

Department of Biochemical Engineering and Biotechnology
Indian Institute of Technology, Delhi

MAJOR TEST: BBL132 General Microbiology (I Semester, 2015-2016)

Date: 19.11.2015

Timing: 10.30 – 12.30 hrs

Maximum Marks: 30

Note: Attempt all questions. Answer Part A and Part B in separate answer books.

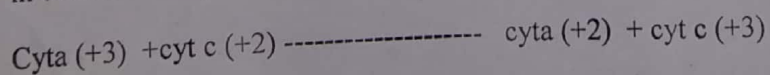
PART A

- Q. 1. (a). What are compatible solutes, and why are they synthesized by the cell? (2)
- (b). While thermophilic microorganisms have been isolated from cold environments (say, at temperature of 5°C), psychrophilic microorganisms have not been isolated from hot environments (say, at temperature of 90°C). Why? (2)
- (c). How do superoxide dismutase and catalase protect a cell from toxic forms of oxygen? (2)
- Q. 2. (a). What are the main intermediates and products of hexose monophosphate (HMP) pathway. Write the names and functions of **any two** such compounds. (Do not write the pathway). (3)
- (b). Microorganisms growing on acetate as the sole source of carbon and energy use glyoxalate cycle, whereas microorganisms growing on succinate do not. Why is it so - justify your answer. (3)
- Q. 3. In *Escherichia coli*, synthesis of the enzyme nitrate reductase is repressed by oxygen (that is nitrate reductase is not synthesized in the presence of oxygen). On the basis of energetic considerations, explain why is this phenomenon advantageous to the organism? (3)

The half-cell potential of the following redox couples are as follows:

$$\begin{aligned} E_0' (\text{NAD}^+/\text{NADH}) &= -0.32 \text{ volts} \\ E_0' (\text{FAD}/\text{FADH}_2) &= +0.02 \text{ volts} \\ E_0' (\text{NO}_3^-/\text{NO}_2^-) &= +0.43 \text{ volts} \\ E_0' (1/2 \text{O}_2/\text{H}_2\text{O}) &= +0.82 \text{ volts} \end{aligned}$$

Q. 4. Most aerobic microorganisms have cytochrome c and cytochrome a as electron carriers in electron transport chain. Consider the reduction of cytochrome a by cytochrome c:



$$\begin{aligned} \text{Given, } E_0' (\text{cyt c (+3)}/\text{cyt c (+2)}) &= +0.27 \text{ V} \\ E_0' (\text{cyta (+3)}/\text{cyta (+2)}) &= +0.22 \text{ V} \end{aligned}$$