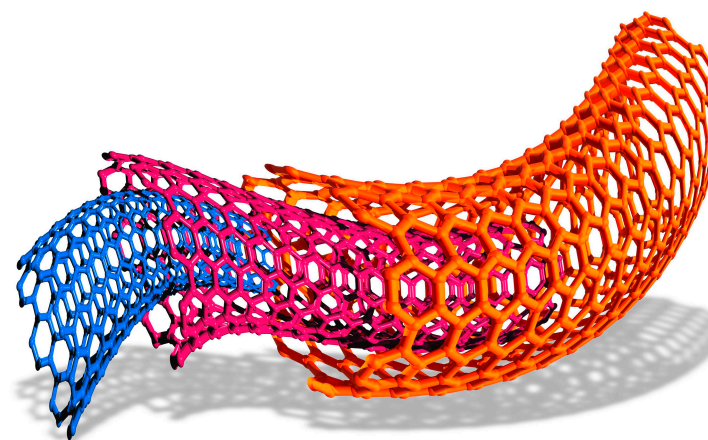


Interactive Example Candidate Responses

Paper 6 (May / June 2016), Question 2

Cambridge IGCSE™
Chemistry 0620



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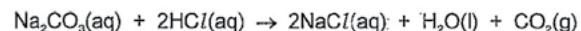
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- 2 A student investigated the reaction between aqueous sodium carbonate and two different solutions of dilute hydrochloric acid, **A** and **B**.
The reaction is:



Three experiments were carried out.

(a) *Experiment 1*

Using a measuring cylinder, 25 cm³ of aqueous sodium carbonate were poured into a conical flask.

Thymolphthalein indicator was added to the conical flask.

A burette was filled up to the 0.0 cm³ mark with solution **A** of dilute hydrochloric acid. **A** was added to the flask, until the solution just changed colour.

Use the burette diagram to record the reading in the table.



final reading

Experiment 2

Experiment 1 was repeated using methyl orange indicator instead of thymolphthalein.

Methyl orange is red-orange in acidic solutions and yellow in alkaline solutions.

Use the burette diagrams to record the readings in the table and complete the table.



initial reading



final reading

	experiment 1	experiment 2
final burette reading/cm ³	13.2	39.2
initial burette reading/cm ³	0.0	12.8
difference/cm ³	13.2	26.4

[4]

Select
page

Your
Mark

2(a)

2(b)

2(c)

2(d)

2(e)

2(f)

2(g)

2(h)(i)

2(h)(ii)

2(i)

Q2 Mark scheme

(a)	final readings completed correctly: 13.2, 39.2; initial readings completed correctly: 0.0, 12.8; differences completed correctly: 13.2, 26.4; all readings and differences to 1 decimal place;
(b)	<u>yellow</u> to orange/red/pink;
(c)	initial and final readings completed correctly: 9.9, 16.5; difference completed correctly: 6.6;
(d)	bubbles/fizzing/effervescence;
(e)	Experiment 2;
(f)	use a pipette/burette;
(g)	effect on results: none owtte; reason: no change in concentration owtte;
(h)(i)	2:1;
(h)(ii)	acid B is double the concentration of acid A ora/acid B is more concentrated ora;
(i)	any suitable correct and different method M1 method; M2 reagents; M3 result;

(b) What colour change was observed in the flask in experiment 2?

from yellow to orange [1]

(c) Experiment 3

Experiment 1 was repeated using solution **B** of acid instead of solution **A**.

Use the burette diagrams to record the readings in the table and complete the table.



initial reading



final reading

experiment 3	
final burette reading / cm ³	16.5
initial burette reading / cm ³	9.9
difference / cm ³	6.6

[2]

(d) Suggest **one** observation, other than colour change, that is made when hydrochloric acid is added to sodium carbonate.

Effervescence and bubbles of a colourless gas [1]

↓
(carbon dioxide)

(e) Complete the sentence below.

