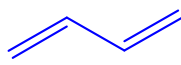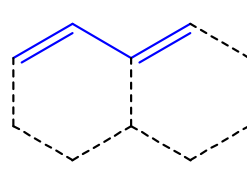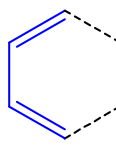1. Use the Woodward-Fieser table to estimate the λ_{max} observed in a UV spectra of the following cross-conjugated systems (6 pts)
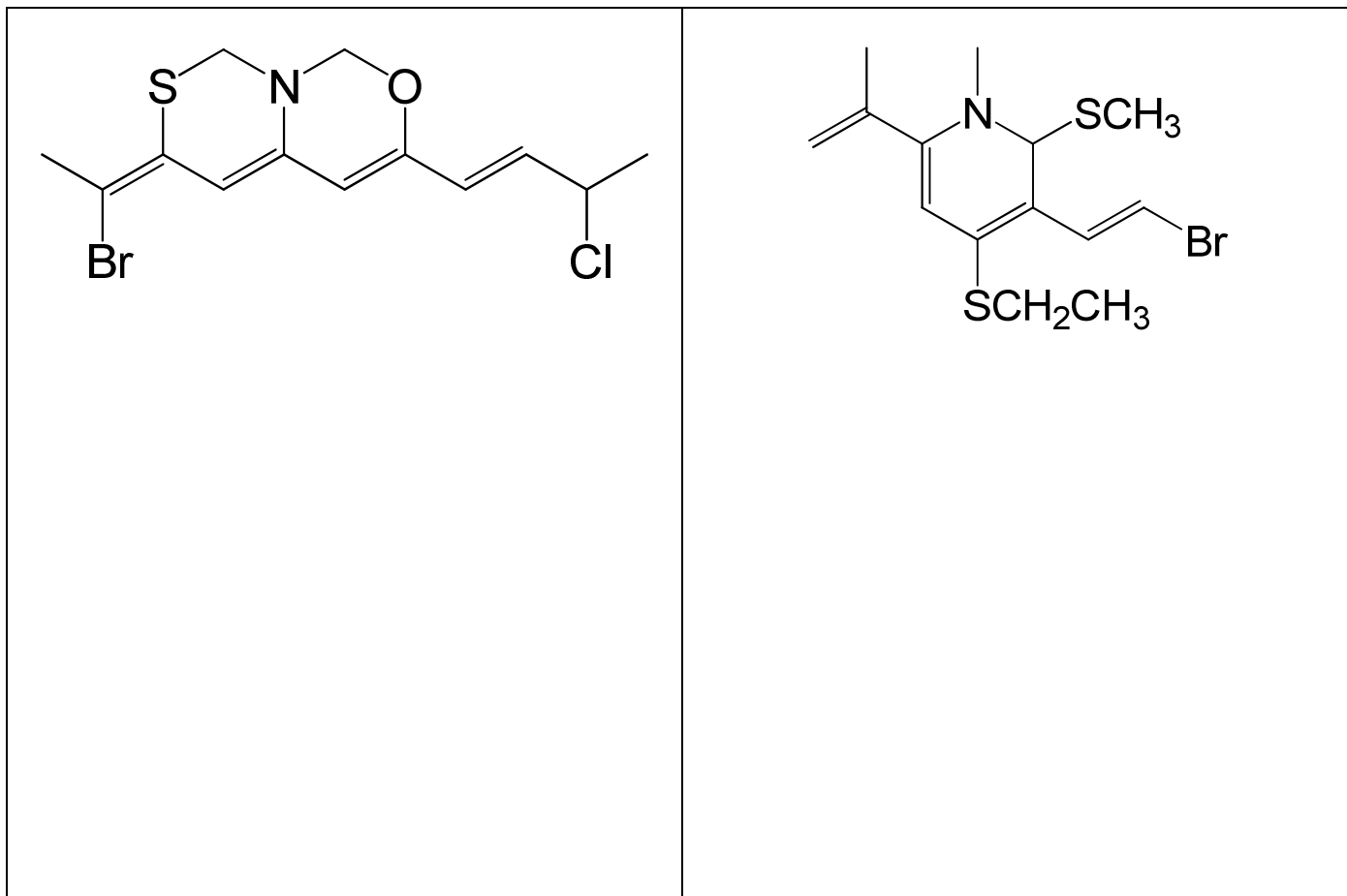
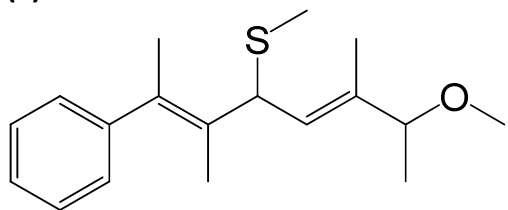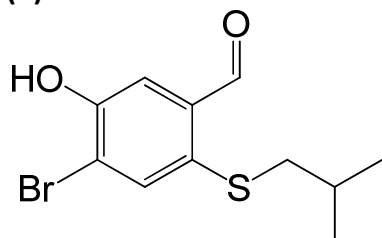| Acyclic		217 nm
Heteroannular		214 nm
Homoannular		253 nm

