

1st Semester Final Exam Study Guide (excluding DNA/protein synthesis)

Identify the choice that best completes the statement or answers the question.

Use the following information to answer the following questions.

Succinate dehydrogenase catalyzes the conversion of succinate to fumarate. The reaction is inhibited by malonic acid, which resembles succinate but cannot be acted upon by succinate dehydrogenase. Increasing the ratio of succinate to malonic acid reduces the inhibitory effect of malonic acid.

1. Based on this information, which of the following is correct?
 - a) Succinate dehydrogenase is the enzyme, and fumarate is the substrate.
 - b) Succinate dehydrogenase is the enzyme, and malonic acid is the substrate.
 - c) Succinate is the substrate, and fumarate is the product.
 - d) Fumarate is the product, and malonic acid is a noncompetitive inhibitor.
 - e) Malonic acid is the product, and fumarate is a competitive inhibitor.
2. What is the purpose of using malonic acid in this experiment?
 - a) It is a competitive inhibitor.
 - b) It blocks the binding of fumarate.
 - c) It is a noncompetitive inhibitor.
 - d) It is able to bind to succinate.
 - e) It replaces the usual enzyme.
3. Which of the following triggers the cell's passage past the G2 checkpoint into mitosis?
 - a) PDGF
 - b) MPF
 - c) protein kinase
 - d) cyclin
 - e) Cdk
4. All of the following statements concerning saturated fats are true except
 - a) They are more common in animals than in plants.
 - b) They have multiple double bonds in the carbon chains of their fatty acids.
 - c) They generally solidify at room temperature.
 - d) They contain more hydrogen than saturated fats having the same number of carbon atoms.
 - e) They are one of several factors that contribute to atherosclerosis.
5. Grana, thylakoids, and stroma are all components found in
 - a) vacuoles.
 - b) chloroplasts.
 - c) mitochondria.
 - d) lysosomes.
 - e) nuclei.

6. Which of the following store and transmit hereditary information?

- a) carbohydrates
- b) lipids
- c) proteins
- d) nucleic acids

7. When hydrogen ions are pumped from the mitochondrial matrix across the inner membrane and into the intermembrane space, the result is the

- a) formation of ATP.
- b) reduction of NAD.
- c) restoration of the Na/K balance across the membrane.
- d) creation of a proton gradient.
- e) lowering of pH in the mitochondrial matrix.

8. If there are 20 chromatids in a cell, how many centromeres are there?

- a) 10
- b) 20
- c) 30
- d) 40
- e) 80

9. DNA is replicated at this time of the cell cycle:

- a) G₀
- b) G₁
- c) S
- d) G₂
- e) M

10. Pure, freshly-distilled water has a pH of 7. This means that

- a) there are no H ions in the water.
- b) there are no OH ions in the water.
- c) the concentration of H ions in the water equals the concentration of OH ions in the water.
- d) the concentration of H ions in the water is 7 times the concentration of OH ions in the water.
- e) The concentration of OH ions in the water is 7 times the concentration of H ions in the water.

11. From the perspective of the cell receiving the message, the three stages of cell signaling are

- a) the paracrine, local, and synaptic stages.
- b) signal reception, signal transduction, and cellular response.
- c) signal reception, nucleus disintegration, and new cell generation.
- d) the alpha, beta, and gamma stages.
- e) signal reception, cellular response, and cell division.

12. Which of these often serve as receptors or cell recognition molecules on cell surfaces?

- a) transmembrane proteins
- b) integral proteins
- c) peripheral proteins
- d) integrins
- e) glycoproteins

13. Approximately how many molecules of ATP are produced from the complete oxidation of two molecules of glucose ($C_6H_{12}O_6$) in cellular respiration?

- a) 2
- b) 4
- c) 15
- d) 38
- e) 76

14. The oxygen consumed during cellular respiration is involved directly in which process or event?

- a) glycolysis
- b) accepting electrons at the end of the electron transport chain
- c) the citric acid cycle
- d) the oxidation of pyruvate to acetyl CoA
- e) the phosphorylation of ADP to form ATP

15. Which of the following normally occurs whether or not oxygen (O_2) is present?

- a) glycolysis
- b) fermentation
- c) oxidation of pyruvate to acetyl CoA
- d) citric acid cycle
- e) oxidative phosphorylation (chemiosmosis)

16. In glycolysis, for each molecule of glucose oxidized to pyruvate

- a) 2 molecules of ATP are used and 2 molecules of ATP are produced.
- b) 2 molecules of ATP are used and 4 molecules of ATP are produced.
- c) 4 molecules of ATP are used and 2 molecules of ATP are produced.
- d) 2 molecules of ATP are used and 6 molecules of ATP are produced.
- e) 6 molecules of ATP are used and 6 molecules of ATP are produced.

