Please do not open this exam until you are told to do so.

GOOD LUCK!!

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208
CIRCLE THE MOST NEARLY CORRECT ANSWER FOR EACH QUESTION (4 PTS).

1. A body fluid has a [H⁺] (conc.of H⁺) = 10⁻⁸ M. Its pH is:
   - 6
   - 7
   - 8
   - 10
   - 8

2. A cell membrane typically
   - is a barrier to all non-polar molecules
   - has a polar hydrophilic interior
   - has a hydrophilic surface
   - always freely passes ions like Na⁺ or Cl⁻
   - has a hydrophilic surface

3. CH₂CH₂OH is:
   - ethanol, active ingredient of booze
   - methanol, a toxic alcohol
   - methane (natural gas)
   - isopropanol (rubbing alcohol)
   - ethanol, active ingredient of booze

4. The drawback of the original penicillin is:
   - very narrow antibacterial spectrum.
   - no part of it can be modified without loss of drug activity.
   - none of the above
   - highly toxic.
   - none of the above

5. Comparing viruses, bacteria:
   - bacteria are usually larger and more complex
   - antibiotics are effective against both
   - only bacteria cause epidemics
   - Viruses have thicker cell walls
   - bacteria are usually larger and more complex
6. HIV is termed a "retrovirus" because:
   - it incorporates the host's DNA into its RNA
   - its genetic RNA is transcribed "backwards" to DNA
   - it was discovered using retro-grade analysis
   - it "retro-fits" into the enzyme active site

7. Oxygen has atomic weight 16.00. The molecular weight of \( \ce{O_2} \) is:
   - 16 grams
   - 16 moles/gram
   - 32 grams/mole
   - 32 moles/gram

8. The key role of HIV in destroying the immune system seems to be:
   - HIV attacks \( T_{\text{killer}} \) cells, impairing both \( T_{\text{killer}} \) cell and B cell (antibody) production.
   - HIV attacks \( T_{\text{helper}} \) cells, impairing both \( T_{\text{killer}} \) cell and B cell (antibody) production.
   - HIV kills red blood cells.
   - HIV attacks B cells (antibody production).

9. AIDS-linked diseases (opportunistic infections) include:
   - herpes simplex
   - pneumocystis (pneumonia)
   - shingles
   - all of the above

10. A patent is:
    - a right to use an invention.
    - a license to use an invention
    - a monopoly on use of an invention.
    - all of the above.
11. I find a new method for making someone else's patented drug. I can obtain:
   - a composition of matter patent.
   - a process patent.
   - a use patent.
   - none of the above.

12. An example of a basic compound is:

   - R-NH₂
   - R-NH₃⁺
   - R-CO₂H
   - HCl

13. The first step in HIV infection of a cell:

   - HIV RT copies viral RNA to DNA
   - HIV integrase inserts viral DNA into host cell DNA
   - HIV protease slices viral polyprotein into functional enzyme fragments
   - HIV gp120 surface protein recognizes host CD-4 membrane protein

14. The molecule shown is:

   - thymidine, a nucleoside
   - serine, an amino acid
   - adenine, a DNA purine
   - sequanavir, a protease inhibitor
15. For the DNA sequence 5'—A—G—C—T—3', the complementary sequence
5'—X—Y—Z—W—3' is:

- 5'—T—C—G—A'—3'
- 5'—A—G—C—T—3'
- 5'—A—G—G—C—3'
- 5'—A—G—C—U—3'

16. HIV replicates:
   - by expressing its genes in the host cell genome, using the cell’s biochemical machinery
   - by expressing its genes separately from the host cell genome, using the cell’s biochemical machinery
   - by expressing its genes independently of the host cell genome, using viral biochemical machinery
   - outside the host cell

17. After infection with HIV, without treatment the time for progression to disease symptoms is usually about:
   - 7-10 years
   - 1-2 years
   - more than 20 years
   - a few months

18. Proteins consist of:
   - nucleosides linked by phosphate bonds
   - 50 or more amino acids linked by peptide bonds
   - fewer than 5 amino acids linked by peptide bonds
   - nucleic acids linked by amide bonds
19. An enzyme protein in an aqueous environment (e.g., blood):
- stretches out into a linear structure
- folds to move its hydrophobic R groups into its interior, while placing its ionic and polar groups on or near its surface
- folds to move its ionic and polar groups into its interior, while placing its hydrophobic R groups on or near its surface
- shows no preference in placing its R, ionic and polar groups

