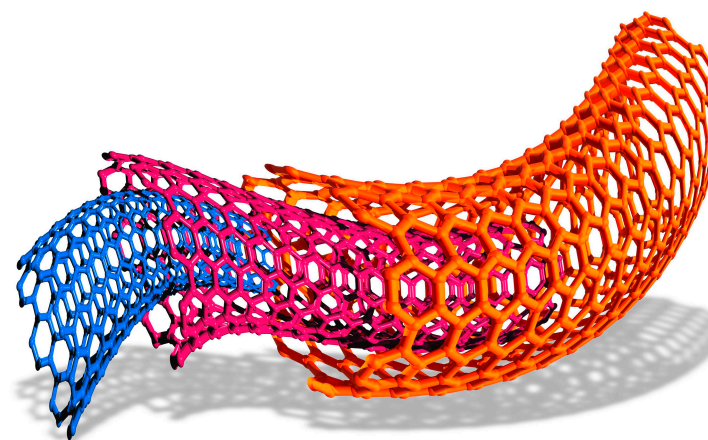


# Interactive Example Candidate Responses

Paper 4 (May / June 2016), Question 3

Cambridge IGCSE™  
Chemistry 0620



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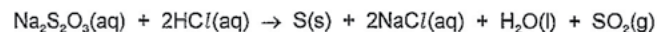
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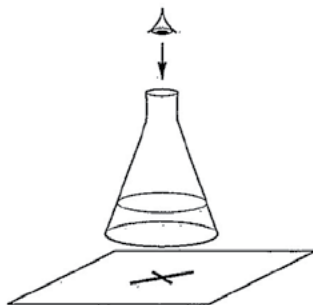
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- 3 When aqueous sodium thiosulfate and dilute hydrochloric acid are mixed, a precipitate of insoluble sulfur is produced. This makes the mixture difficult to see through.



The time taken for the cross to disappear from view is measured.



A student adds the following volumes of aqueous sodium thiosulfate, dilute hydrochloric acid and distilled water to the conical flask.

The time taken for the formation of the precipitate of sulfur to make the cross disappear from view is recorded.

experiment number	volume of sodium thiosulfate /cm <sup>3</sup>	volume of hydrochloric acid /cm <sup>3</sup>	volume of distilled water /cm <sup>3</sup>	time taken for cross to disappear from view/s
1	10	10	40	56
2	20	10	30	28
3	20	10	15	14

- (a) State the order in which the aqueous sodium thiosulfate, hydrochloric acid and distilled water should be added to the flask.

~~volume of distilled water then hydrochloric acid then sodium thiosulfate~~  
 sodium thiosulfate then hydrochloric acid then distilled water [1]

Select page

Your Mark

3(a)

3(b)(i)

3(b)(ii)

3(c)

Q3	Mark scheme			
(a)	1 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 1 HCl 1 H <sub>2</sub> O 1 H <sub>2</sub> O	2 H <sub>2</sub> O 2 H <sub>2</sub> O 2 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 2 HCl	3 HCl 3 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 3 HCl 3 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	OR OR OR ;
(b)(i)	<b>M1</b> volumes 40 : 10 : 10; <b>M2</b> time = 14;			
(b)(ii)	<b>M1</b> more particles per unit volume/particles are closer together; <b>M2</b> increases the rate of collisions/there are more collisions per unit time;			
(c)	<b>M1</b> particles gain more energy and move faster; <b>M2</b> increasing rate of collisions/more collisions per unit time; <b>M3</b> higher proportion of particles have sufficient energy to react/collisions have sufficient energy to react/are above the activation energy;			

(b) In experiment 3 the student wanted the sodium thiosulfate to be double the concentration used in experiment 2.

(i) Complete the table to show the **volumes** which should be used and the **expected** time taken for the cross to disappear from view in experiment 3. [2]

(ii) Use collision theory to explain why increasing the concentration of sodium thiosulfate would change the rate of reaction.

