

## (Reversible reactions and dynamic equilibrium)

Q1.(2018)

What does the symbol  $\rightleftharpoons$  mean?

[1 mark]

Tick **one** box.

Endothermic

☐

Exothermic

☐

Reversible

☐

Polymerisation

☐

Q2.(2019)

Hydrogen is a raw material in the Haber process.

Hydrogen is produced from methane.

The word equation for the reaction is:



How can you tell that the reaction is reversible?

[1 mark]

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Q3.(2019)

The forward reaction is endothermic.

Name the type of energy change in the reverse reaction.

[1 mark]

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Q4.(2020)

This question is about ammonia and fertilisers.

Ammonia is produced from nitrogen and hydrogen.

A catalyst is used to speed up the reaction.

The word equation for the reaction is:



] What does the symbol  $\rightleftharpoons$  show about the reaction?

[1 mark]

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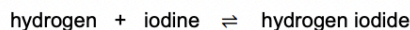
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### Q5.a)(2021)

This question is about reactions between gases.

When hydrogen gas is heated with iodine gas, hydrogen iodide gas is produced.

The equation for this reversible reaction is:



This reversible reaction reaches equilibrium in a sealed container.

How does the equation show that the reaction is reversible?

[1 mark]

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### Q5.b)(2021)

Which **two** statements are correct when the reaction reaches equilibrium?

[2 marks]

Tick (✓) **two** boxes.

The forward reaction and reverse reaction are both exothermic.

☐

The gases have escaped from the container.

☐

The hydrogen no longer reacts with iodine.

☐

The mass of each substance does not change.

☐

The rates of the forward reaction and reverse reaction are equal.

☐

### Q5.c)(2021)

The initial mixture of hydrogen and iodine in the sealed container is purple.

Hydrogen iodide is colourless.

How will the colour of the mixture in the sealed container have changed when equilibrium is reached?

[1 mark]

Tick (✓) **one** box.

The mixture will have become a deeper purple.

☐

The mixture will have become a paler purple.

☐

The mixture will have become colourless.

☐

### Q6.a)(2022)

A student investigated the change in mass when hydrated cobalt chloride was heated.

The word equation for the reaction is:



This is the method used.

1. Add 2.0 g of hydrated cobalt chloride to an empty test tube.
2. Measure the mass of the test tube and contents.
3. Heat the test tube and contents gently for 30 seconds.
4. Allow the test tube and contents to cool.
5. Measure the mass of the test tube and contents.
6. Repeat steps 3 to 5 until the mass of the test tube and contents does not change.

Table 9 shows the results.

Table 9

| Total heating time in seconds | Mass of test tube and contents in grams |
|-------------------------------|-----------------------------------------|
| 0                             | 26.5                                    |
| 30                            | 26.2                                    |
| 60                            | 25.9                                    |
| 90                            | 25.6                                    |
| 120                           | 25.6                                    |

Determine the mass of the empty test tube.

[1 mark]

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Mass of empty test tube = \_\_\_\_\_ g

Q6.b)(2022)

Explain why the mass of the test tube and contents decreased.

[2 marks]

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Q6.c)(2022)

Suggest why the test tube and contents were heated until the mass did not change.

[1 mark]

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Q6.d)(2022)

Energy is taken in from the surroundings when hydrated cobalt chloride is heated.

When 238 g of hydrated cobalt chloride is heated until the mass does not change, 88.1 kJ of energy is taken in.

The student heated 2.00 g of hydrated cobalt chloride until the mass did not change.

Calculate the energy taken in during this reaction.

Give your answer to 3 significant figures.

[3 marks]

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Energy taken in (3 significant figures) = \_\_\_\_\_ kJ

Q6.e)(2022)

What type of reaction takes place when hydrated cobalt chloride is heated?

[1 mark]

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Q7.a)(2023)

This question is about a reversible reaction.

A student heated calcium hydroxide to produce calcium oxide and water vapour.

This is the method used.

1. Add 2.00 g of calcium hydroxide into a test tube.
2. Heat the test tube and contents for 1 minute using a Bunsen burner.
3. Allow the test tube and contents to cool.
4. Weigh the test tube and contents.
5. Repeat steps 2 to 4 five more times.

