Fundamentals of Biochemistry 6th edition Heilman Test Bank

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***Fundamentals of Biochemistry, 6e* (Voet)**
Chapter 1 Introduction to the Chemistry of Life

Choose the correct answer from the list. Not all the answers will be used. Write only the letter of the correct answer, not the full word or phrase.

A) phylogenetic
B) negative
C) H_2O
D) $\Delta H°$
E) $H - TS$
F) halobacteria
G) open
H) entropy
I) flux
J) polymers
K) $\Delta G°$
L) thermophiles
M) nitrogen
N) positive

1) The most abundant molecule in the human body is _____.
Answer: C
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.1 Discuss the origins and evolution of biological molecules
Section Reference: 1.1 The Origin of Life

2) During chemical evolution, small organic molecules condense to form more complex molecules called _____.
Answer: J
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.1 Discuss the origins and evolution of biological molecules
Section Reference: 1.1 The Origin of Life

3) Evolutionary relationships can be visualized using a _____ tree.
Answer: A
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
Section Reference: 1.2 Cellular Architecture

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4) The organisms most likely to be found in a brine environment would be _____.
Answer: F
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
Section Reference: 1.2 Cellular Architecture

5) The organisms most likely to be found in high temperature environments would be _____.
Answer: L
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
Section Reference: 1.2 Cellular Architecture

6) The term used to indicate the degree of randomness within a system is _____.
Answer: H
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
Section Reference: 1.3 Thermodynamics

7) Spontaneous processes are characterized by a change in Gibbs free energy that is _____.
Answer: B
Diff: 1
Bloom's: Understand
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
Section Reference: 1.3 Thermodynamics

8) Gibbs free energy is defined as G = _____.
Answer: E
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
Section Reference: 1.3 Thermodynamics

9) The symbol for free energy under standard biochemical conditions is _____.
Answer: K
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
Section Reference: 1.3 Thermodynamics

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10) Living creatures can be described thermodynamically as _____ systems.
Answer: G
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
Section Reference: 1.3 Thermodynamics

11) What are the four most abundant elements in a human body?
A) C, N, O, H
B) C, N, O, P
C) C, S, O, H
D) C, Na, O, H
Answer: A
Diff: 2
Bloom's: Analyze
Learning Objective: LO 1.1 Discuss the origins and evolution of biological molecules
Section Reference: 1.1 The Origin of Life

12) The atmosphere of prebiotic earth probably contained the following molecules:
A) H_2O, CO_2, N_2, CH_4, and NH_3.

B) H_2O, CO_2, CH_4, $C_6H_{12}O_6$, and NH_3.

C) H_2O, CO_2, CH_4, $C_6H_{12}O_6$, and $COO\text{-}CH_2NH^+_3$.

D) H_2O, CO_2, CH_4, $COOHCH_2NH_3$, and NH_3.

Answer: A
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.1 Discuss the origins and evolution of biological molecules
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13) In 1953, Urey and Miller carried out an experiment in which they subjected a mixture of H_2O, CH_4, NH_3, and H_2 to electrical discharges. Which of the following were among the products?
A) proteins
B) amino acids
C) nucleic acids
D) ribosomes
Answer: B
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.1 Discuss the origins and evolution of biological molecules
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14) Which of the following statements about hydrothermal vents is TRUE?
A) The vents have temperatures as high as 1000°C and emit H_2S and metal sulfides.

B) The vents have temperatures as high as 800°C and emit H_2S and metal sulfides.

