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GCSE Chemistry Topic 6 AQA: Rate and extent of chemical change

Exam Questions/Mock Exam Questions

Questions For Foundation, Higher, and Triple Science (scroll down for questions for higher and triple science only):
(It would still be recommended to answer the foundation tier questions for triple science and higher tier to ensure you have good understanding).

Q1.
Jack adds magnesium ribbon to hydrochloric acid and measures the rate of reaction.

(a) State two things Jack could measure to find the rate of the reaction.

_____

_____

[2]

(b) How would increasing the concentration of the acid affect the rate of reaction?

_____

[1]

[Total: 3 marks]

Q2.
Tom reacts calcium carbonate with hydrochloric acid.

(a) Write the word equation for this reaction.

_____

[2]

(b) State the gas produced in this reaction.

_____

[1]

[Total: 3 marks]

Q3.
Harry investigates the effect of surface area on reaction rate.

(a) Explain why powdered calcium carbonate reacts faster than large lumps.

[2]

(b) State the factor that has changed between powder and lumps.

[1]

[Total: 3 marks]

Q4.
Ben measures how quickly a reaction takes place.

(a) State the formula used to calculate the mean rate of reaction.

[1]

(b) The reaction makes 120 cm^3 of gas in 60 seconds. Calculate the mean rate of reaction.

[2]

[Total: 3 marks]

Q5.
Daniel looks at temperature and reaction rate.

(a) Explain why increasing the temperature increases the rate of reaction.

[2]

(b) Suggest one everyday example of a reaction that happens faster at a higher temperature.

[1]

[Total: 3 marks]

Q6.
Oliver investigates the effect of catalysts.

(a) State what a catalyst does.

_____

[1]

(b) Explain why catalysts are useful in industry.

_____

_____

[2]

[Total: 3 marks]

Q7.
Ethan records results for a reaction that produces gas.

(a) Suggest one way Ethan could collect the gas.

_____

[1]

(b) State one way to make sure the experiment is accurate.

_____

[1]

[Total: 2 marks]

Q8.
Sam investigates concentration and rate.

(a) Explain why a higher concentration of acid makes particles react more quickly.

[2]

(b) State one way Sam could increase the concentration of hydrochloric acid.

[1]

[Total: 3 marks]

Q9.
Charlie studies reversible reactions.

(a) What does the term reversible reaction mean?

[1]

(b) Give one example of a reversible reaction.

[1]

[Total: 2 marks]

Q10.
Noah learns about equilibrium.

(a) State what is meant by the term equilibrium.

[2]

(b) At equilibrium, what happens to the concentrations of reactants and products?

[1]

[Total: 3 marks]

Q11.
William investigates the effect of temperature on equilibrium.

(a) If the forward reaction is exothermic, explain what happens to the position of equilibrium when temperature is increased.

[2]

(b) Explain what happens if the temperature is decreased.

[2]

[Total: 4 marks]

Q12.
Alex looks at pressure and equilibrium.

(a) What happens to the position of equilibrium if the pressure is increased in a reaction that produces fewer molecules of gas?

[2]

(b) Explain why this happens.

[2]

[Total: 4 marks]

Q13.
Jacob learns about catalysts in reversible reactions.

(a) How does a catalyst affect the rate of reaction?

---

[1]

(b) How does a catalyst affect the position of equilibrium?

---

[1]

[Total: 2 marks]

Q14.
James investigates the Haber process.

(a) Write the word equation for the Haber process.

---

[2]

(b) State the two raw materials needed for the Haber process.

---

[2]

[Total: 4 marks]

Q15.
Luke designs an experiment to investigate how temperature affects the rate of reaction between sodium thiosulfate and hydrochloric acid.

In your answer include:

- apparatus he would use
- how he would carry out the experiment

- the measurements he would take

[6]

[Total: 6 marks]

Higher Tier

Q16.
Jack reacts magnesium with hydrochloric acid and measures the gas produced.

(a) State the equation for mean rate of reaction.

[1]

(b) The reaction produces 240 cm^3 of gas in 120 seconds. Calculate the mean rate of reaction.

[2]

[Total: 3 marks]

Q17.
Tom investigates how surface area affects the rate of reaction of calcium carbonate with hydrochloric acid.

(a) Explain why powdered calcium carbonate reacts faster than lumps.

[2]

(b) Sketch a graph to show the difference in gas volume over time for powder and lumps.