Table 3 gives the appearance of the reactant and of the products.

Table 3

|          | Compound          | Appearance     |
|----------|-------------------|----------------|
| Reactant | calcium hydroxide | white powder   |
| Products | calcium oxide     | white powder   |
|          | water vapour      | colourless gas |

The student looked at the test tube and contents during heating.

The student could **not** tell that a chemical reaction was taking place by looking at the test tube and contents.

Give **two** reasons why.

Use the information in Table 3.

[2 marks]

1 \_\_\_\_\_

2 \_\_\_\_\_

Q7.b)(2023)

## The Rate and Extent of Chemical Change

<http://www.pcfgstudy.com>

Accurate results are **not** produced if solid powders escape from the test tube during heating.

Suggest why sealing the test tube with a stopper is **not** a good way of preventing the solid powders from escaping.

[1 mark]

### Q7.c)(2023)

The student wanted to calculate the mass of the contents of the test tube after each minute of heating.

The student weighed the test tube and contents after each minute of heating.

What **other** measurement is also needed to calculate the mass of the contents of the test tube?

[1 mark]

Tick (✓) **one** box.

The change in mass of the contents of the test tube at the end

☐

The mass of the contents of the test tube at the start

☐

The mass of the empty test tube

☐

### Q7.d)(2023)

The student heated 2.00 g of calcium hydroxide to produce calcium oxide and water vapour.

Table 4 shows the results.

Table 4

| Total heating time in minutes | Mass of contents of test tube in grams |
|-------------------------------|----------------------------------------|
| 0                             | 2.00                                   |
| 1                             | 1.76                                   |
| 2                             | 1.64                                   |
| 3                             | 1.56                                   |
| 4                             | 1.52                                   |
| 5                             | 1.51                                   |
| 6                             | 1.51                                   |

Complete the sentence.

Choose the answer from the box.

Use Table 4.

[1 mark]

3 minutes

4 minutes

5 minutes

6 minutes

The minimum heating time needed for all of the calcium hydroxide to be changed into calcium oxide and water vapour is \_\_\_\_\_.

## Q7.e)(2023)

Calculate the total mass of water vapour produced by heating the calcium hydroxide.

Use **Table 4**.

[2 marks]

\_\_\_\_\_

\_\_\_\_\_

Mass = \_\_\_\_\_ g

## Q7.f)(2023)

The word equation for the reaction is:

calcium hydroxide  $\rightleftharpoons$  calcium oxide + water

The reaction is reversible.

When 4.00 g of calcium hydroxide is completely changed into calcium oxide and water:

- 3.03 g of calcium oxide is produced
- 5.90 kJ of energy is taken in from the surroundings.

3.03 g of calcium oxide reacts completely with water to produce 4.00 g of calcium hydroxide.

How much energy is transferred to the surroundings in this reaction?

[1 mark]

Tick (✓) **one** box.

Less than 5.90 kJ

☐

5.90 kJ

☐

More than 5.90 kJ

☐

## Q7.g)(2023)

The forward reaction takes in energy from the surroundings.

Complete the sentence.

Choose the answer from the box.

[1 mark]

|            |             |            |
|------------|-------------|------------|
| combustion | endothermic | exothermic |
|------------|-------------|------------|

The forward reaction is \_\_\_\_\_.

## Q8.(2024)

This question is about water.

Hydrogen gas reacts with oxygen gas to produce water.

Water is decomposed into hydrogen gas and oxygen gas using electricity.

Which **two** words describe the reaction between hydrogen gas and oxygen gas?

**[2 marks]**

Tick (✓) **two** boxes.

Alloying

☐

Combustion

☐

Corrosion

☐

Endothermic

☐

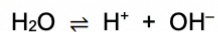
Reversible

☐

Q9.(2024)

Water molecules break down into hydrogen ions and hydroxide ions.

The equation for the reaction is:



Which sentence describes this reaction at equilibrium?

**[1 mark]**

Tick (✓) **one** box.

Water molecules break down at a higher rate than they reform.

☐

Water molecules break down and reform at the same rate.

☐

Water molecules break down at a lower rate than they reform.

☐