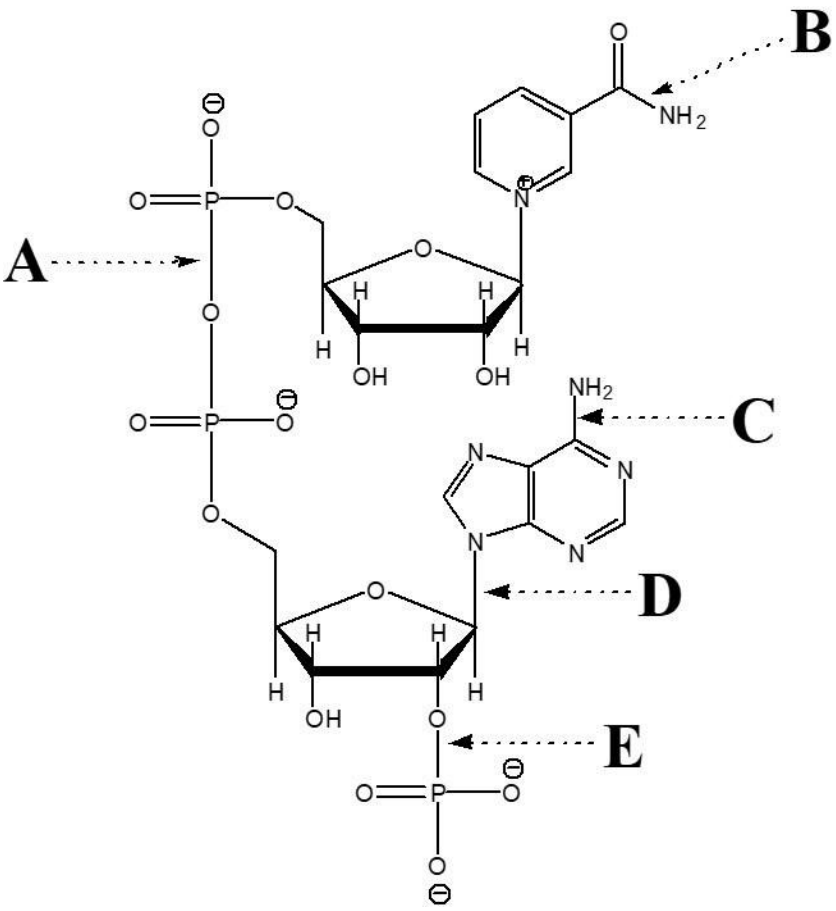
C) The vents have temperatures as high as 600°C and emit H_2S and metal nitrates.

D) The vents have temperatures as high as 400°C and emit H_2S and metal sulfides.

Answer: D
Diff: 2
Bloom's: Apply
Learning Objective: LO 1.1 Discuss the origins and evolution of biological molecules
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For the following question(s), consider the structure of the coenzyme NADP.



15) Which arrow points at a phosphate ester bond?
A) A
B) B
C) D
D) E
Answer: D
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.1 Discuss the origins and evolution of biological molecules
Section Reference: 1.1 The Origin of Life

16) Which arrow points at an amide bond?
A) B
B) C
C) D
D) E
Answer: A
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.1 Discuss the origins and evolution of biological molecules
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17) Which arrow points at an anhydride bond?
A) A
B) B
C) D
D) E
Answer: A
Diff: 2
Bloom's: Apply
Learning Objective: LO 1.1 Discuss the origins and evolution of biological molecules
Section Reference: 1.1 The Origin of Life

18) Which of the following developed during the evolution of eukaryotic cells from prokaryotic cells?
A) DNA
B) the cell membrane
C) nuclear membranes
D) ribosomes
Answer: C
Diff: 1
Bloom's: Understand
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
Section Reference: 1.2 Cellular Architecture

19) Using phylogeny, all living organisms can be divided into the following domains:
A) bacteria, eukarya, and vertebrate.
B) archaea and eukarya.
C) bacteria, eukarya, and archaea.
D) eukarya and bacteria.
Answer: C
Diff: 2
Bloom's: Analyze
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
Section Reference: 1.2 Cellular Architecture

