25 minutes
- (E) 50 minutes

47. Anesthetic Y will first produce loss of consciousness in

- (A) 5 minutes
- (B) 10 minutes
- (C) 25 minutes
- (D) 40 minutes
- (E) an hour or more

Items 54-56



The graphs shown illustrate the change in bronchomotor tone produced by the independent procedures labeled 1-5 under the sequential experimental conditions noted in the diagram.

- (A) Administration of carbachol
- (B) Sympathetic nerve stimulation
- (C) Vagal nerve stimulation
- (D) Administration of histamine
- (E) Administration of isoproterenol

54. Procedure 2

55. Procedure 3

56. Procedure 4

Items 57-58

- (A) Dioctyl sodium sulfosuccinate
- (B) Liquid petrolatum (mineral oil)
- (C) Methylcellulose
- (D) Bisacodyl
- (E) Castor oil

57. May cause pneumonitis

58. Increased fecal mass; promotes peristalsis

Items 59-60

- (A) Vitamin C
- (B) Para-aminobenzoic acid (PABA)
- (C) Pyridoxine (vitamin B₆)
- (D) Cholecalciferol (vitamin D₃)
- (E) Nicotinic acid

59. Ability to lower plasma concentrations of cholesterol and produce hepatic dysfunction

60. Minimizes peripheral neuritis associated with isoniazid

Items 61-62

- (A) Amantadine
- (B) Chloroquine
- (C) Griseofulvin
- (D) Metronidazole
- (E) Thiabendazole

Effective in the treatment of:

- 61. Mixed helminthic infestations; may cause migration of *Ascaris lumbricoides*
- 62. Vaginitis caused by *Trichomonas vaginalis*

Items 63-64

- (A) Penicillin
- (B) Chloramphenicol
- (C) Sulfamethoxazole
- (D) Kanamycin
- (E) Amphotericin B

- 63. Inhibits bacterial protein synthesis by inhibiting peptidyl transferase
- 64. Distorts a ribosome site by binding the 30S subunit

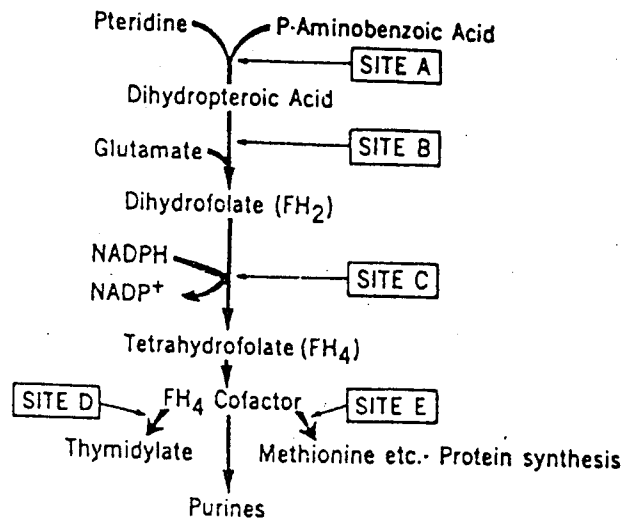
Items 65-66

- (A) Jaundice
- (B) Dizziness
- (C) Bruising
- (D) Photosensitivity
- (E) Loss of visual acuity

Associated with:

- 65. Gentamicin
- 66. Isoniazid

Items 67-69



- 67. Primary site of action of 5-fluorouracil
- 68. Primary site of action of sulfadiazine
- 69. Primary site of action of methotrexate

Items 70-72

- (A) Bleomycin
- (B) Cyclophosphamide
- (C) Doxorubicin (Adriamycin)
- (D) Methotrexate
- (E) Vincristine

Adverse effect:

- 70. Pulmonary toxicity
- 71. Neurotoxicity
- 72. Cardiotoxicity