Experiment 2 needed the largest volume of hydrochloric acid to change the colour of the indicator. [1]

(f) What would be a more accurate method of measuring the volume of the aqueous sodium carbonate?

using a burette [1]

Your
Mark

2(a)

2(b)

2(c)

2(d)

2(e)

2(f)

2(g)

2(h)(i)

2(h)(ii)

2(i)

Q2 Mark scheme

(a)	final readings completed correctly: 13.2, 39.2; initial readings completed correctly: 0.0, 12.8; differences completed correctly: 13.2, 26.4; all readings and differences to 1 decimal place;
(b)	<u>yellow</u> to orange/red/pink;
(c)	initial and final readings completed correctly: 9.9, 16.5; difference completed correctly: 6.6;
(d)	bubbles/fizzing/effervescence;
(e)	Experiment 2;
(f)	use a pipette/burette;
(g)	effect on results: none owtte; reason: no change in concentration owtte;
(h)(i)	2:1;
(h)(ii)	acid B is double the concentration of acid A ora/acid B is more concentrated ora;
(i)	any suitable correct and different method M1 method; M2 reagents; M3 result;

- (g) What would be the effect on the results, if any, if the solutions of sodium carbonate were warmed before adding the hydrochloric acid? Give a reason for your answer.

effect on results ~~increase~~ NO change

reason It's hard to decompose sodium (reactive metal) [2]

- (h) (i) Determine the ratio of volumes of dilute hydrochloric acid used in experiments 1 and 3.

Experiment 3 used double volume of experiment 2 [1]

- (ii) Use your answer to (h)(i) to deduce how the concentration of solution A differs from that of solution B.

Solution A is more concentrated (double) than B [1]

- (i) Suggest a **different** method, using standard laboratory chemicals, to determine which of the solutions of dilute hydrochloric acid, A or B, is more concentrated.

Using the same mass and particle size of a reactive metal (e.g. magnesium), add each to a separate conical flask. Add a known volume of solution A (25cm³) to the first conical flask and measure the rate of gas (hydrogen) production over a period of time. Repeat with solution B (same volume of 25cm³) in the other flask, measure the rate of gas production over the same time. Compare. One that produced more gas at time interval has more concentrated acid solution. [3]

Your
Mark

2(a)

2(b)

2(c)

2(d)

2(e)

2(f)

2(g)

2(h)(i)

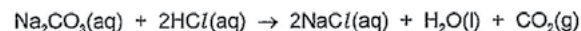
2(h)(ii)

2(i)

Q2 Mark scheme

(a)	final readings completed correctly: 13.2, 39.2; initial readings completed correctly: 0.0, 12.8; differences completed correctly: 13.2, 26.4; all readings and differences to 1 decimal place;
(b)	<u>yellow</u> to orange/red/pink;
(c)	initial and final readings completed correctly: 9.9, 16.5; difference completed correctly: 6.6;
(d)	bubbles/fizzing/effervescence;
(e)	Experiment 2;
(f)	use a pipette/burette;
(g)	effect on results: none owtte; reason: no change in concentration owtte;
(h)(i)	2:1;
(h)(ii)	acid B is double the concentration of acid A ora/acid B is more concentrated ora;
(i)	any suitable correct and different method M1 method; M2 reagents; M3 result;

- 2 A student investigated the reaction between aqueous sodium carbonate and two different solutions of dilute hydrochloric acid, **A** and **B**.
The reaction is:



Three experiments were carried out.

(a) *Experiment 1*

Using a measuring cylinder, 25 cm³ of aqueous sodium carbonate were poured into a conical flask.

Thymolphthalein indicator was added to the conical flask.
A burette was filled up to the 0.0 cm³ mark with solution **A** of dilute hydrochloric acid. **A** was added to the flask, until the solution just changed colour.
Use the burette diagram to record the reading in the table.



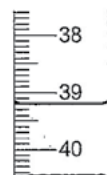
final reading

Experiment 2

Experiment 1 was repeated using methyl orange indicator instead of thymolphthalein. Methyl orange is red-orange in acidic solutions and yellow in alkaline solutions. Use the burette diagrams to record the readings in the table and complete the table.



initial reading



final reading

	experiment 1	experiment 2
final burette reading / cm ³	13.8 cm ³	39.6 cm ³
initial burette reading / cm ³	0.0 cm ³	12.8 cm ³
difference / cm ³	13.8 cm ³	26.8 cm ³

[4]

Select
page

Your
Mark

2(a)

2(b)

2(c)

2(d)

2(e)

2(f)

2(g)

2(h)(i)

2(h)(ii)

2(i)

Q2 Mark scheme

(a)	final readings completed correctly: 13.2, 39.2; initial readings completed correctly: 0.0, 12.8; differences completed correctly: 13.2, 26.4; all readings and differences to 1 decimal place;
(b)	yellow to orange/red/pink;
(c)	initial and final readings completed correctly: 9.9, 16.5; difference completed correctly: 6.6;
(d)	bubbles/fizzing/effervescence;
(e)	Experiment 2;
(f)	use a pipette/burette;
(g)	effect on results: none owtte; reason: no change in concentration owtte;
(h)(i)	2:1;
(h)(ii)	acid B is double the concentration of acid A ora/acid B is more concentrated ora;
(i)	any suitable correct and different method M1 method; M2 reagents; M3 result;

(b) What colour change was observed in the flask in experiment 2?

from yellow to red-orange [1]

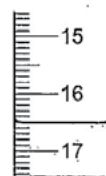
(c) Experiment 3

Experiment 1 was repeated using solution B of acid instead of solution A.

