

NAME (Last, First) _____ Disc. Instructor _____

(PRINT CLEARLY, LAST, then First)

Your participation in the course requires that you follow examination policies.

Instructions: To prevent cheating, **nothing** may be on your desk but a pencil and eraser.

Nothing may be on the empty seats: everything must be under your own seat, and out of sight. This includes:

Water bottles, drinks, cups

Phones

Books and notes

Hats and jackets

etc.


All watches must be removed and put away inside backpacks. All cell phones must be turned off AND put inside backpacks.

Keep your exams and answer sheets flat on your desk; do not lift them up to your face to read them, as others will be able to see your answers too.

When there are 10 minutes left, stay in your seats until the exam is finished. We will also not answer any questions during the last 10 minutes to avoid disturbing others.

Please write your answers clearly on your answer sheet.

See below and write your responses clearly. Be sure to include the version (after

Name	Version (A) (B) (C) (D) (E)
ID	Other
<u>Discussion # (not lab)</u>	Marking Instructions Be sure to completely fill in the appropriate bubble. Example 
Date: Sept. 30, 2024	

This exam is 50 minutes long. When the timer goes off, you must stop working. If you continue to work, we may not accept your exam. **This includes filling in your name, SID and answers** on the answer sheet; this needs to be done before the timer goes off.

Do not begin until instructed to do so. Each question is worth 2.5 points unless indicated otherwise. (Version of the exam is always worth 0 points, but very important).

1) In a water molecule, what kind of bond is formed between the two hydrogen atoms and the oxygen atoms?

- a) Hydrogen bonds
- b) Non-polar covalent bonds
- c) Polar covalent bonds
- d) Ionic bonds
- e) Metallic bonds

2) How does the polarity of water contribute to its ability to dissolve so many substances?

- a) Tap water has a pH of 5.6, which is slightly acidic. Acids can dissolve more substances than bases can.
- b) Water's polarity allows it to form covalent bonds with many substances.
- c) Because water is polar, water forms ionic bonds with the ions in substances such as NaCl (salt).
- d) Because it is polar, water's partially negatively charged oxygen atoms and partially positively charged hydrogen atoms are attracted to positively and negatively charged ions and molecules.

3) The pH of your small intestines is around 7.5 and the pH of your large intestine can be 5.5. As substances travel from the small intestine to the large intestine, what would happen to the H^+ concentration?

- a) It decreases 100-fold
- b) It increases by 100-fold
- c) It increases 10-fold
- d) It increases 2-fold
- e) It decreases 10-fold

4) In a hydrolysis reaction, _____, and in this process, water is _____.

- a) Monomers are assembled to produce a polymer; consumed
- b) A polymer is broken up into its constituent monomers; produced
- c) A monomer is broken up into its constituent polymers; produced
- d) A polymer is broken up into its constituent monomers; consumed
- e) Monomers are assembled to produce a polymer; produced.

5) The formula for glucose is $C_6H_{12}O_6$. What is the formula for a polymer made by linking 10 glucose molecules together via dehydration synthesis?

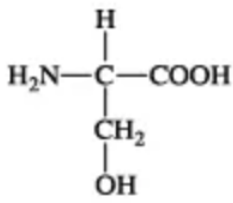
- a) $C_{60}H_{111}O_{51}$
- b) $C_{60}H_{102}O_{51}$
- c) $C_{60}H_{120}O_6$
- d) $C_{60}H_{100}O_{50}$

6) You are on a team that retrieves a sample of a novel archeal microorganism that grows in the boiling hot water of a deep-sea thermal vent. You wish to understand how the organism can withstand such high temperatures by evaluating the base composition of its DNA. Which ONE of the following do you expect to be enriched in the DNA of this organism?

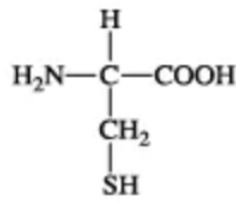
- a) G-C base pairs
- b) G-G base pairs
- c) U-A base pairs
- d) A-T base pairs

7) Insulin has two polypeptide chains linked by an amino acid that can be oxidized to form a cross link. Which one of the following serves this role? Images shown below.

