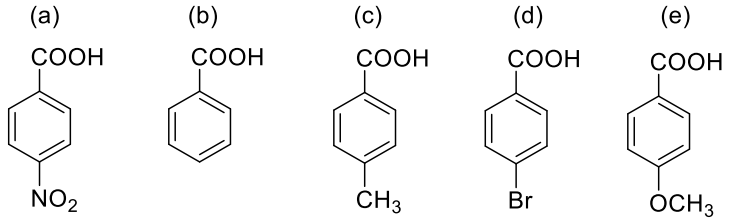
Organic Chemistry (2nd semester)

examination (Friday, Jun. 18th, 2021, 8:00 ~ 10:10)

Name: _____ ; Student ID number: _____ ; Score: _____/328

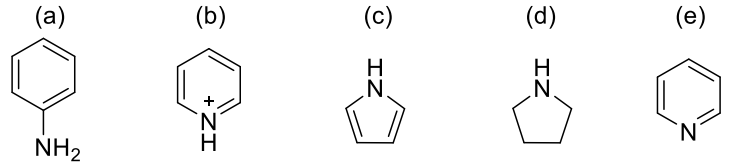
1. Rank the following acids in order of decreasing acidity. (5 point)



(A) e > c > b> d > a (B) c > e > d > a > b (C) e > c > b > a > d

(D) a > d > b > c > e (E) a > b > d > c > e

2. Rank the following compounds in order of decreasing basicity. (5 point)

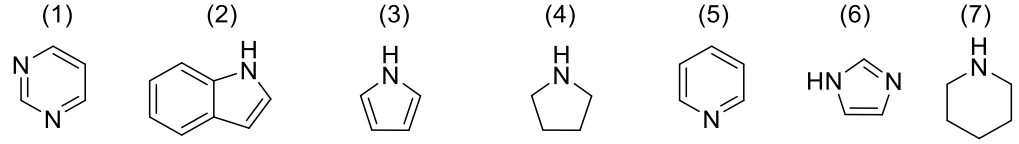


(B) e > c > a > b > d (B) b > c > a > e > d (C) d > e > a > c > b

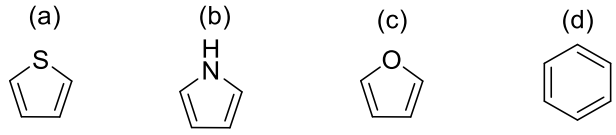
(D) e > a > c > d > b (E) d > a > e > c > b

3. Match the names of the following compounds with their structures. (3 point each)

(A) pyrimidine (B) imidazole (C) piperidine (D) pyrrole (E) pyrrolidine



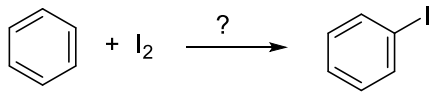
4. Rank the reactivity order toward electrophilic aromatic substitution for the following compounds (5 point)



