The Rate and Extent of Chemical Change: Review 2 (Higher Tier) Worksheet

Combined Science - Chemistry - Key Stage 4

The Rate and Extent of Chemical Change

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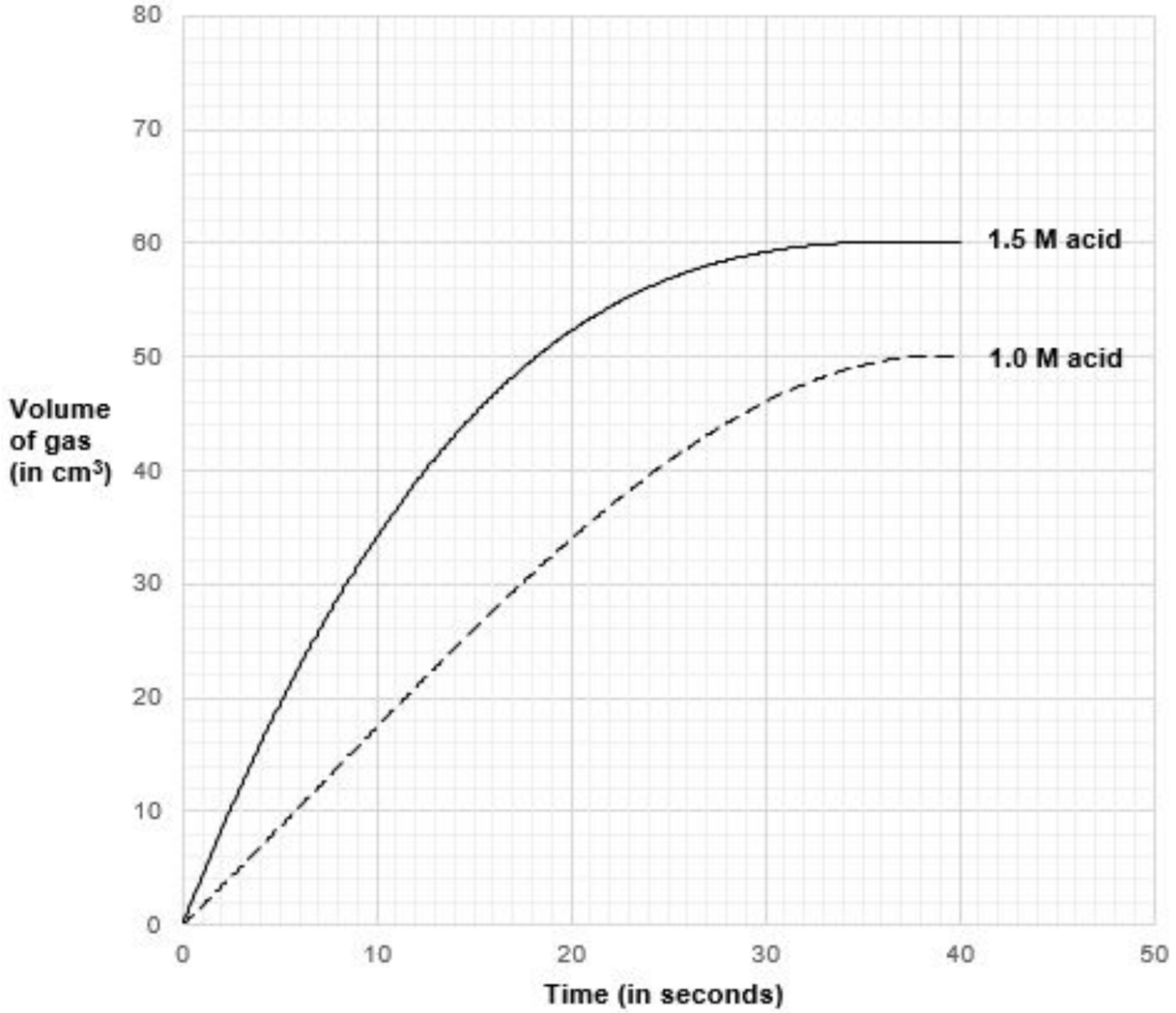
Independent practice

(a) Determine the rate of reaction at 10 seconds when:

i) Concentration of acid used is 1.0 M
ii) Concentration of acid used is 1.5 M

(b) From question (a), determine which reaction was faster at 10 seconds.



