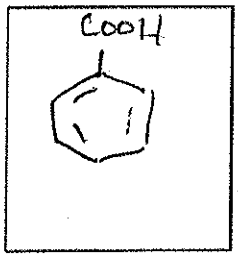
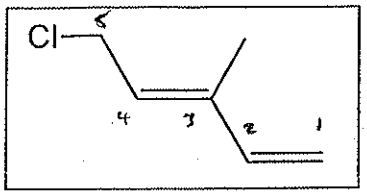
Your Name: Answers

2.1 Nomenclature (14 pts)

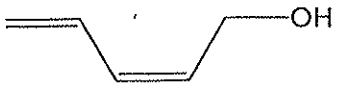
Name or provide the structure for the compounds below. Either IUPAC or common names are ok. (2 point each/14 pts total)



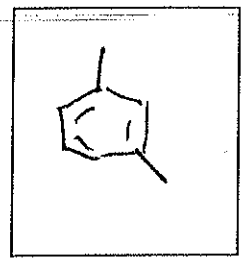
Benzoic acid



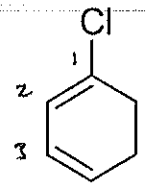
5-chloro-3-methyl-1,3-pentadiene



2,4-pentadien-1-ol

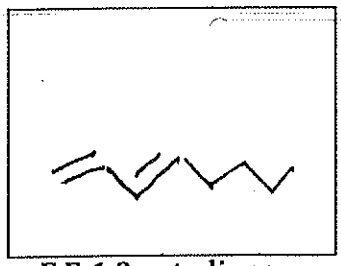


m-xylene



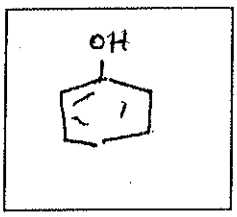
1-chloro-1,3-cyclohexadiene

(note: it's not a benzene structure)



E,E-1,3-octadiene

↑ Isn't E not logical

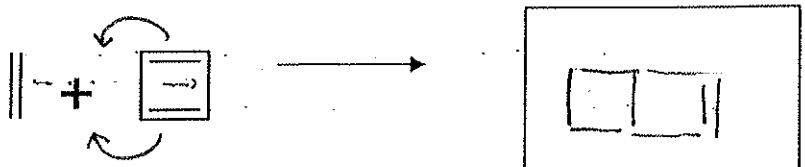


Phenol

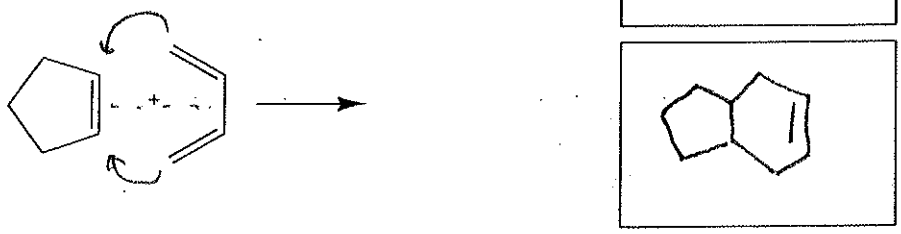
2.2. Diene cycloaddition chemistry (12 points)

Predict the products in the cycloadditions below: (3 pts per box)

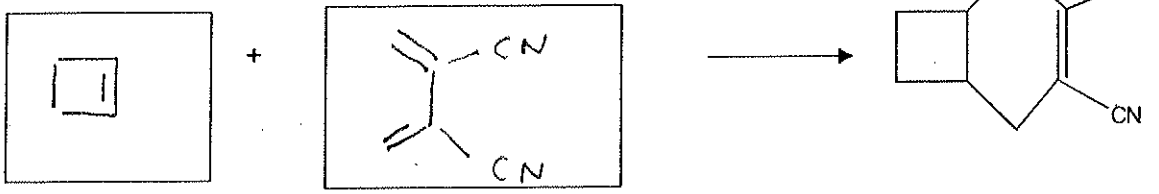
a)



b)



c)

