Topic 8 - data-based questions

Page 378
1. OMP decarboxylase has the slowest uncatalysed rate;
2. OMP decarboxylase has the highest catalysed rate;
3. ketosteroid isomerase $3.8 \times 10^{11}$; nuclease $5.6 \times 10^{20}$; OMP decarboxylase $1.4 \times 10^{24}$;
4. OMP decarboxylase is the most effective as it is the slowest reaction without a catalyst and the most rapid reaction with a catalyst;
5. the substrate binds to the active site of the enzyme; the binding leads to a conformational change in the enzyme that strains bonds within the substrate making it more reaction; or it makes collisions between substrates more effective in terms of promoting a reaction;

Page 379
1. appears to be independent of temperature therefore must be part of the uncertainty of the measuring device;
2. 

<table>
<thead>
<tr>
<th>Temperature [°C]</th>
<th>Reaction rate [%/s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0.01</td>
</tr>
<tr>
<td>21</td>
<td>0.013</td>
</tr>
<tr>
<td>34</td>
<td>0.23</td>
</tr>
<tr>
<td>51</td>
<td>0.007</td>
</tr>
</tbody>
</table>
3. 

Page 385
1. pyruvate is a substrate for aerobic respiration; pyruvate is broken down in the link reaction which will not occur in absence of oxygen; oxygen is consumed during oxidative phosphorylation which requires reduced molecules produced from pyruvate breakdown;
2. ADP needed to be added so that Krebs cycle could occur; as ADP is raw material for Krebs cycle; no Krebs cycle, no electron transport chain; no electron transport chain, no oxygen consumption;
3. oxygen level would not have declined any lower; as no Krebs cycle would occur and therefore no electron transport chain would occur;
4. all pyruvate has been used up; no more Krebs cycle occurring; so no oxygen consumption in the electron transport chain; so ADP is no longer rate limiting;

Page 390
1. multiple fracture layers are visible;
2. integral proteins are embedded in both halves of a bilayer; the bilayer fractures down the middle, but the proteins remain embedded in one half giving the studded appearance;
3. $10^6$
4. other membranes that might be visible are stroma lamellae, inner membrane and outer membrane / membranes of other organelles in the cell;
1. **a)** the higher the pH of ADP solution, the more rapid is the rate of ATP production. This is a direct relationship at lower pH but rate of increase increases with pH;  
   **b)** because the magnitude of concentration gradient between inside and outside is being increased;  
2. the lower the incubation pH, the higher the yield of ATP. This also increases the magnitude of the concentration gradient/difference in concentration;  
3. ATP production powered by movement of H\(^+\) down concentration gradient. Once movement occurs, concentration, difference is lowered so less ATP production;  
4. in the presence of light, photolysis occurs, which generates H\(^+\) and therefore affects concentration gradient;  

Page 396  
1. the dark period causes the concentration of glycerate 3-phosphate to rise. The dark period causes the concentration of ribulose bisphosphate to fall;  
2. **a&b)** in the light reactions energy for Calvin cycle is produced; in the dark, RuBP is converted to glycerate-3-phosphate; glyerate-3–phosphate cannot be converted to RuBP; some of the glycerate-3-phosphate is converted to carbohydrate;  
3. RuBP concentration would rise and glycerate-3–phosphate levels would fall;  
4. **a)** lower concentration of glycerate-3–phosphate;  
   **b)** lower concentration of RuBP;  

Page 398  
2. bundle sheath chloroplasts are larger; bundle sheath chloroplasts lack grana; bundle sheath chloroplasts have more starch granules; mesophyll chloroplasts have more higher density of thylakoid membrane;  
3. **a)** mesophyll chloroplast because of higher density of thylakoid membrane;  
   **b)** bundle sheath chloroplasts because of the presence of the starch granules;  
   **c)** mesophyll because of the higher density of thylakoid membrane.
**Topic 8 - end of topic questions**

1. a) chain or cycle of reaction; enzyme catalyse;

   b) (i) pyr;  (ii) FDP;  (iii) PEP;

   c) (i) pyruvate is accumulating; pyruvate is the product of the pathway;

      (ii) enzyme that converts F6P to FDP; F6P accumulates; FDP concentration is lower;

2. a) (i) zero light intensity then sudden/instantaneous rise; slower rise to a maximum then these changes in reverse;

   (ii) sudden rises and falls when light switches on or off; slower rise to a maximum and fall due to natural light changes;

   b) (i) same maximum/1200 lux/maximum beyond range of meter;

   (ii) daily maximum falls; falls rapidly at first then more slowly;

   (iii) no significant change in maximum intensity; fluctuation from day to day (due to natural light variation);

   c) *Chlorella* culture has multiplied/more cells per unit volume; more chlorophyll per unit volume; light absorbed by the chlorophyll/*Chlorella* cells;

   d) *Chlorella* culture has reached a maximum density; nutrients in water are used up; light intensity/carbon dioxide concentration is restricting growth;

3. a) (i) increasing fructose 6-phosphate concentration (initially) causes an increase in activity; activity levels out/remains constant as (substrate) concentration continues to rise;

   (ii) more collisions with active site as concentration rises; at high substrate levels all active sites are occupied so no further increase in rate/enzyme working at maximum rate;

   b) (i) decreases activity; at all fructose 6-phosphate concentrations; most effect at intermediate fructose 6-phosphate concentrations/little difference at high fructose 6-phosphate concentrations; ATP acts as an inhibitor;

   (ii) end-product inhibition; respiration rate decreased if ATP already available;

4. a) between 1.5 and 3.5 hours (or number between these figures) after feeding mealworm RQ values are higher than for millet; no difference in RQ values between 3.5 hours and 6 hours; between 0.5 and 1.5 hours (or number between these figures) millet RQ values much higher than for mealworm; between 2 and 3 hours mealworm RQ values are slightly higher than for millet;

   b) millet is not composed entirely of carbohydrates; millet contains more carbohydrates; mealworms contain more lipids/proteins;

   c) (i) using carbohydrate (from millet as a respiratory substrate)

   (ii) reverting to other substrates / carbohydrates (from millet) used up