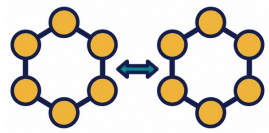
# Benzene Structure Map

Edexcel A Level Chemistry · Topic 18A Benzene Structure and Stability

### 1 Two models 18A.1

- $C_6H_6$: one H on each carbon
- Kekulé: **alternating** C=C and C–C
- Cyclohexa-1,3,5-triene
- Delocalised: **six equal bonds**



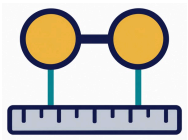
### 2 Bonding 18A.1

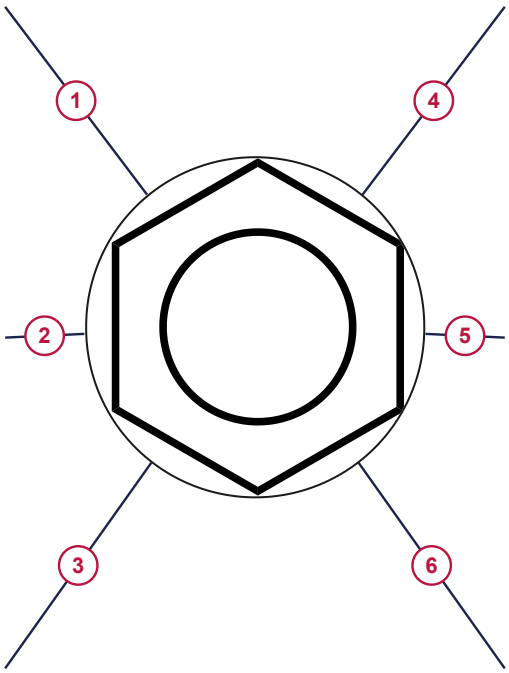
- Each C: three σ-bonds, planar, 120°
- One **p-orbital** per carbon
- p-orbitals **overlap sideways**
- π-system above and below the ring



### 3 Bond lengths 18A.2

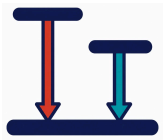
- C–C 0.154 nm; C=C 0.134 nm
- Benzene: all six **0.139 nm**
- **Between** single and double
- So not alternating






### 4 Hydrogenation 18A.2

- Cyclohexene −120 kJ mol$^{-1}$
- Kekulé predicts **−360**
- Benzene measured **−208**
- **152 kJ mol$^{-1}$ more stable**



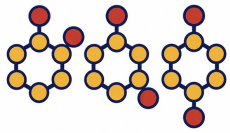
### 5 Bromine water 18A.3

- Cyclohexene: orange to colourless
- Benzene: **no reaction**
- Alkene: localised, polarises $Br_2$
- Benzene: delocalised, **lower density**



### 6 Isomers 18A.2

- Kekulé: four dibromobenzenes
- Two 1,2-forms predicted
- Only **three** exist
- So all ring bonds **equal**



## Kekulé against the evidence what each model predicts and what is found

| Test | Kekulé predicts | Found |
|---|---|---|
| Ring bond lengths | Two | One, 0.139 nm |
| ΔH hydrogenation | −360 kJ mol$^{-1}$ | −208 kJ mol$^{-1}$ |
| Bromine water | Decolourises | No reaction |
| Dibromobenzenes | Four | Three |

## Worked examples

### Formula

- 92.3% C, Mr 78
- C:H = 1:1, so CH
- **78 ÷ 13 = 6: $C_6H_6$**

### Stability

- 3 × −120 = −360
- −360 against −208
- **152 kJ mol$^{-1}$**

### Drawing

- Kekulé ring or circle
- Both accepted
- **Corners are C–H**

Electrophilic substitution and phenol follow in Topic 18B.

**Online Learning System** · onlinelearningsystem.net · © 2026 Online Learning System. All rights reserved. Not for redistribution.