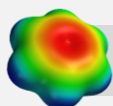


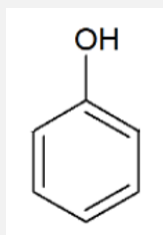


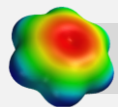
Reações do fenol e derivados



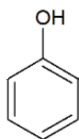
Fenol

- Joseph Lister (1867): propôs o uso do fenol (ácido carbólico) na desinfecção de materiais cirúrgicos e feridas
- Hoje os termos “fenóis” e “compostos fenólicos” são usados de forma genérica para derivados $\text{Ar}-\text{OH}$

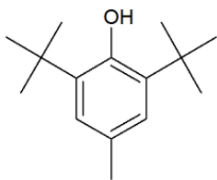
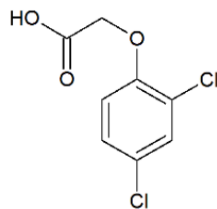
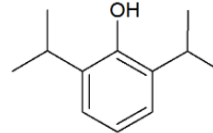




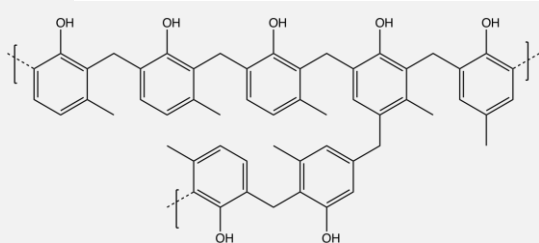
Fenol - derivados



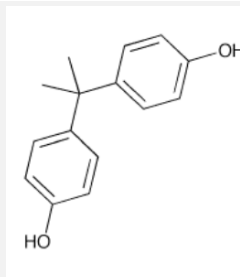
phenol

butylated hydroxytoluene
BHT (food preservative)2,4-dichlorophenoxyacetic acid
2,4-D (herbicide)

propofol (pharmaceutical)

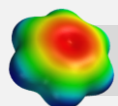


Phenol-formaldehyde resin



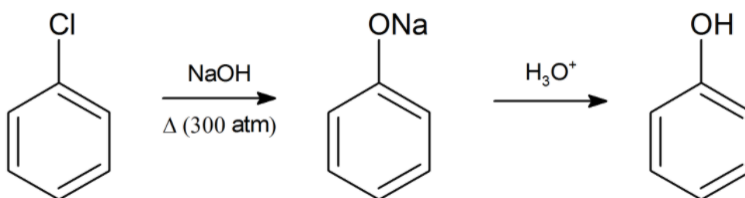
Bisphenol-A (BPA)

3

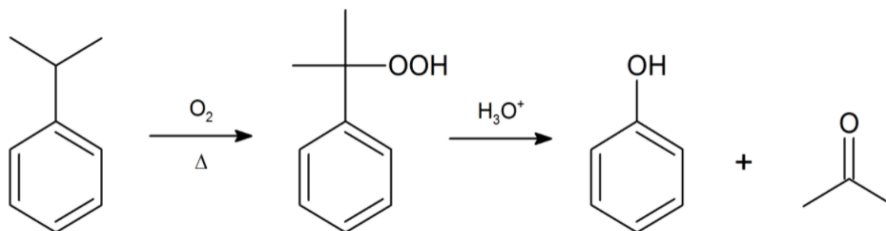


Preparo do fenol

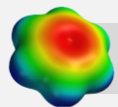
1. Processo Dow



2. Processo do cumeno

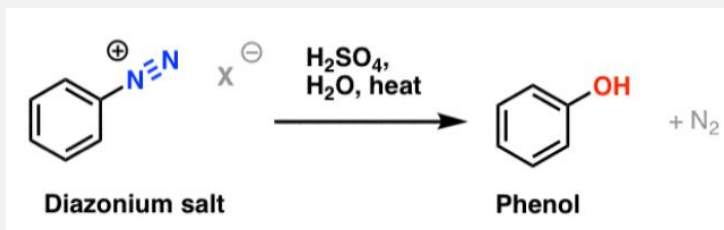
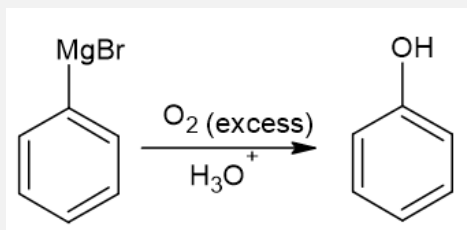


