

APOLLO

Electron-pair sharing reactions

HL

Chemistry

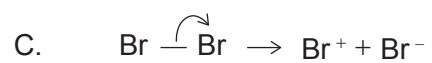
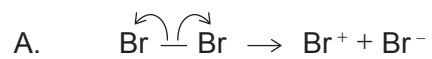
First assessment 2025

16 questions | questions

36. Which alcohol and conditions would produce the highest yield of methylpropanoic acid?

	Alcohol	Conditions
A.	2-methylpropan-2-ol	Reflux
B.	2-methylpropan-1-ol	Reflux
C.	2-methylpropan-2-ol	Distillation
D.	2-methylpropan-1-ol	Distillation

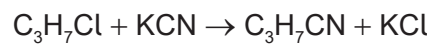
37. Which correctly shows heterolytic bond fission?



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2225-0201

- 38.** What is the role of the CN^- ion in the reaction of 1-chloropropane with excess KCN in ethanol?



- A. Electrophile and Lewis base
- B. Nucleophile and Lewis acid
- C. Electrophile and Lewis acid
- D. Nucleophile and Lewis base

40. Which species would take part in a substitution reaction with benzene?

- A. Cl_2
- B. $\text{Cl}\cdot$
- C. Cl^+
- D. Cl^-

Turn over

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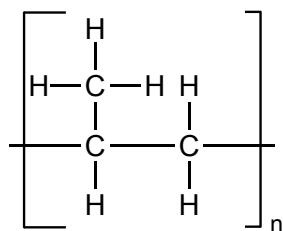
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References:

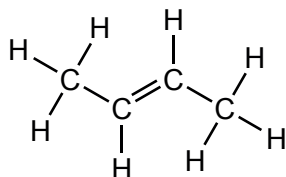
10. 영원파란, 2017. N₂O 루이스 구조 그리기. [online] Available at: <http://ywpop.tistory.com/7363> [Accessed 7 May 2024].
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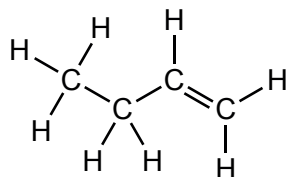
11. Which monomer produces this addition polymer?



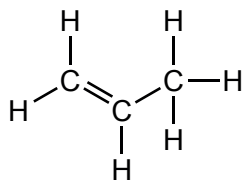
A.



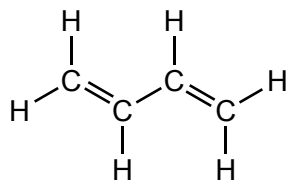
B.



C.



D.



38. Which compound can be reduced to produce butanal?

- A. Butanoic acid
- B. Butan-1-ol
- C. Butanone
- D. Butan-2-ol

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Turn over

2220-0219

40. Which of these ions would be a suitable species to react with benzene in a substitution reaction?



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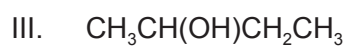
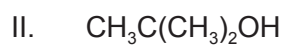
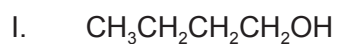
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References:

4. With permission from Jim Clark. www.chemguide.co.uk/analysis/masspec/elements.html.

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35. Which compound undergoes oxidation when heated with acidified potassium dichromate?



A. I and II only

B. I and III only

C. II and III only

D. I, II and III

38. But-2-ene undergoes a variety of addition reactions.

Which of the following is correct?

	Reagent added	Product
A.	H ₂	But-1-ene
B.	H ₂ O	Butan-1-ol
C.	HBr	2-bromobutane
D.	Br ₂	2,2-dibromobutane

40. Which statement is correct about an S_N2 mechanism?

- A. Two molecules are involved in the rate-determining step of the mechanism.
 - B. Two steps are involved in the mechanism.
 - C. A nucleophile is substituted by an electrophile.
 - D. The mechanism involves formation of an intermediate carbocation.
-

38. Which product may be obtained by the reduction of $\text{CH}_3\text{CH}_2\text{COOH}$?

- A. $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$
- B. $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- C. $\text{CH}_3\text{CH}_2\text{OCH}_3$
- D. $\text{CH}_3\text{COOCH}_3$

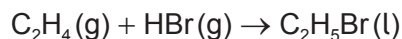
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0020-0219

40. What is the main product of the reaction between but-1-ene, $\text{CH}_2\text{CHCH}_2\text{CH}_3$, and hydrogen bromide, HBr ?