17. The bonding of two amino acid molecules to form a larger molecule requires

- a) the release of a water molecule.
- b) the release of a carbon dioxide molecule.
- c) the addition of a nitrogen atom.
- d) the addition of a water molecule.
- e) both B and C

18. Which of the following contains its own DNA and ribosomes?

- a) lysosome
- b) vacuole
- c) mitochondrion
- d) Golgi apparatus
- e) peroxisome

19. A molecule with the chemical formula $C_6H_{12}O_6$ is probably a

- a) carbohydrate.
- b) lipid.
- c) monosaccharide
- d) A and B only.
- e) A, B, and C.

20. What is the pH of a solution with a hydroxyl ion $[OH^-]$ concentration of $10^{-10} M$?

- a) pH 2
- b) pH 4
- c) pH 10
- d) pH 12
- e) pH 14

21. In the absence of oxygen, yeast cells can obtain energy by fermentation, resulting in the production of

- a) ATP, CO_2 , and ethanol (ethyl alcohol).
- b) ATP, CO_2 , and lactate.
- c) ATP, NADH, and pyruvate.
- d) ATP, pyruvate, and oxygen.
- e) ATP, pyruvate, and acetyl CoA.

22. Which of the following is a statement of the first law of thermodynamics?

- a) Energy cannot be created or destroyed.
- b) The entropy of the universe is decreasing.
- c) The entropy of the universe is constant.
- d) Kinetic energy is stored energy that results from the specific arrangement of matter.
- e) Energy cannot be transferred or transformed.

23. You are working on a team that is designing a new drug. In order for this drug to work, it must enter the cytoplasm of specific target cells. Which of the following would be a factor that determines whether the molecule enters the cell?

- a) blood or tissue type of the patient
- b) non-polarity of the drug molecule
- c) lack of charge on the drug molecule
- d) similarity of the drug molecule to other molecules transported by the target cells
- e) lipid composition of the target cells' plasma membrane

24. Which of the following hydrocarbons has a double bond in its carbon skeleton?

- a) C_3H_8
- b) C_2H_6
- c) CH_4
- d) C_2H_4
- e) C_2H_2

25. A covalent chemical bond is one in which

- a) electrons are removed from one atom and transferred to another atom so that the two atoms become oppositely charged.
- b) protons and neutrons are shared by two atoms so as to satisfy the requirements of both atoms.
- c) outer-shell electrons of two atoms are shared so as to satisfactorily fill the outer electron shells of both atoms.
- d) outer-shell electrons of one atom are transferred to the inner electron shells of another atom.
- e) the inner-shell electrons of one atom are transferred to the outer shell of another atom.

26. When biological membranes are frozen and then fractured, they tend to break along the middle of the bilayer. The best explanation for this is that

- a) the integral membrane proteins are not strong enough to hold the bilayer together.
- b) water that is present in the middle of the bilayer freezes and is easily fractured.
- c) hydrophilic interactions between the opposite membrane surfaces are destroyed on freezing.
- d) the carbon-carbon bonds of the phospholipid tails are easily broken.
- e) the hydrophobic interactions that hold the membrane together are weakest at this point.

27. Which of the following is likely to lead to an increase in the concentration of ATP in a cell?

- a) an increase in a cell's anabolic activity
- b) an increase in a cell's catabolic activity
- c) an increased influx of cofactor molecules
- d) an increased amino acid concentration
- e) the cell's increased transport of materials to the environment

28. Calcium has an atomic number of 20 and an atomic mass of 40. Therefore, a calcium atom must have

- a) 20 protons.
- b) 40 electrons.
- c) 40 neutrons.
- d) A and B only
- e) A, B, and C

29. Through a microscope, you can see a cell plate beginning to develop across the middle of a cell and nuclei re-forming on either side of the cell plate. This cell is most likely

- a) an animal cell in the process of cytokinesis.
- b) a plant cell in the process of cytokinesis.
- c) an animal cell in the S phase of the cell cycle.
- d) a bacterial cell dividing.
- e) a plant cell in metaphase.

30. Which term most precisely describes the cellular process of breaking down large molecules into smaller ones?

- a) catalysis
- b) metabolism
- c) anabolism
- d) dehydration
- e) catabolism

31. How many molecules of glucose (molecular mass =180 daltons) would be present in one mole of glucose?

- a) 24
- b) 342
- c) 23×10^{14}
- d) 180×10^{14}
- e) 6.02×10^{23}

32. Which of the following statements concerning prokaryotic and eukaryotic cells is not correct?

- a) Prokaryotic cells lack a membrane-bound nucleus.
- b) Prokaryotic cells contain small membrane-enclosed organelles.
- c) Eukaryotic cells contain a membrane-bound nucleus.
- d) DNA, or deoxyribonucleic acid, is present in both prokaryotic cells and eukaryotic cells.
- e) DNA or deoxyribonucleic acid is present in the nucleus of eukaryotic cells.

