國立成功大學

111學年度碩士班招生考試試題

編　號：58

系　所：生命科學系

科　目：生物化學

日　期：0220

節　次：第 3 節

備　註：不可使用計算機

編號： 58　　國立成功大學 111 學年度碩士班招生考試試題

系　　所：生命科學系

考試科目：生物化學　　考試日期：0220，節次：3

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. *Escherichia coli* cells are about 2 μm (microns) long and 0.8 μm in diameter, in a cylinder shape.

a. What is the approximate volume of an *E. coli* cell? (5 points)

b. Glucose, a major energy-yielding nutrient, is present in bacterial cells at a concentration of about 1 mM. What is the concentration of glucose, expressed as mg/mL? How many glucose molecules are contained in a typical *E. coli* cell? (Here, the molecular weight of glucose = 180; Avogadro's number = 6.0×10^{23}.) (5 points x 2)

2. Which of the following best describes the difference between dehydration reactions and hydrolysis? (5 points)

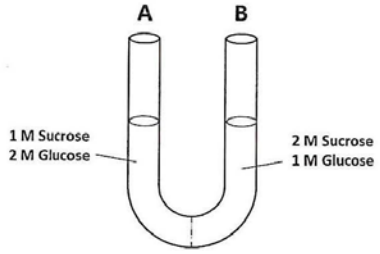
A) Dehydration reactions assemble polymers; hydrolysis reactions break polymers apart.

B) Dehydration reactions eliminate water from membranes; hydrolysis reactions add water to membranes.

C) Dehydration reactions and hydrolysis reactions assemble polymers from monomers.

D) Hydrolysis reactions assemble polymers; dehydration reactions break polymers apart.

3. The sugar solutions in the two arms of a U-tube are separated by a membrane that is permeable to water and glucose but not to sucrose. Side A is half-filled with a solution of 1 *M* sucrose and 2 *M* glucose. Side B is half-filled with 2 *M* sucrose and 1 *M* glucose. Initially, the liquid levels on both sides are equal.



a. Which of the following statements best describes the relationship between the solutions on both sides of the U-tube? (5 points)

A) side A is hypertonic to side B.

B) side A is hypotonic to side B.

C) side A is isotonic to side B.

D) side A is more turgid than side B.

b. Which is the higher in water level, side A or B, when the system has reached equilibrium? (5 points)

c. When the system illustrated above reaches equilibrium, answer the sugar concentrations (glucose, sucrose) on both sides (A, B) of the U-tube. (2 points x 4)

4. You try to amplify the following short DNA duplex of sequence (5'→3') by PCR:

5'-ATGTTTCTGATGCTCATTACGATCCAGCATAGCACAGGGATCCACATGCACACACATGACAT AGGATGGCCAGATAGCAT-3'

What oligonucleotide primers (18-mers) would be required for PCR amplification? (6 points)

5. What are the differences between Southern blotting, Northern blotting, and Western blotting? Briefly explain the principle of these methods. (6 points)

6. Why is it important that gluconeogenesis is not exact reversal of glycolysis? (10 points)

7. The V_{max} of glycogen phosphorylase from skeletal muscle is much greater than the V_{max} of the same enzyme from liver tissue.

a. what is the physiological function of glycogen phosphorylase in skeletal muscle? In liver tissue? (5 points)

b. why does the V_{max} of the muscle enzyme need to be greater than that of the liver enzyme? (5 points)

8. Write the net biochemical equation for the metabolism of a molecular of glucose by glycolysis and

a. the citric acid cycle, (5 points)

b. ethanol fermentation, including all cofactors. (5 points)

9. In a nutrient medium that lacks histidine, a thin layer of agar containing ~10^9 *Salmonella typhimurium* histidine auxotrophs (mutant cells that require histidine to survive) produces ~13 colonies over a two-day incubation period at 37°C. How do these colonies arise in the absence of histidine? The experiment repeated in the presence of 0.4μg of 2-aminoanthracene. The number of colonies produced over two days exceeds 10,000. What does this indicate about 2-aminoanthracene? What can you surmise about its carcinogenicity? (10 points)

10. Explain how mutations in the R or C subunit of c-AMP-dependent protein kinase (PKA) might lead to

a. a constantly active PKA (5 points)

b. a constantly inactive PKA. (5 points)