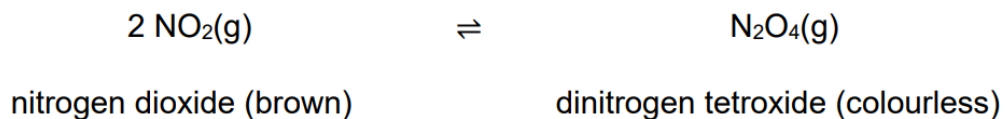


( Le Chatelier's principle (effects of concentration, pressure, temperature) )

Q1. ( 2023 )

The gases nitrogen dioxide and dinitrogen tetroxide reach dynamic equilibrium in a sealed container.

The equation for the reaction is:



The forward reaction is exothermic.

What happens to the position of the equilibrium in this reaction if the temperature is increased?

[1 mark]

Tick (✓) **one** box.

Shifts to the left

☐

Stays the same

☐

Shifts to the right

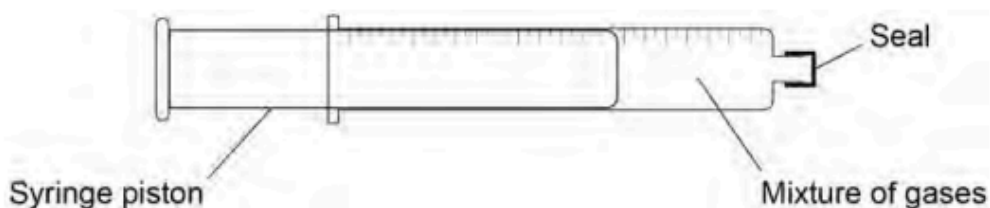
☐

Q2. ( 2023 )

A teacher seals a brown-coloured mixture of nitrogen dioxide and dinitrogen tetroxide in a gas syringe.

**Figure 8** shows the sealed gas syringe.

**Figure 8**



The teacher pushes the syringe piston in.

This increases the pressure in the gas syringe.

What is the colour of the mixture when a new equilibrium position is reached?

**[1 mark]**

Tick (✓) **one** box.

The mixture is a darker shade of brown.

☐

The mixture is the same shade of brown.

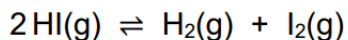
☐

The mixture is a lighter shade of brown.

☐

Hydrogen iodide gas decomposes into hydrogen gas and iodine gas at high temperatures.

The equation for the reaction is:



Explain the effect of increasing the pressure on the equilibrium position of this reaction.

**[2 marks]**

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Q3. b). ( 2023 )

Suggest the effect of adding a catalyst on the equilibrium position of this reaction.

**[1 mark]**

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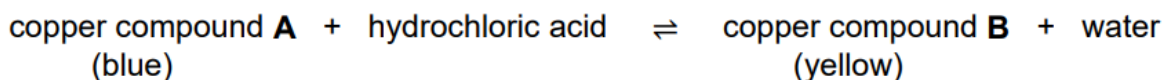
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Q4. a). ( 2023 )

Copper forms coloured compounds.

Hydrochloric acid is added to an aqueous solution of copper compound **A**.

The word equation for the reaction is:



The reaction mixture is green when both copper compounds are present in a solution at equilibrium.

How can the equilibrium position be shifted to make the reaction mixture more yellow?  
[1 mark]

Tick (✓) **one** box.

Add more hydrochloric acid

☐

Add more water

☐

Leave the reaction mixture for 30 minutes

☐

Q4. b). ( 2023 )

The concentrations of the substances in this reaction do **not** change at dynamic equilibrium.

Explain why.

[2 marks]

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Q5. a). ( 2024 )

This question is about sulfuric acid.

Sulfuric acid contains sulfate ions.

Describe the test for the presence of sulfate ions in sulfuric acid.

Give the result of the test.

**[2 marks]**

Test \_\_\_\_\_

\_\_\_\_\_

Result \_\_\_\_\_

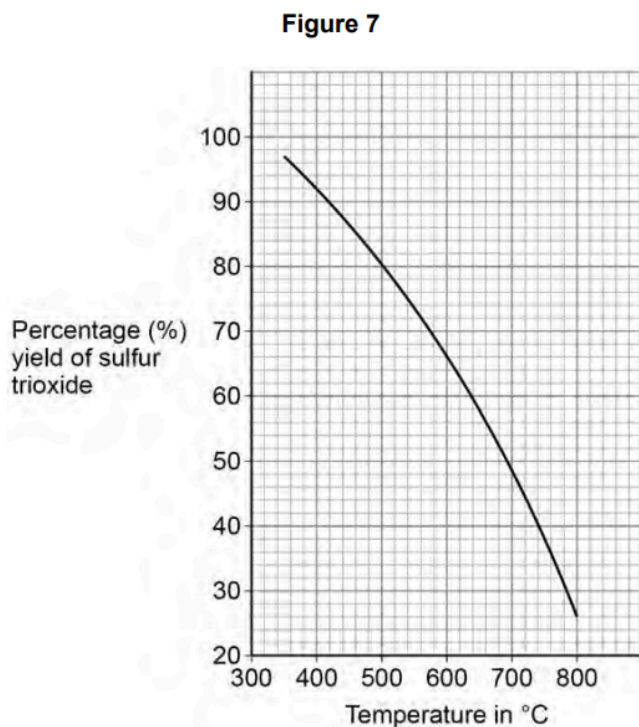
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Q5. b). ( 2024 )

One stage in the industrial production of sulfuric acid is the reaction of sulfur dioxide with oxygen to produce sulfur trioxide.

This reversible reaction reaches dynamic equilibrium.

**Figure 7** shows the percentage yield of sulfur trioxide in this reaction at different temperatures.



Which statement about the forward reaction is correct?

Use **Figure 7**.

**[1 mark]**

Tick (✓) **one** box.

The yield is greater at higher temperatures because the reaction is exothermic.

☐

The yield is greater at higher temperatures because the reaction is endothermic.

☐

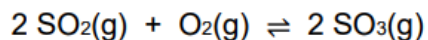
The yield is smaller at higher temperatures because the reaction is exothermic.

☐

The yield is smaller at higher temperatures because the reaction is endothermic.

☐

The equation for the reaction is:



Explain why the percentage yield of sulfur trioxide in this reaction is greater if the pressure is higher.

[2 marks]

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Q5. d). ( 2024 )

In industry, the reaction is done at 450 °C and atmospheric pressure.

Under these conditions the yield of sulfur trioxide is 86%.

Suggest **two** reasons why a higher pressure is **not** used.

[2 marks]

1 

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2 

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Q5. e). ( 2024 )

## The Rate and Extent of Chemical Change

<http://www.pcfgstudy.com>

This reaction uses a catalyst to increase the rate of the reaction.

The catalyst is a metal oxide.

Which is the most likely metal in the metal oxide catalyst?

Use the periodic table.

**[1 mark]**

Tick (✓) **one** box.

Aluminium (Al)

☐

Barium (Ba)

☐

Potassium (K)

☐

Vanadium (V)

☐