BI/CH 422 & BI/CH 622

One-Hour Examination # 3   **Monday, April 9, 2012**

Suggested Answers.

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1. Explain why protein degradation by proteasomes requires ATP even though proteolysis is an exergonic process. What is the reaction involved?   *(2 marks)*

Ans:

> *ATP is required to activate ubiquitin (Ub) in the first step of linking it to the target protein:*
> $$Ub + E1\text{-}SH + ATP = Ub\text{-}S.E1 + AMP + PP$$

2. By what enzymic steps is NH_3 liberated from most aminoacids $R.CH(NH_3^+)COO^-$? *(2 marks)*

Ans:

(1) Transamination with a-ketoglutarate $\longrightarrow$ α-ketoacid + glutamate, followed by

(2) Glutamate + NAD(P)$^+$ $\longrightarrow$ α-ketoglutarate + NAD(P)H + H^+ + NH_3

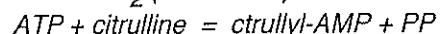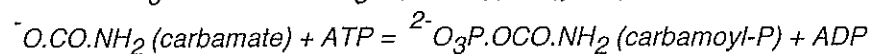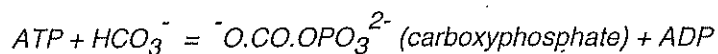3. How is NH_3 liberated from serine and threonine?   *(2 marks)*

Ans:

(1) Condensation with enzyme-bound pyridoxal-phosphate (PLP) to form a Schiff base, followed by

(2) Hydrolysis to α-ketoacid + NH_3

4. In which reactions of the urea cycle is ATP required?   *(3 marks)*

Ans:

$$ATP + HCO_3^- = {}^-O.CO.OPO_3^{2-} \text{ (carboxyphosphate)} + ADP$$
$${}^-O.CO.NH_2 \text{ (carbamate)} + ATP = {}^{2-}O_3P.OCO.NH_2 \text{ (carbamoyl-P)} + ADP$$
$$ATP + citrulline = ctrullyl\text{-}AMP + PP$$
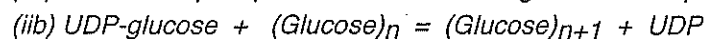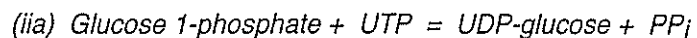
5. Which reactions of the urea cycle take place in the mitochondrion?   *(2 marks)*

Ans:
The synthesis of carbamoyl-P and the transcarbamoylation of ornithine to citrulline

6. There are two photosystems (PS I and PS II) in green plants.   How do we know that?
                    (3 marks)

(iia) Glucose 1-phosphate + UTP = UDP-glucose + PP$_i$

(iib) UDP-glucose + (Glucose)$_n$ = (Glucose)$_{n+1}$ + UDP

12. What is meant by an "anaplerotic" pathway? What anaplerotic reactions are used by *E.coli* to enable them to grow on **acetate** (CH_3COO^-) as sole carbon source? *[3 marks]*

Ans:
An anaplerotic pathway effects the nett synthesis of intermediates of the TCA cycle as these intermediates are drained away for biosyntheses of cell constituents.
The anaplerotic reactions during growth on acetate are those that by-pass the loss of CO_2 from isocitrate and a-ketoglutarate in the TCA cycle:

isocitrate = glyoxylate + succinate
glyoxylate + acetyl-coenzyme A = malate + CoASH