Enzymatics

Part A – Multiple Choice

1. C
2. B
3. D
4. C
5. C
6. D
7. C
8. C
9. C
10. A
11. A
12. A
13. A
14. A
15. C
16. C
17. C
18. D
19. B
20. C
21. D
22. B
23. B
24. C
25. A
26. B
27. B
28. A
29. C
30. A
31. D
32. D
33. D
34. C
35. C

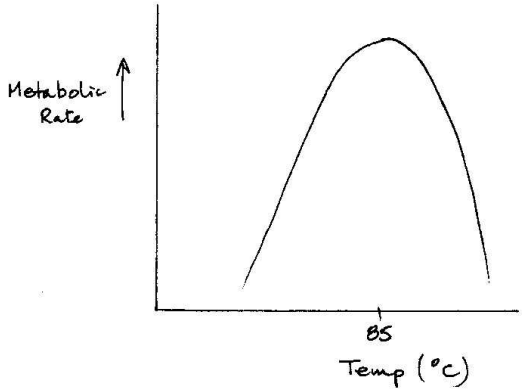
Part B – Written Answers

Note: The answers provided here are correct, but they may NOT be the only possible answers.

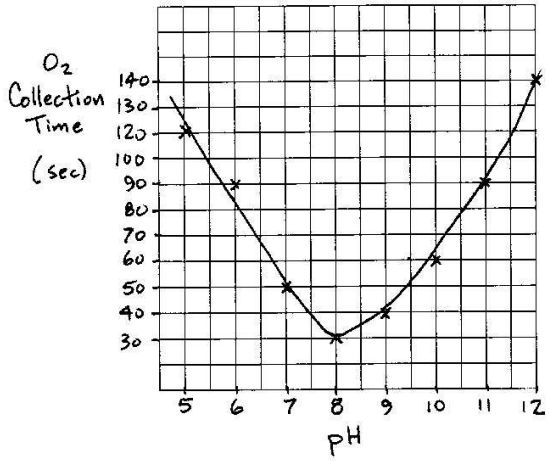
1. a. Adding more E_3 will increase the rate that D will be formed (as long as C is not limited and E_4 is not also increased). Also, inhibiting E_4 will mean that more (all?) of Substance C will be converted into D instead of some of it being converted into Substance F.

   b. The substance added must selectively block E_4 from functioning, while not affecting E_3. This substance is likely a competitive inhibitor that blocks the active site of E_4. The inhibitor will not block E_3 from functioning because the active site of E_3 has a different configuration, which allows it to continue to function.

   1. This graph will display metabolic activity as dependent on temperature. It will have an optimum at 85°C, as illustrated below:



2. a.

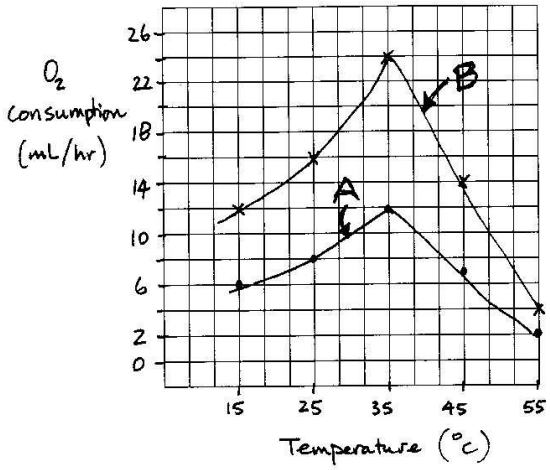


   b. Based on the graph, it should take about 68 seconds to collect the oxygen.
   c. The reaction rate is slowing down from pH 8 to pH 12 as indicated by the increased length of time it takes to collect oxygen, the product. This observation can be explained by the fact that the pH has surpassed the optimum (of about 8.0) and the enzyme catalase is becoming progressively denatured. In this condition, it will not work as well because the active site becomes more distorted and the substrate will not fit properly. Thus the E-S complex will not form as readily, so no products can be formed.

4. Substrates and inhibitors may be structurally similar, but they are distinct enough that an enzyme will react properly with the substrate, where it will only combine with the competitive inhibitor. If an E-S complex cannot form properly (as in the case of the enzyme combining with the inhibitor), then no reaction can proceed, and no products can be formed.

5. Reaction rate may depend on the concentration of enzymes. If they are the limiting factor, then additional substrates cannot increase the reactions rate.

6. a.



b. There would be approximately 13.5 mL oxygen consumed per hour

c. Far less oxygen is consumed per hour with Sample A. This can be attributed to the fact that there is no thyroxin in Sample A.

d. i) 15°C is lower than optimum temperature therefore the reaction rate is lower. The KMT predicts this observation because the molecules move slower and there are fewer collisions between them.

ii) 35°C appears to be about the optimum, therefore the reaction rate should be the greatest.

iii) 55°C greatly exceeds the optimum, which suggests that the enzyme should be somewhat denatured allowing for fewer e-s complexes to form, therefore fewer reactions are possible and fewer products can result.