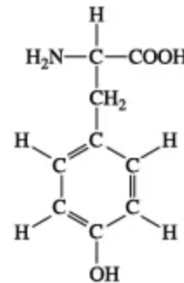
- a) Serine
- b) Cysteine
- c) Tyrosine
- d) Glutamine



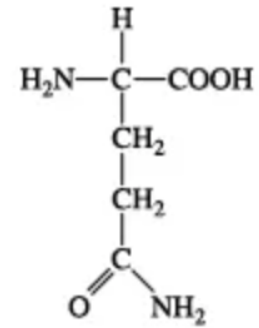
serine
(Ser, S)



cysteine
(CysH, C)



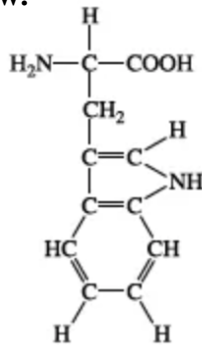
tyrosine
(Tyr, Y)



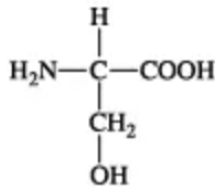
glutamine
(GluNH₂, GluN,
or Gln, Q; Glx or Z)

8) Most of the amino acids have a chiral alpha carbon. Which ONE of the following is an exception? Images shown below.

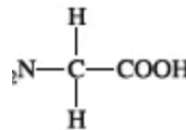
- a) Tryptophan
- b) Serine
- c) Glycine
- d) Leucine



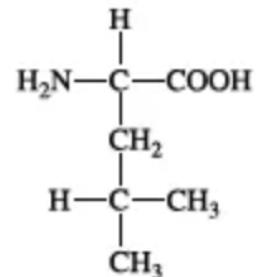
tryptophan
(Try or Trp, W)



serine
(Ser, S)



glycine
(Gly, G)



leucine
(Leu, L)

9) Which ONE of the following molecules does not contain a glycosidic linkage?

- a) Glucose
- b) Glycogen
- c) NAD⁺
- d) Adenosine

10) Alpha helices and beta-pleated sheets are examples of the secondary structure of proteins. What type of bonding is primarily involved in stabilizing these structures?

- a) Covalent bonding
- b) Hydrophobic interactions
- c) Disulfide bonds
- d) Hydrogen bonds

11) Which of the following statements describes a major advantage of light microscopy over electron microscopy?

- a) Light microscopy provides higher magnification than electron microscopy
- b) Light microscopy provides higher resolution than electron microscopy
- c) Light microscopy allows visualization of dynamic processes in living cells
- d) Light microscopy provides visualization of the topography of cell surfaces

12) Which ONE of the following is the most appropriate technique for observing and measuring the size of ribosomes in a eukaryotic cell?

- a) Cell Fractionation
- b) Magnifying glass
- c) Light microscopy
- d) Electron microscopy

13) A particular cell contains the following molecules and structures: enzymes, DNA, ribosomes, plasma membrane, and mitochondria. Based on this composition, it could be a cell from which of the following organisms?

- a) A bacterium, but not a eukaryote
- b) An animal, but not a plant
- c) Nearly any eukaryotic organism
- d) A plant, but not an animal

Please Mark A, upper right corner of your answer sheet. You have version A.

14) Which ONE of the following properties applies to lipoproteins such as LDL?

- a) Lipoproteins are made in the nucleus and transported through the nuclear pore
- b) LDL dissolves plaques in arteries
- c) LDL particles fuse with the cell surface to secrete cholesterol
- d) LDL is important in the control of cholesterol biosynthesis

15) Bacterial cells have which ONE of the following properties?

- a) A peptidoglycan layer which maintains cell integrity.
- b) Cells generate ATP from a Na⁺/K⁺ ATPase.
- c) Chromosome surrounded by a nuclear membrane.
- d) Use an electron transport chain to maintain a constant cell temperature.

16) What type of amino acids would you expect to find in the transmembrane portion of a membrane protein?

- a) Charged amino acids
- b) Polar amino acids
- c) Non-polar amino acids
- d) Hydrophilic amino acids

17) Which ONE of the following does not proceed by a dehydration reaction?

- a) ATP synthesis (ADP + Pi)
- b) Reduction of NAD⁺
- c) Peptide bond formation
- d) Polynucleotide synthesis

Did you mark the exam version, upper right corner of your answer sheet?

18) Membranes with short chain-length fatty acids influence the membrane bilayer in the same way as do fatty acids with unsaturated bonds. Which ONE of the fluid properties of a membrane will be affected by short chain fatty acids?

- a) Lower the temperature at which the membrane transitions from fluid to frozen.
- b) Decrease the membrane fluidity.
- c) Decrease the rate of recovery in a FRAP experiment.
- d) Increase the phase transition temperature.

19) Each layer of a bilayer membrane is known as a leaflet. A particular glycolipid is located in the Golgi. When vesicles bud off of the Golgi and fuse with the plasma membrane, where is that particular glycolipid located?

