

Practice Exam: Paper 1

Topic 6: Kinetics

SL

1. Which statements describe the action of a catalyst?

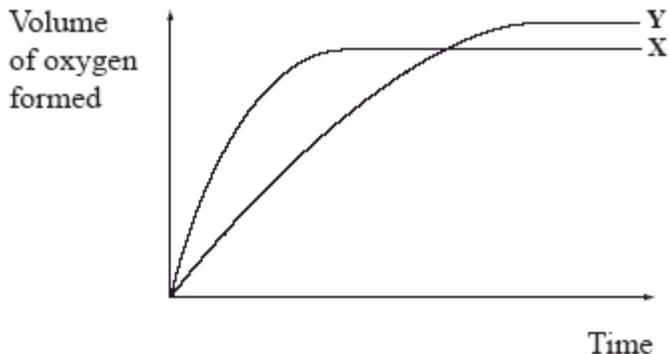
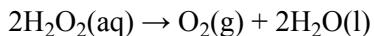
- I. It does **not** alter the ΔH for a reaction.
 - II. It increases the E_a for the reaction.
 - III. It alters the mechanism (pathway) of a reaction.
- A. I and II only C. II and III only
B. I and III only D. I, II and III

2. Consider the reaction between gaseous iodine and gaseous hydrogen.



Why do some collisions between iodine and hydrogen **not** result in the formation of the product?

- A. The I_2 and H_2 molecules do not have sufficient energy.
 - B. The system is in equilibrium.
 - C. The temperature of the system is too high.
 - D. The activation energy for this reaction is very low.
3. Curve X on the graph below shows the volume of oxygen formed during the catalytic decomposition of a 1.0 mol dm^{-3} solution of hydrogen peroxide.



Which change would produce the curve Y?

- A. Adding water
- B. Adding some 0.1 mol dm^{-3} hydrogen peroxide solution
- C. Using a different catalyst
- D. Lowering the temperature

4. At 25 °C, 200 cm³ of 1.0 mol dm⁻³ nitric acid is added to 5.0 g of magnesium powder. If the experiment is repeated using the same mass of magnesium powder, which conditions will result in the same initial reaction rate?

	Volume of HNO₃ / cm³	Concentration of HNO₃ / mol dm⁻³	Temperature / °C
A.	200	2.0	25
B.	200	1.0	50
C.	100	2.0	25
D.	100	1.0	25

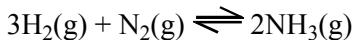
5. Sodium carbonate and hydrochloric acid react according to the equation below.



Which conditions will produce the fastest initial rate with 2.0 g of powdered sodium carbonate?

- A. 100 cm³ of 1.0 mol dm⁻³ hydrochloric acid at 323 K
 - B. 50 cm³ of 2.0 mol dm⁻³ hydrochloric acid at 323 K
 - C. 100 cm³ of 1.0 mol dm⁻³ hydrochloric acid at 348 K
 - D. 50 cm³ of 2.0 mol dm⁻³ hydrochloric acid at 348 K
6. Under which conditions will the reaction between 1.0 g calcium carbonate and excess hydrochloric acid be the fastest? Assume that all reactions are carried out at the same temperature.
- A. One large piece of calcium carbonate and 2 mol dm⁻³ hydrochloric acid
 - B. One large piece of calcium carbonate and 1 mol dm⁻³ hydrochloric acid
 - C. Powdered calcium carbonate and 2 mol dm⁻³ hydrochloric acid
 - D. Powdered calcium carbonate and 1 mol dm⁻³ hydrochloric acid
7. Powdered manganese(IV) oxide, MnO₂(s), increases the rate of the decomposition reaction of hydrogen peroxide, H₂O₂(aq). Which statements about MnO₂ are correct?
- I. The rate is independent of the particle size of MnO₂.
 - II. MnO₂ provides an alternative reaction pathway for the decomposition with a lower activation energy.
 - III. All the MnO₂ is present after the decomposition of the hydrogen peroxide is complete.
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