20. A small amount of a drug is added to an enzyme, and we analyze the effect using kinetics (Lineweaver-Burk plot). \( V_{\text{max}} \) increases, \( K_m \) is unchanged. This suggests that the drug inhibits the enzyme:
- reversibly and non-competitively, or irreversibly and non-competitively
- not at all
- irreversibly but not non-competitively
- reversibly and competitively

21. Once symptoms appear and an AIDS diagnosis is made, the average life left to an untreated patient is about:
- a few months
- 7-10 years
- more than 20 years
- 1-2 years

22. For acetic acid shown below, draw in all covalent bonds (use single lines) and unshared electrons (use double dots). Be sure your structure obeys the octet rule!
23. A drug taken orally, to be effective, should:
   - resist stomach acid
   - be readily absorbed by the gastrointestinal tract
   - be only slowly broken down in the liver
   - All of the above are true

24. In order to design a more effective drug, we might consider changing the parent drug structure's
   - size
   - shape
   - polarity
   - All of the above

25. For very large ranges of "P" vs. "C" data in pharmacodynamics studies of a certain drug, we obtain the equation the log (1/C) = 2.1 log P - 0.2 log (P²) + 0.5. The equation predicts that a plot of log(1/C) vs. log P will:
   - be linear, positive slope
   - be linear, negative slope
   - be a bell-shaped curve, with both + and − slopes
   - be a hyperbola

26. A fly-by-night company makes a new AIDS drug sloppily, specifying that the average amount (x) of drug/pill is 39.0 mg with a standard deviation (x) = ±10 mg. It is known that double the normal dose causes fatal side effects. If 1,000,000 patients take this drug once, how many are likely to be killed? (see "Z table", next page) [Recall: Z = (x−μ)/σ] Z : \( \frac{39 \times Z - 39}{10} \) from table
   - none
   - about 1
   - about 50
   - about 2,400

27. A drug company gets IND approval for its hot new drug from the FDA
   - ready to start Phase I clinical trials
   - ready to start toxicology studies in an animal model
   - ready to sell the drug on the market
   - ready to start Phase III clinical trials
28. Key difference in going from Phase I - Phase II clinical trials of an AIDS drug is:

- Phase I, larger patient base
- Phase II, looking for toxicity
- Phase II, looking for efficacy
- Phase I in usually a single-blind study

Table 11.1 Area under the Standard Normal Curve

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Diagram of Area under the Standard Normal Curve.
29. In two clinical trials A and B, A uses 50 patients, B uses 5 patients. We are looking for the statistical significance of a certain toxic side effect that appears in a few patients in both trials. If we use the data from B instead of A, we: (Hint: see table on next page.)
   - increase the value of “t”, the test statistic for a given “level of significance” of a result
   - decrease the value of “t”, the test statistic for a given “level of significance” of a result
   - don’t change the value of “t”, the test statistic for a given “level of significance” of a result
   - increase the degrees of freedom associated with our result

30. AIDS as a disease in the USA was first recognized in the:
   - early 50’s
   - early 60’s
   - early 70’s
   - [early 80’s]

31. HIV stands for:
   - [human immunodeficiency virus]
   - health impairing virus
   - highly immunogenic virus
   - none of the above

32. The most efficient path for HIV transmission:
   - blood transfusions (infected blood).
   - heterosexual intercourse (infected partner)
   - air mist (coughing or sneezing)
   - kissing (mouth to mouth).

33. A recommended procedure for HIV-testing to avoid false positives is:
   - initial Western Blot.
   - initial ELISA.
   - [ELISA; repeat; then if still positive, Western Blot.
   - Western Blot; repeat; then if still positive, ELISA.

34. The ELISA test for HIV involves three steps:
A. patient’s anti-HIV p24 antibody (blood sample) binds to immobilized HIV p24
B. An enzyme linked to an antigen specific for human antibody is added.
C. A colorless compound converted by this enzyme into a yellow product is added.

