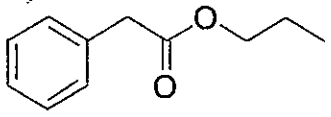
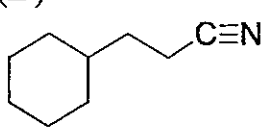
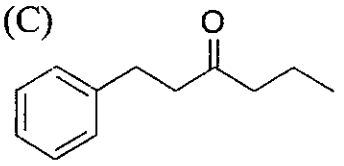
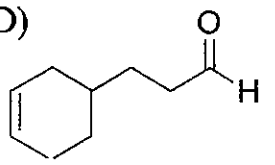
(1) Which of the following will not undergo catalytic reduction in the presence of H_2 and metal catalyst? (3%)

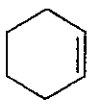
(A) 

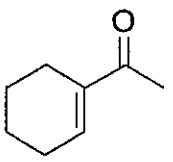
(B) 

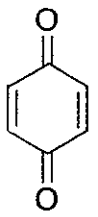
(C) 

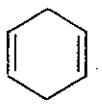
(D) 

(2) Which of the following compounds would show the longest wavelength λ_{max} in its UV spectrum? (3%)

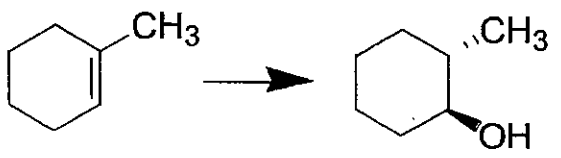
(A) 

(B) 

(C) 

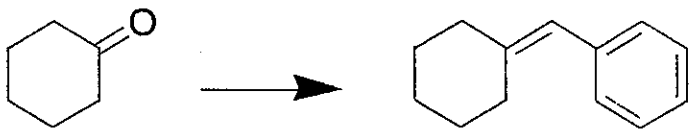
(D) 

(3) The best reagents for accomplishing the below transformation are: (3%)



(A) 1. OsO_4, pyridine; 2. $NaHSO_3$, H_2O
(B) 1. $Hg(OAc)_2$, H_2O; 2. $NaBH_4$
(C) 1. RCO_3H, CH_2Cl_2; 2. H_3O^+
(D) 1. BH_3, THF; 2. H_2O_2, –OH

(4) Choose the *BEST* reagent for carrying out each of the following conversions. (3%)



(A) $(C_6H_5)_3P{=}CHC_6H_5$, THF
(B) 1. $PhCH_2MgBr$, ether; 2. H_3O^+
(C) 1. PhMgBr, ether; 2. H_3O^+
(D) $Li(C_6H_5)_2Cu$, ether

(5) Which of the following methods of preparation of amines can be used to prepare primary, secondary, and tertiary amines? (3%)

(A) reduction of a nitrile
(B) Gabriel synthesis from an alkyl halide
(C) reduction amination of a ketone
(D) Hofman rearrangement of an amide

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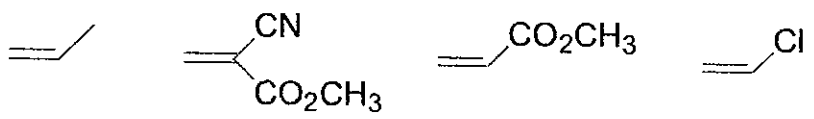
(6) Rank the following monomers in order of *increasing* reactivity toward anionic polymerization (least reactive to most reactive). (3%)

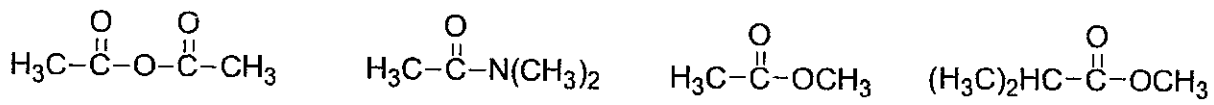
(I) (II) (III) (IV)



(A) III, II, IV, I (B) II, III, I, IV (C) I, IV, III, II (D) IV, III, II, I

(7) What is the order of *decreasing* reactivity towards nucleophilic acyl substitution for the carboxylic acid derivatives? (most reactive first) (3%)

(I) (II) (III) (IV)

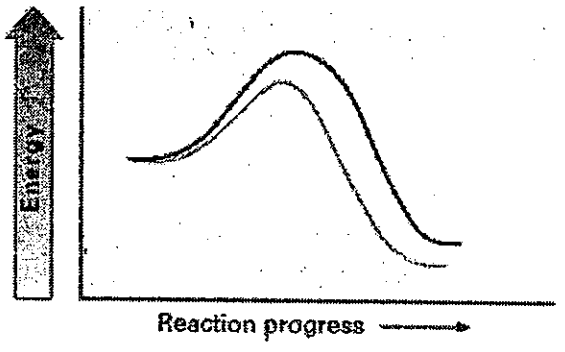


(A) I, II, III, IV (B) I, III, IV, II (C) II, IV, III, I (D) II, I, III, IV

(8) Which of the following could successfully undergo a Friedel-Crafts alkylation? Assume an appropriate catalyst. (3%)

