Bi336: Cell Biology Midterm 1: 21. Oct. 2002

Name:_____

Select the ONE answer that best answers the question, read questions carefully!

1.Based on organization and internal structures (as opposed to evolutionary relationship), the most basic division of all cells is into the following two types:
a. *Archaea* and *Bacteria*;
b. *Eukarya* and *Archaea*;
c. * Prokaryotes and eukaryotes;
d. Cindaria and Monera;
e. Plant and animal.

2.Chloroplasts are derived from:
a. * Endosymbiotic bacteria;
b. Invagination of the eukaryotic cell membrane;
c. Expression of nuclear genes;
d. Archaeal symbionts;
e. None of the above.

3.The Golgi apparatus can be found in:
a. *Bacteria*;
b. *Archaea*;
c. * *Eukarya*;
d. a and b;
e. a and c.

4. Flagella are present in which groups of organisms?
a. Prokaryotes
b. Eukaryotes
c. Neither
d. * Both

5.Most of the metabolic and evolutionary diversity of life on Earth can be found within the:
a. Insects;
b. Mollusks;
c. Animals;
d. * Prokaryotes;
e. Fungi.

6.Prior to the radical changes in taxonomy introduced in the 1980's, based largely on ribosomal RNA sequences, Bacteria and Archaea were classified together in the same:
a. Genus;
b. Phylum;
c. Class;
d. * Kingdom;
e. Domain.

7. Chaperones are:
a. * proteins that help other proteins to fold properly;
b. protein molecules that guide newly synthesized proteins to their correct site in the cell;
c. lipid tubules;
d. recognition proteins on the cell surface;
e. none of the above.

8.Ester bonds are formed from:
a. an amine and a carboxyl group;
b. an amine and a methyl group;
c. an alcohol and an amine;
d. an alcohol and a methly group;
e. * an alcohol and a carboxyl group.

9.DNA contains:
a. a carboxyl group;
b. a methyl group;
c. an amino group;
d. a and b;
e. * b and c.

10.Lysine, which has a R group of $-(CH_2)_4NH_3^+$, is a member of what group of amino acids:
a. * polar charged amino acids;
b. polar uncharged amino acids;
c. nonpolar amino acids;
d. other amino acids.

11. The types of amino acid side chains found on the surface of proteins are generally:
a. hydrophobic
b. * charged
c. non-polar
d. a and b
e. a and c

12. Alpha-helices and beta sheets are hallmarks of what level of protein structure?
a. primary structure;
b. * secondary structure;
c. tertiary structure;
d. quaternary structur

13.The valence of oxygen is:
a. * 2;
b. 3;
c. 4;
d. 6;
e. 8.

14.A two-electron reduction of a carboxyl group would produce:

a. * a keto group;
b. an alcohol group;
c. an aldehyde group;
d. a methylene group;
e. a methyl group.

15.The part of a phospholipid that is least hydrophobic is the:
a. acyl group;
b. acetyl group;
c. * phosphate group;
d. methylene group;
e. sugar.

16 Galactose cyclizes:
a. by dehydration, joining the keto oxygen to another carbon of the glucose;
b. * by joining the keto oxygen to another carbon of the glucose (the reaction does not result in a dehydration);
c. by a specific enzyme;
d. a and c;
e. b and c.

17: Starch is a polymer of
a. N-acetyl-glucosamine
b. * Glucose
c. Galactose
d. Fructose
e. None of the above

18. An αβ protein is an example of a:
a. homodimer
b. * heterodimer
c. protein containing 4 subunits
d. a membrane glycoprotein
e. a structural protein

19. Peptide bonds are formed by
a. oxidation
b. reduction
c. * dehydration
d. hydration
e. isomerization

20: What is the correct order of compounds produced during glycolysis
a. * glucose-6-phosphate, 3-phosphoglycerate, phosphoenolpyruvate, pyruvate
b. glucose-6-phosphate, phosphoenolpyruvate, 3-phosphoglycerate, pyruvate
c. pyruvate, phosphoenolpyruvate, 3-phosphoglycerate, glucose-6-phosphate
d. phosphoenolpyruvate, pyruvate, 3-phosphoglycerate, glucose-6-phosphate
e. none of the above