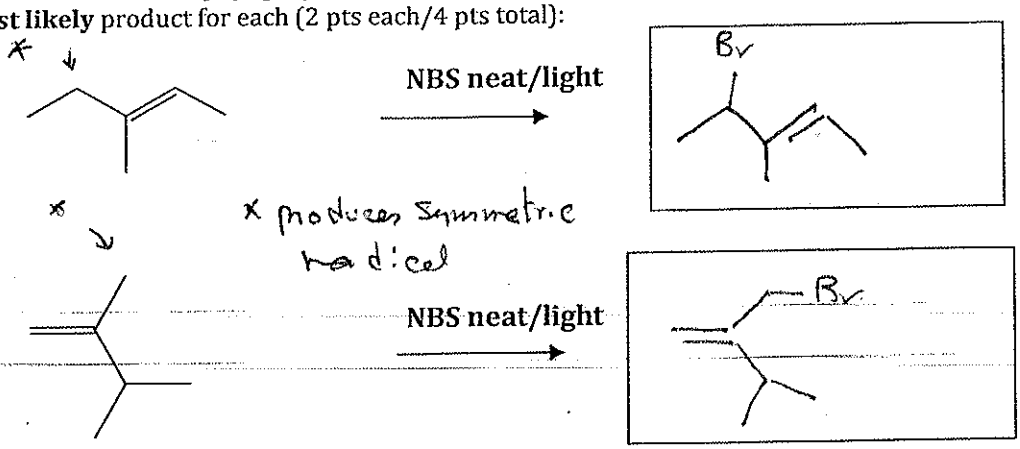


___/26

2.3. Classical Diene and Allyl Chemistry (24 pts)

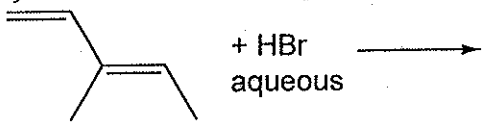
2.3.1. Allyl Radical chemistry (4 pts)

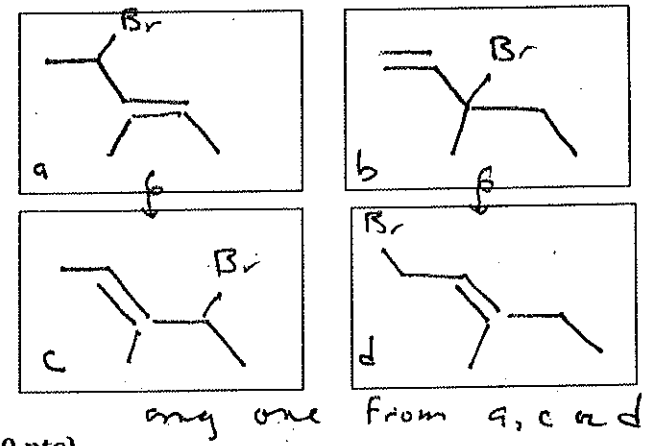
Predict the **most likely** product for each (2 pts each/4 pts total):



2.3.2. Carbocation diene chemistry (10 pts)

a) Predict all 4 unique monobromo addition products of the reaction below (2 pt each)





From primary Carbocations

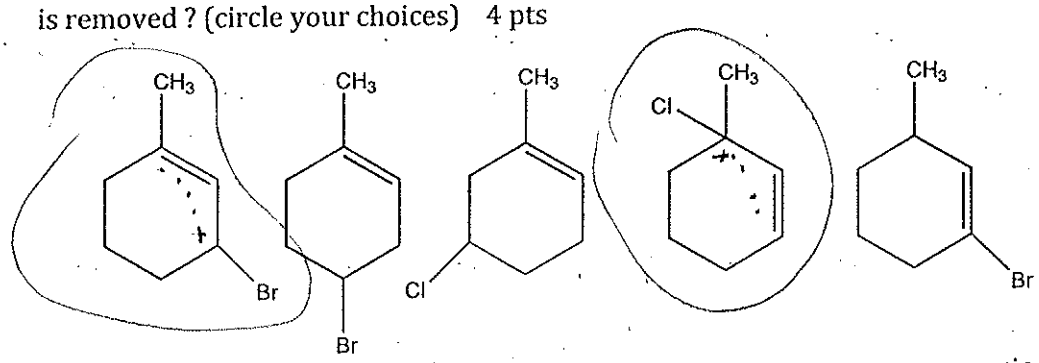
From allylic shifts

b) Circle the thermodnamically most stable one (2 pt)

