

AQA (GCSE Notes)

Chapter 6: The Rate and Extent of Chemical Change

- Q1.** How can the rate of a chemical reaction be calculated using the quantity of a reactant?
- Q2.** How do you calculate the rate of reaction using the quantity of a product formed?
- Q3.** What are the units for rate of reaction when mass is measured in grams?
- Q4.** What are the units for rate of reaction when volume is measured in cm^3 ?
- Q5.** What is meant by the "mean rate of reaction"?
- Q6.** How can moles be used to calculate the rate of reaction?
- Q7.** What is the unit for rate of reaction when using moles?
- Q8.** How can a graph be used to determine the rate of a reaction?
- Q9.** How do you draw a tangent to a curve on a graph showing a chemical reaction?
- Q10.** What does the slope of a tangent represent in a rate of reaction graph?
- Q11.** Why might it be more useful to use moles rather than mass in some rate of reaction calculations?
- Q12.** How can you estimate the rate of a reaction at a specific time from a graph?
- Q13.** How do you calculate the gradient of a straight line on a graph?
- Q14.** What is the effect of increasing the concentration of a reactant on the rate of reaction?
- Q15.** How does increasing the surface area of a solid affect the rate of reaction?
- Q16.** What impact does increasing the temperature have on the rate of reaction?
- Q17.** How does pressure affect the rate of reaction in gases?
- Q18.** What role do catalysts play in chemical reactions?
- Q19.** Why does increasing the concentration increase the rate of reaction?
- Q20.** What is the effect of using powdered solids instead of lumps in reactions?
- Q21.** How can the rate of a reaction be compared at different times using a graph?
- Q22.** Why does increasing temperature usually increase reaction rate?

- Q23.** What happens to the particles in a reaction when temperature is increased?
- Q24.** How do catalysts speed up a reaction without being used up?
- Q25.** How can a student measure the volume of gas produced in a reaction?
- Q26.** What practical method can be used to measure mass loss during a reaction?
- Q27.** How would you plot a graph of reactant quantity against time?
- Q28.** What does a steeper slope on a reaction rate graph tell you?
- Q29.** How would you describe a reaction that slows down over time on a graph?
- Q30.** Why is it important to keep all variables constant except one when investigating rate?
- Q31.** What equipment would you need to measure the rate of reaction involving gas?
- Q32.** What is meant by the term "initial rate of reaction"?
- Q33.** Why might the reaction rate decrease as the reaction continues?
- Q34.** How can data from a reaction be used to estimate the time for completion?
- Q35.** What factors must be controlled to ensure a fair test when studying reaction rates?
- Q36.** How does increasing pressure affect collisions between gas particles?
- Q37.** How does collision theory explain the effect of temperature on reaction rate?
- Q38.** What is meant by activation energy?
- Q39.** How do catalysts affect the activation energy of a reaction?
- Q40.** How would you explain the effect of surface area on reaction rate using collision theory?
- Q41.** Why is it useful to repeat experiments when measuring reaction rate?
- Q42.** What safety precautions should be taken when measuring reaction rates?
- Q43.** How could you investigate the effect of concentration on reaction rate in a lab?
- Q44.** What are some sources of error when measuring reaction rate?
- Q45.** Why is drawing a tangent important for finding the rate at a specific point?
- Q46.** What data would you collect in an experiment to measure mean rate of reaction?
- Q47.** What does a flat line on a graph of product formed over time indicate?