20) The theory of evolution includes which of the following principles?
A) Evolution is not directed toward a specific goal.
B) Evolution is ongoing, and is constrained by its past.
C) Evolution does not require variation among individuals for adaptation to occur.
D) A and B
Answer: D
Diff: 1
Bloom's: Understand
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21) Which three cellular components are present in both prokaryotes and eukaryotes?
A) ribosomes, chloroplasts, mitochondria
B) nucleus, ribosomes, RNA
C) RNA, DNA, ribosomes
D) mitochondria, DNA, RNA
Answer: C
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
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22) The bulk of aerobic metabolism in eukaryotic cells takes place in:
A) the endoplasmic reticulum.
B) the nucleus.
C) the mitochondria.
D) peroxisomes.
Answer: C
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
Section Reference: 1.2 Cellular Architecture

23) Which cellular compartment or organelle is involved in the synthesis of cellular components such as proteins and lipids?
A) endoplasmic reticulum
B) lysosomes
C) peroxisomes
D) vacuoles
Answer: A
Diff: 2
Bloom's: Apply
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
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24) Which of the following is a similarity between all prokaryotes and all eukaryotes?
A) Both contain DNA in a nucleus.
B) Both contain some of the same membrane bound cell organelles (like mitochondria, Golgi complexes, etc.).
C) Both have a cell wall.
D) Both have ribosomes.
Answer: D
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
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25) Which of the following statements concerning prokaryotes is FALSE?
A) Prokaryotes are made up of two major groupings: the eubacteria and the archaea, which are as different from each other as from the eukaryotes.
B) Prokaryotes are generally much smaller than the eukaryotic cells.
C) Archaea diverged from prokaryotes, as illustrated in the more accurate phylogenetic tree made up of prokarya, archaea and eukarya.
D) Prokaryotes do not have organelles.
Answer: C
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
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26) Which of the following statements about eukaryotes is NOT true?
A) They contain organelles like mitochondria, chloroplasts, the endoplasmic reticulum, and the nucleus.
B) They are usually 10 to 100 microns in diameter.
C) They can be either unicellular or multicellular.
D) They are also called archaea.
Answer: D
Diff: 1
Bloom's: Understand
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
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27) Which of the following statements about the theories of (bio)chemical evolution is NOT true?
A) Margulis suggested that mitochondria and chloroplasts evolved from the symbiotic relationship between primordial prokaryotic and eukaryotic cells.
B) The first cells were probably formed when self-replicating systems were enveloped in membranous vesicles.
C) Oparin and Haldane demonstrated that by passing an electrical discharge through a vessel containing H_2O, CO_2, N_2, CH_4, and NH_3 some basic biological building blocks (like simple amino acids) could have formed abiotically in the earth's early atmosphere.
D) The RNA world hypothesis as proposed by Woese, Crick and Orgel states that RNA, instead of protein, was the first self-replicating biochemical molecule that evolved because RNA could have stored genetic information and performed the catalytic roles necessary for primitive self-replication.
Answer: C
Diff: 2
Bloom's: Apply
Learning Objective: LO 1.1 Discuss the origins and evolution of biological molecules
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28) Which of the following statement(s) is (are) NOT true?
A) Margulis proposed the endosymbiotic theory to explain the evolution of mitochondria and chloroplasts.
B) Woese proposed the "new" phylogenic tree that divides living organisms into the 3 domains of bacteria, archaea and eukarya based upon genetic relationships rather than obvious morphological similarities.
C) Urey and Miller conducted an experiment that involved sparking a mixture of NH_3, CH_4, H_2O, and H_2 gases to yield amino acids, some of the fundamental building blocks of life.
D) Earlier than Margulis, Wallin in 1927 noted the similarity between mitochondria and smaller eukaryotic cells.
Answer: D
Diff: 1
Bloom's: Understand
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
Section Reference: 1.2 Cellular Architecture