Increasing the concentration would mean more particles on sodium thiosulfate in that particular volume to react with HCl. There will be more frequent collisions between sodium thiosulfate and HCl and thus rate of reaction would speed up. [2]

(c) The student repeated experiment 1 at a higher temperature.

Use collision theory to explain why the rate of reaction would increase.

At higher temperature, particles gain more kinetic energy and move more faster. There would be more frequent collisions between reactants due to speed and reactants will collide with greater energy. [3]

[Total: 8]

Your  
Mark

3(a)

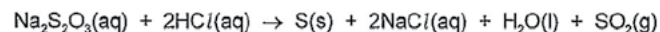
3(b)(i)

3(b)(ii)

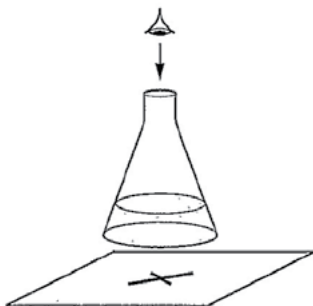
3(c)

Q3	Mark scheme			
(a)	1 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 1 HCl 1 H <sub>2</sub> O 1 H <sub>2</sub> O	2 H <sub>2</sub> O 2 H <sub>2</sub> O 2 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 2 HCl	3 HCl 3 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 3 HCl 3 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	OR OR OR ;
(b)(i)	<b>M1</b> volumes 40 : 10 : 10; <b>M2</b> time = 14;			
(b)(ii)	<b>M1</b> more particles per unit volume/particles are closer together; <b>M2</b> increases the rate of collisions/there are more collisions per unit time;			
(c)	<b>M1</b> particles gain more energy and move faster; <b>M2</b> increasing rate of collisions/more collisions per unit time; <b>M3</b> higher proportion of particles have sufficient energy to react/collisions have sufficient energy to react/are above the activation energy;			

- 3 When aqueous sodium thiosulfate and dilute hydrochloric acid are mixed, a precipitate of insoluble sulfur is produced. This makes the mixture difficult to see through.



The time taken for the cross to disappear from view is measured.



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The time taken for the formation of the precipitate of sulfur to make the cross disappear from view is recorded.

experiment number	volume of sodium thiosulfate /cm <sup>3</sup>	volume of hydrochloric acid /cm <sup>3</sup>	volume of distilled water /cm <sup>3</sup>	time taken for cross to disappear from view/s
1	10	10	40	56
2	20	10	30	28
3	40	10	10	14

- (a) State the order in which the aqueous sodium thiosulfate, hydrochloric acid and distilled water should be added to the flask.

The sodium thiosulfate and water should be added first, followed by the hydrochloric acid. [1]

Select page

Your Mark

3(a)

3(b)(i)

3(b)(ii)

3(c)

### Q3 Mark scheme

(a)	1 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 1 HCl 1 H <sub>2</sub> O 1 H <sub>2</sub> O	2 H <sub>2</sub> O 2 H <sub>2</sub> O 2 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 2 HCl	3 HCl 3 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 3 HCl 3 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	OR OR OR ;
(b)(i)	M1 volumes 40 : 10 : 10; M2 time = 14;			
(b)(ii)	M1 more particles per unit volume/particles are closer together; M2 increases the rate of collisions/there are more collisions per unit time;			
(c)	M1 particles gain more energy and move faster; M2 increasing rate of collisions/more collisions per unit time; M3 higher proportion of particles have sufficient energy to react/collisions have sufficient energy to react/are above the activation energy;			

(b) In experiment 3 the student wanted the sodium thiosulfate to be double the concentration used in experiment 2.

(i) Complete the table to show the **volumes** which should be used and the **expected** time taken for the cross to disappear from view in experiment 3. [2]

(ii) Use collision theory to explain why increasing the concentration of sodium thiosulfate would change the rate of reaction.

