

# Biology 204

## Principles of Biology I

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### Assignment 1B

For students with first names starting with the letters H to N.

This assignment is graded out of 110 points, and is worth 10% of your final mark. Please submit this assignment after you have completed Chapter 7 and before you write the midterm exam.

### A. Definition/Comparison Questions

**Instructions:** *In your own words*, define the pairs of terms given below. Write in complete sentences, stating the differences and relationships between the two terms, and give specific examples where appropriate. A complete answer usually requires four to eight sentences.

Each question is worth four marks, for a total of 40 marks.

1. bioluminescence / fluorescence
2. endoplasmic reticulum (ER) / Golgi complex
3. microtubule / microfilament
4. enthalpy / free energy
5. active site / allosteric site
6. first law of thermodynamics / second law of thermodynamics
7. antiport / symport
8. exocytosis / pinocytosis
9. NADH / NADPH
10. aerobic respiration / photorespiration

## B. Short Answer/Short Essay Questions

**Instructions:** Answer each of the questions given below in your own words. Write in complete sentences where appropriate. A complete answer usually requires one to two sentences per mark, so a three-mark question would be answered in three to six sentences. This section is worth a total of 40 marks.

- (2 marks) 1. What is a circadian rhythm?
- (2 marks) 2. What is a ribozyme?
- (3 marks) 3. Define *adiabatic cooling*.
- (5 marks) 4. Explain what it means when a reaction has a positive  $\Delta G$ .
- (2 marks) 5. What are gated channels?
- (4 marks) 6. Explain what *exchange diffusion* means, and give an example.
- (9 marks) 7. Compare mitochondria and chloroplasts. Include both structure and function in your answer.
- (5 marks) 8. The electron transport chain of aerobic respiration leads to oxidative phosphorylation of ATP. What is an alternative way to synthesize ATP? Give an example of a specific reaction that uses this alternative way.
- (8 marks) 9. Chemiosmosis is a process that occurs both in aerobic respiration and photosynthesis. Explain similarities and differences in chemiosmosis between the two pathways.

## C. Multiple Choice Questions

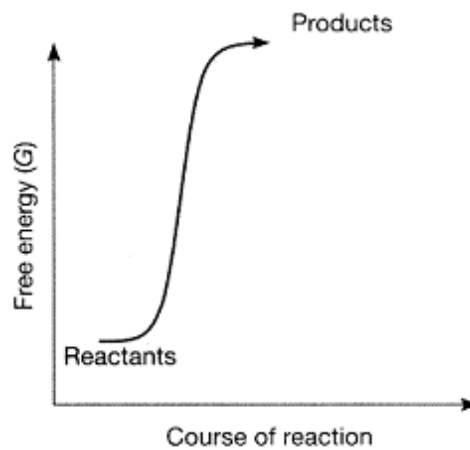
**Instructions:** Select the single best answer to each of the questions given below. Each question is worth one mark, for a total of 30 marks.

1. Organisms likely use visible light because
  - a. a large proportion of the electromagnetic radiation on Earth is light.
  - b. radiation with a higher energy than light might damage biological molecules more easily.
  - c. radiation with a lower energy content than light might not have enough energy to excite electrons.
  - d. radiation with longer wavelengths than light are absorbed by water and carbon dioxide.
  - e. all of the above
2. Which of the following statements is NOT correct?
  - a. DNA can be damaged by ultraviolet radiation.
  - b. The pigment *melanin* protects plants from excessive damage to their photosynthetic apparatus.
  - c. Shorter wavelengths of radiation are more harmful to organisms than longer wavelengths.
  - d. Human skin cells can be harmed by ultraviolet radiation.
  - e. Visible light contains less energy than ultraviolet radiation.
3. Photoheterotrophs
  - a. use light as an energy source.
  - b. are found in protists.
  - c. use carbon dioxide as a carbon source.
  - d. are found in certain groups of plants.
  - e. are NOT found in prokaryotes.
4. Chemoautotrophs
  - a. use organic or inorganic substances as an energy source.
  - b. are found in protists.
  - c. use organic substances as a carbon source.
  - d. are found in certain groups of plants.
  - e. are not found in prokaryotes.

5. Under what conditions may adaptive radiation occur?
  - a. when islands are colonized
  - b. after the demise of a successful group of organisms
  - c. after the emergence of new physiological pathways
  - d. when organisms move into new adaptive zones
  - e. all of the above
6. Climbing plants in tropical forests have a competitive advantage over trees because
  - a. they grow relatively slowly.
  - b. they have a high amount of supporting structure.
  - c. they have a low amount of leaf biomass.
  - d. they receive a good amount of sunlight
  - e. they are usually parasites supported by trees.
7. Which of the following groups of organisms are decomposers?
  - a. animals
  - b. fungi
  - c. plants
  - d. algae
  - e. all of the above
8. Which of the following items is NOT associated with monsoons?
  - a. rain shadow
  - b. reversal of wind direction
  - c. adiabatic cooling
  - d. high precipitation
  - e. low air pressure
9. Which of the following is NOT true about ocean currents?
  - a. They move clockwise in the northern hemisphere.
  - b. They move counter-clockwise in the southern hemisphere.
  - c. They are partly caused by trade winds and westerlies.
  - d. They mix water thoroughly, resulting in a uniform water temperature at similar latitudes.
  - e. They are influenced by the Earth's rotation.