- A. $\text{CH}_3\text{CHBrCH}_2\text{CH}_3$
 - B. $\text{CH}_2\text{BrCH}_2\text{CH}_2\text{CH}_3$
 - C. $\text{CH}_2\text{BrCHBrCH}_2\text{CH}_3$
 - D. $\text{CH}_2\text{BrCH}(\text{CH}_3)_2$
-

4. Bromoethane, $\text{C}_2\text{H}_5\text{Br}$, is produced by reacting ethene, C_2H_4 , with hydrogen bromide, HBr .



- (a) (i) State the type of reaction and the role of HBr . [1]

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- (ii) Outline why ethene is susceptible to attack by molecules such as HBr . [1]

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- (b) (i) Determine the standard enthalpy change of the reaction, in kJ mol^{-1} . Use section 12 of the data booklet. [2]

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- (ii) State **two** reasons why the result using bond enthalpies is less accurate than one calculated from enthalpies of formation. [2]

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(This question continues on the following page)



(Question 4 continued)

(iii) Outline why the entropy change of the reaction is negative.

[1]

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(iv) Predict, showing your working, if the reaction is spontaneous at 298 K.
Use section 13 of the data booklet and your answer for part (b)(i). If you did not
get an answer in part (b)(i), use -58 kJ mol^{-1} .

[2]

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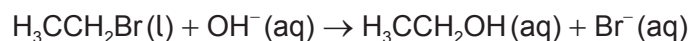
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Turn over

(Question 4 continued)

- (c) Bromoethane can react with aqueous hydroxide ions to produce ethanol.



- (i) State the type of reaction. [1]

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- (ii) Sketch the mechanism of the reaction, using curly arrows to represent the movement of electron pairs. [3]

- (iii) Outline why the reaction takes place by this mechanism. [1]

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- (iv) State the order of reaction. [1]

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(Question 4 continued)

- (v) Predict, with a reason, a halogenoethane that would react more quickly than bromoethane.

[1]

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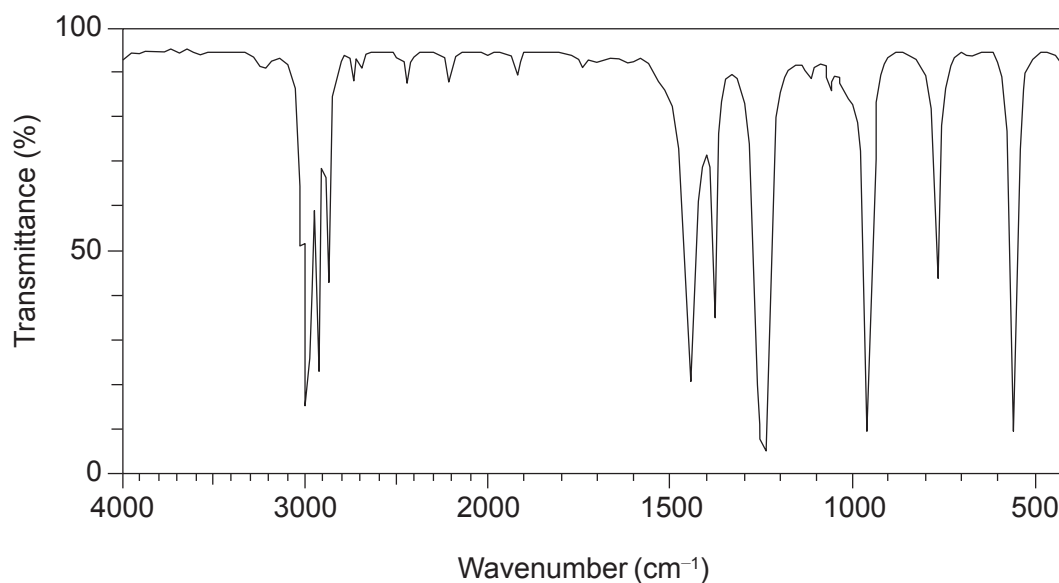
- (vi) Bromoethane shows a signal in the 3.5–4.4 ppm region of its ^1H NMR spectrum. Deduce the splitting pattern of this signal. Use section 21 of the data booklet.

[1]

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- (vii) Deduce whether this infrared spectrum is produced by bromoethane or ethanol. Give evidence from section 20 of the data booklet.

[1]



[Source: SDBS. National Institute of Advanced Industrial Science and Technology.]

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**Turn over**

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0020–0221

38. Which ion is a better leaving group in nucleophilic substitutions?

- A. bromide ion
- B. chloride ion
- C. fluoride ion
- D. iodide ion

- 39.** Which statement is correct when 2-chloro-2-methylpentane reacts with water to form 2-methylpentan-2-ol?
- A. Water acts as a nucleophile and attacks the chlorine atom.
 - B. The reaction occurs in a single step.
 - C. A carbocation intermediate is formed.
 - D. Homolytic bond fission occurs.

Turn over

40. Which illustrates the correct intermediate formed in the nitration of benzene by NO_2^+ ?