- Q48.** How can you check your answer when calculating the mean rate of reaction?
- Q49.** What mathematical steps are needed to find the rate of reaction from a graph?
- Q50.** How do different units (g/s, cm³/s, mol/s) help us understand different types of reactions?
- Q51.** Explain why a chemical reaction only occurs when particles collide with enough energy.
- Q52.** What is meant by the term activation energy in a chemical reaction?
- Q53.** Describe how increasing the concentration of a solution affects the rate of a reaction.
- Q54.** Why does increasing the pressure of a gas increase the rate of reaction?
- Q55.** Explain how increasing the surface area of a solid reactant affects the rate of reaction.
- Q56.** Describe the effect of increasing temperature on the energy of collisions in a reaction.
- Q57.** Explain how increasing temperature affects both the frequency and energy of collisions.
- Q58.** How does collision theory explain the effect of temperature on the rate of a reaction?
- Q59.** Predict the effect on the rate of reaction if the concentration of a reactant is halved.
- Q60.** Predict the effect on rate if a gas is compressed into a smaller volume at constant temperature.
- Q61.** Why does breaking a solid into smaller pieces increase the rate of reaction?
- Q62.** How can surface area to volume ratio be used to explain the effect of particle size on reaction rate?
- Q63.** What happens to the rate of reaction when large pieces of solid are replaced by powder?
- Q64.** Describe the relationship between frequency of collisions and concentration.
- Q65.** Explain using collision theory why a reaction slows down as it proceeds.
- Q66.** How does a catalyst affect the activation energy of a chemical reaction?
- Q67.** Why are catalysts not written in the chemical equation for a reaction?
- Q68.** What feature of a catalyst allows it to be used again and again?
- Q69.** Explain why different reactions require different catalysts.
- Q70.** Describe how a reaction profile changes when a catalyst is used.
- Q71.** How do enzymes act as catalysts in biological systems?

- Q72.** Why does using a catalyst increase the rate of a reaction even though the number of collisions remains the same?
- Q73.** Explain why catalysts are important in industrial chemical processes.
- Q74.** What is meant by the term “reaction pathway” in a catalysed reaction?
- Q75.** Describe how a catalyst provides an alternative pathway for a reaction.
- Q76.** A student added a metal salt to a reaction and noticed it sped up. How could they confirm the metal salt was acting as a catalyst?
- Q77.** Why might a catalyst be used even though it does not increase the amount of product formed?
- Q78.** In terms of energy, how does a catalysed reaction differ from an uncatalysed one?
- Q79.** How can collision theory explain the difference in rate between a catalysed and uncatalysed reaction?
- Q80.** Predict the effect on the rate of reaction if temperature is reduced from 50°C to 20°C.
- Q81.** Why does increasing temperature have a greater effect on rate than increasing concentration?
- Q82.** Why do particles need to collide in the correct orientation for a reaction to occur?
- Q83.** Explain the importance of effective collisions in chemical reactions.
- Q84.** How can proportional reasoning help explain the effect of doubling concentration on rate?
- Q85.** What happens to the rate of reaction when particles collide without sufficient energy?
- Q86.** How does the rate of a gas reaction change if the gas is cooled?
- Q87.** Describe a way to increase the number of successful collisions in a reaction between a solid and a solution.
- Q88.** Explain why powdered limestone reacts faster with acid than limestone chips.
- Q89.** Predict how the rate of a reaction would change if both concentration and temperature are increased.
- Q90.** Why might a reaction with a low activation energy happen quickly at room temperature?
- Q91.** What type of reaction profile would show a large activation energy?
- Q92.** How can you use a reaction profile to identify a catalysed reaction?
- Q93.** What is the role of metal salts in the catalytic decomposition of hydrogen peroxide?

- Q94.** Why is it important to use only the required amount of catalyst in a reaction?
- Q95.** A reaction is too slow at room temperature. What change would you make to increase its rate?
- Q96.** Why does increasing surface area lead to more frequent collisions?
- Q97.** Explain the combined effect of increasing temperature and adding a catalyst.
- Q98.** A reaction produces gas. How could you measure the rate of reaction?
- Q99.** Describe how you could investigate the effect of particle size on reaction rate in a school lab.
- Q100.** What is the difference between the rate of a catalysed and an uncatalysed reaction on a graph?
- Q101.** What is meant by a reversible reaction in chemistry?
- Q102.** Write a balanced symbol equation for a reversible reaction and label the forward and reverse reactions.
- Q103.** How is a reversible reaction represented using symbols?
- Q104.** Explain what happens to the products and reactants in a reversible reaction over time.
- Q105.** What effect does a change in temperature have on the direction of a reversible reaction?
- Q106.** What happens to the position of equilibrium if the temperature is increased in an exothermic reaction?
- Q107.** Explain how pressure affects the direction of a reversible reaction involving gases.
- Q108.** What is meant by dynamic equilibrium?
- Q109.** Describe the conditions needed for a reversible reaction to reach equilibrium.
- Q110.** Explain why equilibrium can only be reached in a closed system.
- Q111.** In a reversible reaction, what does it mean if the forward reaction is endothermic?
- Q112.** What is the energy relationship between the forward and reverse reactions in a reversible reaction?
- Q113.** Describe what happens to the temperature of the surroundings during the exothermic direction of a reversible reaction.
- Q114.** How does changing the concentration of reactants affect a reversible reaction?
- Q115.** What does the \rightleftharpoons symbol in a chemical equation tell you?