29) Halophiles and thermophiles are:
A) early versions of eukaryotic cells.
B) highly evolved organisms that thrive in their specific environments.
C) relatively inefficient and unevolved organisms.
D) more complex than eukaryotes.
Answer: B
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
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30) The mitochondrion is important to energy production in almost all eukaryotes. Those cells that produce energy through photosynthesis do so through:
A) peroxisomes.
B) Golgi apparatus.
C) endoplasmic reticulum.
D) chloroplasts.
Answer: D
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
Section Reference: 1.2 Cellular Architecture

31) Lynn Margulis' Theory of Endosymbiosis is an explanation for the origin of:
A) the endoplasmic reticulum.
B) the nucleus.
C) the mitochondria.
D) the Golgi apparatus.
Answer: C
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
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32) Phylogeny is:
A) the science of biological classification based on gross morphology.
B) the science of biological classification based on the evolutionary relationships between organisms.
C) the science of biological classification based on reproductive strategies.
D) the branch of science that studies phyllopods.
Answer: B
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
Section Reference: 1.2 Cellular Architecture

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33) Taxonomy is:
A) the science of biological classification based on gross morphology.
B) the science of biological classification based on the evolutionary relationships between organisms.
C) the science of biological classification based on reproductive strategies.
D) the branch of science that studies taxidermy.
Answer: A
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
Section Reference: 1.2 Cellular Architecture

34) Which group of organisms does NOT include prokaryotes or archea?
A) Fungi
B) Eukarya
C) Purple bacteria
D) Cyanobacteria
Answer: A
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
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35) The term *molecular weight* is a term used by biochemists that refers to:
A) the density of a particle.
B) a dimensionless quantity that is defined as the ratio of the mass of the particle to 1/12 the mass of a ^{12}C atom.
C) Daltons divided by the mass of a hydrogen atom.
D) 1/12 the mass of a ^{12}C atom.
Answer: B
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
Section Reference: 1.3 Thermodynamics

36) The second law of thermodynamics states:
A) that spontaneous processes are characterized by the overall conversion of order to disorder.
B) that spontaneous processes are characterized by the conversion of work to force.
C) that nonspontaneous processes are characterized by the conversion of order to disorder.
D) that spontaneous processes are characterized by the conversion of heat to pressure.
Answer: A
Diff: 1
Bloom's: Understand
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
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37) Change in enthalpy (ΔH) is best defined as:
A) the sum of heat absorbed and work done.
B) the heat transferred at constant pressure.
C) the pressure change at constant temperature.
D) the measure of disorder in a system.
Answer: B
Diff: 2
Bloom's: Apply
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
Section Reference: 1.3 Thermodynamics

38) If gas molecules in an enclosed chamber are allowed to enter a second chamber, the resulting redistribution of gas molecules represents an increase in:
A) enthalpy.
B) entropy.
C) force.
D) chemical potential.
Answer: B
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
Section Reference: 1.3 Thermodynamics

39) Consider the reaction A + B ↔ C + D. After reaching equilibrium at 25°C, the following concentrations of reactants and products were measured: [A] = 10 μM, [B] = 15 μM, [C] = 10 μM, [D] = 10 μM. Calculate $\Delta G°'$ for this reaction.
A) 1000 J/mol
B) 10 kJ/mol
C) 1 J/mol
D) insufficient data to determine answer
Answer: A
Diff: 2
Bloom's: Apply
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
Section Reference: 1.3 Thermodynamics

40) A reaction with a _____ ΔH and a _____ ΔS, will never be spontaneous.
A) positive; positive
B) positive; negative
C) negative; positive
D) negative; negative
Answer: B
Diff: 2
Bloom's: Analyze
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
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41) An endergonic reaction with a _____ ΔH and a _____ ΔS can be changed into an exergonic reaction by decreasing the temperature.
A) positive; positive
B) positive; negative
C) negative; positive
D) negative; negative
Answer: D
Diff: 2
Bloom's: Analyze
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
Section Reference: 1.3 Thermodynamics