4



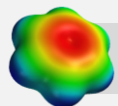
Outras vias para formação de fenol

1. Oxidação do fenilmagnésio (Grignard)
2. Hidrólise ácida de sal de diazônio



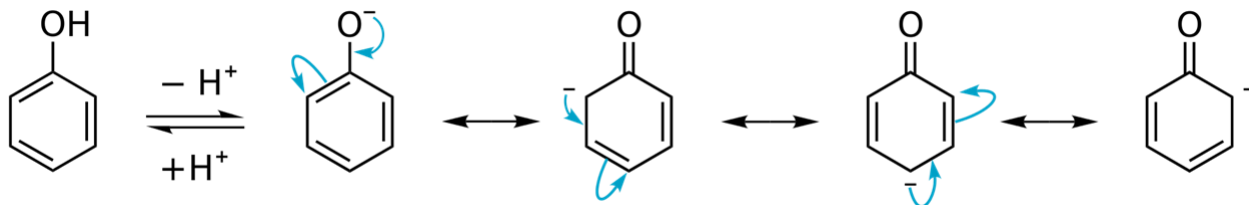
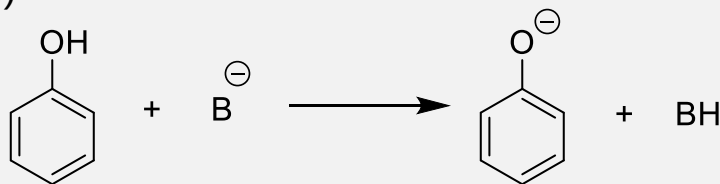
Insere OH de forma branda

5

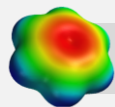


Reações com fenóis – ácido-base

- Reações ácido-base: fenol ($pK_a = 10$) é mais ácido que álcoois ($pK_a \sim 16$)

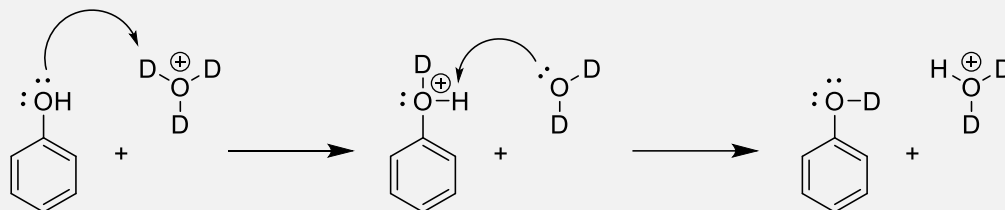


6

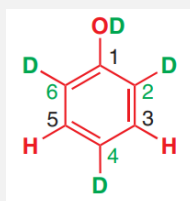


Reações com fenóis – ácido-base + S_EAr

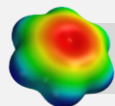
Um efeito interessante ocorre quando tratamos fenol com uma solução ácida de D₂O (água deuterada)



Produto formado:

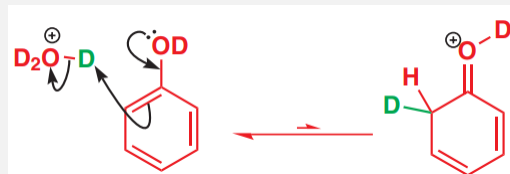


7

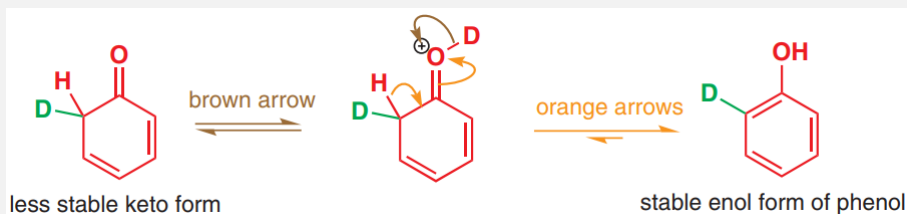


Reações com fenóis – S_EAr

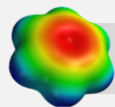
- Reação: S_EAr (D substitui H)