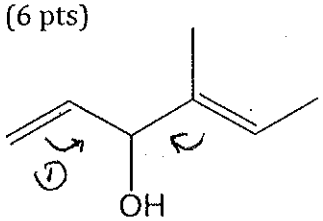
any one from a, c and d

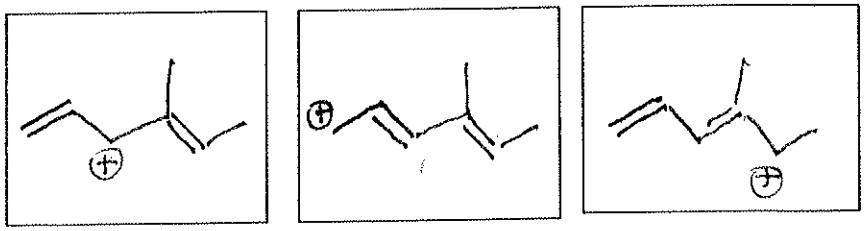
2.3.3 Allylic carbocation chemistry (10 pts)

a) Which two compounds below would have equivalent carbocations if the halogen anion (Cl^- or Br^-) is removed ? (circle your choices) 4 pts



b) Draw all the unique carbocations formed when the hydroxyl anion OH^- is removed from the compound below: (6 pts)





primary ① shift ② shift

/24

2.4 Aromaticity: the big picture (20 pts)

1) What 3 criteria must be met for a molecule to exhibit aromatic character ? (3 pts)

a) Rigidly flat

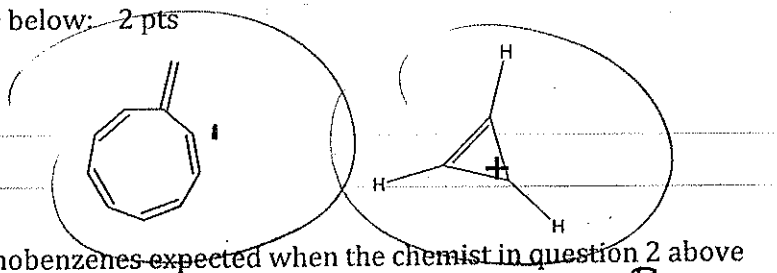
b) conjugation

c) obeys $4n+2 = \pi e^-$ count $n = 0, 1 \ldots$

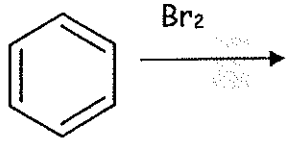
2) What 19th century chemist had a dram that is responsible for developing the current resonance picture of benzene ? Kekule (spelling counts) 1 pt

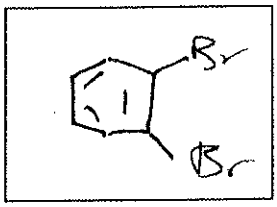
3) Circle all the aromatic compounds below: 2 pts

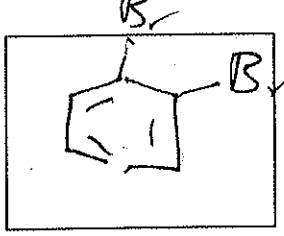
$CH_2=CH_2$ $CH_2=CH-CH_3$



4) Draw the two different 1,2-dibromobenzenes ~~expected~~ when the chemist in question 2 above assumed the fixed (static) structure drawn here: (2 pts)

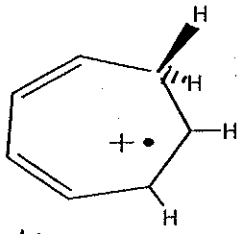




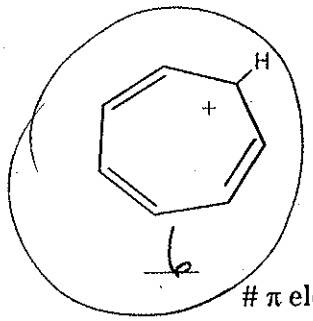


hypothetical 1,2-dibromo isomers

5) How many pi (π) electrons in the 4 systems shown: (4 pts)

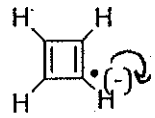


4

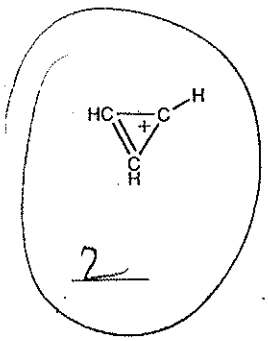


6

π electrons



4



2

6) circle the compounds in 5 above that are also aromatic (2 pts)

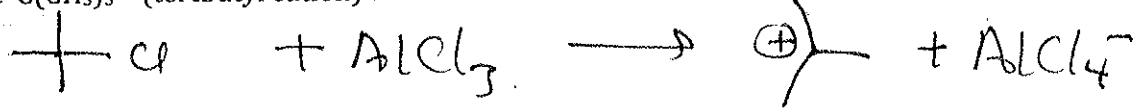
2.5. Aromatic, Electrophilic Reactions (36 pts)

