A. Multiple choice (2 pt each)

The following choices are used for questions 1 – 5.

(a) Trypan red       (d) Penicillin
(b) Arspheniamine (Salvarsan) (e) Streptomycin
(c) Sulfonamide

1. This substance, isolated from a common mold, was discovered in 1928 by Fleming and developed into an antibiotic by Florey and Chain in the late 1930s.
2. This heavy metal derivative was treatment for syphilis in the early 20th century.
3. The first of the sulfa drugs, this substance was derived from a dye called Prontosil Red that Domagk had found to be effective against staphylococcal infections in the 1920s.
4. This antibiotic, isolated from a soil bacterium by Waksman in the 1940s after screening 10000 isolates, was found to be effective against tuberculosis and many other bacterial infections.
5. In 1904, Ehrlich found that this dye was effective against the parasite (Trypanosoma) that caused sleeping sickness.

The following choices are used for questions 6 – 10.

(a) selective toxicity       (d) therapeutic index
(b) therapeutic dose         (e) side effects
(c) toxic dose

6. The amount of a drug which, if administered to a patient would produce undesired effects in the patient.
7. The amount of a drug required for clinical treatment; that is, the amount required to produce antimicrobial activity.
8. The ability of drug to kill or inhibit a pathogen while damaging host as little as possible.
9. The toxic dose of a drug divided by its therapeutic dose.
10. Undesired effects produced by a drug.
The following choices are used for questions 11 – 15.

(a) minimal inhibitory concentration
(b) minimal lethal concentration
(c) dilution susceptibility test
(d) Kirby-Bauer disk diffusion test
(e) Etest

11. This method for antibiotic susceptibility uses circular disks impregnated with standardized concentrations of antibiotics. The disks are placed on confluent inoculated Mueller Hinton agar plates with the bacteria to be tested, and after incubation the diameters of the zones of inhibition are determined.

12. This is the lowest concentration of a drug that kills a pathogen.

13. This method for antibiotic susceptibility uses a series of broth tubes containing dilutions of the antibiotic, inoculated with the bacterium.

14. This is the lowest concentration of drug that inhibits growth of pathogen.

15. This method for antibiotic susceptibility uses a horizontal strip containing a gradient of the antibiotic concentration. The strip is placed on a confluent inoculated plate with the bacterium to be tested. By noting the point at which the oval zone of inhibition intersects the strip, one determines the precise value at which the antibiotic inhibited the bacterium.

The following choices are used for questions 16 – 22.

(a) Inhibits cell wall synthesis
(b) Inhibits protein synthesis
(c) Inhibits nucleic acid synthesis (either DNA or RNA)
(d) Disrupts cell membrane structure
(e) Inhibits folic acid synthesis (metabolic antagonist)

16. This is the mechanism of action of tetracycline.

17. This is the mechanism of action of rifampin.

18. This is the mechanism of action of ciprofloxacin.

19. This is the mechanism of action of penicillin.

20. This is the mechanism of action of sulfonamide.

21. This is the mechanism of action of polymyxin B.

22. This is the mechanism of action of vancomycin.
The following choices are used for questions 23 – 27.

(a) topoisomerase
(b) DNA polymerase
(c) primase
(d) DNA ligase
(e) helicase

23. In DNA replication, this enzyme removes supercoiling.
24. This enzyme is used to seal the final phosphodiester bond between two fragments of DNA in the formation of recombinant DNA.
25. In DNA replication, this enzyme begins the unwinding of the DNA helix at the origin of replication.
26. This enzyme synthesizes short RNA strands to begin the synthesis of a new nucleic acid strand.
27. DNA nucleotides are added to a growing DNA chain by this type of enzyme. In addition, this enzyme also has exonuclease activity for proofreading functions.
B. Other questions.

1. A pharmaceutical company has developed a compound that inhibits the synthesis of lipid A, a component of the outer membrane in gram negative bacteria. The company plans to test this compound as a possible chemotherapeutic agent.

(a) Do you believe that the compound will most likely be a broad-spectrum or a narrow-spectrum agent? Explain your answer, giving exact detail to what you mean by “broad-” or “narrow-spectrum.” (4 pt)

(b) In addition to toxicity to the bacteria, there are other factors that the company will have to consider before it can market this compound as a chemotherapeutic agent. List and briefly discuss two other factors (besides toxicity to the bacteria) that the company will have to determine about the compound. (6 pt)
2. Compare the mutagenic action mechanisms of base analog substitution, specific mispairing, intercalating agents, and bypass of replication. Give one example of each. (12 pt)
3. Briefly outline the Ames test, and describe what it is used to test for. (7 pt)
4. List and briefly describe the different regions found in a freshwater pond and the types of microbes found in each region. (8 pt)
5. Outline the stages in a typical municipal wastewater treatment facility. (9 pt)