Answer

(a) Determine the rate of reaction at 10 seconds when:

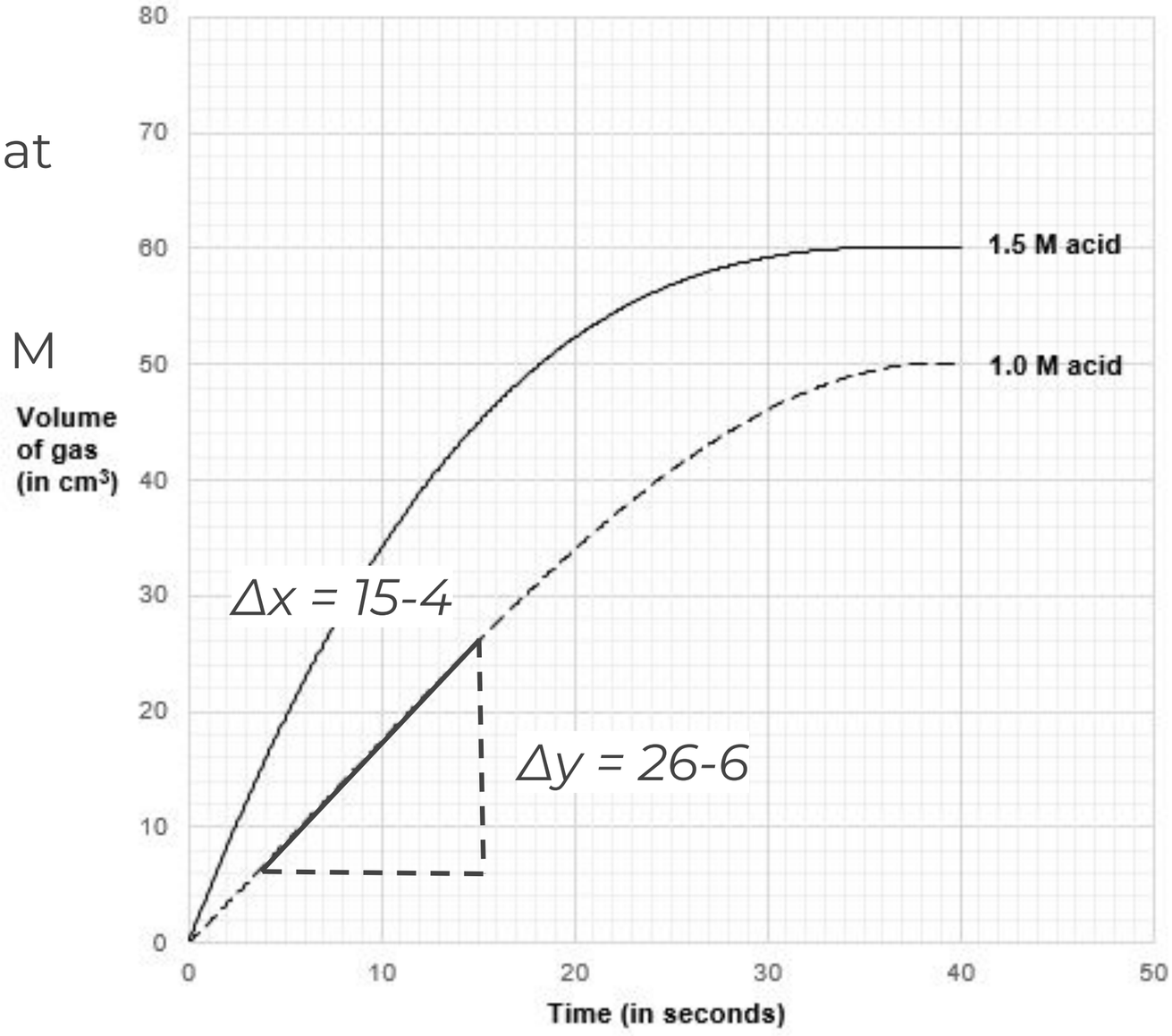
i) Concentration of acid used is 1.0 M

$$Rate = \frac{\Delta y}{\Delta x}$$

$$= \frac{26 - 6\ cm^3}{15 - 4\ s}$$

$$= \frac{20\ cm^3}{11\ s}$$

$$= 1.81\ cm^3/s$$



Answer

(a) Determine the rate of reaction at 10 seconds when:

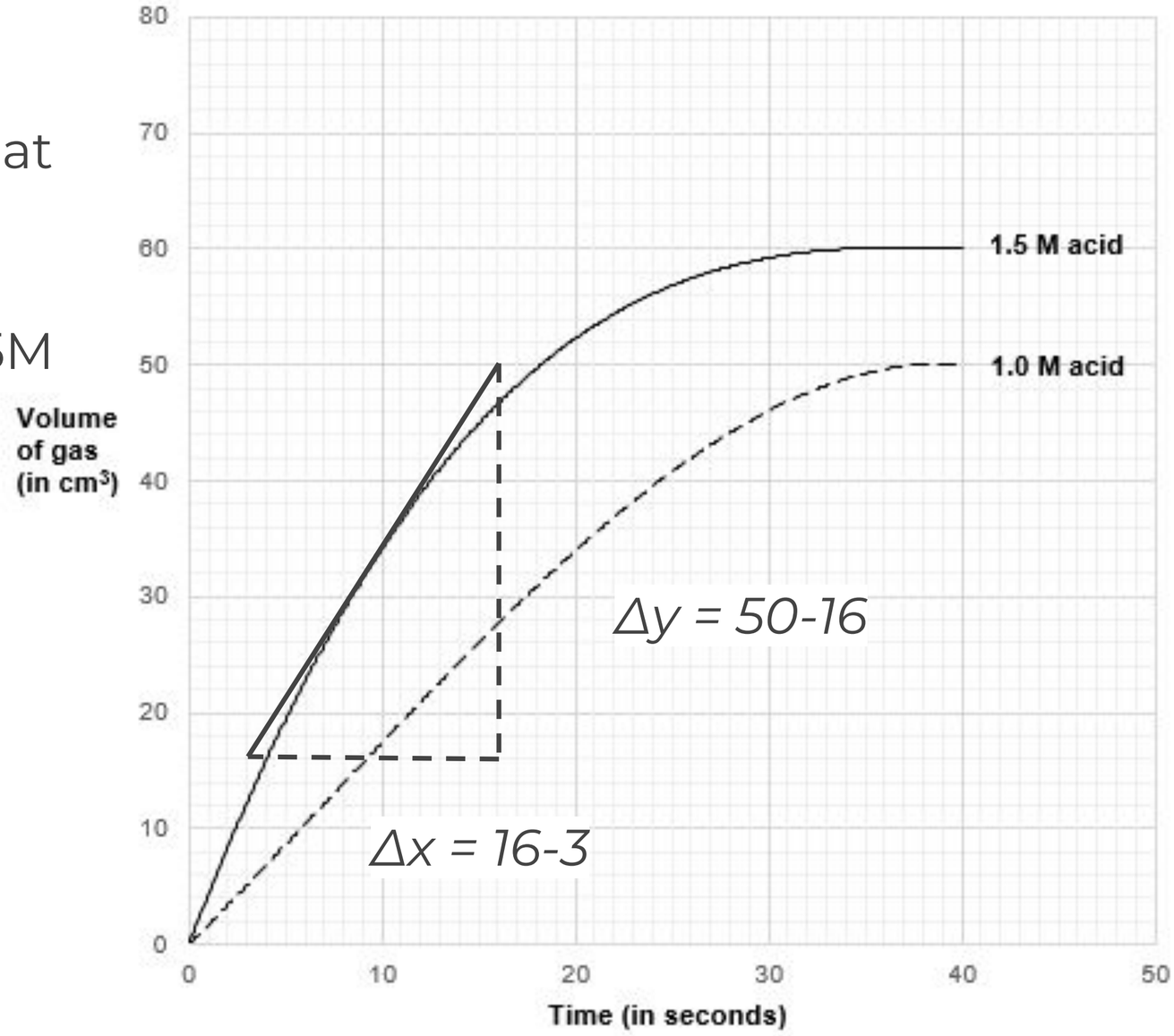
ii) Concentration of acid used is 1.5M

$$Rate = \frac{\Delta y}{\Delta x}$$

$$= \frac{50\text{-}16\ cm^3}{16\text{-}3\ s}$$

$$= \frac{34\ cm^3}{13\ s}$$

$$= 2.62\ cm^3/s$$



Answer

(a) The rate of reaction at 10 seconds when:

i) Concentration of acid used is 1.0M - 1.81 cm^3/s

ii) Concentration of acid used is 1.5M - 2.62 cm^3/s

(b) *Reaction with the higher concentration of acid used (1.5 M) was faster at 10 seconds.*

Task

Cobalt is a transition metal that forms coloured compounds. The following reaction is endothermic in the forward direction:

pink cobalt compound + hydrochloric acid ⇌ blue cobalt compound + water

Explain what happens to the colour of the equilibrium mixture when the concentration of hydrochloric acid is increased. (2)

Answer

Cobalt is a transition metal that forms coloured compounds. The following reaction is endothermic in the forward direction:

pink cobalt compound + hydrochloric acid ⇌ blue cobalt compound + water

When the concentration of hydrochloric acid is increased, equilibrium shifts to the right, away from hydrochloric acid. The equilibrium mixture will become blue as the concentration of blue cobalt compound increases.

Multiple choice quiz

In order to determine the rate of reaction at a specific point, we must draw a _____ on the curve at that point.

A

Line

B

Tangent

C

Triangle

D

Arrow

In order to determine the rate of reaction at a specific point, we must draw a _____ on the curve at that point.

B

Tangent

In a reaction involving solutions, if the concentration of a solute is increased, in which direction will equilibrium shift to?

A

Increase

B

Decrease

C

Away from the solute

D

Towards the solute

In a reaction involving solutions, if the concentration of a solute is increased, in which direction will equilibrium shift to?

C

Away from the solute

In a reaction that is exothermic in the forward reaction, what will happen to the equilibrium if the temperature is increased?

