Q.1 Discuss the multiple roles of sulfur and its compounds in the metabolism of microorganisms.

Q.2 Explain how deletion of each of the following genes would affect the ability of *Escherichia coli* to utilize PTS sugars, non-PTS sugars, and acetate.

(a) the gene encoding Enzyme I (Ei) of the phosphotransferase system (PTS)
(b) both the gene for Ei and the gene for Enzyme IIA\text{Glucose} of the PTS
(c) the gene encoding isocitrate dehydrogenase kinase/phosphatase
(d) the gene encoding HPr of the PTS
(e) both the gene for HPr and the gene for the regulatory protein FruR (Cra).

Q.3 Give a detailed account of BOTH:

(a) the dissimilative reduction of CO₂ to CH₄ by methanogens, and
(b) the dissimilative oxidation of CH₄ to CO₂ by methanotrophs.

Q.4 Compare, in detail, with structures, catabolism of glucose by homofermentative and heterofermentative lactic acid bacteria.
Q.5 Answer TWO of the following:
(i) Compare primary and secondary active transport, giving examples.
(ii) Give an account of regulation of the bgl operon of E. coli by antitermination.
(iii) Explain, in detail, the role of specific activity in monitoring protein purification.

Q.6 Compare the conventional to the reverse, or reductive, TCA cycle.

Q.7 Describe BOTH:
(a) anoxygenic photophosphorylation in purple bacteria and  (15 marks)
(b) reduction of NAD(P)^+ for CO_2 fixation in purple bacteria.  (10 marks)

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