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CHEMICAL ENGINEERING REGULAR REVIEW

BIOCHEMICAL ENGINEERING

1. Typical Ks value of Saccharomyces cerevisiae in mg/L.
   a. >1000
   b. 150
   c. 5 to 10
   d. <1

2. How many overall ATP's are produced per glucose in an aerobic cellular respiration?
   a. 30-32
   b. 50-52
   c. 80-82
   d. 100-102

3. Determine the molecular weights of glucose and urea respectively.
   a. 180 amu; 60 amu
   b. 120 amu; 72 amu
   c. 84 amu; 38 amu
   d. 96 amu; 36 amu

4. Fatty acids such as lauric acid and palmitic acid and oleic acid are long unbranched carboxylic acids consisting of 12 to 20 carbon atoms. Which type of fatty acid should people avoid ingesting, saturated or unsaturated and why?
   a. Saturated, because the risk of cardiovascular disease is increased.
   b. Fatty acids are safe to ingest.
   c. Unsaturated, because the risk of cardiovascular disease is increased.
   d. Both fatty acids, because the risk of cardiovascular disease is increased.

5. Which of the following is **NOT** a catabolic pathway or reaction?
   a. Oxidative phosphorylation
   b. TCA cycle
   c. Polymerization
   d. glycolysis

6. Assume that an enzyme-catalyzed reaction follows Michaelis-Menten kinetics with a Km = 1 μM. The initial velocity is 0.1 μM/min at 10 mM substrate. Calculate the initial velocity at 10 μM substrate.
   a. 9.1
   b. 0.91
   c. 0.091
   d. 0.009

7. The molecular weight (molar mass) of the enzyme trypsin is 25 kDa. In a kinetic experiment, we find that trypsin (2.0 μg) catalyses the hydrolysis of 3.3 μmol of a given substrate in 5 min, in a total incubation volume of 3.0 mL. Compute the enzyme activity (μmol/s), specific activity (μmol/s*μg) and turnover number (per s).
   a. 0.022, 6.6×10^{-3}, 1097.6
   b. 0.077, 8.9×10^{-4}, 20.9
   c. 0.126, 1.72×10^{-3}, 656.3
   d. 0.011, 5.5×10^{-3}, 137.5

8. If the T-A content of a certain DNA molecule is 60%, what are the percentages of the four bases?
   a. T=40;G=20;C=20;A=20
   b. T=30;G=20;C=20;A=30
   c. T=30;G=60;C=60;A=30
   d. cannot be determined

9. During sterilization of a fermentation medium in a given bioreactor, ∇ heating = 12.56, ∇ cooling = 7.48 and the total value of ∇ required for whole sterilization process is 52, where ∇ is the design criteria. What is the value of ∇ holding?
   a. 31.96
   b. 42.32
   c. 52.43
   d. 61.18

10. The growth of S. cerevisiae on glucose under anaerobic conditions can be described by the following overall reaction (note the MW of glucose is 180):

    $C_6H_{12}O_6 + x\ NH_3 \rightarrow 0.59\ CH_{1.74}N_{0.2}O_{0.45}$ (biomass) $+ 0.43\ C_3H_8O_3 + 1.54\ CO_2 + 1.3\ C_2H_5OH + 0.036\ H_2O$

    Determine the biomass yield coefficient $Y_{X/S}$ in g/g.
    a. 0.078
    b. 1.099
    c. 0.0082
    d. 0.32

11. Biochemical compounds are either hydrophilic, hydrophobic or amphiphatic. Classify the following compounds; glucose, stearic acid, soaps, fatty acids.
    a. Amphiphatic, amphiphatic, hydrophobic, hydrophobic
    b. Hydrophilic, hydrophobic, amphiphatic, hydrophobic
    c. Hydrophilic, amphiphatic, amphiphatic, hydrophobic
    d. Hydrophobic, hydrophilic, hydrophobic, amphiphatic

12. Taurine, a beta amino acid belongs to the acidic group of:
    a. $-SO_2OH$
    b. $-COONH_3$
    c. -COOH
    d. -C=OH

13. If one gallon of blood was added in three gallons of water, and one ounce of that dilution was added to 9 ounces of water, what is the final dilution when 7 mL of that dilution is added to 563 mL of water?
    a. 5.65×10^{-3}
    b. 2.24×10^{-2}
    c. 1.72×10^{-1}
    d. 3.11×10^{-4}

14. In the study of fats and lipids, determine which of the two triglycerides has a higher melting point, Substance A – containing only lauric acid and glycerol, or Substance B – containing only stearic acid and glycerol.
    a. B
    b. A
    c. Both have the same melting point
    d. None of these

15. An enzyme hydrolyzed a substrate concentration of 0.03 mmol/L, the initial velocity was 1.5×10^{-3} mmol/L min^{-1} and the maximum velocity was 4.5×10^{-3} mmol/ L min^{-1}. Calculate the Michaelis constant.
    a. 0.02
    b. 0.06
    c. 0.52
    d. 1.03