- a) In the interior of the bilayer
- b) In the Inner leaflet of the plasma membrane (facing the cytosol)
- c) In the outer leaflet of the plasma membrane (facing the exterior of the cell)
- d) Released to the cytosol

20) The voltage-gated K⁺ channel has which ONE of the following properties?

- a) Initiates a depolarizing action potential
- b) Selects anhydrous K⁺ over Na⁺
- c) Uses ATP hydrolysis to import K⁺
- d) Transports 2K⁺ out for every 3 Na⁺ taken into the cell

21) Which of the following correctly states the relationship between anabolic and catabolic pathways?

- a) Energy derived from catabolic pathways is used to drive the breakdown of organic molecules in anabolic pathways.
- b) Degradation of organic molecules by anabolic pathways provides the energy to drive catabolic pathways.
- c) Anabolic pathways synthesize more complex organic molecules using energy derived from catabolic pathways.
- d) The flow of energy between catabolic and anabolic pathways is reversible.
- e) Catabolic pathways produce usable cellular energy by synthesizing more complex organic molecules.

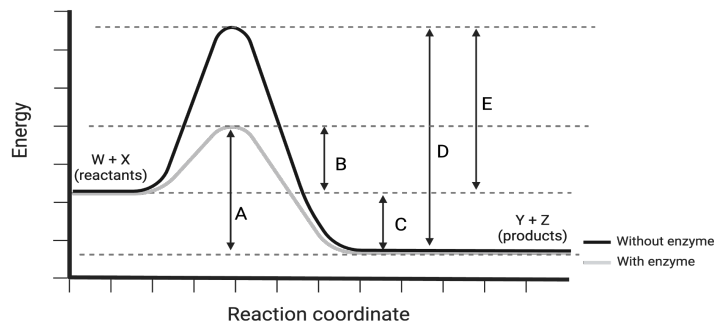
22) Cells use ATP to drive endergonic reactions because:

- a) ATP is the universal catalyst
- b) Energy released by ATP hydrolysis makes ΔG for coupled reactions more negative
- c) Energy released by ATP hydrolysis makes ΔG for coupled reactions more positive
- d) The conversion of ATP to ADP + Pi is endergonic

23) In the original test to see if the Watson-Crick model is correct, which ONE of the following trinucleotide pairs do you expect to be in equivalent amounts?

- a) 5'AGC3' = 5'GGT3'
- b) 5'CGA3' = 5'GCT3'
- c) 5'AAG3' = 5'CTC3'
- d) 5'GGA3' = 5'TCC3'

24) In the reaction coordinate, which of the following, A-E, is describing the ΔG of the reaction without an enzyme?



25) Which of the following is changed by the presence of an enzyme?

- The G value for the reactants
- The activation energy
- The sign of ΔG
- The magnitude of ΔG
- The G value of the products

26) What does the sign and magnitude of the ΔG of a reaction tell us about the speed of the reaction?

- The more negative the ΔG , the faster the reaction
- Neither the sign nor magnitude of the ΔG has anything to do with the speed of the reaction.
- The sign determines whether the reaction is spontaneous, and the magnitude tells you the speed
- The sign does not matter, but the larger the magnitude of ΔG , the faster the reaction.

27) A reaction, $A \rightarrow B$ has a ΔG° of + 3.4 kcal/mole based upon the initial concentration of 0.5 moles/L of A and 0.5 moles/L of B. What is the ΔG° of the reverse reaction, $B \rightarrow A$ (using the same initial concentration of 0.5 moles/L of A and B).

- 0.0 kcal/mole
- + 3.4 kcal/mole
- 3.4 kcal/mole
- cannot be determined

28) What is the key step in the coupling of endergonic and exergonic reactions?

- Introducing a transport protein
- Adjusting the temperature and pH
- Decreasing the free energy
- The formation of a phosphorylated intermediate

29) What is the oxidizing agent in the chemical reaction below:



- Pyruvate
- NADH
- Lactate
- NAD^+

Please mark A (version A), upper right on your answer sheet.

30) Which ONE of the following steps in photosynthesis is NOT an example of a redox reaction?

- a) Electron transfer from the P680 reaction center to the primary electron acceptor
- b) Reduction of P680⁺ by the splitting of water
- c) Synthesis of ATP by ATP synthase
- d) Synthesis of NADPH by NADP⁺ reductase

31) Which of the statements best describes the relationship between autotrophs and heterotrophs?