(A) b > a > c > d (B) d > b > a > c (C) d > a > c > b (D) c > a > b > d

(E) b > c > a > d

5. Select the correct reagent and conditions of the following reaction. (5 point)



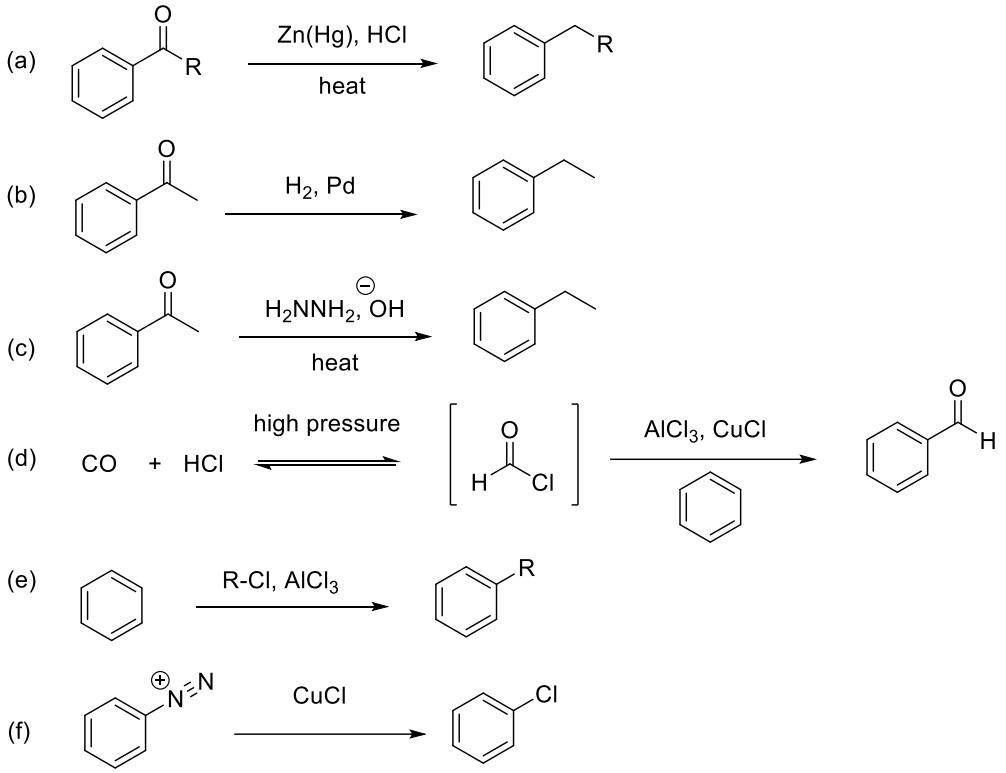
(A) HOAc, HCl (B) H_2O_2, H_2SO_4 (C) Fe, NaCl (D) $NaNO_2$, HI

(E) H_2O_2, NaOH

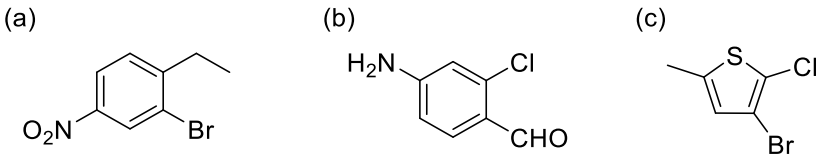
6. Indicate the names to the following reactions. (3 point each)

(1) Clemmensen reduction (2) Gatterman-Koch Reaction (3) Friedel-crafts alkylation

(4) Catalytic Hydrogenation (5) Sandmeyer reaction (6) Wolff-Kishner reduction



7. Give **systematic names** to the following compounds. (5 point each)



8. Provide correct structures of the following compounds. (5 point each)

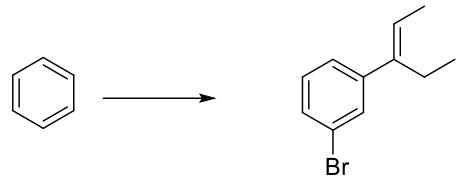
(a) 3-hydroxynitrobenzene

(b) 2-bromo-4-iodophenol

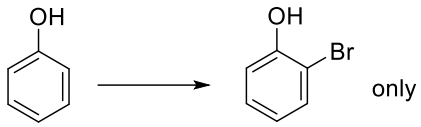
(c) *N*-ethyl-*N*-methyl-3-hexanamine

9. Design a multi-step synthesis to show how each compounds could be prepared from the given starting material. Show all necessary reagent(s) and also **intermediate(s)**. (20 point each)

(a)

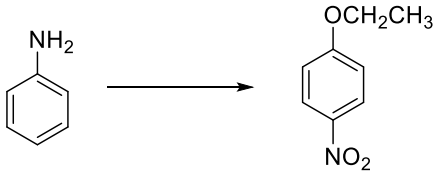


(b)

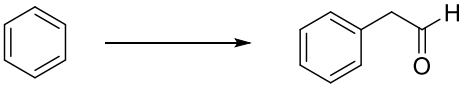


only

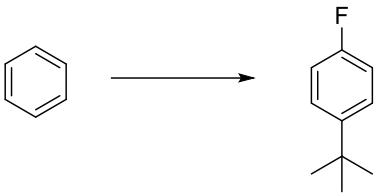
(c)



