**Exam 2: Chemistry 4524 \_\_\_\_/100 P 1/7**

**Your Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**2.1 Nomenclature (10 pts)**

Name or provide the structure for the compounds below. (1 point each/10 pts total)

**include E,Z**

****





**p-cresol \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**common name IUPAC (include E,Z)**



**p-xylene \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**common name aniline**



**Phenol**

**anthracene \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**common name**

**2.2. Diene cycloaddition chemistry** (8 points)

Predict the products in the cycloadditions below: (2 pts per box)





**c)**



**+**

**\_\_\_\_/18**

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**2.3. Classical Diene and Allyl Chemistry (12 pts)**

**2.3.1. Allyl Radical chemistry (2 pts)**

Predict the **most likely** product:



**NBS neat/light**

**2.3.2. Allylic carbocation chemistry (4 pts)**

a) Predict the unique alcohol products of the carbocation reaction below (2 pt each)



**+**

**2.3.3. Classic Diene Chemistry (6 pts)**

a) Predict the unique monobromo addition products of the carbocation- based reaction below (1 pt each)



b)The diene below undergoes radical substitution of the indicated H atoms when a low concentration of Br2 is added along with uv light . Predict all the monobromo-substitution products. (3 pts)





1. One of the products above is expected to be most likely to form because of symmetry. Circle it (1 pt)

**\_\_\_\_\_\_\_\_/12**

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**2.4 Aromaticity: the big picture (10 pts)**

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

a) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

c) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2) Circle all the aromatic compounds below: 2 pts



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

lone pair in sp2





lone pair in

un-hybridized

p orbit above plane

of C8H8- anion



sp3



sp3

-





(-)

\_\_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_\_ \_\_\_\_\_\_\_

# π electrons

5) circle the compound(s) in above that is/are also aromatic (1 pt)

**2.5. Aromatic, Electrophilic Reactions (30 pts)**

**2.5.1. Making Lewis acids for electrophilic aromatic substitution (1 pt each/2 pts total)**

a) How do you make CH3+ ?

b) How do you make HSO3+?

**2.5.2 One Step Programs (4 pts)**

Given the directing properties by each group, provide the most likely **one step reaction** to the  **o,p**



compounds on the right: (2 pts each/4 pts total)

**o,p**

**m**

**m**



**o,p**

**o,p**

\_\_\_\_\_\_\_\_/16

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**2.5.3. Two step program (3 pts)**

Given the directing properties by each group, provide the most likely **two step reaction** to the

compound on the right:



**m**

**o,p**

**m**

**2.5.4. Aromatic Reaction Boxing (21 points)**

1)



2)



+

3)



4)





5)



6)

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7)



8)



9)



**AlCl3**



11) **2 +**

remember that t-butyl is o,p directing

12)



13)



14)



N2H4/OH-

15)



**n**

**name me : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**w/light**

**\_\_\_/10**

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

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



1)



2)

Beware of

rearrangements !

1. Starting from bromobenzene (shown below) and any other compounds you might need, suggest a route to phenyl ethanol





phenyl ethanol

**2.5.6 Reactions to Alcohols (15 pts)**



**1)**

**+**



**2)**

**3)**



**4)**



**+**

**\_\_/22**

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**5)**

**6)**



**7)**





**8)**

**\_\_\_/8**