The correct order of steps is:
Table 11.5  Percentage points for the \( t \) distribution

![Diagram of the t distribution with area shaded on one side.]

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For larger values of \( \nu \) treat \( t \) as a \( z \) score and use the standard normal table.
35. Total cost of bringing a new AIDS drug to market, including development is about:

- $2.5 M
- $25,000
- $250 M
- $250,000

36. Key criterion/criteria for a patentable invention:

- novel
- useful
- novel and useful
- single inventor

37. The key problem in distributing modern drugs to AIDS patients in many “third world” countries is:

- lack of local drug manufacturing facilities
- shortage of physicians to write prescriptions
- lack of drug patent protection in those countries
- cost of licensing patented drugs

38. After exposure to HIV, taking AZT immediately on a daily basis for several months:

- will delay AIDS for 5 - 10 years
- will prevent getting AIDS
- may provide protection against getting AIDS in a few cases
- has no benefit in preventing AIDS

39. What is a “mole”?

- subterranean burrowing animal
- individual within an intelligence agency who secretly works for a foreign agency
- an Avogadro number (6.02 x 10^23) of molecules
- twice the number of molecules in 12.0 g of carbon

40. The drug action of AZT is due to:

- inactivating RT, the enzyme needed for viral DNA replication
- its stopping viral DNA replication by preventing further addition of bases to new DNA strands.
- incorporation of viral DNA into host cell DNA.
- its blocking competitively inhibiting HIV protease
41. The active form of AZT is:
   - AZT monophosphate
   - AZT diphosphate
   - **AZT triphosphate**
   - as taken in the pill (nucleoside).

42. An unexpected (Khalsa) side effect of protease inhibitors is:
   - large fat deposits and high cholesterol.
   - baldness.
   - mental disorders
   - gum disease

43. The best current anti-HIV (AIDS) drug strategy (“HAART”):
   - one drug from each drug class (at least two)
   - two drugs from the same drug class.
   - three drugs from the same drug class.
   - **one drug from each drug class (at least three).**

44. “Gene therapy” of AIDS could involve:
   - repairing “sick” genes
   - is a current basis of AIDS treatment
   - is about to emerge as a key new therapy
   - currently is only a conceptual therapy that may be years in the future

45. One statement is not true:
   - CH₃C(=O)CH₃ is a ketone
   - CH₃NH₂ is an amine
   - Glu–Lys–Gly defines the primary structure of a small peptide
   - in a reaction A + B → C + energy, where k = rate constant and energy = ΔH, an added catalyst will decrease k and increase ΔH

46. The AIDS drug structure shown is a
   - protease inhibitor
   - **nucleoside RT inhibitor**
   - non-nucleoside RT inhibitor
   - all of the above
47. Abacavir is also called Ziagen. Why the dual names for this AIDS drug?
   - one is a company trademark, the other is generic
   - drug companies use multiple names to confuse the consumer
   - companies and FDA couldn’t agree on names.
   - one is for patients, the other for doctors.

48. HIV “viral load”:
   - measures capacity of virus to withstand mutations
   - measures anti-HIV antibody in the blood
   - measures amount of virus RNA in the blood
   - measures a drug’s breadth of action against different viruses

49. A drug that decreases “viral load” by “3 logs” has decreased the amount of virus by:
   - 3
   - 10
   - 300
   - 1000

50. The main problem facing drug therapy for HIV infection in the USA is:
   - drug resistance caused by rapid mutation of the virus
   - less than 2 lead compounds have entered clinical trials in the past two years
   - there are no rational targets for viral drug design
   - there are only 2 classes of AIDS drugs currently available
BONUS QUESTIONS (@4 pts):

B1. If an HIV test gives 1/25 false positives and the known rate of HIV infection among UCLA students is 1/100, what are the odds that a UCLA student who tests positive ONCE is really HIV positive? Explain.

\[
\text{100 students} \rightarrow 1 \text{ real positive} + 4 \text{ false positives} \left( \frac{1}{25} \times 100 \right) \\
5 \text{ odds are } 1 : 5
\]

B2. Give two examples of ethical problems unique to the phenomenon of AIDS, & discuss BRIEFLY.

(any discussed in lecture or in Shire's text ok)