10. Some sea slugs are able to perform photosynthesis. They do this by
- producing their own chlorophyll.
  - eating algal cells and moving the cells to the endodermis.
  - having a mutualistic association with algae.
  - having algal chloroplasts in their endodermis.
  - all of the above.
11. The total potential energy in a system is called
- entropy.
  - free energy.
  - enthalpy.
  - exothermic.
  - endothermic.
12. Under which condition will a reaction be spontaneous?
- when  $\Delta G$  is positive
  - when  $\Delta H$  is negative
  - when the product(s) will have more free energy than the reactant(s)
  - when  $\Delta S$  is negative
  - none of the above
13. The binding of a substrate to an enzyme causes a change in the enzyme's shape. This shape change is known as
- allosteric inhibition.
  - activation.
  - reversible inhibition.
  - induced fit.
  - denaturation.
14. The part of an enzyme that interacts with its substrate(s) is called
- an allosteric site.
  - an induced-fit.
  - a reaction site.
  - an active site.
  - a cofactor.

Use the following figure to answer the next question.



15. Which of the following statements is TRUE?
- a. The figure represents a spontaneous reaction.
  - b. The reactants have more free energy than the products.
  - c. The products have more free energy than the reactants.
  - d. The figure represents an exergonic reaction.
  - e.  $\Delta G$  is negative.
16. Which of the following substances is most difficult to move across a membrane?
- a.  $\text{Na}^+$
  - b.  $\text{O}_2$
  - c.  $\text{H}_2\text{O}$
  - d. glycerol
  - e.  $\text{CO}_2$
17. Receptor mediated endocytosis
- a. moves liquids out of the cell.
  - b. moves unspecified substances into the cell by forming a pocket in the plasma membrane.
  - c. is very specific.
  - d. involves a proton pump.

18. Which of the following does NOT apply to electrochemical gradients?
- There is a difference in the concentration of ions between the two sides of the membrane.
  - There is a difference in the electrical charge between the two sides of the membrane.
  - There is a difference in the electrical charge but not in the concentration of ions between the two sides of the membrane.
  - The energy of the gradient can be used for a number of purposes.
  - Nerve impulses are based on electrochemical gradients.
19. Which of the following is NOT true of symport?
- Two substances move in opposite directions.
  - Two substances move in the same direction.
  - The diffusion of one substance provides the energy for the transport of a second one.
  - Ions are usually involved.
  - Amino acids are one type of substance involved.
20. A cell needs \_\_\_\_\_ to obtain unsaturated fatty acids from saturated fatty acids.
- glycoproteins
  - glycerol
  - cholesterol
  - phospholipids
  - desaturases
21. The role of the oxygen molecules required for aerobic respiration is to
- accept electrons directly from either NADH or FADH<sub>2</sub>.
  - accept the low energy electrons at the end of the electron transport chain.
  - form ATP.
  - to produce CO<sub>2</sub>.
  - store high energy electrons to pass to complex I of the electron transport chain.

22. During chemiosmosis, \_\_\_\_\_ are transferred from NADH and  $\text{FADH}_2$  to electron acceptor molecules, and the energy released is used to create a(n) \_\_\_\_\_ gradient across the inner mitochondrial membrane.
- ATP molecules; ADP molecule
  - water molecules; oxygen
  - protons; electron
  - ADP molecules; ATP molecule
  - electrons; proton
23. Which of the following terms would you associate with lactate fermentation?
- NADPH
  - glycolysis
  - ethanol
  - citric acid cycle
  - electron transport chain
24. During the citric acid cycle, each acetyl group entering the cycle yields
- four ATP, two NADH, and one  $\text{FADH}_2$ .
  - one ATP, two NADH, and four  $\text{FADH}_2$ .
  - three ATP, two NADH, and one  $\text{FADH}_2$ .
  - one ATP, three NADH, and one  $\text{FADH}_2$ .
  - one ATP, two NADH, and three  $\text{FADH}_2$ .
25. Which of the following statements concerning decarboxylation reactions is FALSE?
- They are one type of general reaction that occurs during aerobic respiration.
  - They involve the removal of two protons and two electrons.
  - They occur as part of the citric acid cycle.
  - They produce  $\text{CO}_2$  that is then exhaled via breathing.
  - They involve the removal of a carboxyl group ( $-\text{COOH}$ ) from a substrate.



26. The genes coding for rubisco are found
- both in the nuclear DNA and in the chloroplast DNA.
  - both in the nuclear DNA and the mitochondrial DNA.
  - only in the nuclear DNA.
  - only in the chloroplast DNA.
  - only in the mitochondrial DNA.
27. How (exactly) is water split and oxygen released during photosynthesis?
- An energy-rich photon directly provides the energy to split water.
  - An enzyme in photosystem I uses the energy of a photon to split water.
  - The oxidized form of P680 splits water.
  - A proton pump provides the energy to split water in the thylakoid lumen.
  - ATP originating from the Calvin cycle splits water.
28. Which of the following reactions occur(s) during the Calvin cycle?
- photolysis of water
  - synthesis of NADPH
  - synthesis of ATP
  - synthesis of sugars
  - all of the above
29. Reaction centre complexes of the light-dependent reactions contain \_\_\_\_\_ and \_\_\_\_\_, which receive energy from \_\_\_\_\_.
- chlorophyll; antenna complexes; carotenoids
  - accessory pigments; chlorophyll; antenna complexes
  - carotenoids; proteins; chlorophyll
  - proteins; antenna complexes; carotenoids
  - chlorophyll; proteins; antenna complexes
30. In photosynthesis, how many molecules of carbon dioxide, ATP, and NADPH are needed to form two molecules of glucose?
- 12, 36, and 24
  - 6, 18, and 12
  - 24, 18, and 24
  - 26, 18, and 24
  - 3, 9, and 6

— End of Assignment 1B —