Intermediário de Wheland

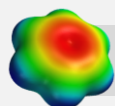
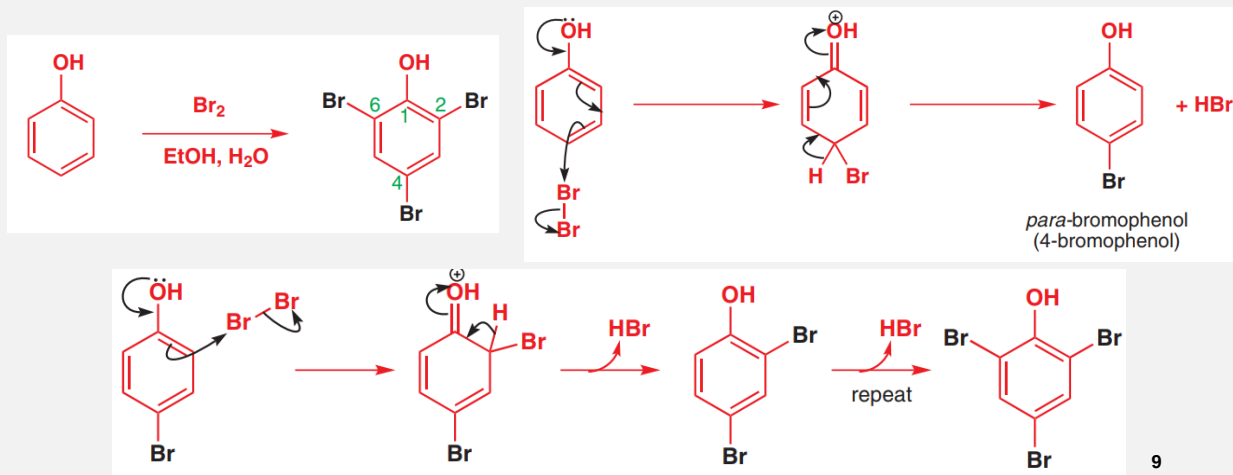