(d)

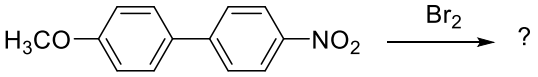


(e)

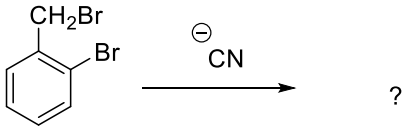


10. Complete each of following reactions by providing **major product**. (8 point each)

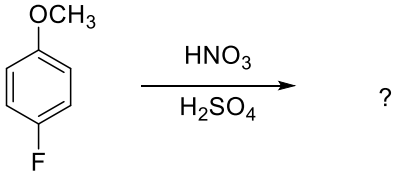
(a)



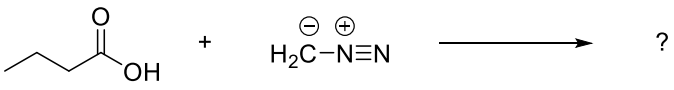
(b)



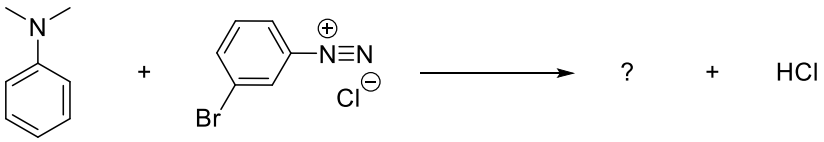
(c)



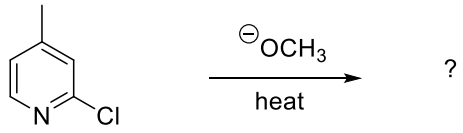
(d)

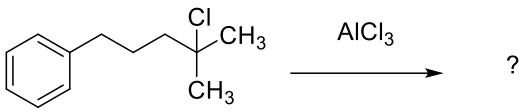


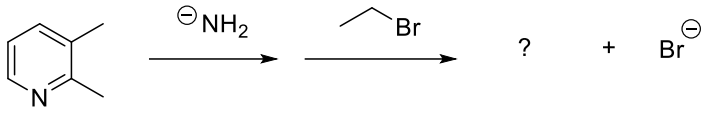
(e)

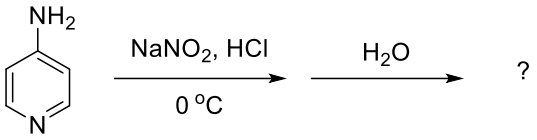


(f)

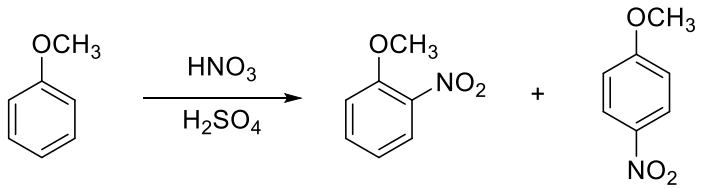
(g) 

(h) 

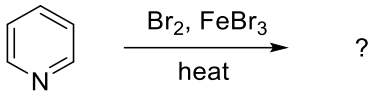
(i) 

(j) 

11. Propose mechanisms for the nitration to an anisole, Draw the resonance forms of each sigma complex to explain why the reaction undergoes ortho and para attack. (20 points)



12. Propose mechanisms for pyridine reacts with bromine and expect the product. Draw the resonance forms of each sigma complex and compare their stabilities. (15 points)



13. When 1,2-dibromo-3,5-dinitrobenzene is treated with excess NaOH at 50 ºC, only one of the bromine atoms is replaced. Draw the product you expect (5 point) and give a mechanism (include resonance forms) to explain the selectivity. (10 points)

14. Propose a reasonable mechanism for the following reaction. (15 point)