**SAC 2: Rate of reaction investigation**

***HCl and thiosulfate reaction, producing S and SO2***

***(Note to teachers: I modified Part A and ran the experiment at room temperature, then 30 , 40 and 50 0C.***

***Part B: I only asked students to repeat Part A room temperature run twice using***

* ***25 mL of water, not 35***
* ***then 15 mL of water – no other procedure given)***

Part A: Measurements in Logbook 3 marks

Graph of results 4 marks

Part B: Measurements in Logbook 2 marks

Graph of results 2 marks

**Questions**

Safety

State two safety precautions taken in this experiment and why they were taken 2 marks

**Part A**

1. a. What aspect of the reaction are we using to measure the rate of this reaction? – refer

to the equation for the reaction? 2 marks

b. Suggest another way we could monitor the rate of this reaction. Justify your answer.

Does your idea offer any advantages over the method we used. 3 marks

2. List the independent and dependent variables and two controlled variables. 3 marks

3. Explain why rate changes with temperature. 2 marks

4. What can you conclude from your graph? 2 marks

5. You have data for Part A that has temperature and time values. Add a third column to your table and calculate the reciprocal of each time value – I have given you an example in the first cell of the third column.

Plot a graph of 1/time against temperature taking care with making the scale of the vertical axis spreading the data out. 4 marks

|  |  |  |
| --- | --- | --- |
| Temp C | Time sec | 1/time |
| 18 | 208 | 1/208 = 0.0084 |
| 30 | 79 |  |
| 40 |  |  |

6. What is the point of this new graph? What does it show? 2 marks

7. One group in the class chose to ensure the beaker contents mixed properly by giving the

mixture an occasional stir. Discuss the impact of occasional stirring. 2 marks

Part B

8. Why does rate change with concentration? 1 mark

9. Give reasons why it is more difficult to study the impact of concentration on rate.

3 marks

10. A student investigating concentration, decides to run one mixture of the reactants, then to

repeat the experiment halving the concentration of the Na2S2O3.

Given: Mixture 1: 10 mL of 0.2 M Na2S2O3 5 mL of HCl and 30 mL of water

Mixture 2: 5 mL of 0.2 M Na2S2O3, 5 mL of HCl and 30 mL of water

1. Use calculations to explain if the student has halved the concentration in the reaction of Na2S2O3 4 marks
2. In running the two mixtures above, the student has also changed another variable that was controlled in Part A. What is this variable and does it affect the results? 2 marks

Errors

11. A student repeats part A and finds the results are similar to the first time but not exactly precise. How might you refine the procedure to improve the precision? (Same procedure but improved results) 3 marks

12. a. Suggest a likely random error in part A. 1 mark

b. Suggest a likely systematic error in part A. 1 mark