**Mark Scheme for Human Biology Unit 1 Science Inquiry – Enzymes Weighting 6% Total \_\_\_\_/36 Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| Question | Mark | Description |
| Carrying out | /3 | Answers to questions 2, 3, 4 correct, one mark each |
| Observations | /2 | Appropriate observation for each (1)  Accurate and detailed observations for all (2) |
| Planning own investigation | /4 | Equipment list (1)  Method is feasible (1) eg if temperature must be suitable 10 degrees, 30 degrees, 50 degrees  All main variables controlled and details on how (1)  Suitable table given to record results (1) |
| Q5 | /2 | Catalase is an enzyme (1)  It lowers the activation energy required for the decomposition to take place (1) |
| Q6 | /2 | Simple statement of how factor affected the experiment eg as the temperature increased the time taken for the decomposition decreased.  Detailed explanation including all aspects eg at low temperatures the decomposition was very slow, as temperature increased it took less time, however there was an optimum temperature after which the decomposition went slower/ until it stopped |
| Q7 | /3 | https://upload.wikimedia.org/wikipedia/commons/thumb/2/24/Induced_fit_diagram.svg/2000px-Induced_fit_diagram.svg.png  Diagram must be labelled with enzyme as catalase, substrate as hydrogen peroxide, products should be labelled water and oxygen, a full explanation must accompany the diagram (3)  If products not labelled but rest correct (2)  Diagram basic, explanation has enzymes catalase and substrate hydrogen peroxide and enzymes decomposing the substrate (1). |
| Q8 | /4 | Temperature – at lower temperatures the decomposition would be slow, as temp increased decomposition would increase until reached optimum, then slow until enzymes denatured and no more decomposition take place – difference between.(1)  Enzymes are more tolerable to temperature variations below 37 degrees (ie. Enzymes still work at 10 degrees) but are less tolerable to temps over 37 degrees (ie. Most enzymes denature between 40-50 degrees)(2)  Enzyme function best at optimum pH 7, will decompose hydrogen peroxide, at either side the rate of decomposition will decrease.(1)  Enzyme is able to function between pH 7-11, in acidic conditions enzyme will not function and no decomposition will occur.(2)  As the substrate conc increases the rate of decomposition will also increase to a point where no further increase will take place.(1)  Because enzymes have a maximum rate of reaction (top speed)(2)  As the enzyme concentration increases so does the rate of decomposition, more enzyme, and more substrate can be decomposed.(1)  Substrate is in excess in the body, as more enzyme is added, this dramatically increases the rate of reaction.(2)  Or any other reasonable answer eg co-factor/co-enzyme/removal of products  *1- brief outline of what happens, 2 – detailed outline of what happens (2 per factor)* |
| Q9 | /2 | There is a pause in the reaction/decomposition – transition chemical made, then decomposition resumes.(1), once decomposition complete, more hydrogen peroxide can be added and it will be decomposed – enzyme not used up (1) |
| Q10 | /5 | Graph – 1 for title including independent and dependent, 1 for accurate scales, 1 for accurate label of axis with units, 1 for plotting points and 1 for correct graph |
| Q11 | /1 | the rate of decomposition of starch will be reduced the further from the optimum enzyme pH level the solution gets or feasible hypothesis |
| Q12 | /3 | From pH 4.5 to pH 6 there is a gradual increase in the rate of decomposition, (1)  pH 6 appears to be the optimum pH level for amylase to work at as this had the largest level of activity (1)  from pH6 up to pH 7 there is a rapid decline in the relative activity levels, declining at a much faster rate than when the pH levels dropped below pH 6. (1) *some comparison of rate of decomposition before and after is needed to get full marks* |
| Q13 | /2 | The activity level will be 16-18 (1) as conditions become too acidic for the enzyme to function the relative activity decreases (1) |
| Q14 | /2 | Frogs are cold blooded so body temp is colder 37 degrees (1), its enzymes will function at a lower temperature so could have been denatured at 37 degrees (1) |
| Q15 | /1 | Without them would never have enough energy to get chemical reactions started/would not be able to create enough energy to have all vital reactions happening/reactions would be too slow for the bodies requirements |