[2]

[Total: 4 marks]

Q18.
Harry looks at collision theory.

(a) State two factors that increase the frequency of collisions between reacting particles.

[2]

(b) State one factor that increases the energy of collisions.

[1]

[Total: 3 marks]

Q19.
Ben heats hydrochloric acid and reacts it with magnesium.

(a) Explain why increasing the temperature increases the rate of reaction.

[2]

(b) State one piece of evidence that a reaction is faster at a higher temperature.

[1]

[Total: 3 marks]

Q20.
Daniel investigates catalysts.

(a) Explain how a catalyst speeds up a reaction.

[2]

(b) State one advantage of using catalysts in industry.

[1]

[Total: 3 marks]

Q21.
Oliver records data for a reaction.

(a) Describe how the gradient of a graph shows the rate of reaction.

[2]

(b) On a rate of reaction graph, explain what it means if the curve becomes horizontal.

[2]

[Total: 4 marks]

Q22.

Ethan investigates how concentration affects the rate of reaction.

(a) Explain, using collision theory, why higher concentration increases the rate of reaction.

[2]

(b) Sketch a graph of volume of gas against time for a low and high concentration.

[2]

[Total: 4 marks]

Q23.

Sam measures the rate of reaction with a gas syringe.

(a) Give one advantage of using a gas syringe instead of an upturned measuring cylinder.

[2]

(b) Suggest one source of error when using a gas syringe.

[1]

[Total: 3 marks]

Q24.
Charlie is revising reversible reactions.

(a) Define a reversible reaction.

[1]

(b) State one everyday example of a reversible reaction.

[1]

(c) In a reversible reaction, how do the forward and reverse processes differ in energy change?

[2]

[Total: 4 marks]

Q25.
Noah looks at dynamic equilibrium.

(a) Explain what is meant by dynamic equilibrium.

[2]

(b) At equilibrium, why do the concentrations of reactants and products remain constant?

[2]

[Total: 4 marks]

Q26.
William studies Le Chatelier's principle.

(a) State Le Chatelier's principle.

[2]

(b) Explain what happens to the equilibrium position when the pressure is increased in a reaction with fewer gas molecules on the product side.

[2]

[Total: 4 marks]

Q27.
Alex looks at temperature changes on equilibrium.

(a) If the forward reaction is exothermic, explain what happens to the equilibrium position when temperature increases.

[2]

(b) Explain what happens when the temperature decreases.

[2]

[Total: 4 marks]

Q28.
Jacob revises catalysts in equilibrium.

(a) Explain how a catalyst affects the rate of a reversible reaction.

[2]

(b) Explain why a catalyst does not affect the position of equilibrium.

[2]

[Total: 4 marks]

Q29.
James investigates the Haber process.

(a) Write the balanced symbol equation for the Haber process.

[2]

(b) State the temperature and pressure used in industry for the Haber process.

[2]

(c) State the catalyst used.

[1]

[Total: 5 marks]

Q30.
Luke evaluates the Haber process.

Discuss why the conditions used are a compromise between rate, yield, and cost.

[6]

[Total: 6 marks]

Q31.
Jack studies pressure changes.

If the forward reaction produces more molecules of gas, explain what happens to the position of equilibrium when pressure is increased.

[2]

[Total: 2 marks]

Q32.
Tom looks at reaction rate graphs.

(a) Describe how you can tell which line on a graph shows the fastest reaction.

[1]

(b) Explain why that reaction is faster.

[2]

[Total: 3 marks]

Q33.
Harry studies temperature and collision theory.

(a) Explain why more particles react when temperature increases.

[2]

(b) Sketch a diagram to show the distribution of particle energies at low and high temperatures.

[2]

[Total: 4 marks]

Q34.
Ben investigates concentration.

(a) Explain, using collision theory, why increasing concentration increases the frequency of successful collisions.

[2]

(b) State one way of increasing concentration in solution.

[1]

[Total: 3 marks]

Q35.
Daniel compares catalysts and temperature.

Explain why using a catalyst is often preferred to increasing temperature in industrial reactions.

[4]

[Total: 4 marks]

Q36.
Oliver studies rates of reaction graphs.

(a) State what the steepest part of the curve shows.

[1]

(b) Explain why the curve levels off.

[2]

[Total: 3 marks]

Q37.
Ethan investigates collision theory.

(a) Define activation energy.

