

I.D. #: G: _____ Name: _____

BIOL 230: Cell & Molecular Biology MIDTERM EXAM #2 Dr. Nathan Staples

Scantron Instructions:

1. Make sure you have a **200-** question, **RED/ORANGE** form!!
2. Use a **#2** or **HB** pencil to complete the form.
3. Write in your **name, date, and I.D. #** on BOTH the **scantron & each page of the examination.**
4. Fill-in on Scantron: **G#** ("**G**" = "**0**" + 8 digits), exam #: **232**, Form: **A**.
5. **Darkly** Fill-in the **entire rectangle** for the answer you choose.

M/C = _____ / **60**

Essays = _____ / **40**

Total = _____ / 100

READ ALL QUESTIONS THOROUGHLY. FOR ALL M/C questions, PICK THE BEST ANSWER.
38 QUESTIONS, 2 or 20 POINTS EACH; 100 points total. (4 total pages = 2, double-sided sheets)
RELAX, CONCENTRATE, AND GOOD LUCK!!

***** IMPORTANT: Turn-in BOTH your signed Scantron and your signed copy of the Exam.**

Multiple Choice: Identify the letter of the choice that best completes the statement or answers the question.

1. Which of the following is an Endergonic process that must be driven by coupling to an Exergonic process?
 - a. The flow of hydrogen protons from the mitochondrial intermembrane space into the matrix
 - b. The passage of electrons from cytochrome oxidase to O₂ to form H₂O.
 - c. The addition of two phosphate groups to sugar intermediates during the first 5 steps of glycolysis.
 - d. ATP → ADP + Pi
 - e. Getting out of bed on a Monday morning. ☺
2. Where is the location of the enzymes and reactions of glycolysis in a eukaryotic cell?
 - a. The plasma membrane
 - b. The cytoplasm
 - c. The mitochondrial matrix
 - d. The mitochondrial inner membrane
 - e. The mitochondrial outer membrane
3. When a molecule loses hydrogen atoms (not hydrogen ions/protons), it becomes
 - a. Reduced
 - b. Oxidized
 - c. Diminished
 - d. Hydrogenated
 - e. Hydrolyzed
4. During glycolysis, for each mole of glucose oxidized to pyruvate,
 - a. 6 moles of ATP are produced.
 - b. 4 moles of ATP are used, and 2 moles of ATP are produced
 - c. 2 moles of ATP are used, and 4 moles of ATP are produced.
 - d. 2 moles of NAD⁺ are produced
 - e. No ATP is produced
5. Which of the following is produced during the citric acid (TCA) cycle?
 - a. FAD
 - b. Pyruvate
 - c. Reduced electron carriers
 - d. Lactic acid
 - e. Really tasty orange juice! ☺
6. Animals breathe in air rich in oxygen and breathe out air with less oxygen and more carbon dioxide. The carbon dioxide comes from
 - a. The carbon from hydrocarbons and the oxygen from the air
 - b. The citric acid (TCA) cycle and pyruvate oxidation
 - c. Glycolysis
 - d. The Electron Transport Chain
 - e. All of the above
7. According to the Chemiosmotic Theory, the energy for the synthesis of ATP during the flow of electrons down the respiratory chain (ETC) to O₂ is provided directly by the
 - a. Hydrolysis of GTP
 - b. Reduction of NAD⁺
 - c. Diffusion of protons
 - d. Hydrolysis of ATP
 - e. Reduction of FAD
8. In human cells (muscle cells), the fermentation process produces
 - a. Lactic acid
 - b. 12 moles of ATP
 - c. Pyruvic acid
 - d. An excessive amount of energy
 - e. Intoxicated partiers at Castro Street. ☺
9. Which of the following molecules carries the most free energy during cellular metabolism?
 - a. ADP
 - b. ATP
 - c. FADH₂
 - d. NADH + H⁺
 - e. Dilithium crystals ☺
10. Pyruvate oxidation and the TCA cycle together produce 8 NADH + H⁺ and 2 FADH₂ per glucose. How many ATP can be generated from these electron carriers in the ETC and ATP Synthase?
 - a. 10 ATP
 - b. 20 ATP
 - c. 22 ATP
 - d. 28 ATP
 - e. 30 ATP

I.D. #: G:

Name: _____

11. Most ATP made in our bodies is made directly
- By glycolysis
 - In the citric acid cycle
 - Using ATP synthase
 - From photosynthesis
 - By burning fat
12. During respiration, energy is not stored in the bonds of
- ATP phosphates
 - NADH electrons
 - FADH₂ electrons
 - Linkages between coenzyme A and organic molecules
 - All of the above store energy during respiratory catabolism
13. The reduction of pyruvate to lactic acid during fermentation allows glycolysis to continue in the absence of oxygen. Why is this necessary?
- Water is formed during this reaction
 - This reaction is a phosphorylation reaction
 - This reaction is coupled to oxidation of NADH to regenerate NAD⁺
 - This reaction is coupled to the formation of ATP.
 - This reaction is coupled to the reduction of NAD⁺ to generate NADH
14. A graph that plots the rate at which CO₂ is converted to glucose versus the wavelength of light illuminating a leaf is called
- A Krebs equation.
 - an absorption spectrum.
 - enzyme kinetics.
 - an electromagnetic spectrum.
 - an action spectrum.
15. The light reactions provide the Calvin–Benson cycle with
- protons and electrons.
 - CO₂ and glucose.
 - water and photons.
 - NADH and FADH₂.
 - ATP and NADPH.
16. The net energy outcome of phototrophic cyclic electron flow is
- ATP.
 - ATP and NADH.
 - NADPH.
 - ATP and NADPH.
 - NADH.
17. During CO₂ fixation, CO₂ combines with
- Oxaloacetate.
 - 3PG.
 - G3P.
 - water.
 - 1,5-ribulose biphosphate (RuBP).
18. Which of the following statements about photosynthesis is *false*?
- The water for photosynthesis in land plants comes primarily from the soil.
 - CO₂ is taken in, and water and O₂ are released through stomata.
 - Light is absolutely necessary for the production of O₂ and carbohydrates.
 - Photosynthesis is the exact reverse of cellular respiration.
 - All the O₂ gas produced during photosynthesis comes from water.
19. What happens when a photon is absorbed by chlorophyll?
- Chlorophyll becomes “excited,” or energized.
 - A greater number of light wavelengths can be absorbed.
 - ATP is split into ADP, phosphate, and energy.
 - Hydrogen ions are absorbed.
 - The molecule launches into a rendition of “I Feel Good!”, ... a-la James Brown. ☺
20. In noncyclic photophosphorylation, water is used for the
- hydrolysis of ATP.
 - excitation of chlorophyll.
 - reduction of chlorophyll.
 - oxidation of NADPH.
 - oxidation of chlorophyll.
21. In a photosystem, electrons are trapped and held by a special chlorophyll molecule called a
- Cytochrome
 - Plastocyanin
 - Hemoglobin
 - Reaction center
 - Beta-carotene
22. In both photosynthesis and respiration, protons are pumped across a membrane during
- electron transport.
 - photolysis.
 - CO₂ fixation.
 - reduction of O₂.
 - glycolysis.
23. Chemiosmosis drives the production of ATP during
- Respiration
 - Dark reactions of photosynthesis
 - Light reactions of photosynthesis
 - Fermentation
 - Both A and C above
24. Frederick Griffith’s experiments with virulent and avirulent pneumococcus demonstrated that
- DNA is the genetic material
 - Smooth bacteria are avirulent
 - A polysaccharide capsule is not required for virulence
 - Material from dead cells can transform the hereditary characteristics of nearby live cells
 - Mice REALLY need to cover their mouths when they cough! ☺

I.D. #: G:

Name: _____

25. Semiconservative replication of DNA involves
- each of the original strands acting as a template for a new strand.
 - only one of the original strands acting as a template for a new strand.
 - the use of the original double-stranded molecule as a template.
 - None of the above
 - DNA synthesized by a rare collaboration between Democratic and Republican Parties. ☺
26. During Hershey and Chase's experiments infecting *E. coli* with bacteriophage T2,
- ^{15}N was detected in the pelleted bacterial cells
 - ^{15}N was detected in the culture supernatant.
 - ^{35}S was detected in the pelleted bacterial cells.
 - ^{35}S was detected in the culture supernatant.
 - ^{32}P was detected in the culture supernatant.
27. The various experiments that conclusively proved that DNA was the genetic material depended upon knowledge that
- Hydrolytic (degradative) enzymes are very specific in their choice of substrates
 - Phosphorus is contained in DNA and not in proteins
 - Sulfur is contained in proteins and not in DNA
 - Each class of macromolecule can be chemically separated from the others in a cell-free extract
 - All of the above
28. What is the order of each of the following enzymes' participation in DNA replication (synthesis)?
- | |
|--|
| 1. DNA Ligase
2. DNA Helicase
3. DNA Polymerase I
4. DNA Polymerase III
5. RNA Primase |
|--|
- 1-2-3-4-5
 - 3-4-2-5-1
 - 5-2-4-3-1
 - 2-5-4-3-1
 - 2-5-3-4-1
29. When adding the next monomer to a growing DNA strand, the monomer is added to which carbon of the deoxyribose?
- 1'
 - 2'
 - 3'
 - 4'
 - 5'
30. One strand of DNA has the sequence 5'—ATTCCG—3'. The complementary strand for this is
- 5'—TAAGGC—3'
 - 5'—ATTCCG—3'
 - 5'—ACCTTA—3'
 - 5'—CGGAAT—3'
 - 5'—GCCTTA—3'
31. The enzyme DNA ligase is required continuously during DNA replication because
- fragments of the leading strand must be joined together.
 - fragments of the lagging strand must be joined together.
 - the parental strands must be joined back together.
 - 3'-deoxynucleoside triphosphates must be converted to 5'-deoxynucleoside triphosphates.
 - The molecules in the reaction suffer from Severe Codependence Anxiety, and must be kept together. ☺
32. Hershey and Chase labeled bacteriophage nucleic acids by using phage to infect *E. coli* cells grown in
- ^{14}C -labeled CO_2 .
 - ^3H -labeled water.
 - ^{32}P -labeled phosphate.
 - ^{35}S -labeled sulfate.
 - ^{18}O -labeled water.
33. Information sources used by Watson and Crick to determine the structure of DNA included
- Chargaff's rules
 - Knowledge of nucleotide base structure
 - X-ray crystallography of double-stranded DNA.
 - Model-building with DNA strands scaffolded by a sugar-phosphate backbone
 - All of the above
34. Which of the following features summarizes the molecular architecture of DNA?
- The two strands run in opposite directions.
 - The molecule twists in the same direction as the threads of most screws ("right-handed").
 - The molecule is a double-stranded helix.
 - It has a uniform diameter.
 - All of the above
35. In the Meselson–Stahl experiment, which of the following observations ruled out the conservative model of DNA replication?
- No completely "heavy" DNA is observed after the first round of replication.
 - No completely "light" DNA ever appears, even after several replications.
 - The product that accumulates after two rounds of replication is completely "heavy."
 - Completely "heavy" DNA is observed throughout the experiment.
 - Three different DNA densities are observed after a single round of replication.

I.D. #: G: _____ Name: _____

Short Essays (40 pts total): Answer **ONLY TWO** of the following 3 questions **BRIEFLY** but **COMPLETELY**. *Use diagrams whenever helpful.*

36. Diagram and describe the flow of carbon atoms through glycolysis and the respiratory pathways. In what form does carbon enter each process, and in what form does it leave?

37. Diagram and describe the relationship between the light reactions and the dark reactions in photosynthesis. (Be sure to name the energetic molecules that are exchanged between the reactions).

38. Diagram and describe how the experiments of Hershey and Chase contributed to our current understanding of molecular genetics? (Be sure to diagram the basics of their experimental design, results, and conclusions.)

I.D. #: G: _____ Name: _____

BIOL230 AA/AB PRACTICE MIDTERM #2
Answer Key -- Fall Semester

Only look here AFTER you have thoughtfully and thoroughly completed the Practice Exam!!! NO CHEATING!!

1.	C
2.	B
3.	B
4.	C
5.	C
6.	B
7.	C
8.	A
9.	D
10.	D
11.	C
12.	E
13.	C
14.	E
15.	E
16.	A
17.	E
18.	D
19.	A
20.	C
21.	D
22.	A
23.	E
24.	D
25.	A
26.	D
27.	E
28.	D
29.	C
30.	D
31.	B
32.	C
33.	E
34.	E
35.	A