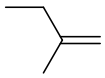
[有機化学基礎]

以下の問（１）～（４）に答えよ.

（１）分子式 C_5H_{10} からなる化合物 **1** およびその異性体について，問(a)～(e)に答えよ.



1

(a) 化合物 **1** の異性体の中で環構造を持たない化合物の構造を全て描き，それぞれを命名せよ．幾何異性体については *E* /*Z* 命名法を用いること.

(b) 化合物 **1** をオゾンと反応させ，H_2/Pd による後処理を行った際に生じる２つの生成物の構造を描け.

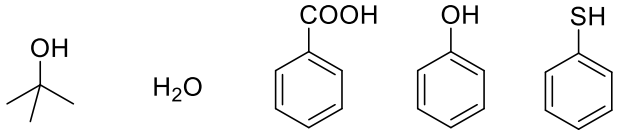
(c) 化合物 **1** の異性体のうち光学活性を持つ化合物の構造を１つ描き，そのすべての不斉中心について *R* /*S* 表示法による絶対配置を示せ.

(d) 化合物 **1** に CF_3COOOH を作用させたのち，塩基性条件下で NaBr を反応させた際の主生成物の構造を描け．立体異性体は考慮しなくてよい.

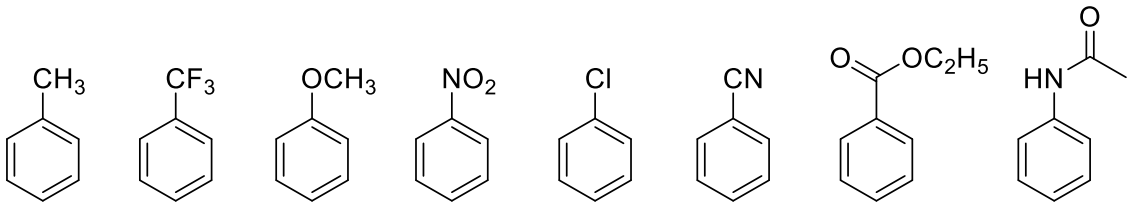
(e) 化合物 **1** に水中で Br_2 を反応させた際の主生成物の構造を描け. 立体異性体は考慮しなくてよい.

（２）以下に示す問(f), (g)に答えよ.

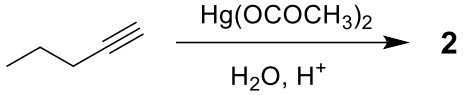
(f) 以下の化合物について，水中での pK_a が小さいものから順に左から右へ並べよ.



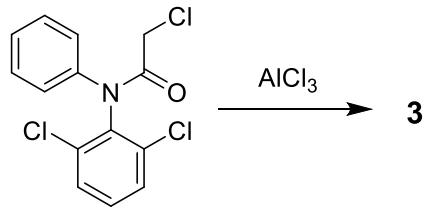
(g) 次の化合物の中から，HNO_3/H_2SO_4 によるニトロ化反応において，メタ位が優先的にニトロ化されるものを全て選べ.



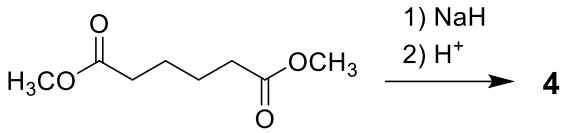
（３） 以下に示す反応(h)～(k)について，主生成物 **2**～**5** の構造を描け.

(h) 

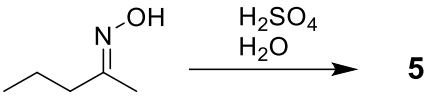
2

(i) 

3

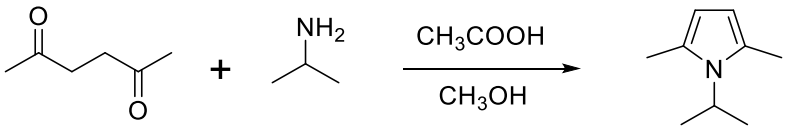
(j) 

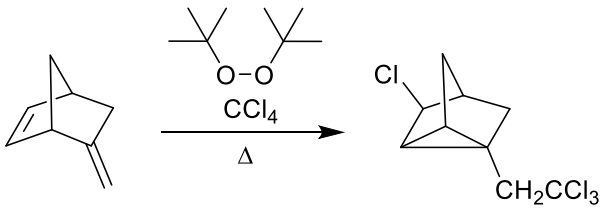
4

(k) 

5

（４） 以下に示す反応(l), (m)について，電子の移動を表す巻矢印表記法を用いて，可能な中間体の構造を二つ以上示しつつ合理的な反応機構を示せ.