- Q116.** If a reversible reaction is endothermic in the forward direction, what can be said about the reverse reaction?
- Q117.** Explain what is meant by the term "position of equilibrium."
- Q118.** How can the position of equilibrium be changed?
- Q119.** Why does a change in pressure only affect reactions involving gases?
- Q120.** Give an example of a reversible reaction and describe how changing temperature affects the yield of products.
- Q121.** How can equilibrium be shifted to increase the yield of products?
- Q122.** Describe how the Haber process is an example of a reversible reaction.
- Q123.** What role does energy transfer play in reversible reactions?
- Q124.** What is the effect of cooling an equilibrium mixture where the forward reaction is exothermic?
- Q125.** How can we tell that equilibrium has been reached in a reversible reaction?
- Q126.** Why does a reversible reaction not stop once equilibrium is reached?
- Q127.** How can we favour the formation of products in an endothermic reversible reaction?
- Q128.** Describe what is observed when ammonium chloride is heated and cooled again.
- Q129.** Why is the amount of energy the same in both directions of a reversible reaction?
- Q130.** What happens to the equilibrium position if more product is removed as it forms?
- Q131.** What is meant by the term "closed system" in the context of reversible reactions?
- Q132.** Explain the relationship between energy change and direction in a reversible reaction.
- Q133.** What does it mean if equilibrium lies to the left?
- Q134.** How can a chemist use changes in conditions to favour the reverse reaction?
- Q135.** Describe how increasing the temperature affects both endothermic and exothermic directions of a reversible reaction.
- Q136.** Why is it important to know whether a reaction is reversible in industry?
- Q137.** What happens to the concentrations of reactants and products at equilibrium?
- Q138.** Explain how Le Chatelier's Principle applies to reversible reactions.

- Q139.** Give a reason why a reversible reaction might never reach completion.
- Q140.** What does it mean if the forward and reverse reactions occur at the same rate?
- Q141.** What is the result of increasing the concentration of products in a reversible reaction?
- Q142.** How does adding a catalyst affect the position of equilibrium?
- Q143.** What happens to the rate of reaction when a catalyst is added to a reversible reaction?
- Q144.** Describe the energy change when the forward reaction absorbs heat.
- Q145.** In a sealed container, how does a change in volume affect gaseous equilibrium?
- Q146.** What does it mean when we say the system has reached “dynamic” equilibrium?
- Q147.** How does decreasing the concentration of a reactant affect the position of equilibrium?
- Q148.** Explain why equilibrium is a balance between the forward and reverse reactions.
- Q149.** What would be observed if equilibrium shifts to favour the products?
- Q150.** Why is it important that the rates of the forward and reverse reactions are equal at equilibrium?
- Q151.** What happens to the position of equilibrium when the concentration of a reactant is increased?
- Q152.** How does decreasing the concentration of a product affect the equilibrium of a reversible reaction?
- Q153.** Why does the system shift its equilibrium position when concentration is changed?
- Q154.** Describe how Le Chatelier’s Principle applies when more of a product is removed from the system.
- Q155.** What is meant by the term “equilibrium” in a reversible reaction?
- Q156.** Explain how a system at equilibrium responds to an increase in the concentration of a product.
- Q157.** Predict the effect on the yield of products when the concentration of a reactant is increased.
- Q158.** What does it mean if a system is said to be no longer at equilibrium?
- Q159.** How can the concentration of substances in a reaction mixture affect the rate at which equilibrium is re-established?
- Q160.** What change in concentration would shift the equilibrium to the left?
- Q161.** Give one example of how equilibrium can be disturbed by changing concentration.