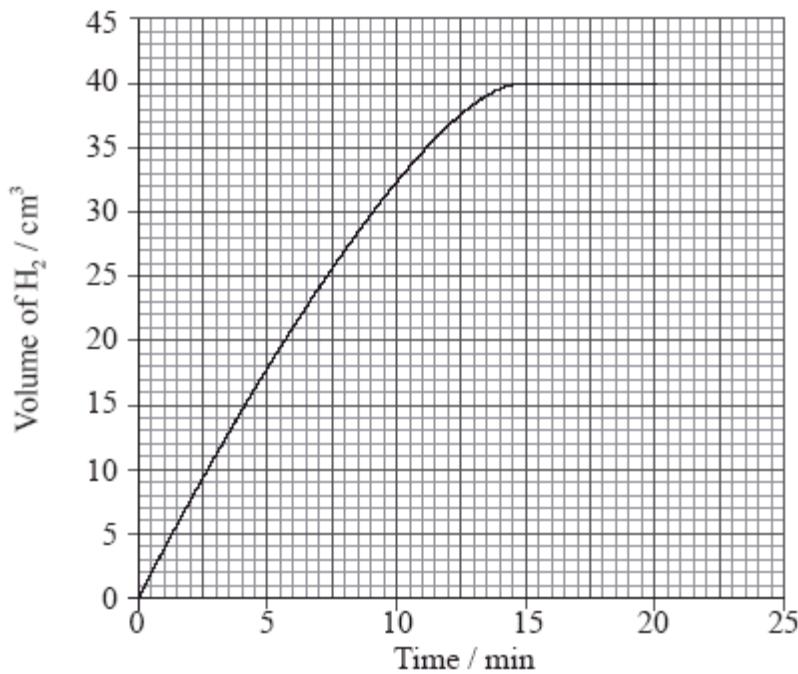
8. The Haber process uses an iron catalyst to convert hydrogen gas, H₂(g), and nitrogen gas, N₂(g), to ammonia gas, NH₃(g).



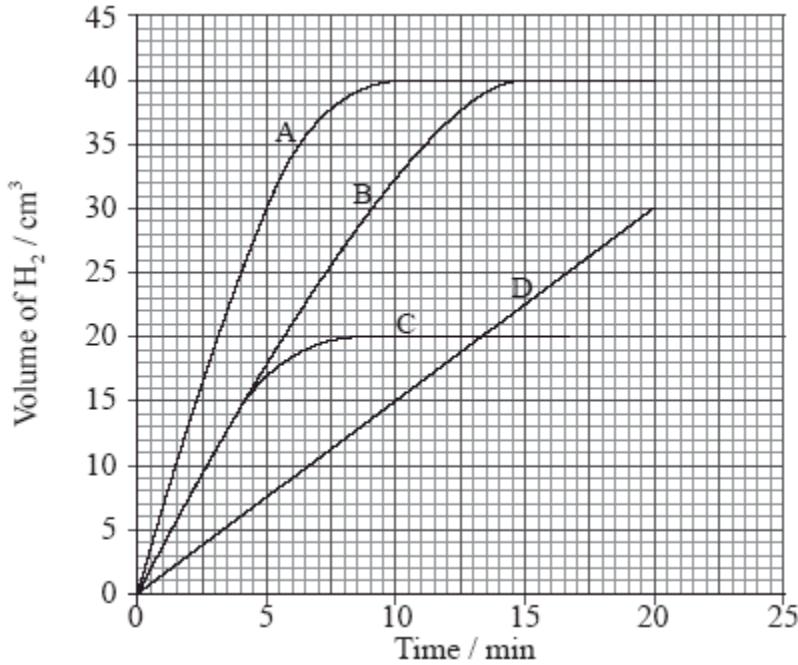
Which statements are correct for this equilibrium system?

- I. The iron catalyst increases the rates of the forward and reverse reactions equally.
 - II. The iron catalyst does not affect the value of the equilibrium constant, K_c.
 - III. The iron catalyst increases the yield of ammonia gas, NH₃(g).
- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III
9. Which unit could be used for the rate of a chemical reaction?
- A. mol
- B. mol dm⁻³
- C. mol dm⁻³ s⁻¹
- D. dm³
10. Which of the following can **increase** the rate of a chemical reaction?
- I. Increasing the temperature
 - II. Adding a catalyst
 - III. Increasing the concentration of reactants
- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

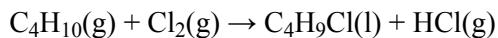
11. A piece of zinc was added to aqueous nitric acid and the volume of hydrogen gas produced was measured every minute. The results are plotted on the graph below.



Which graph would you expect if the same mass of powdered zinc was added to nitric acid with the same concentration?

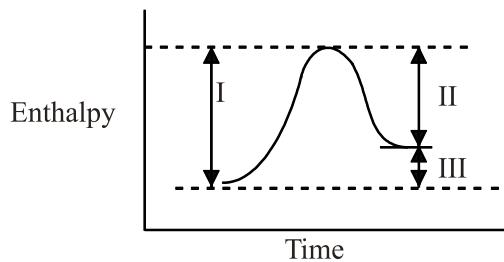


12. Which changes increase the rate of the reaction below?



- I. Increase of pressure
 - II. Increase of temperature
 - III. Removal of HCl(g)
- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

13. Which quantities in the enthalpy level diagram are altered by the use of a catalyst?



- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III
14. The formation of nitric acid, $\text{HNO}_3(\text{aq})$, from nitrogen dioxide, $\text{NO}_2(\text{g})$, is exothermic and is a reversible reaction.



What is the effect of a catalyst on this reaction?

- A. It increases the yield of nitric acid.
- B. It increases the rate of the forward reaction only.
- C. It increases the equilibrium constant.
- D. It has no effect on the equilibrium position.