21: What is the correct order of compounds produced during gluconeogenesis?
a. glucose-6-phosphate, 3-phosphoglycerate, phosphoenolpyruvate, pyruvate
b. glucose-6-phosphate, phosphoenolpyruvate, 3-phosphoglycerate, pyruvate
c. * pyruvate, phosphoenolpyruvate, 3-phosphoglycerate, glucose-6-phosphate
d. phosphoenolpyruvate, pyruvate, 3-phosphoglycerate, glucose-6-phosphate
e. none of the above

22: Heterotrophs can use which of the following as energy sources
a. Sunlight
b. Hydrogen sulfide
c. * Protein
d. A and C
e. A and B

23: When glucose is phosphorylated in glycolysis it is to
a. Activate the phosphate so that it can be transferred to ATP
b. * Keep the glucose inside the cell
c. So that it can transfer an electron to NAD
d. To allow the glucose to be isomerized to fructose
e. All of the above

24: For the complete oxidation of glucose to carbon dioxide and water the $\Delta G^{0'}$ is –686 kcal/mol. The $\Delta G^{0'}$ for the formation of ATP is + 7.3 kcal/mol. If these reactions were directly coupled how many ATPs could theoretically be made?
a. 2
b. 4
c. 10
d. 36
e. * 90

25: Substrate level phosphorylation
a. Moves a phosphate from one molecule to another without the requirement for free phosphate
b. Occurs in glycolysis
c. Is catalyzed by enzymes
d. * All of the above
e. None of the above

26: The transformation of cellulose to glucose is
a. * A catabolic reaction
b. An anabolic reaction
c. Has a positive delta G
d. Chemoautotrophic

e. Thermodynamically impossible

27: Allosteric modulation generally
a. Is competitive enzyme inhibition
b. Is specific for one stereoisomer of glucose
c. * Is Non-competitive enzyme inhibition
d. Lowers the ΔG of the reaction
e. Changes the Km of the enzyme

28: Fermentation is critical for animal cells lacking oxygen as a terminal electron acceptor to:
a. make ATP
b. make high energy electrons
c. oxidize NADPH
d. * reduce NADH (N.B. Not graded, typo!)
e. make lactate

29: Your student shows you some data on an enzyme assay that she has done with a new enzyme. She has plotted the data on a Lineweaver-Burk plot (1/[S] vs. 1/V) to determine the Vmax and Km of the uninhibited enzyme. Then she added a new compound to the reaction and repeated the experiment and replotted the data. The slope of the line is less than that of the enzyme assay without addition but her X-intercept is the same, is this new compound that she tried a
a. Competitive inhibitor
b. Non-competitive inhibitor
c. Allosteric inhibitor
d. * None of the above

30: What kind of mechanisms are NOT used to regulate metabolism in heterotrophic cells
a. Allosteric inhibitors
b. * Irreversible inhibitors
c. Protein phosphorylation
d. Competitive inhibitors
e. Non-competitive inhibitors

31: Active sites of enzymes are
a. Often very close in the primary structure of the protein
b. * Often highly electrostatically charged
c. Usually large parts of the protein
d. Usually very inflexible
e. Usually bind many chemically different substrates

32: Enzymes
a. Align substrates
b. Change the charge of substrates
c. Stress the substrate
d. A and C
e. * A, B and C

33: Enzymes
a. Increase the ΔG of reactions
b. Decrease the ΔG of reactions
c. Increase the activation energy of reactions
d. * Decrease the activation energy of reactions
e. Allow reactions to proceed in both forward and reverse directions

