30. Hydrocarbons

Starter Quiz ·

A-Level Chemistry Name: _____ Score: _____

1. Benzene reacts mostly by electrophilic substitution because:

   ☐ addition is impossible

   ☐ it has no electrons

   ☐ this keeps the stable delocalised ring, while addition would destroy it

   ☐ the ring is unstable

2. A halogen reacts in the ring (not the side-chain) when there is:

   ☐ water present

   ☐ UV light and no catalyst

   ☐ a halogen-carrier catalyst ($AlCl_3$) and no UV light

   ☐ only heat

3. Nitration of benzene uses:

   ☐ concentrated HNO_3 and concentrated H_2SO_4

   ☐ hydrogen and a catalyst

   ☐ dilute NaOH

   ☐ bromine water

4. Under UV light with no catalyst, the halogen substitutes:

   ☐ in the ring

   ☐ in the side-chain (free-radical substitution)

   ☐ at the catalyst

   ☐ nowhere

5. A Friedel–Crafts reaction (with $AlCl_3$) is used to:

   ☐ oxidise the ring

   ☐ remove a hydrogen as a radical

   ☐ add an alkyl or acyl group to the ring

   ☐ hydrogenate the ring

6. Groups already on a benzene ring direct where the next group attaches.

   ☐ True ☐ False

7. Benzene reacts mainly by electrophilic substitution, not addition, because that keeps its stable delocalised ring intact.

   ☐ True ☐ False

8. An –OH group already on the ring directs the next substituent to:

   ☐ the side-chain

   ☐ no particular position

   ☐ position 3 only

   ☐ positions 2 and 4

9. In electrophilic substitution, after the ring bonds to the electrophile:

   ☐ another electrophile adds

   ☐ a radical forms

   ☐ an H^+ is lost, restoring the stable ring

   ☐ the ring opens up

10. Arenes such as benzene typically react by:

    ☐ electrophilic substitution

    ☐ free-radical addition

    ☐ electrophilic addition

    ☐ nucleophilic substitution

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Answers ·

A-Level Chemistry

1. **this keeps the stable delocalised ring, while addition would destroy it**

   Substitution preserves the aromatic stabilisation; addition would break up the delocalised system.

2. **a halogen-carrier catalyst ($AlCl_3$) and no UV light**

   The catalyst makes the electrophile for ring substitution; UV with no catalyst gives side-chain free-radical substitution.

3. **concentrated HNO_3 and concentrated H_2SO_4**

   The conc. acid mixture generates the NO_2^+ electrophile, giving nitrobenzene.

4. **in the side-chain (free-radical substitution)**

   UV light starts free-radical substitution in the alkyl side-chain.

5. **add an alkyl or acyl group to the ring**

   Friedel–Crafts alkylation/acylation adds a carbon-based group to benzene.

6. **True**

   This is the directing effect.

7. **True**

   Addition would break the delocalised ring and lose its stability, so substitution (swapping an H) is favoured.

8. **positions 2 and 4**

   $-NH_2$, –OH and –R are 2,4-directing; $-NO_2$, –COOH and –COR are 3-directing.

9. **an H^+ is lost, restoring the stable ring**

   Losing H^+ from that carbon restores the delocalised ring, completing the substitution.

10. **electrophilic substitution**

    Substitution keeps the stable ring intact.