- Q162.** Describe the effect of removing one product from a system at equilibrium.
- Q163.** If more reactants are added to a system at equilibrium, what will happen to the amount of product?
- Q164.** Explain why changing concentration does not change the equilibrium constant.
- Q165.** What happens to the forward and reverse reaction rates when a reactant is increased?
- Q166.** In a reaction where $A + B \rightleftharpoons C + D$, what effect would increasing $[A]$ have?
- Q167.** How does the equilibrium position shift when a product is added?
- Q168.** Describe how concentration changes can help increase the yield in industrial chemical processes.
- Q169.** Why does a decrease in the concentration of a product cause more reactants to react?
- Q170.** Predict what will happen if both reactants and products are increased at the same time.
- Q171.** What is the role of Le Chatelier's Principle in predicting the outcome of concentration changes?
- Q172.** How can you use concentration data to determine the new equilibrium position?
- Q173.** What evidence shows that equilibrium has been re-established after a concentration change?
- Q174.** What is meant by the phrase "the system counteracts the change"?
- Q175.** What happens to the concentrations of other substances when one is removed at equilibrium?
- Q176.** How is dynamic equilibrium affected by a sudden increase in reactant concentration?
- Q177.** Why might a chemical plant deliberately decrease the concentration of a product?
- Q178.** What does it mean if the equilibrium shifts to the right?
- Q179.** What will happen to the backward reaction if a product is removed?
- Q180.** Can a system reach equilibrium again after a change in concentration? Explain how.
- Q181.** What would you expect to happen if both a reactant and a product are increased?
- Q182.** If a product is removed continuously, what happens to the yield of the reaction?
- Q183.** How do the concentrations of all substances respond when one is increased?
- Q184.** What type of data would help predict the effect of concentration changes?

- Q185.** Explain why removing a product increases the rate of the forward reaction.
- Q186.** Describe a situation where equilibrium shifts to favour the reverse reaction.
- Q187.** In what way does Le Chatelier's Principle help chemists in production settings?
- Q188.** What will happen if a catalyst is added during a change in concentration?
- Q189.** How is the equilibrium position linked to the amounts of substances present?
- Q190.** Why does equilibrium shift towards the side with fewer moles when concentration is reduced?
- Q191.** Is it always possible to predict the exact amounts of products formed after a concentration change?
- Q192.** What happens to the ratio of products to reactants at equilibrium after changing concentration?
- Q193.** What is the difference between a shift to the left and a shift to the right?
- Q194.** Describe how concentration changes affect closed systems versus open systems.
- Q195.** Why must a reaction vessel be closed for equilibrium to be maintained?
- Q196.** What condition must be true for equilibrium to be disturbed by a concentration change?
- Q197.** What does Le Chatelier's Principle assume about how a system behaves?
- Q198.** Why is it important to understand concentration effects in reversible reactions?
- Q199.** Can increasing the concentration of a product ever increase product yield? Explain.
- Q200.** What is the long-term effect on equilibrium if concentration changes are repeated?
- Q201.** What happens to the position of equilibrium if the temperature is increased for an endothermic reaction?
- Q202.** Why does the yield of products decrease when the temperature is raised in an exothermic reaction?
- Q203.** If a reversible reaction is exothermic in the forward direction, what effect will decreasing the temperature have on the position of equilibrium?
- Q204.** Explain how an increase in temperature affects the equilibrium position in a reversible exothermic reaction.
- Q205.** What is meant by the term "position of equilibrium"?
- Q206.** How does Le Chatelier's Principle explain the effect of temperature changes on equilibrium?