8



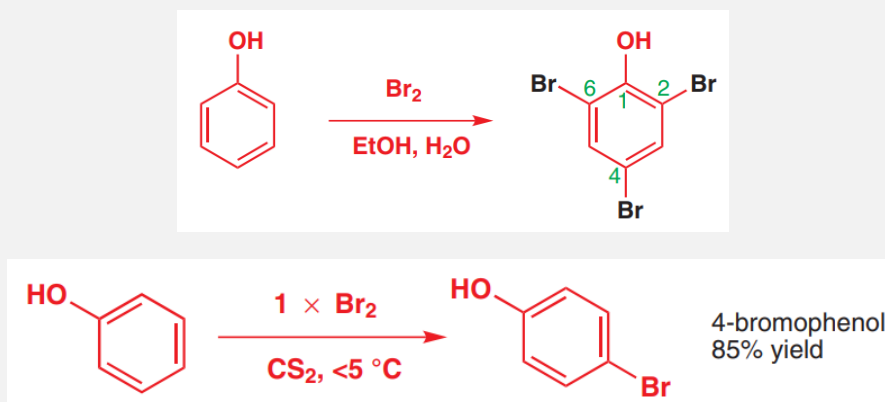
Reações com fenóis – S_EAr

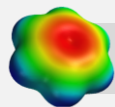
- Reação: bromação



Reações com fenóis – S_EAr

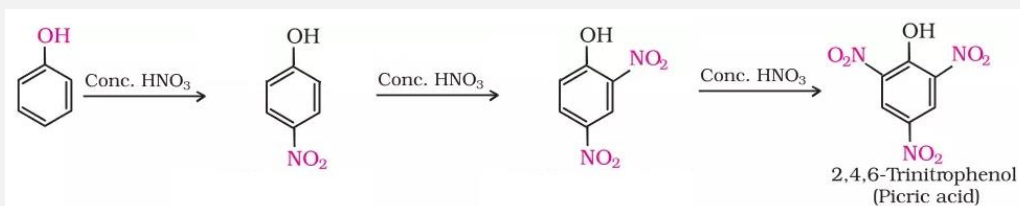
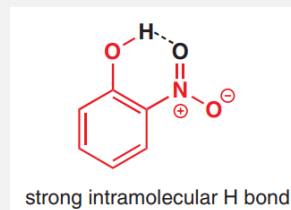
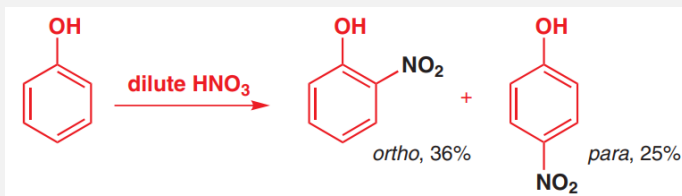
- Reação: bromação