42) The $\Delta G°$ for the conversion of glucose 6-phosphate (G6P) to fructose 6-phosphate (F6P) is +1.7 kJ/mole. In a particular human cell, the concentration G6P is 8.0 µM and the concentration F6P is 1.0 µM. Calculate the ΔG of the reaction as it occurs in this cell at 37°C.
A) −37 kJ/mol
B) −3.7 kJ/mol
C) 0 kJ/mol
D) +7.1 kJ/mol
Answer: B
Diff: 2
Bloom's: Apply
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
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43) For a reaction with ΔH = 23 kJ/mol and ΔS = 22 J/K•mol, at 2°C, the reaction is:
A) spontaneous.
B) nonspontaneous.
C) at equilibrium.
D) impossible to determine reactivity.
Answer: B
Diff: 2
Bloom's: Apply
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
Section Reference: 1.3 Thermodynamics

44) Calculate the ΔG for a reaction with ΔH = 20. kJ/mol and ΔS = 20. J/K•mol, that is carried out at 27°C.
A) 14 J/mol
B) 140 J/mol
C) 1400 J/mol
D) 14,000 J/mol
Answer: D
Diff: 2
Bloom's: Apply
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
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45) A spontaneous process:
A) occurs with the addition of free energy.
B) has a $\Delta G>0$.
C) is exergonic.
D) has a positive Gibb's free energy.
Answer: C
Diff: 1
Bloom's: Understand
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
Section Reference: 1.3 Thermodynamics

46) An increase in disorder in the system:
A) is required for a process to be spontaneous.
B) is found in every exergonic process.
C) is characteristic of a system increasing in enthalpy.
D) results in the factor $T\Delta S$ being positive.
Answer: D
Diff: 2
Bloom's: Analyze
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
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47) Living organisms:
A) are closed systems.
B) maintain a non-equilibrium steady state.
C) maintain an equilibrium steady state.
D) exist outside the laws of thermodynamics.
Answer: B
Diff: 1
Bloom's: Understand
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
Section Reference: 1.3 Thermodynamics

48) What is the relationship between the rate of a process and its thermodynamic spontaneity?
A) Exothermic reactions are rapid.
B) Spontaneous reactions are rapid.
C) Rate is not dependent on ΔG.
D) Rate is dependent on ΔS alone.
Answer: C
Diff: 2
Bloom's: Apply
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
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49) A van't Hoff plot:
A) plots ln K_{eq} versus T.

B) determines K_{eq} by plotting ΔH° versus $1/T$.

C) is a good method to determine ln K_{eq}.

D) is a good method to determine $\Delta H°$ and $\Delta S°$.
Answer: D
Diff: 2
Bloom's: Analyze
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
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50) K_{eq} can be determined from the change in standard free energy using the equation:

A) $K_{eq} = e^{-\Delta G°/RT}$.

B) $K_{eq} = \ln e^{-\Delta G°/T\Delta S}$.

C) $K_{eq} = e^{-\Delta H/RT}$.

D) $K_{eq} = e^{-\Delta G°/T\Delta S}$.

Answer: A
Diff: 1
Bloom's: Understand
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
Section Reference: 1.3 Thermodynamics

51) Living organisms are classified thermodynamically as:
A) open systems.
B) closed systems.
C) isolated systems.
D) thermally isolated.
Answer: A
Diff: 1
Bloom's: Remember
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
Section Reference: 1.3 Thermodynamics

52) Carbohydrates, proteins, nucleotides, and nucleic acids are important groups of molecules found in living organisms. Which 6 elements are in highest concentration in living organisms to build these molecules?
Answer: C, H, O, N, S, P
Diff: 2
Bloom's: Apply
Learning Objective: LO 1.1 Discuss the origins and evolution of biological molecules
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53) Explain in one or two sentences why scientists believe that phylogeny is more adequate than taxonomy to describe relationships between organisms.
Answer: Scientists believe phylogeny is more adequate than taxonomy because it reflects evolutionary history and genetic relationships, providing a more accurate representation of how organisms are related.
Diff: 2
Bloom's: Analyze
Learning Objective: LO 1.2 Explain how important features of cellular architecture relate to the structure and function of cells
Section Reference: 1.2 Cellular Architecture