33. A small molecule that specifically binds to another molecule, usually a larger one

- a) is called a signal transducer.
- b) is called a ligand.
- c) is called a polymer.
- d) seldom is involved in hormonal signaling.
- e) usually terminates a signal reception.

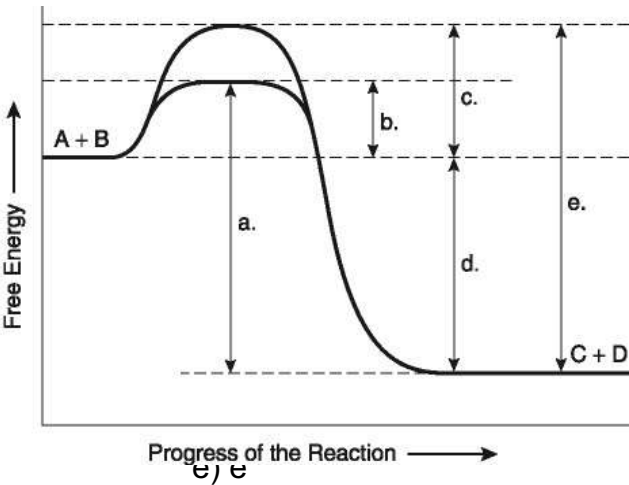
34. In chemiosmotic phosphorylation, what is the most direct source of energy that is used to convert ADP + to ATP?

- a) energy released as electrons flow through the electron transport system
- b) energy released from substrate-level phosphorylation
- c) energy released from ATP synthase pumping hydrogen ions from the mitochondrial matrix
- d) energy released from movement of protons through ATP synthase
- e) No external source of energy is required because the reaction is exergonic.

35. Whenever energy is transformed, there is always an increase in the

- a) free energy of the system.
- b) free energy of the universe.
- c) entropy of the system.
- d) entropy of the universe.
- e) enthalpy of the universe.

The following questions are based on the reaction $A + B \rightarrow C + D$ shown in Figure 8.2.



activation energy required for the enzyme-

37. Which of the following would be the same in an enzyme-catalyzed or noncatalyzed reaction?
- a
 - b
 - c

38. Which of the following represents the activation energy required for a noncatalyzed reaction?

- a
- b
- c
- d
- e

39. Where does glycolysis takes place?

- mitochondrial matrix
- mitochondrial outer membrane
- mitochondrial inner membrane
- mitochondrial intermembrane space
- cytosol

40. Which of the following correctly lists the order in which cellular components will be found in the pellet when homogenized cells are treated with increasingly rapid spins in a centrifuge?

- ribosomes, nucleus, mitochondria
- chloroplasts, ribosomes, vacuoles
- nucleus, ribosomes, chloroplasts
- vacuoles, ribosomes, nucleus
- nucleus, mitochondria, ribosomes

41. Which of the following statements is true concerning catabolic pathways?

- They combine molecules into more energy-rich molecules.
- They are usually coupled with anabolic pathways to which they supply energy in the form of ATP.
- They are endergonic.
- They are spontaneous and do not need enzyme catalysis.
- They build up complex molecules such as protein from simpler compounds.

42. A type of protein critical to all cells is organic catalyts called

- a) feedback activators.
- b) feedback inhibitors.
- c) enzymes.
- d) metabolites.
- e) nutrients.

43. All of the following are part of a prokaryotic cell except

- a) DNA.
- b) a cell wall.
- c) a plasma membrane.
- d) ribosomes.
- e) an endoplasmic reticulum.

44. Ions diffuse across membranes down their

- a) chemical gradients.
- b) concentration gradients.
- c) electrical gradients.
- d) electrochemical gradients.
- e) A and B are correct.

45. Sucrose is a disaccharide, composed of the monosaccharides glucose and fructose. The hydrolysis of sucrose by the enzyme sucrase results in

- a) bringing glucose and fructose together to form sucrose.
- b) the release of water from sucrose as the bond between glucose and fructose is broken.
- c) breaking the bond between glucose and fructose and forming new bonds from the atoms of water.
- d) production of water from the sugar as bonds are broken between the glucose monomers.
- e) utilization of water as a covalent bond is formed between glucose and fructose to form sucrase.

46. Choose the pair of terms that correctly completes this sentence: Catabolism is to anabolism as _____ is to _____.

- a) exergonic; spontaneous
- b) exergonic; endergonic
- c) free energy; entropy
- d) work; energy
- e) entropy; enthalpy

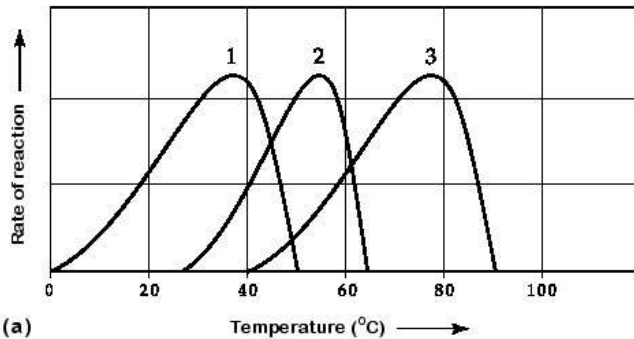
47. When you have a severe fever, what may be a grave consequence if this is not controlled?