- a) Autotrophs produce their organic molecules from CO₂ and other inorganic molecules, whereas heterotrophs obtain their organic molecules from compounds produced by other organisms.
- b) Heterotrophs produce their organic molecules from CO₂ and other inorganic molecules, whereas autotrophs obtain their organic molecules from compounds produced by other organisms.
- c) Both autotrophs and heterotrophs produce some of their organic molecules from CO₂ and other inorganic molecules.
- d) Heterotrophs are considered the producers of the biosphere, where autotrophs are consumers.

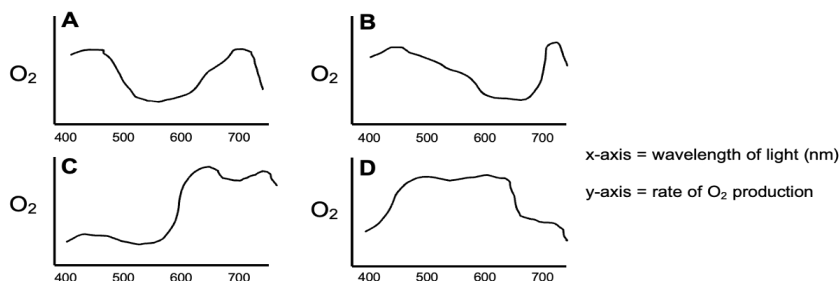
32) Which of the following processes is directly associated with Photosystem I?

- a) Extracting hydrogen electrons from the splitting of water
- b) Generating molecular oxygen
- c) Passing electrons to NADP⁺
- d) Receiving electrons from the thylakoid membrane electron transport chain

33) Which of the following molecules is the primary reducing agent in the Calvin cycle reaction?

- a) ATP
- b) NADH
- c) NADP⁺
- d) NADPH

34) Cyanobacteria are photosynthetic organisms that are commonly called “blue-green algae” because of their blue and green coloring. Which of the following curves is a reasonable approximation of the action spectra of cyanobacteria?



35) Which of the statements best describes the relationship between photosynthesis and cellular respiration?

- a) Cellular respiration runs the same exact biochemical pathways of photosynthesis in reverse
- b) Photosynthesis stores energy in complex organic molecules; cellular respiration releases energy from complex organic molecules
- c) Photosynthesis occurs only in plants; cellular respiration occurs only in animals
- d) Photosynthesis is catabolic; cellular respiration is anabolic

EXAM CONTINUES

- 36) Which of the following statements correctly describes the relationship between the light reactions and the Calvin-Benson Cycle?**
- a) The light reactions produce water, ATP, and NADPH, all of which are used in the Calvin-Benson Cycle
 - b) The light reactions produce carbon dioxide and water, both of which are used in the Calvin-Benson cycle
 - c) The light reactions produce ADP and NADP⁺, both of which are used in the Calvin-Benson Cycle
 - d) The light reactions produce carbon dioxide, ATP, and NADH, all of which are used in the Calvin-Benson cycle.
 - e) The light reactions produce ATP and NADPH, both of which are used in the Calvin-Benson cycle
- 37) In a time-course, pulse labeling experiment of a C₄ plant leaf with a heavy carbon isotope, ¹⁴C (similar to the “lollipop” experiment done by Calvin and Benson), which one of the following compounds would you expect to be the first ¹⁴C-labeled product detected at the earliest time point?**
- a) 3-phosphoglycerate
 - b) Ribulose biphosphate
 - c) Oxaloacetate
 - d) Glyceraldehyde 3-phosphate
- 38) A major purpose of the Electron Transport Chain (ETC) in mitochondria is to**
- a) regenerate reduced molecules, NADH, FADH₂
 - b) produce ADP + Pi
 - c) regenerate oxidized molecules, NAD⁺, FAD
 - d) diminish the proton gradient
 - e) to regenerate NADP⁺
- 39) If you break down three glucose molecules to Acetyl CoA, how many NADH + H⁺ molecules would come out?**
- a) 3
 - b) 6
 - c) 9
 - d) 12
 - e) 15
- 40) What is the typical order for the 4 stages of cellular respiration?**
- a) Glycolysis, Pyruvate oxidation, Citric Acid Cycle, Oxidative Phosphorylation
 - b) Glycolysis, Oxidative Phosphorylation, Pyruvate oxidation, Citric Acid Cycle
 - c) Pyruvate oxidation, Oxidative Phosphorylation, Glycolysis, Citric Acid Cycle
 - d) Citric Acid Cycle, Glycolysis, Pyruvate oxidation, Oxidative Phosphorylation
 - e) Citric Acid Cycle, Pyruvate oxidation, Glycolysis, Oxidative Phosphorylation

END OF THE EXAM