

IB Chemistry HL - R3.4

Electron-pair sharing reactions

Exercises + Practice questions

Official answers appended at the end

this is a **COORDINATION BOND** which is introduced in structure 2.2.

Exercise

- Q1.** What is the essential feature of a nucleophile?
- A** a lone pair of electrons
 - B** a negative charge
 - C** a pi bond
 - D** a positive charge
- Q2.** Which of the following species can act as a nucleophile?
- I. NH_3 II. CH_4 III. H_2O
- A** I, II and III
 - B** II and III
 - C** I and III
 - D** I and II

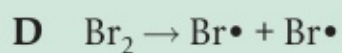
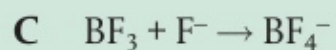
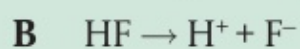
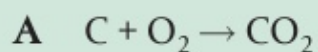
Overall Equation: $\text{H}_2\text{O} + \text{RX} \rightarrow \text{ROH} + \text{HX}$

Exercise

- Q3.** In the reaction $\text{R-X} + \text{OH}^- \rightarrow \text{R-OH} + \text{X}^-$
 X^- acts as a:
- A** nucleophile **B** electrophile
C reducing agent **D** leaving group
- Q4.** Explain what is meant by nucleophilic substitution, using the reaction between NaOH and chloroethane to illustrate your answer.
- Q5.** Use curly arrows to show how hydroxide ions react with bromomethane to form methanol.
- Q6.** Use Section 12 in the data booklet to predict which halide ion will be the best leaving group in a nucleophilic substitution reaction.

Exercise

Q7. Which of the following reactions best represents heterolytic fission?



Q8. Use curly arrows to explain the difference between the homolytic and heterolytic fission of a H–Br bond.

Exercise

Q9. What is the essential feature of an electrophile?

- A** It has a lone pair of electrons.
- B** It can accept a pair of electrons.
- C** It has a negative charge.
- D** It has a positive charge.

Q10. Which of the following species can act as an electrophile?

I. HBr II. Br₂ III. NH₃

- A** I, II and III
- B** II and III
- C** I and III
- D** I and II

Exercise

- Q11.** In the reaction between ethene and hydrogen chloride, $\text{CH}_2\text{CH}_2 + \text{HCl}$, the product is:
- A** $\text{CH}_2\text{ClCH}_2\text{Cl}$
 - B** CH_3CH_3
 - C** no reaction occurs
 - D** $\text{CH}_3\text{CH}_2\text{Cl}$
- Q12.** Give the condensed formulas and names of the products for the following reactions:
- (a)** $\text{CH}_3\text{CH}=\text{CHCH}_3 + \text{HBr}$
 - (b)** $\text{CH}_2=\text{CH}_2 + \text{conc. H}_2\text{SO}_4$
 - (c)** $\text{CH}_3\text{CH}=\text{CH}_2 + \text{Br}_2$
- Q13.** Explain how bromine water, $\text{Br}_2(\text{aq})$, can be used to distinguish between an alkane and an alkene.