

IGCSE CHEMISTRY

Multiple-choice practice • Reversible reactions, equilibrium and fertilisers

Instructions

- Answer all questions.
- For each question, choose the one answer that is correct.
- Each question is worth one mark. There is no penalty for an incorrect answer.

1 Which statement describes a reversible reaction?

- A The reactants are completely used up in every reaction.
- B The reaction can proceed in both forward and reverse directions.
- C The reaction only occurs when a catalyst is present.
- D The products cannot react to form the original reactants.

2 Hydrated copper(II) sulfate is heated. Which observation is expected?

- A White powder turns blue.
- B Blue crystals turn into a white powder.
- C Blue crystals turn into a pink liquid.
- D White powder gives off oxygen.

3 A student adds a few drops of water to anhydrous copper(II) sulfate. The solid turns blue. What does this show?

- A The water is pure.
- B The water is alkaline.
- C Water is present.
- D The water has a boiling point of 100 °C.

4 Which test is used to check whether a sample of water is pure?

- A Add anhydrous cobalt(II) chloride.
- B Add anhydrous copper(II) sulfate.
- C Check whether it is colourless.
- D Measure its boiling point at standard pressure.

5 Which condition is necessary for a gaseous reversible reaction to establish equilibrium?

- A The reaction vessel must be open.
- B All reactants must be gases.
- C The system must be closed.
- D A catalyst must be present.

6 At dynamic equilibrium, which statement is correct?

- A The forward reaction has stopped.
- B The reverse reaction has stopped.
- C Reactant and product concentrations are equal.
- D Forward and reverse reactions occur at equal rates.

7 Ammonium chloride is heated in a sealed tube. White solid forms again on a cooler part of the tube. Which gases form the solid?

- A Nitrogen and hydrogen
- B Ammonia and hydrogen chloride
- C Hydrogen and chlorine
- D Ammonia and oxygen

8 For an exothermic reversible reaction, what happens when the temperature is increased?

- A Equilibrium shifts in the exothermic direction.
- B Equilibrium shifts in the endothermic direction.
- C The position of equilibrium never changes.
- D The reverse reaction stops.

9 The forward reaction in an equilibrium is endothermic. Which change favours the forward reaction?

- A Decreasing temperature
- B Increasing temperature
- C Adding a catalyst only
- D Removing a reactant

10 For the equilibrium $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$, what is the effect of increasing pressure at constant temperature?

- A The equilibrium shifts left because there are more gas molecules on the left.
- B The equilibrium shifts right because there are fewer moles of gas on the right.
- C The equilibrium position does not change because all substances are gases.
- D The equilibrium shifts right because ammonia is more reactive.

11 For which equilibrium would a change in pressure have no effect on the position of equilibrium?

- A $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$
- B $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$
- C $\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{NO}(\text{g})$
- D $2\text{NO}(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$

12 For $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$, what happens when some ammonia is removed at constant temperature?

- A Equilibrium shifts left and less nitrogen forms.
- B Equilibrium shifts right and more ammonia forms.
- C Equilibrium shifts left and more ammonia forms.
- D The equilibrium position is unchanged.

13 A catalyst is added to a mixture at equilibrium. What is the effect?

- A The equilibrium shifts towards the products.
- B The equilibrium shifts towards the reactants.
- C The equilibrium is reached faster but its position is unchanged.
- D The yield of products increases permanently.

14 Which set of conditions is used in the Haber process according to the notes?

- A 450 °C, 200 atm, iron catalyst
- B 100 °C, 1 atm, vanadium(V) oxide catalyst
- C 450 °C, 1 atm, copper catalyst
- D 800 °C, 200 atm, no catalyst

15 Why is a temperature of about 450 °C used in the Haber process?

- A It gives the maximum possible equilibrium yield.
- B It makes the reaction exothermic.
- C It balances reaction rate and ammonia yield.
- D It prevents the reverse reaction.

16 Why is high pressure used in the Haber process?

- A It favours the side with more gas molecules.
- B It increases the equilibrium yield of ammonia.
- C It makes the iron catalyst more selective.
- D It changes nitrogen into a liquid.

17 How is ammonia separated from unreacted nitrogen and hydrogen in the Haber process?

- A By filtering the gas mixture.
- B By passing the mixture through an iron catalyst again.
- C By cooling the mixture so ammonia condenses.
- D By dissolving nitrogen in water.

18 What happens to unreacted nitrogen and hydrogen in the Haber process?

A They are released immediately into the atmosphere.

B They are converted into sulfur dioxide.

C They are recycled through the reactor.

D They are removed as a solid.

19 Which catalyst is used in the Contact process?

A Finely divided iron

B Vanadium(V) oxide

C Copper(II) sulfate

D Calcium carbonate

20 The forward reaction in the Contact process is exothermic: $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$. Which conditions favour the formation of SO_3 ?

A High temperature and low pressure

B Low temperature and high pressure

C High temperature and high pressure

D Low temperature and low pressure

21 Why is sulfur trioxide absorbed in concentrated sulfuric acid rather than directly in water?

A Sulfur trioxide does not react with water.

B Water is too expensive to use.

C Direct reaction with water forms acid mist.

D Sulfuric acid acts as the catalyst.

22 Which combination contains all three elements supplied by an NPK fertiliser?

A Nitrogen, phosphorus and potassium

B Nitrogen, oxygen and potassium

C Nickel, phosphorus and potassium

D Nitrogen, phosphorus and calcium

23 What is the main function of nitrogen in plant nutrition?

A Healthy root development

B Formation of flowers and fruit

C Healthy leaf development

D Neutralising acidic soil

24 Why can excessive use of fertilisers cause environmental problems?

- A Fertilisers remove all oxygen from the air.
- B They cause excessive algal growth in waterways.
- C Fertilisers make all water permanently acidic.
- D Fertilisers stop plants absorbing water through their roots.

25 Which statements about ammonium salts used as fertilisers is correct?

- A They are insoluble in water.
- B They supply nitrogen for plant growth.
- C They always make soil alkaline.
- D They contain all three NPK elements