54) Consider a reaction in which ΔH = -20. kJ/mol and ΔS = 10. J/mol · K.

a. Calculate the ΔG for this reaction at 25°C.
b. Is the reaction spontaneous (explain your answer)?
Answer: a. $\Delta G = \Delta H - T\Delta S \Rightarrow \Delta G$ = -20,000 J/mol -(298 × 10 J/mol) = −23,000 J/mol
b. The reaction is spontaneous because the ΔG is negative.
Diff: 2
Bloom's: Apply
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
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55) Consider the isomerization reaction R $\overleftarrow{\rightarrow}$ P, in which R is converted to P. The $\Delta G^{\circ\prime}$ for this reaction is −10. kJ/mol. Calculate the [P]/[R] at equilibrium at 25°C.
Answer: At equilibrium [P]/[R] = $K_{eq} = e^{-\Delta G^{\circ}/RT} \Rightarrow$
[P]/[R] = $e^{-\text{-}(-\text{-}10000\,\text{J/mol})/8.3145\,\cdot\text{x}\,298}$ J/mol = $e^{10000/8.3145\,\times\text{x}\,298} = 57$
Diff: 2
Bloom's: Apply
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
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56) Phosphoglucomutase catalyses the reaction in which a phosphate group is transferred from the 1 carbon of glucose to the 6 carbons of glucose (G1P $\rightleftarrows$ G6P). A student at SDSU incubates a 0.2 M solution of glucose-1-phosphate overnight with a small amount of the enzyme. At equilibrium, the concentration of glucose 1-phosphate is 9.0×10^{-3} M and the concentration of glucose 6-phosphate is 19.1×10^{-2} M.

Calculate the equilibrium constant (K_{eq}) and the standard state free energy ($\Delta G^{\circ\prime}$) for this reaction at 25°C.

Answer: The equilibrium constant K_{eq} = [G6P]eq/[G1P]eq = 19.1×10^{-2} M/ 9.0×10^{-3} M = 21.

$\Delta G^{\circ\prime} = -RT\ln K_{eq} = -8.3145 \times 298$ J/mol × ln 21.2 = −7,600 J/mol.

Diff: 3
Bloom's: Create
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
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57) The reaction pyruvate + ATP $\rightleftarrows$ PEP + ADP is catalyzed by the enzyme pyruvate kinase. The $\Delta G^{\circ\prime}$ for this reaction is 31.4 kJ/mol. Use this information to answer the following questions.

a. Does this reaction move forward (from left to right) or backward under standard state conditions? Explain you answer in one sentence.
b. Calculate the K_{eq} for this reaction at 25°C.
c. After the reaction has reached equilibrium at 25°C [ATP] = 5 mM, [ADP] = 0.5 mM, [pyruvate] = 0.2 mM. Calculate the concentration PEP.

Answer: a. The reaction goes backward (from right to left) because $\Delta G^{\circ\prime}$ for the forward reaction is positive.

b. $K_{eq} = e^{-\Delta G^{\circ\prime}/RT} = e^{-31400/8.3145 \times 298} = 3.13 \times 10^{-6}$

c. $K_{eq} = [ADP]_{eq} \times [PEP]_{eq}/[ATP]_{eq} \times [Pyruvate]_{eq} \Rightarrow$

$3.1 \times 10^{-6} = 0.5$ mM × $[PEP]_{eq}$/0.2 mM × 5 mM ⇒

$[PEP]_{eq} = (3.1 \times 10^{-6} \times 0.2$ mM × 5 mM)/0.5 mM = 6.2×10^{-6} mM (6.2×10^{-9} M)

Diff: 3
Bloom's: Create
Learning Objective: LO 1.3 Distinguish the first and second laws of thermodynamics
Section Reference: 1.3 Thermodynamics

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