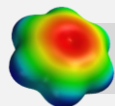


Reações com fenóis – S_EAr

- Reação nitração
- HNO₃ diluído em vez de HNO₃/H₂SO₄

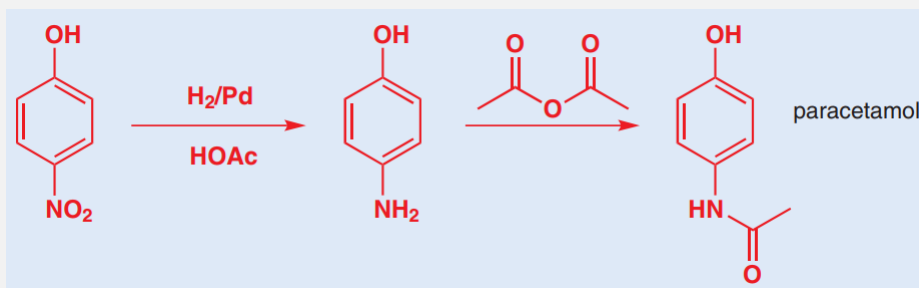


11

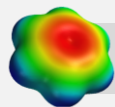


Derivados de fenóis

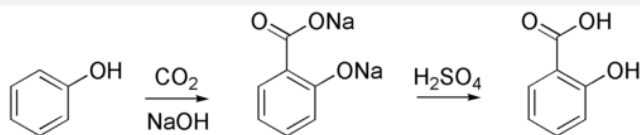
- Síntese do paracetamol



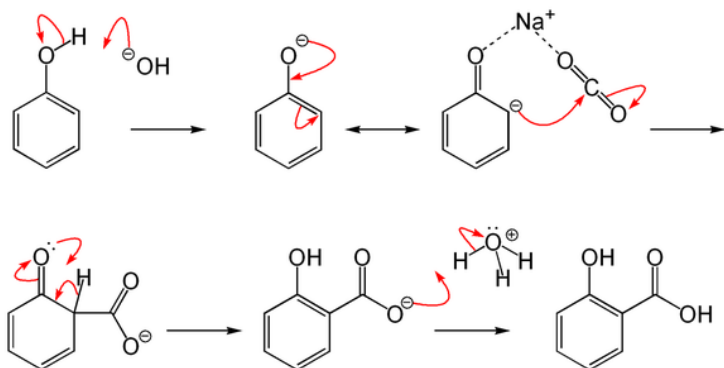
12



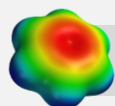
Derivados de fenóis



- Síntese do ácido salicílico (Kolbe-Schmidt)
- 100 atm, 125 °C

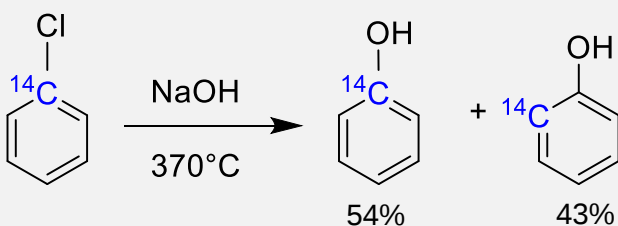
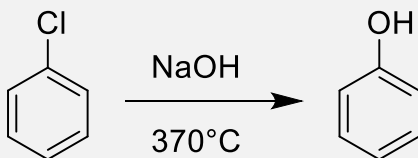


13

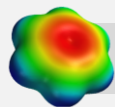


Reações com fenóis – S_NAr

- Reações de substituição nucleofílica

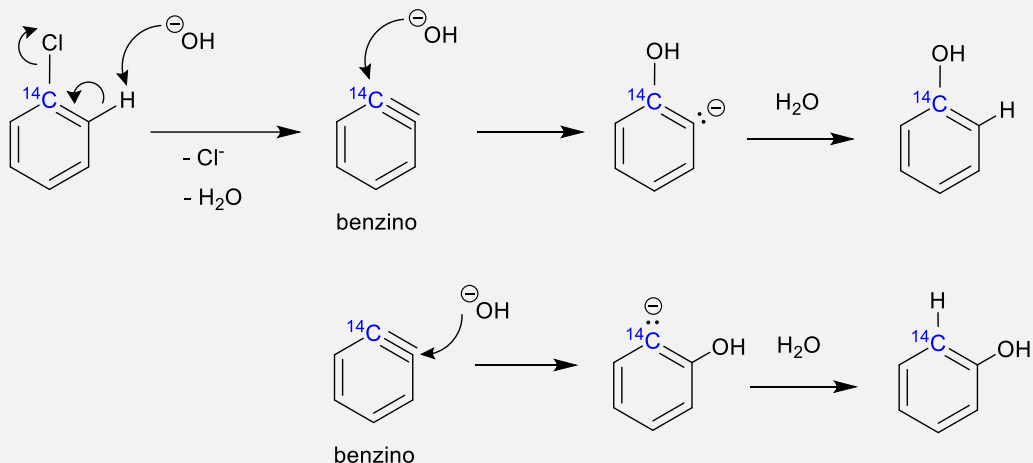


14

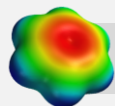


Reações com fenóis – S_NAr

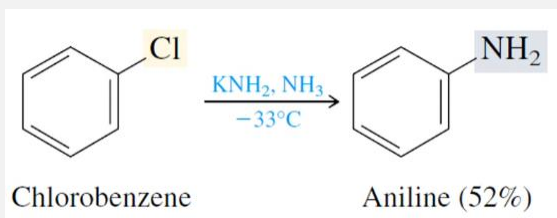
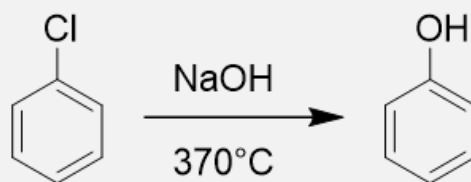
- Reações de substituição nucleofílica