2.5.1. Making Lewis acids for electrophilic aromatic substitution (3 pts each/9 pt total)

a) How do you make Br^+ ?

$$FeBr_3 + Br_2 \longrightarrow FeBr_4^- + Br^+$$

b) How do you make $C(CH_3)_3^+$ (tertbutyl cation) ?



c) How do you make NO_2^+

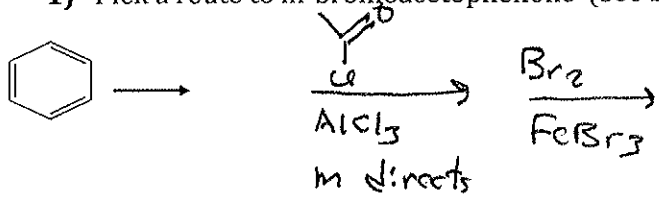
$$HNO_3 + HNO_3 \longrightarrow NO_2^+ + NO_3^- + H_2O$$

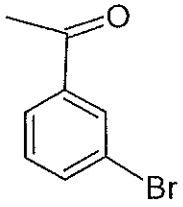
or

$$H_2SO_4 + HNO_3 \longrightarrow NO_2^+ + HSO_3^- + H_2O$$

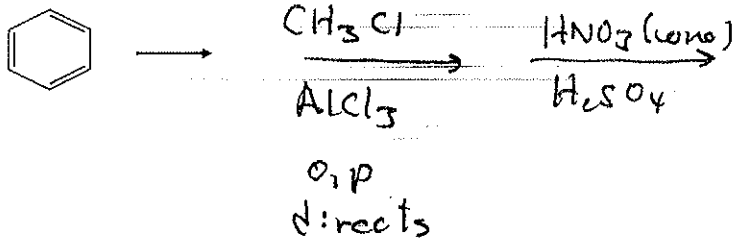
2.5.2 Multi-substituted aromatic syntheses (4 pts each/12 pts total)

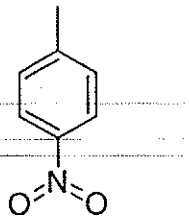
1) Pick a route to m-bromoacetophenone (See Director Properties table provided)



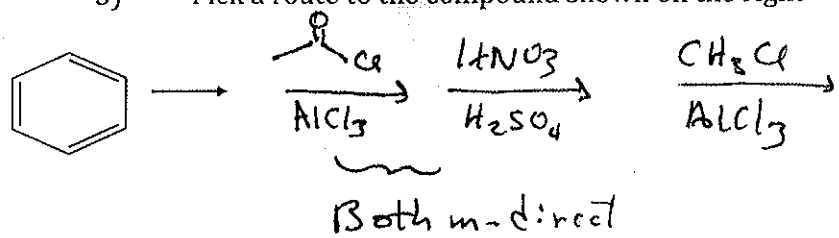


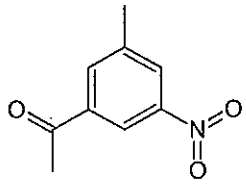
2) Pick a route to p-nitrotoluene





3) Pick a route to the compound shown on the right

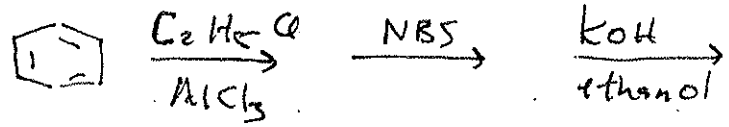


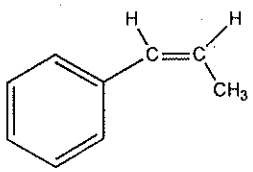


2.5.4 Building Hooks and Handles 5 pts each (15 points total)

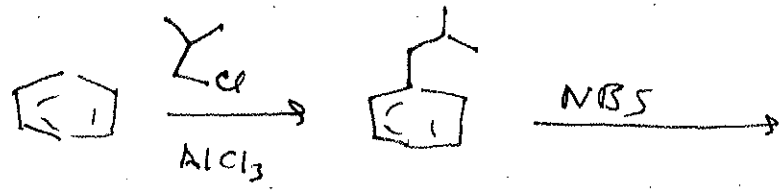
Starting from benzene, alkyl halides or acid chlorides find routes to:

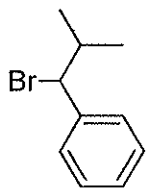
1)





2)





3)