For each additional conjugated double bond	+ 30 nm
For each exocyclic double bond	+ 5 nm
For each substituent C-substituent Cl Br O-Alkyl OCOCH$_3$ N(alkyl)$_2$ S-alkyl	 + 5 nm + 5 nm + 5 nm + 6 nm + 0 nm + 60 nm + 30 nm
Solvent correction	+ 0 nm

2. Name the following compounds (3 x 6 = 18 pts)
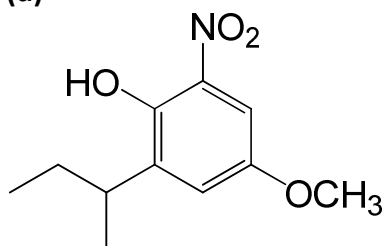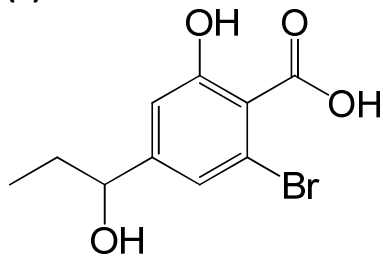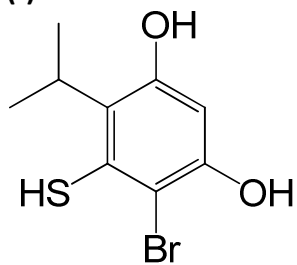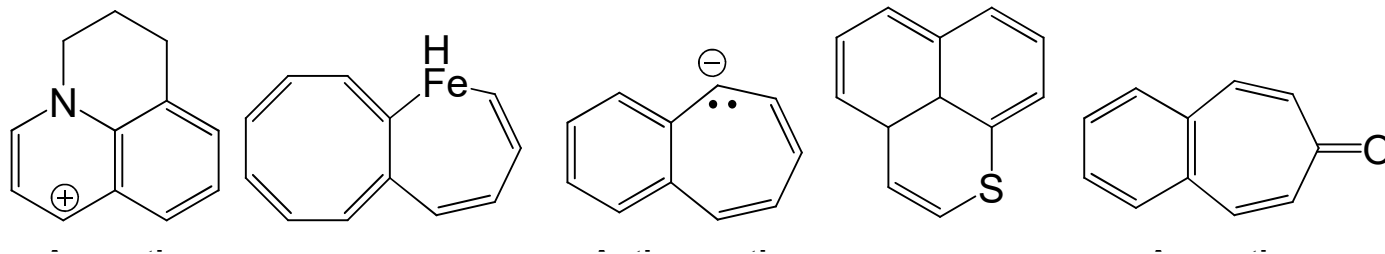
(a)

(b)

(c)
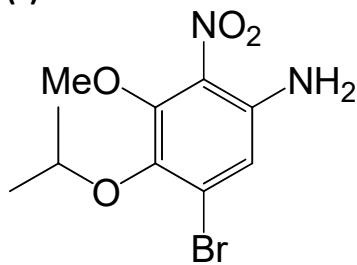
(d)

(e)

(f)

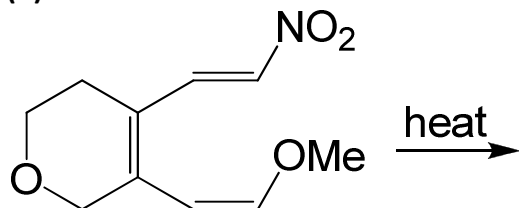3. Classify the following molecules as aromatic, anti-aromatic or non-aromatic (5 pts)