34: The splitting of the peptide bond in the substrate protein by the enzyme chymotrypsin requires
a. Very high energy
b. * The addition of water
c. A dimer of enzyme
d. Low pH
e. High pH

35: Enzymes basically do the same thing as heating up the reactants:
a. * True
b. False

36: Most of the time the concentrations of ADP and ATP in metabolizing cells are
a. In equilibrium
b. * In steady state
c. Changing a lot
d. Impossible to calculate
e. Determined by the amount of glucose available

37: If $K_{eq} = 1$ then the $\Delta G^{0'}$ at 25C is
a. * 0
b. 1
c. 2
d. 2.303
e. 10

38: Which of the following polymers are not known to catalyze chemical reactions:
a. RNA
b. Protein
c. Polysaccharides
d. Lipids
e. * C and D

39: Enzymes are NOT
a. Highly specific
b. Excellent catalysts
c. * Very heat stable
d. Able to be very well controlled
e. Able to lower very high activation energy barriers

40: From knowing the transition state of an enzymatically catalyzed reaction a non-competitive inhibitor can be synthesized

a. True
b. * False

41: In the reaction $Se^{4+} + As^{3+} = Se^{2+} + As^{5+}$ which element is being reduced?
a. * Selenium
b. Arsenic
c. Neither
d. Both

42: For the reaction $CO_2 + 4H_2 \rightarrow CH_4 + 2H_2O$ what is the ΔG^0, given that the ΔG^0_f of CO_2 is -390 kJl/mol, H_2 is 0 kJ/mol, CH_4 is –50 kJ/mol and H_2O is -240 kJ/mol.
a. -100 kJ/rxn
b. -290 kJ/rxn
c. * -130 kJ/rxn
d. -390 kJ/rxn
e. +100 kJ/rxn

43: The addition of a non-competitive enzyme inhibitor to an enzyme catalyzed reaction is equivalent to
a. Lowering the temperature
b. * Lowering the enzyme concentration
c. Raising the substrate concentration
d. Raising the temperature
e. Lowering the product concentration

44.Comparison of what type of energy determines whether a reaction will tend to occur?
a. enthalpy;
b. * free energy;
c. entropy;
d. kinetic energy;
e. atomic.

45.A small K_{eq} (<1) for a reaction implies:
a. * the reaction is strongly endergonic;
b. the reaction is strongly exergonic;
c. the reaction will occur rapidly;
d. the reaction will occur slowly;
e. the reaction will not occur.

46.Decreasing the concentration of a product of a reaction would:
a. * make the free-energy change more negative;
b. make the free-energy change more positive;
c. change the stoichiometry of the reaction;
d. stop the reaction.

47. The standard free-energy of formation of an element in its standard state is:
a. usually negative;
b. usually positive;
c. * always zero;
d. none of the above.

48.The standard free-energy change for hydrolyzing the beta-gamma phosphate bond in ATP to ADP + Pi is almost the same as that for hydrolyzing the alpha-beta phosphate bond in ATP to AMP + pyrophosphate. However, in a typical cell, the actual free-energy change for the latter reaction is much more negative. This is mostly because:
a. Pi has more evenly distributed charge than does pyrophosphate;
b. Pi has a lower ΔG^0_f than does pyrophosphate;
c. [Pi] is less than [ADP];
d. * [Pi] is much greater than [pyrophosphate];
e. ADP and ATP are in a steady state

49.In Michaelis-Menten kinetics, which of the following is assumed:
a. The substrate binds the enzyme irreversibly until the substrate is converted to products;
b. The enzyme is not at its optimal temperature;
c. * The product concentration is so low that it never recombines with the enzyme;
d. All of the enzyme's active sites contain a substrate molecule;
e. The allosteric site is not blocked.

50. When the reaction A -> B reaches equilibrium, the concentration of A is 2 times higher than that of B. This means that under standard conditions, the reaction is:
a. exergonic;
b. from a more reduced to a less reduced state;
c. * endergonic;
d. endothermic;
e. a coupled reaction.