A

Shift to the left

B

Shift to the right

C

Increase

D

Decrease

In a reaction that is exothermic in the forward reaction, what will happen to the equilibrium if the temperature is increased?

A

Shift to the left

Increasing pressure favours the side of the reaction with...

A

Fewer gaseous moles

B

More gaseous moles

C

Less energy

D

More energy

Increasing pressure favours the side of the reaction with...

A

Fewer gaseous moles

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

What is the disadvantage of using a low pressure?

A

Reaction is too fast

B

Reaction is too slow

C

Expensive

D

Low yield

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

What is the disadvantage of using a low pressure?

D

Low yield

Independent practice

Exam style question

In industry, methanol is produced from the reaction between carbon monoxide and hydrogen at 250°C and a pressure of 100 atm.

$$CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$$

The forward reaction is exothermic.

a) Explain the effect on the yield of methanol if a temperature higher than 250°C is used. (2 marks)
b) A pressure of 100 atm is used instead of 1 atm. This high pressure results in a higher rate of reaction and a greater yield of methanol. Explain why. (4 marks)
c) Explain how adding a catalyst speeds up this reaction. (2)

Exam style question answer

a) *The yield of methanol will decrease, equilibrium shifts to the left, increasing temperature favours endothermic reaction.*

b) *Using a high pressure increases yield of methanol because equilibrium shifts to the right where there are fewer molecules of gas. The rate of reaction is higher using a high pressure because gas particles are closer together, increasing the frequency of collision.*

c) *Catalyst speeds up the rate of reaction by lowering the activation energy and providing an alternative pathway for the reaction.*