4. Predict the major product(s) expected from the following reaction sequences (3 x 14 = 42 pts)
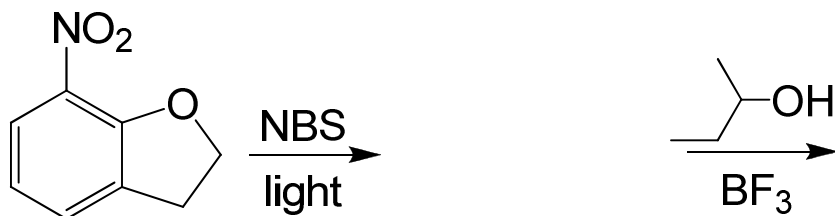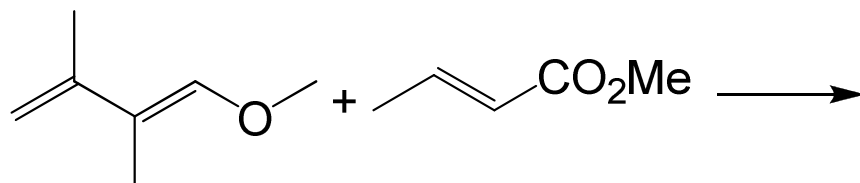
(a)

Br

$\xrightarrow[\text{H}_2\text{SO}_4]{\text{xs HNO}_3}$

$\xrightarrow[\text{pressure}]{\text{NaOH}}$

(b)

NO$_2$

OMe

$\xrightarrow{\text{heat}}$

(c)

$\xrightarrow[\text{CuCl, AlCl}_3]{\text{CO + HCl}}$

$\xrightarrow[\text{1/2 I}_2]{\text{HNO}_3}$

(d)

NO$_2$

$\xrightarrow[\text{light}]{\text{NBS}}$

OH

$\xrightarrow{\text{BF}_3}$

(f)

$$\xrightarrow{HF}$$

$$\xrightarrow[\text{H}_2\text{SO}_4]{\text{Na}_2\text{Cr}_2\text{O}_7}$$

(g)

$+$ CO$_2$Me $\longrightarrow$

(h)

OCH$_3$

$$\xrightarrow[\text{AlCl}_3]{}$$

$$\xrightarrow[\text{HCl}]{\text{Zn(Hg)}}$$

(i)

NHCH$_3$

OH

$$\xrightarrow[\text{BF}_3]{}$$

$$\xrightarrow[\text{BBr}_3]{\text{Br}_2}$$

(j)

$+$ $\longrightarrow$

(k)

$$\xrightarrow[\text{AlCl}_3]{\text{Cl}_2}$$

$$\xrightarrow[\text{D}_2\text{SO}_4]{\text{D}_2\text{O}}$$

(l)

$$\xrightarrow[\text{HCl}]{\text{NaNO}_2}$$

$$\xrightarrow{\text{CuCN}}$$

(m)

$$\xrightarrow[\text{NH}_3, -33^\circ\text{C}]{\text{NaNH}_2}$$

(n)

$$\xrightarrow[\text{conc}]{\text{KMnO}_4}$$

$$\xrightarrow[\text{CH}_3\text{CH}_2\text{OH}]{\text{Na, NH}_3}$$

(o)