15. What is the best definition of *rate of reaction*?

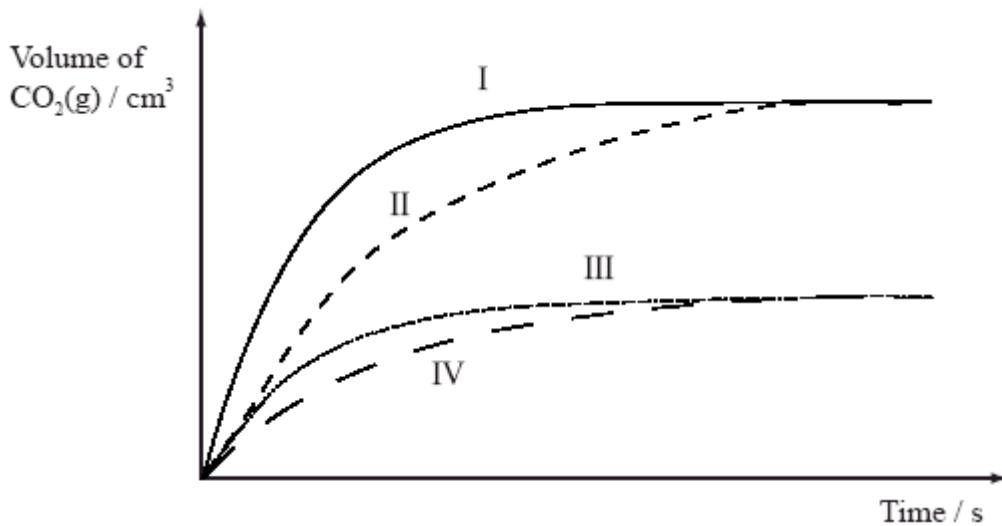
- A. The time it takes to use up all the reactants
- B. The rate at which all the reactants are used up
- C. The time it takes for one of the reactants to be used up
- D. The increase in concentration of a product per unit time

16. Which factors can affect reaction rate?

- I. The state of the reactants
- II. The frequency of the collisions between particles
- III. The average kinetic energy of the particles

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

17. Equal masses of powdered calcium carbonate were added to separate solutions of hydrochloric acid. The calcium carbonate was in excess. The volume of carbon dioxide produced was measured at regular intervals. Which curves best represent the evolution of carbon dioxide against time for the acid solutions shown in the table below.

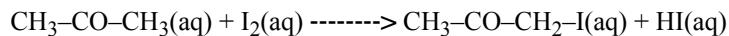


	25 cm ³ of 2 mol dm ⁻³ HCl	50 cm ³ of 1 mol dm ⁻³ HCl	25 cm ³ of 1 mol dm ⁻³ HCl
A.	I	III	IV
B.	I	IV	III
C.	I	II	III
D.	II	I	III

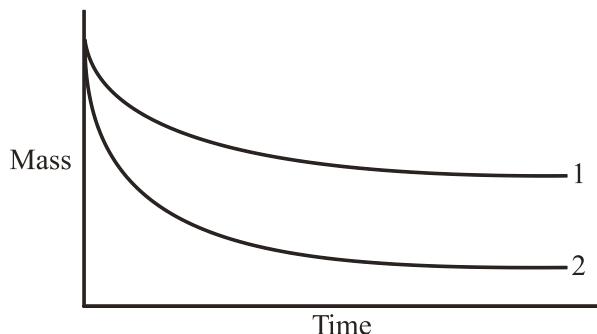
18. What is the function of iron in the Haber process?
- It shifts the position of equilibrium towards the products.
 - It decreases the rate of the reaction.
 - It provides an alternative reaction pathway with a lower activation energy.
 - It reduces the enthalpy change of the reaction.
19. Hydrochloric acid is reacted with large pieces of calcium carbonate, the reaction is then repeated using calcium carbonate powder. How does this change affect the activation energy and the collision frequency?

	Activation energy	Collision frequency
A.	increases	increases
B.	stays constant	increases
C.	increases	stays constant
D.	stays constant	stays constant

20. Which statement is true about using sulfuric acid as a catalyst in the following reaction?



- The catalyst increases the rate of reaction.
 - The catalyst lowers the activation energy for the reaction.
 - The catalyst has been consumed at the end of the chemical reaction.
- | | |
|-------------------|--------------------|
| A. I and II only | C. II and III only |
| B. I and III only | D. I, II and III |
21. Excess magnesium was added to a beaker of aqueous hydrochloric acid. A graph of the mass of the beaker and contents was plotted against time (line 1).



What change in the experiment could give line 2?

- | | |
|-------------------------------------------------------------|-----------------------------------------------|
| A. The same mass of magnesium in smaller pieces | C. A lower temperature |
| B. The same volume of a more concentrated hydrochloric acid | D. A more accurate instrument to measure time |