- a) destruction of your enzymes' primary structure
- b) removal of amine groups from your proteins
- c) change in the folding of enzymes
- d) removal of the amino acids in active sites
- e) binding of enzymes to inappropriate substrates

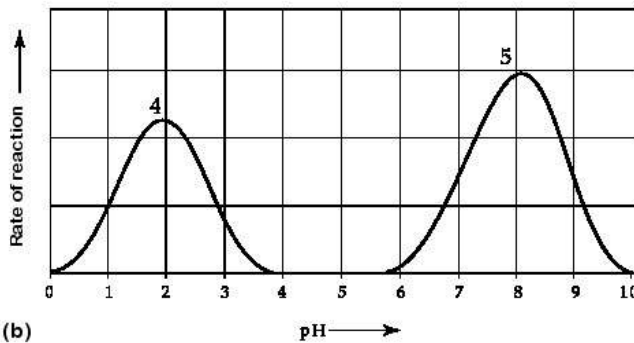
48. If a modern electron microscope (TEM) can resolve biological images to the nanometer level, as opposed to the best light microscope, this is due to which of the following?

- The focal length of the electron microscope is significantly longer.
- Contrast is enhanced by staining with atoms of heavy metal.
- Electron beams have much shorter wavelengths than visible light.
- The electron microscope has much greater ratio of image size to real size.
- The electron microscope cannot image whole cells at one time.

Refer to Figure 8.1 to answer the following questions.



Enzyme taken from a bacterium that lives in a hot spring?



Analysis of an enzyme from a human stomach?

51. Zinc, an essential trace element for most organisms, is present in the active site of the enzyme carboxypeptidase. The zinc most likely functions as a(n)

- competitive inhibitor of the enzyme.
- noncompetitive inhibitor of the enzyme.
- allosteric activator of the enzyme.
- cofactor necessary for enzyme activity.
- coenzyme derived from a vitamin.

52. The main source of energy for producers in an ecosystem is

- light energy.
- kinetic energy.
- thermal energy.
- chemical energy.
- ATP.

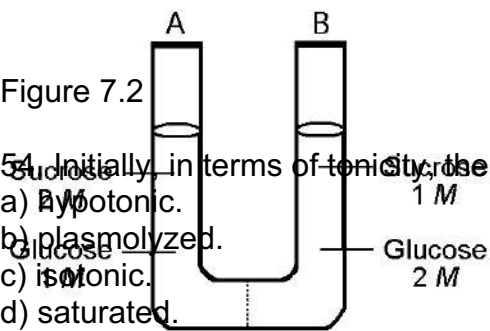
53. Reactants capable of interacting to form products in a chemical reaction must first overcome a thermodynamic barrier known as the reaction's

- entropy.
- activation energy.
- endothermic level.

- d) heat content.
- e) free-energy content.

Use the diagram of the U-tube in Figure 7.2 to answer the questions that follow.

The solutions in the two arms of this U-tube are separated by a membrane that is permeable to water and glucose but not to sucrose. Side A is half filled with a solution of 2 M sucrose and 1 M glucose. Side B is half filled with 1 M sucrose and 2 M glucose. Initially, the liquid levels on both sides are equal.



54. Initially, in terms of tonicity, the solution in side A with respect to that in side B is

- a) hypotonic.
- b) plasmolyzed.
- c) isotonic.
- d) saturated.
- e) hypertonic.

55. A patient has had a serious accident and lost a lot of blood. In an attempt to replenish body fluids, distilled water, equal to the volume of blood lost, is transferred directly into one of his veins. What will be the most probable result of this transfusion?

- a) It will have no unfavorable effect as long as the water is free of viruses and bacteria.
- b) The patient's red blood cells will shrivel up because the blood fluid is hypotonic compared to the cells.
- c) The patient's red blood cells will swell because the blood fluid is hypotonic compared to the cells.
- d) The patient's red blood cells will shrivel up because the blood fluid is hypertonic compared to the cells.
- e) The patient's red blood cells will burst because the blood fluid is hypertonic compared to the cells.

56. After the system reaches equilibrium, what changes are observed?

- a) The molarity of sucrose and glucose are equal on both sides.
- b) The molarity of glucose is higher in side A than in side B.
- c) The water level is higher in side A than in side B.
- d) The water level is unchanged.
- e) The water level is higher in side B than in side A.