$$\xrightarrow[\text{BF}_3]{\triangleright\text{—OH}}$$
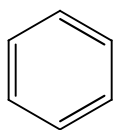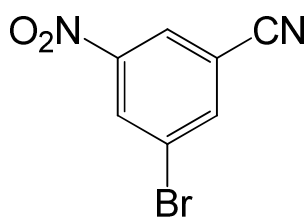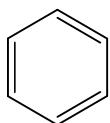
$$\xrightarrow[\text{HCl}]{\text{Zn}}$$
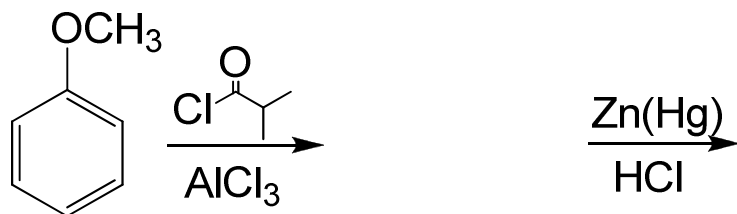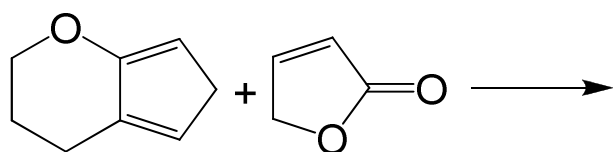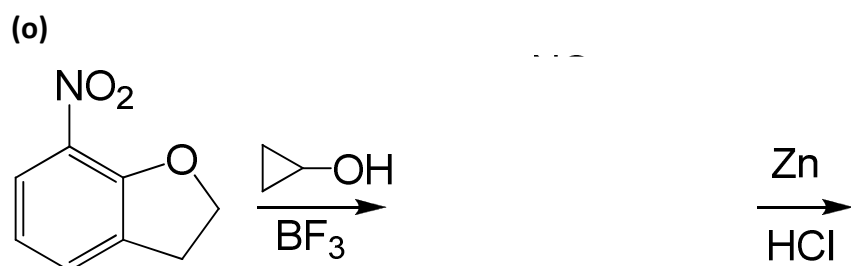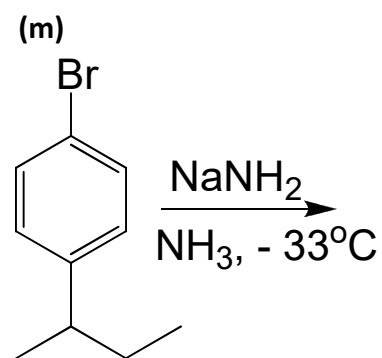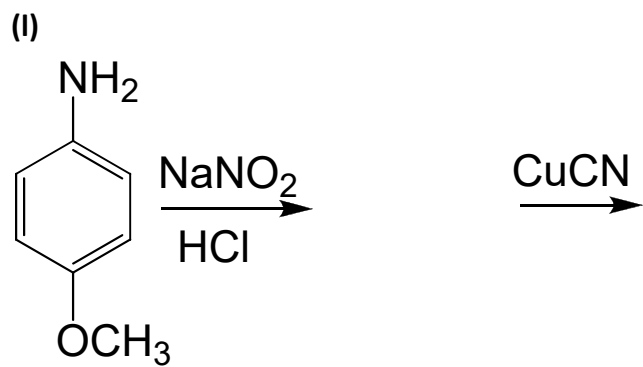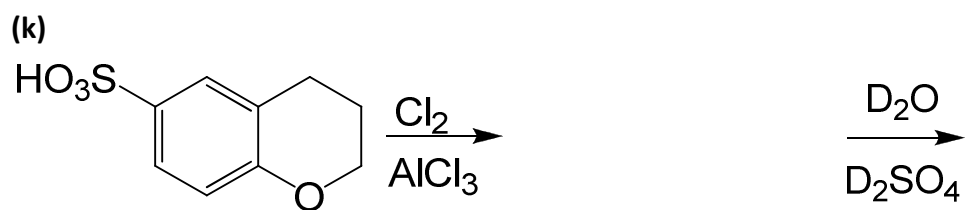
5. Show how you would synthesize each of the following compounds from the given starting material(s). You must draw keys intermediates to receive full credit (3 x 6 = 18 pts)
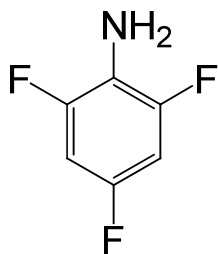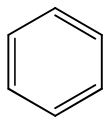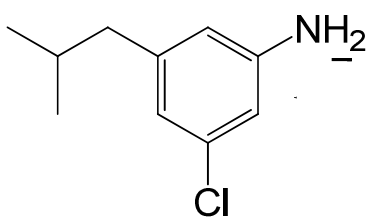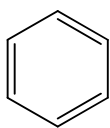
(a)
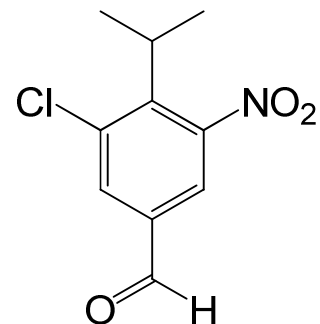
(b)

(c)

(d)

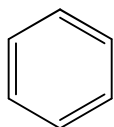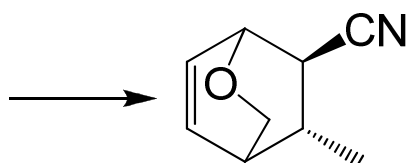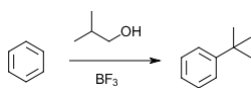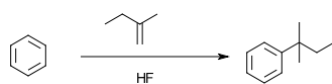**(e)**
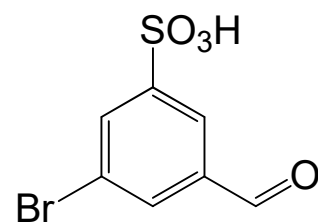
(f)

6. Propose a mechanism consistent with the following reactions (you must show all the intermediates to receive full credit) (3 x 3 = 9 pts)

(a)

(b)

(c)