# <u>Chemistry Fact Sheet – Paper 2 - Triple</u>

**Bold – Triple Content** *Italics – Higher Only*

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| Rate & Extent of Chemical Reactions | Rates of reaction | 1. The rate of a chemical reaction can be found by measuring the quantity of a reactant used or the quantity of product formed over time.<br>• Mean rate of reaction = $\frac{\text{quantity of reactant used}}{\text{Time taken}}$<br>• Mean rate of reaction = $\frac{\text{quantity of product formed}}{\text{Time taken}}$<br>2. The quantity of reactant or product can be measured by the mass (grams) or by volume ($cm^3$)<br>3. The units of rate of reaction are g/s or $cm^3$/s.<br>4. *The quantity of reactions can also be given in terms of moles and the units for rate of reaction in mol/s.*<br>5. Factors which affect the rate of chemical reactions include –<br>• Concentration of reactant<br>• Pressure of reacting gases<br>• Surface area of solid reactants<br>• Temperature<br>• Presence of a catalyst. |
| | Collision theory & activation energy | 6. Collision theory states that chemical reactions can only occur when particles collide with each other with enough energy.<br>7. The minimum amount of energy that particles must have to react is called the activation energy.<br>8. Increasing the concentration of reactants in solution, the pressure of reacting gases and the surface area of solid reactants increases the frequency of collisions and so increases the rate of reaction.<br>9. Increasing the temperature increases the frequency of collisions and makes the collisions more energetic and so increases the rate of reaction. |
| | Catalysts | 10. Catalysts change the rate of chemical reactions but are not changed or used up during the reaction.<br>11. Different reactions need different catalysts.<br>12. Enzymes are catalysts in biological systems.<br>13. Catalysts increase the rate of reaction by providing a different pathway for the reaction that has a lower activation energy. |
| | Reversible reactions | 14. In some chemical reactions, the products of the reaction can react to produce the original reactants. These reactions are called reversible reactions.<br>$A + B \leftrightharpoons C + D$<br>15. The direction of the reversible reactions can be changed by changing the conditions, for example heating or cooling the reaction.<br>cool<br>Ammonium chloride ⇋ ammonia + hydrogen chloride<br>heat |

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| | Energy Changes reversible reactions | 16. If a reversible reaction is exothermic in one direction, it is endothermic in the opposite direction.<br>17. The same amount of energy is transferred in each direction.<br>18. For example –<br>Hydrated copper sulfate (blue) ⇋ (exothermic / endothermic) anhydrous copper sulfate (white) + water |
| | Equilibrium | 19. When a reversible reaction, equilibrium is reached when the forward and reverse reactions occur at exactly the same rate.<br>20. Equilibrium can only be achieved in a closed system where no materials can escape. This is a sealed container for gases but a beaker for liquids is good enough. |
| | *Effect of Changing conditions on equilibrium (Higher Tier Only)* | 21. *If a system is at equilibrium and a change is made to any of the conditions, then the system responds to counteract the change.*<br>22. *The effects of changing conditions on a system at equilibrium can be predicted using Le Chatelier's Principal.*<br>23. *If the concentration of one of the reactants or products is changed, the system is no longer at equilibrium and the concentrations of all the substances will change until equilibrium is reached again.*<br>24. *If the concentration of one of the reactants is increased, more products will be formed until equilibrium is reached again.*<br>25. *If the concentration of a product is decreased, more reactants will react until equilibrium is reached again.*<br>26. *If the temperature of a system at equilibrium is increased, the endothermic reaction is favoured in an attempt to cool the system.*<br>27. *If the temperature of a system at equilibrium is decreased, the exothermic reaction is favoured in an attempt to heat the system.*<br>28. *For gaseous reactions at equilibrium –*<br>• *An increase in pressure causes the equilibrium position to shift towards the side with the smaller number of molecules as shown by the symbol equations for that reaction.*<br>• *A decrease in pressure causes the equilibrium position to shift towards the side with the larger number of molecules as shown by the symbol equations for that reaction.* |