Q207. A reaction at equilibrium is exothermic in the forward direction. Predict the effect of increasing temperature on the yield of products.

Q208. A reversible reaction is endothermic in the forward direction. What happens to the yield if temperature is decreased?

Q209. Why does decreasing the temperature favour the exothermic reaction?

Q210. A student increases the temperature of a system at equilibrium. What information must they know to predict the shift in equilibrium?

Q211. How can you use a balanced symbol equation to determine the effect of pressure changes on equilibrium?

Q212. Describe what happens to the equilibrium position when pressure is increased in a reaction involving gases.

Q213. In a gaseous reaction, how do you identify which side has fewer molecules?

Q214. Explain the effect of decreasing pressure on the position of equilibrium in a gaseous system.

Q215. A gaseous reaction has more molecules on the right side of the equation. What will happen if pressure is increased?

Q216. How does the number of gas molecules affect the response of a system to pressure changes?

Q217. Give a reason why increasing pressure favours the reaction that produces fewer gas molecules.

Q218. Why does decreasing pressure shift the equilibrium to the side with more gas molecules?

Q219. If a reversible reaction has the same number of gas molecules on both sides, what effect does changing the pressure have?

Q220. A reaction is at equilibrium in a sealed container. The pressure is suddenly decreased. What happens to the system?

Q221. What data would you need to predict how pressure changes affect a reaction at equilibrium?

Q222. Explain why the effect of pressure only applies to gases.

Q223. In a sealed container, the pressure is increased. Describe the shift in equilibrium if the forward reaction involves fewer gas molecules.

Q224. Why does the system shift to oppose a change in pressure?

Q225. What is the role of collision frequency in pressure changes affecting equilibrium?

- Q226.** If a gaseous system at equilibrium has 2 moles of gas on the left and 4 moles on the right, what happens when pressure increases?
- Q227.** A chemical reaction at equilibrium is carried out in a closed vessel. What effect will increasing temperature and pressure have on an exothermic reaction?
- Q228.** How can you predict the effect of pressure using the balanced equation of a reaction?
- Q229.** What would happen to the equilibrium if the pressure is reduced in a gaseous reaction where the forward reaction produces more gas molecules?
- Q230.** In a chemical plant, why is pressure carefully controlled during equilibrium reactions?
- Q231.** How can the effect of temperature on equilibrium be useful in industrial processes?
- Q232.** Why might increasing temperature not always be used in industry, even if it increases yield?
- Q233.** A forward reaction is endothermic. Predict the direction of equilibrium shift when heat is added.
- Q234.** How does Le Chatelier's Principle help in deciding the best temperature for a reversible reaction?
- Q235.** Why is a compromise temperature often used in equilibrium reactions?
- Q236.** Explain why increasing temperature increases the rate of both the forward and reverse reactions.
- Q237.** A reaction is exothermic in one direction. How would cooling the system affect the amount of product formed?
- Q238.** If a reaction is endothermic forward and the system is heated, what would happen to the reverse reaction?
- Q239.** In a gaseous reaction, the number of moles is not given. How can you determine the effect of pressure?
- Q240.** A sealed system is in equilibrium. The pressure is increased, and the temperature is decreased. What two changes will influence the equilibrium shift?
- Q241.** Why is it important to know whether a reaction is endothermic or exothermic when changing temperature?
- Q242.** A chemical reaction produces ammonia and involves fewer gas molecules in the forward direction. What would increasing pressure do?
- Q243.** Explain the balance between rate of reaction and yield when considering temperature changes.

Q244. How does temperature affect the energy distribution of reacting particles in equilibrium?

Q245. A reversible reaction has equal gas molecules on both sides. What will happen if pressure is increased?

Q246. What happens to equilibrium if both pressure and concentration of a reactant are increased?

Q247. Why might increasing pressure be dangerous in industrial reactors?

Q248. A system is disturbed by temperature change. How does the system know which way to shift?

Q249. Why are endothermic reactions favoured by increased temperature?

Q250. Describe how equilibrium is re-established after a sudden increase in pressure in a gaseous system.