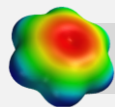
15



Reações com fenóis – S_NAr

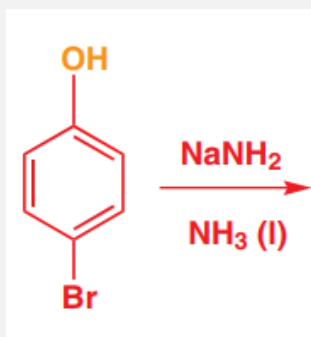


16

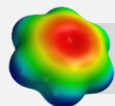


Exercício

- Indique o produto da seguinte reação com 1 ou 2 equivalentes de NH_2^-

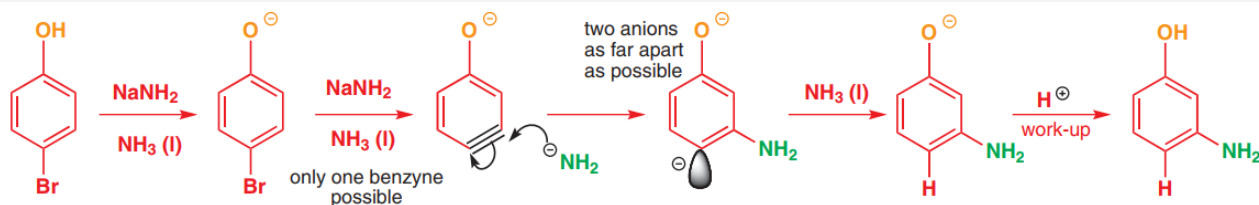


17

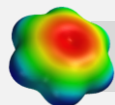


Exercício

- Indique o produto da seguinte reação com 1 ou 2 equivalentes de NH_2^-

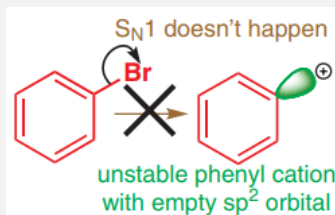
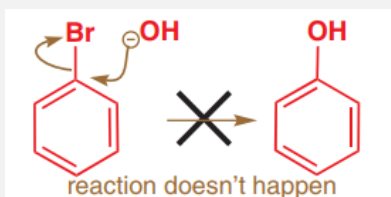


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Reações com fenóis – S_NAr

- Produção de derivados fenólicos por S_NAr

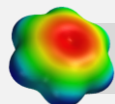


Em que condições um carbocátion instável como esse pode se formar?

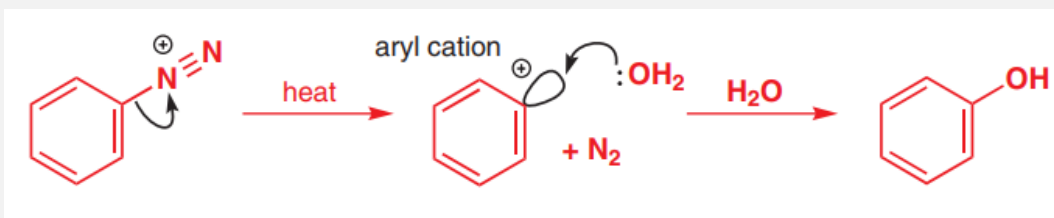
- **A typical nucleophilic aromatic substitution has:**

- an oxygen, nitrogen, or cyanide nucleophile
- a halide for a leaving group
- a carbonyl, nitro, or cyanide group *ortho* and/or *para* to the leaving group.

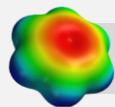
19



Produção de fenol via sal de diazônio

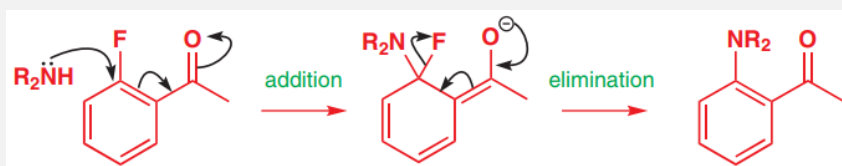
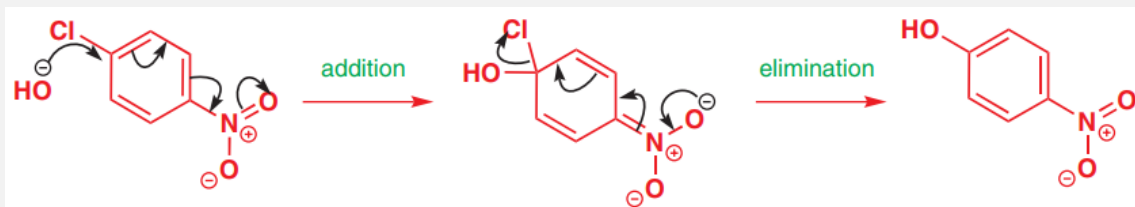