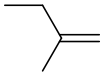
(l) 

(m) 

[Organic Chemistry: Basic]

Answer problems (1) through (4).

(1) Answer problems (a)–(e), regarding the compound **1** and its isomers having the molecular formula of C_5H_{10}.



1

(a) Draw the chemical structures of all isomers of **1** that do not have a ring structure, and name them. For geometrical isomers, use *E* /*Z* nomenclature.

(b) Draw the chemical structures of the two products that form from **1**, after reaction with ozone and a work-up using H_2/Pd.

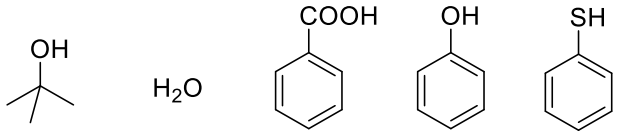
(c) Draw a chemical structure of an isomer of **1** that is optically active. Specify the absolute configuration of each chiral center using *R* /*S* convention.

(d) Predict the main product when **1** is reacted with CF_3COOOH, followed with NaBr under basic conditions. You do not need to consider stereoisomers.

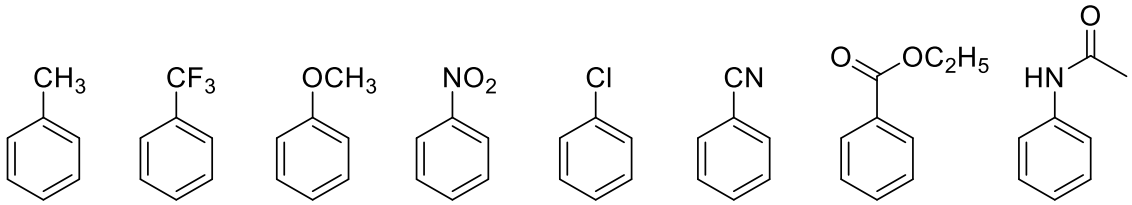
(e) Predict the main product when **1** is reacted with Br_2 in water. You do not need to consider stereoisomers.

(2) Answer problems (f) and (g).

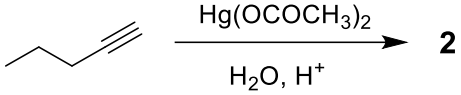
(f) List the compounds shown below in the order of their pK_a values in water (low to high) from left to right.



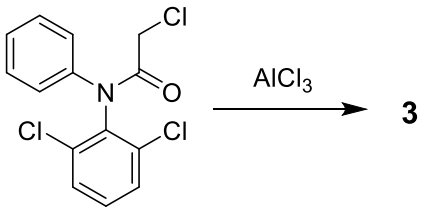
(g) Among the following compounds, choose all that show *meta*-selectivity in the nitration with HNO_3/H_2SO_4.



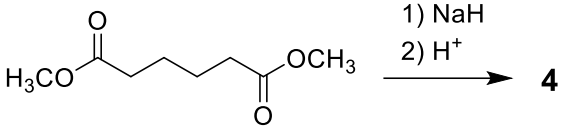
(3) Predict the main products **2**–**5** of the following reactions (h)–(k).

(h) 

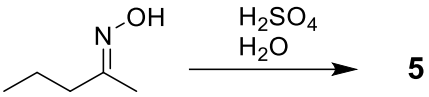
2

(i) 

3

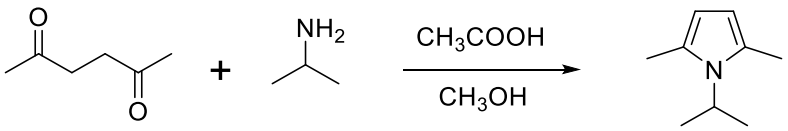
(j) 

4

(k) 

5

(4) Show the reasonable reaction mechanisms of the following reactions (l) and (m), using the curved arrow formalism. For each reaction, specify two or more possible intermediates.

(l) 

(m)