Use the burette diagrams to record the readings in the table and complete the table.



initial reading



final reading

	experiment 3
final burette reading/cm ³	<u>17.5 cm³</u>
initial burette reading/cm ³	<u>10.1 cm³</u>
difference/cm ³	<u>7.4 cm³</u>

[2]

(d) Suggest **one** observation, other than colour change, that is made when hydrochloric acid is added to sodium carbonate.

a gas is formed [1]

(e) Complete the sentence below.

Experiment 2 needed the largest volume of hydrochloric acid to change the colour of the indicator. [1]

(f) What would be a more accurate method of measuring the volume of the aqueous sodium carbonate?

using a volumetric pipette [1]

Your
Mark

2(a)

2(b)

2(c)

2(d)

2(e)

2(f)

2(g)

2(h)(i)

2(h)(ii)

2(i)

Q2 Mark scheme

(a)	final readings completed correctly: 13.2, 39.2; initial readings completed correctly: 0.0, 12.8; differences completed correctly: 13.2, 26.4; all readings and differences to 1 decimal place;
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(c)	initial and final readings completed correctly: 9.9, 16.5; difference completed correctly: 6.6;
(d)	bubbles/fizzing/effervescence;
(e)	Experiment 2;
(f)	use a pipette/burette;
(g)	effect on results: none owtte; reason: no change in concentration owtte;
(h)(i)	2:1;
(h)(ii)	acid B is double the concentration of acid A ora/acid B is more concentrated ora;
(i)	any suitable correct and different method M1 method; M2 reagents; M3 result;

- (g) What would be the effect on the results, if any, if the solutions of sodium carbonate were warmed before adding the hydrochloric acid? Give a reason for your answer.

effect on results The reaction could be fast.
reason There are particles with the activation energy. [2]

- (h) (i) Determine the ratio of volumes of dilute hydrochloric acid used in experiments 1 and 3.

2:1 [1]

- (ii) Use your answer to (h)(i) to deduce how the concentration of solution A differs from that of solution B.

Solution A is twice the concentration of solution B. [1]

- (i) Suggest a **different** method, using standard laboratory chemicals, to determine which of the solutions of dilute hydrochloric acid, A or B, is more concentrated.

You could react it with a base. You let take 20mg of Sodium Carbonate and then add 50cm³ of sample A of an HCl and then note the time. You repeat this for the other sample of the acid. You then compare the time so that the fastest is more concentrated than the other one. [3]

[Total: 17]

Your
Mark

2(a)

2(b)

2(c)

2(d)

2(e)

2(f)

2(g)

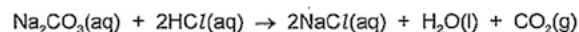
2(h)(i)

2(h)(ii)

2(i)

Q2	Mark scheme
(a)	final readings completed correctly: 13.2, 39.2; initial readings completed correctly: 0.0, 12.8; differences completed correctly: 13.2, 26.4; all readings and differences to 1 decimal place;
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(c)	initial and final readings completed correctly: 9.9, 16.5; difference completed correctly: 6.6;
(d)	bubbles/fizzing/effervescence;
(e)	Experiment 2;
(f)	use a pipette/burette;
(g)	effect on results: none owtte; reason: no change in concentration owtte;
(h)(i)	2:1;
(h)(ii)	acid B is double the concentration of acid A ora/acid B is more concentrated ora;
(i)	any suitable correct and different method M1 method; M2 reagents; M3 result;

- 2 A student investigated the reaction between aqueous sodium carbonate and two different solutions of dilute hydrochloric acid, A and B.
The reaction is:



Three experiments were carried out.

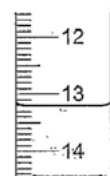
(a) *Experiment 1*

Using a measuring cylinder, 25 cm³ of aqueous sodium carbonate were poured into a conical flask.

Thymolphthalein indicator was added to the conical flask.

A burette was filled up to the 0.0 cm³ mark with solution A of dilute hydrochloric acid. A was added to the flask, until the solution just changed colour.

Use the burette diagram to record the reading in the table.



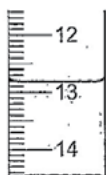
final reading

Experiment 2

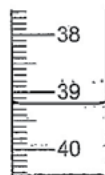
Experiment 1 was repeated using methyl orange indicator instead of thymolphthalein.