20

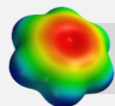


Reações com fenóis – S_NAr

- Produção de derivados fenólicos por S_NAr

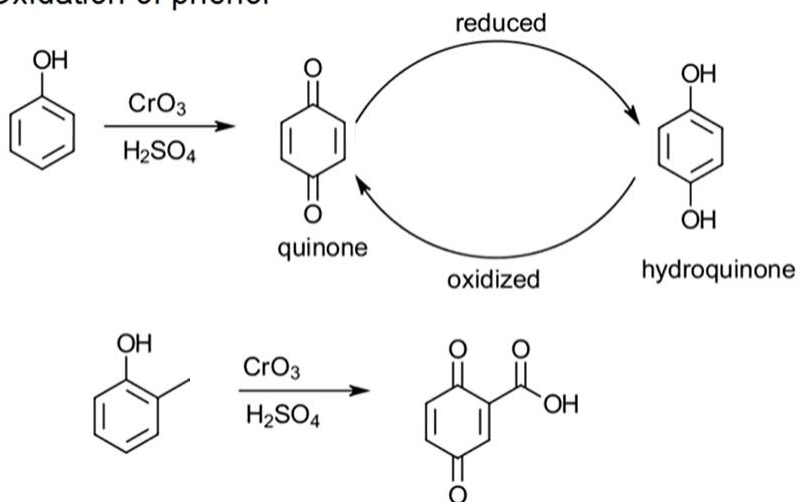


21

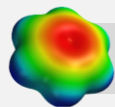


Oxidação do fenol

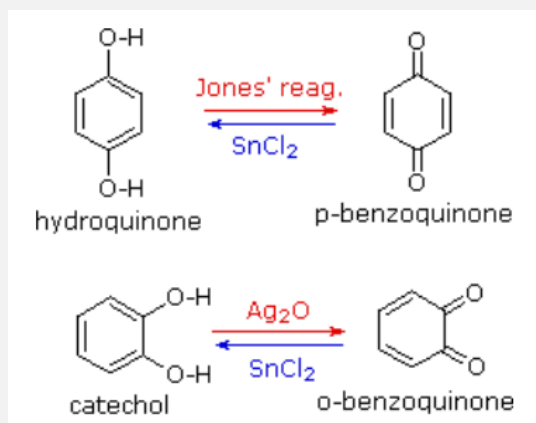
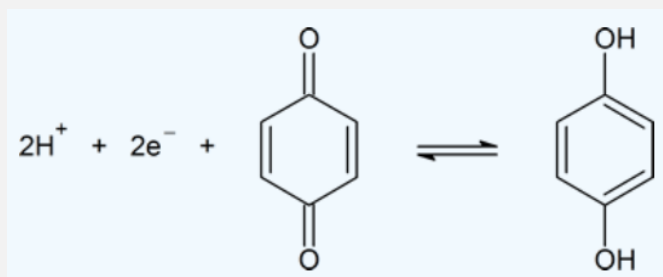
Oxidation of phenol



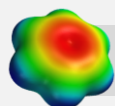
22



Redução: outra via de produção de fenóis



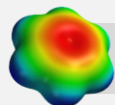
23



Funções de compostos fenólicos

- Vimos algumas aplicações: polímeros, fármacos, conservantes
- Reativos em condições oxidantes = antioxidantes
- Taninos = curtimento do couro
- Atividade microbiana
- Em plantas = proteção contra a luz solar

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Referências

- Solomons, T. W. G., & Fryhle, C. B. (2011). Organic chemistry. Hoboken, NJ: Wiley.
- Clayden, J., Greeves, N., & Warren, S. G. (2012). *Organic chemistry*. Oxford: Oxford University Press.
- <https://www.masterorganicchemistry.com/>
- https://chem.libretexts.org/Courses/Athabasca_University/Chemistry_360%3A_Organic_Chemistry_II/Chapter_17%3A_Alcohols_and_Phenols/17.09_Phenols_and_Their_Uses (17.9 e 17.10)