[2]

(b) Explain how catalysts lower activation energy.

[2]

[Total: 4 marks]

Q38.
Sam investigates equilibrium in the Haber process.

(a) Explain why high pressure increases the yield of ammonia.

[2]

(b) Explain why high temperatures are not used even though they increase the rate.

[2]

[Total: 4 marks]

Q39.
Charlie compares reversible and irreversible reactions.

(a) Give one example of a reversible reaction.

[1]

(b) Give one example of an irreversible reaction.

[1]

(c) Explain the difference between them.

[2]

[Total: 4 marks]

Q40.
Noah plans an experiment to investigate the effect of concentration on the rate of reaction between hydrochloric acid and sodium thiosulfate.

Include:

- the apparatus used
- the method
- the measurements taken
- how to improve accuracy

[6]

[Total: 6 marks]

Triple Science

Q41.
William measures reaction rates using initial rate methods.

(a) State what is meant by initial rate of reaction.

[2]

(b) Explain how William could calculate the initial rate from a graph.

[2]

[Total: 4 marks]

Q42.
Alex looks at Maxwell–Boltzmann distributions.

Draw a Maxwell–Boltzmann distribution curve for particles at two different temperatures on the same set of axes. Label:

- activation energy
- low temperature curve
- high temperature curve

[4]

[Total: 4 marks]

Q43.
Jacob investigates pressure and equilibrium.

Nitrogen and hydrogen react to form ammonia:
$N_2 + 3H_2 \rightleftharpoons 2NH_3$

(a) State the effect of increasing pressure on the yield of ammonia.

[1]

(b) Explain this effect in terms of Le Chatelier's principle.

[2]

[Total: 3 marks]

Q44.
James studies exothermic reversible reactions.

(a) If the forward reaction is exothermic, explain what happens to the equilibrium position when temperature decreases.

[2]

(b) Sketch a reaction profile for an exothermic reaction showing activation energy.

[2]

[Total: 4 marks]

Q45.
Luke studies catalysts.

(a) Explain why catalysts provide an alternative reaction pathway.

[2]

(b) State why this lowers activation energy.

[1]

[Total: 3 marks]

Q46.
Jack investigates rate equations.

For the reaction: A + B → products, the rate equation is:
rate = k[A][B]

(a) State the order of reaction with respect to A.

[1]

(b) State the order of reaction with respect to B.

[1]

(c) What is the overall order of reaction?

[1]

[Total: 3 marks]

Q47.
Tom works with catalysts in equilibrium reactions.

(a) Explain why a catalyst increases the rate but not the yield of a reversible reaction.

[2]

(b) Give one industrial example of where this is important.

[1]

[Total: 3 marks]

Q48.
Harry studies concentration and equilibrium.

In the reaction:
$2SO_2 + O_2 \rightleftharpoons 2SO_3$

(a) State the effect of increasing SO_2 concentration.

[1]

(b) Explain why this happens in terms of Le Chatelier's principle.

[2]

[Total: 3 marks]

Q49.
Ben calculates rates.

A reaction produces 100 cm^3 of gas in 25 seconds.

(a) Calculate the mean rate of reaction.

[2]

(b) State the units.

[1]

[Total: 3 marks]

Q50.
Daniel evaluates the Haber process.

Discuss why the conditions used in the Haber process represent a compromise between rate, yield, and cost.

[6]

[Total: 6 marks]

Q51.
Oliver studies equilibrium shifts.

The forward reaction is endothermic. Explain the effect on yield of:

(a) increasing the temperature.

[2]

(b) decreasing the temperature.

[2]

[Total: 4 marks]

Q52.
Ethan analyses energy diagrams.

Draw and label an energy diagram to show how a catalyst lowers activation energy.

[3]

[Total: 3 marks]

Q53.
Sam investigates particle collisions.

(a) Define activation energy.

[2]

(b) Explain why only some collisions lead to a successful reaction.

[2]

[Total: 4 marks]

Q54.
Charlie looks at reversible reactions.

(a) Explain why reversible reactions are described as dynamic.

[2]

(b) State why equilibrium is reached in a closed system.

[2]

[Total: 4 marks]

Q55.
Noah plans an experiment to investigate the effect of temperature on the rate of reaction between sodium thiosulfate and hydrochloric acid.

Include:

- apparatus used
- how to measure rate of reaction
- variables to control
- safety precautions

[6]

[Total: 6 marks]