Methyl orange is red-orange in acidic solutions and yellow in alkaline solutions.

Use the burette diagrams to record the readings in the table and complete the table.



initial reading



final reading

	experiment 1	experiment 2
final burette reading / cm ³	13.2	39.2
initial burette reading / cm ³	0	12.8
difference / cm ³	13.2	26.4

Select
page

Your
Mark

2(a)

2(b)

2(c)

2(d)

2(e)

2(f)

2(g)

2(h)(i)

2(h)(ii)

2(i)

Q2 Mark scheme

(a)	final readings completed correctly: 13.2, 39.2; initial readings completed correctly: 0.0, 12.8; differences completed correctly: 13.2, 26.4; all readings and differences to 1 decimal place;
(b)	yellow to orange/red/pink;
(c)	initial and final readings completed correctly: 9.9, 16.5; difference completed correctly: 6.6;
(d)	bubbles/fizzing/effervescence;
(e)	Experiment 2;
(f)	use a pipette/burette;
(g)	effect on results: none owtte; reason: no change in concentration owtte;
(h)(i)	2:1;
(h)(ii)	acid B is double the concentration of acid A ora/acid B is more concentrated ora;
(i)	any suitable correct and different method M1 method; M2 reagents; M3 result;

(b) What colour change was observed in the flask in experiment 2?

from Red-orange to Yellow [1]

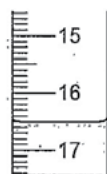
(c) Experiment 3

Experiment 1 was repeated using solution B of acid instead of solution A.

Use the burette diagrams to record the readings in the table and complete the table.



initial reading



final reading

experiment 3	
final burette reading/cm ³	<u>16.5</u>
initial burette reading/cm ³	<u>9.9</u>
difference/cm ³	<u>6.6</u>

[2]

(d) Suggest one observation, other than colour change, that is made when hydrochloric acid is added to sodium carbonate.

~~Bubbles~~ Bubbles are formed [1]

(e) Complete the sentence below.

Experiment 3 needed the largest volume of hydrochloric acid to change the colour of the indicator. [1]

(f) What would be a more accurate method of measuring the volume of the aqueous sodium carbonate?

Measuring cylinder Pipette [1]

Your
Mark

2(a)

2(b)

2(c)

2(d)

2(e)

2(f)

2(g)

2(h)(i)

2(h)(ii)

2(i)

Q2 Mark scheme

(a)	final readings completed correctly: 13.2, 39.2; initial readings completed correctly: 0.0, 12.8; differences completed correctly: 13.2, 26.4; all readings and differences to 1 decimal place;
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(c)	initial and final readings completed correctly: 9.9, 16.5; difference completed correctly: 6.6;
(d)	bubbles/fizzing/effervescence;
(e)	Experiment 2;
(f)	use a pipette/burette;
(g)	effect on results: none owtte; reason: no change in concentration owtte;
(h)(i)	2:1;
(h)(ii)	acid B is double the concentration of acid A ora/acid B is more concentrated ora;
(i)	any suitable correct and different method M1 method; M2 reagents; M3 result;

- (g) What would be the effect on the results, if any, if the solutions of sodium carbonate were warmed before adding the hydrochloric acid? Give a reason for your answer.

effect on results Different temperature
 reason the sodium carbonate ~~is~~ ^{will react faster} should be ~~not~~ [2]

- (h) (i) Determine the ratio of volumes of dilute hydrochloric acid used in experiments 1 and 3.

19.8 [1]

- (ii) Use your answer to (h)(i) to deduce how the concentration of solution A differs from that of solution B.

The ratio of ~~a~~ solution A is higher and more concentrated. [1]

- (i) Suggest a **different** method, using standard laboratory chemicals, to determine which of the solutions of dilute hydrochloric acid, A or B, is more concentrated.

Using ~~conical flask~~ Burette and thymolphthalein indicator and ~~adding~~ adding dilute ~~hydro~~ hydrochloric acid and the more acidic solution is the more concentrated and we can know that by the red ^[3] or orange color.

[Total: 17]

Your
Mark

2(a)

2(b)

2(c)

2(d)

2(e)

2(f)

2(g)

2(h)(i)

2(h)(ii)

2(i)

Q2	Mark scheme
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(d)	bubbles/fizzing/effervescence;
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(h)(ii)	acid B is double the concentration of acid A ora/acid B is more concentrated ora;
(i)	any suitable correct and different method M1 method; M2 reagents; M3 result;

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