When the concentration increases the rate increases  
because there would be more particles to collide  
so the reaction would occur faster so the  
rate would increase [2]

(c) The student repeated experiment 1 at a higher temperature.

Use collision theory to explain why the rate of reaction would increase.

The particles would gain energy when the temperature  
increases causing them to move faster and collide  
more frequently and ~~there~~ there would be more  
successful collisions because more activation energy [3]

[Total: 8]

Your  
Mark

3(a)

3(b)(i)

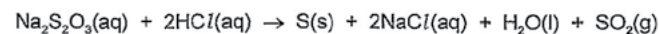
3(b)(ii)

3(c)

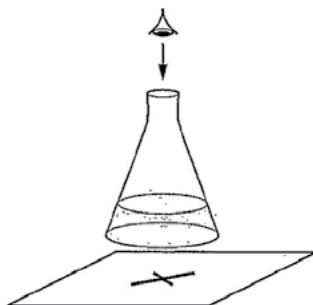
Q3	Mark scheme			
(a)	1 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 1 HCl 1 H <sub>2</sub> O 1 H <sub>2</sub> O	2 H <sub>2</sub> O 2 H <sub>2</sub> O 2 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 2 HCl	3 HCl 3 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 3 HCl 3 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	OR OR OR ;
(b)(i)	<b>M1</b> volumes 40 : 10 : 10; <b>M2</b> time = 14;			
(b)(ii)	<b>M1</b> more particles per unit volume/particles are closer together; <b>M2</b> increases the rate of collisions/there are more collisions per unit time;			
(c)	<b>M1</b> particles gain more energy and move faster; <b>M2</b> increasing rate of collisions/more collisions per unit time; <b>M3</b> higher proportion of particles have sufficient energy to react/collisions have sufficient energy to react/are above the activation energy;			



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1	10	10	40	56
2	20	10	30	28
3	40	10	30	14

- (a) State the order in which the aqueous sodium thiosulfate, hydrochloric acid and distilled water should be added to the flask.

first distilled water, then hydrochloric acid and then sodium thiosulfate. [1]

Select page

Your Mark

3(a)

3(b)(i)

3(b)(ii)

3(c)

Q3	Mark scheme			
(a)	1 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 1 HCl 1 H <sub>2</sub> O 1 H <sub>2</sub> O	2 H <sub>2</sub> O 2 H <sub>2</sub> O 2 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 2 HCl	3 HCl 3 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 3 HCl 3 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	OR OR OR ;
(b)(i)	M1 volumes 40 : 10 : 10; M2 time = 14;			
(b)(ii)	M1 more particles per unit volume/particles are closer together; M2 increases the rate of collisions/there are more collisions per unit time;			
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(b) In experiment 3 the student wanted the sodium thiosulfate to be double the concentration used in experiment 2.

(i) Complete the table to show the **volumes** which should be used and the **expected** time taken for the cross to disappear from view in experiment 3. [2]

(ii) Use collision theory to explain why increasing the concentration of sodium thiosulfate would change the rate of reaction.

There are more particles of sodium thiosulfate which collide with the other particles, making the reaction go faster.

[2]

(c) The student repeated experiment 1 at a higher temperature.

Use collision theory to explain why the rate of reaction would increase.

Increasing the heat ~~gives~~ gives the particles more energy so they collide with each other more often and with greater force, increasing the rate of reaction

[3]

[Total: 8]

Your  
Mark

3(a)

3(b)(i)

3(b)(ii)

3(c)

Q3	Mark scheme			
(a)	1 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 1 HCl 1 H <sub>2</sub> O 1 H <sub>2</sub> O	2 H <sub>2</sub> O 2 H <sub>2</sub> O 2 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 2 HCl	3 HCl 3 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 3 HCl 3 Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	OR OR OR ;
(b)(i)	<b>M1</b> volumes 40 : 10 : 10; <b>M2</b> time = 14;			
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