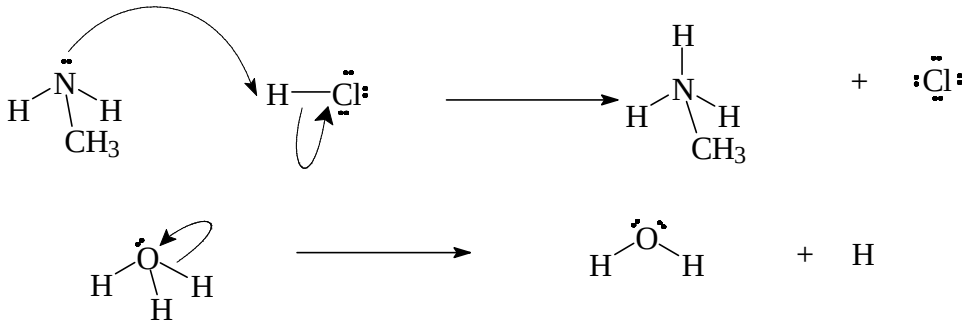
School of Chemistry

Chemistry 1B Advanced and SSP (CHEM1902/1904)

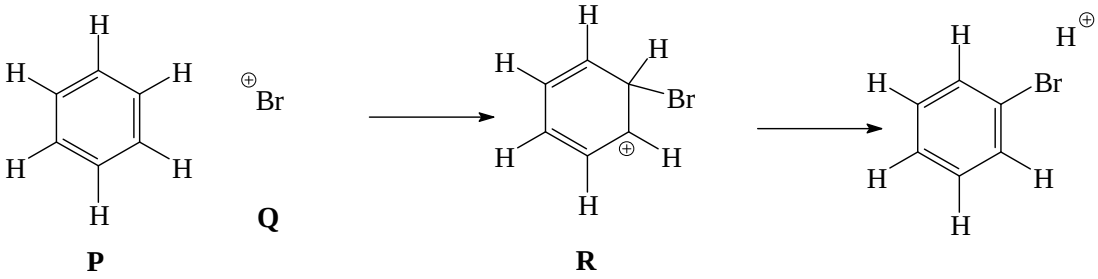
Problem Sheet 3

Work through the ChemCAL modules "*Alkenes, Benzene and Alkynes*" and "*Elimination and Electrophilic Addition Reactions*".

1. All atoms, bonds and lone pairs are shown in the structures below. Use your knowledge of valency and arrow notation to add formal charges, ⊕ and ⊖, on the structures where appropriate. Add partial charges (δ⊕ and δ⊖) to the neutral reagents.



2. Consider the reaction below:



P **Q** **R**

(a) Which species **P - R** is acting as the electrophile?

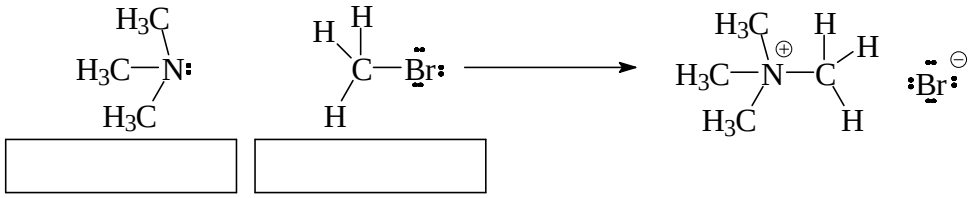
(b) Which species **P - R** is aromatic?

(c) Which species **P - R** is a carbocation intermediate?

(d) Draw in the curly arrows for this reaction.

(e) Classify this type of reaction.

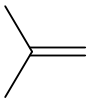
3. Classify the two starting materials (below) as electrophile, nucleophile or neither. What kind of reaction is this? Draw in appropriate partial charges $\delta\oplus$ and $\delta\ominus$ and curly arrows showing the mechanism of the reaction.



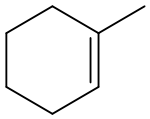
4. What is the major product in the following reactions?

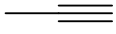
(a)  + Br_2 ⟶

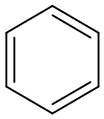
(b)  + HBr ⟶

(c)  + dilute H_2SO_4 ⟶

(d)  + H_2 $\xrightarrow{\text{Pd catalyst}}$

(e)  + HCl ⟶

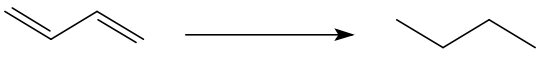
(f)  + 2HBr ⟶

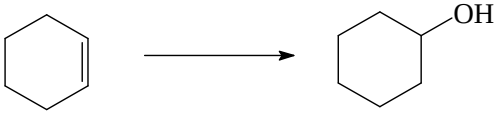
(g)  + Br_2 $\xrightarrow{AlBr_3 \text{ catalyst}}$

5. What reagent would effect the following changes?

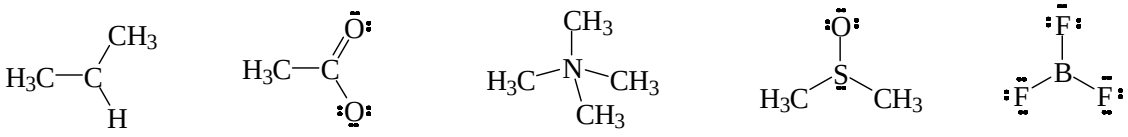
(a) 

(b) 

(c) 

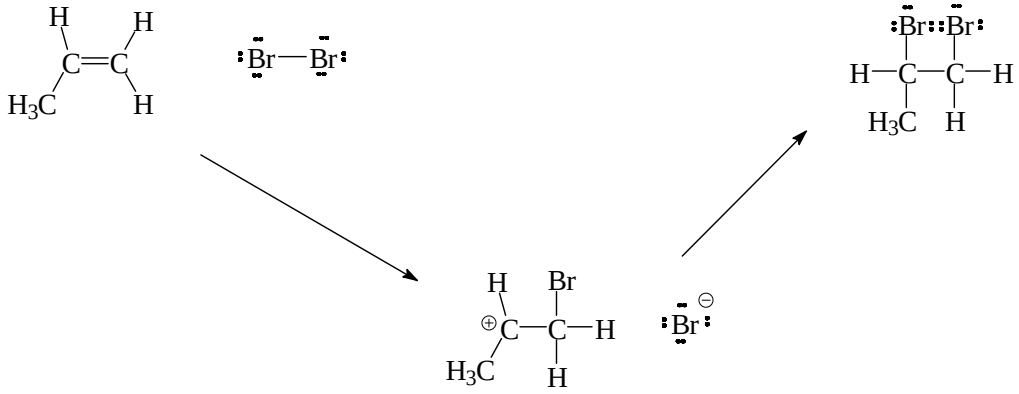
(d) 

6. All atoms, bonds and lone pairs are shown in the structures below. Add formal charges, $\oplus$ and $\ominus$, on the structures where it is appropriate.



7. Complete the mechanisms for the reactions below by inserting curly arrows to indicate the bonding changes that take place.

a.



b.