(A) chlorobenzene reacting with benzene
(B) 2-chloroethene reacting with benzene
(C) 2-chloropropane reacting with benzaldehyde
(D) 2-chlorobutane reacting with benzene

(9) Consider the two lines shown on the energy diagram below. In an S_N2 reaction, these compare the effect of the: (3%)



(A) substrate.
(B) nucleophile.
(C) leaving group.
(D) solvent.
(E) nucleophile or solvent
(F) substrate or leaving group

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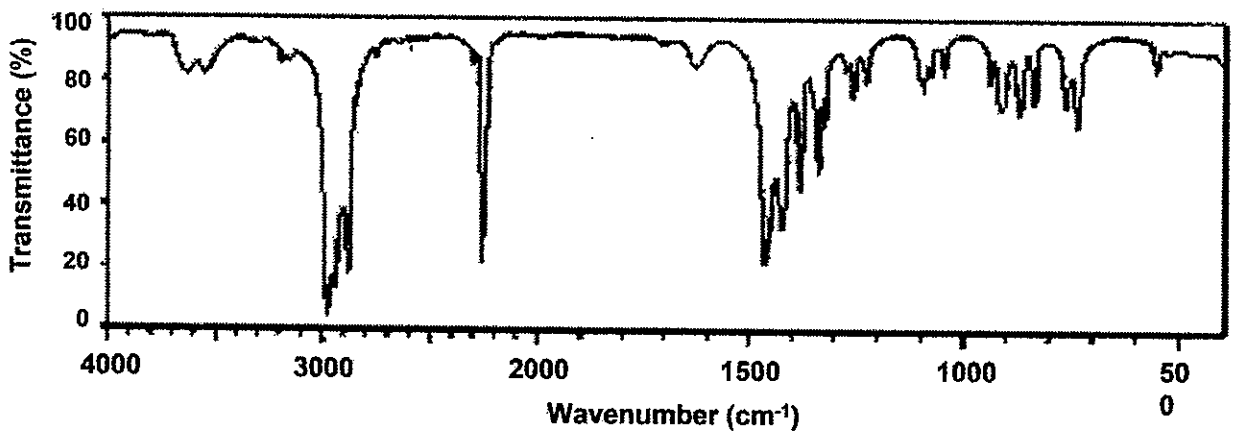
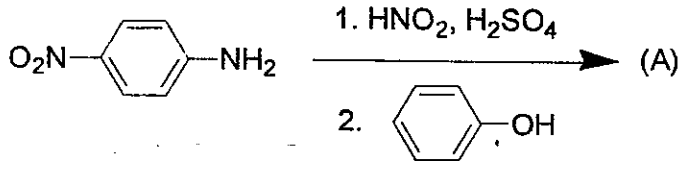
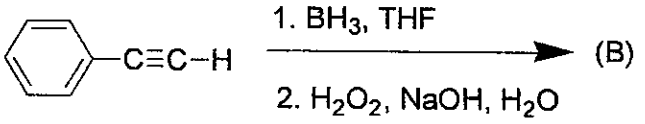
(10) The following spectrum is representative which of the following types of compounds? (3%)

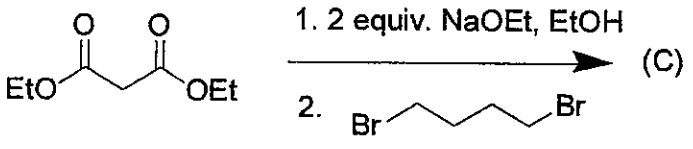


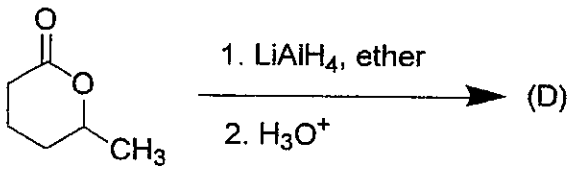
(A) nitrile
(B) aldehyde
(C) carboxylic acid
(D) alcohol
(E) halide

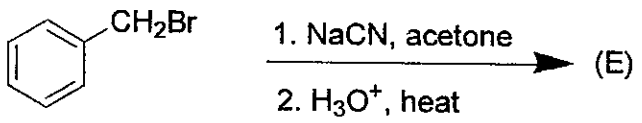
(11) Please provide the structure of the major product(s) in the reactions below. (40%, 5% each)

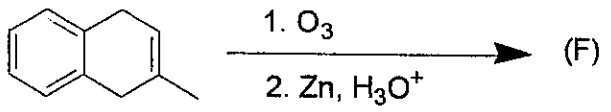


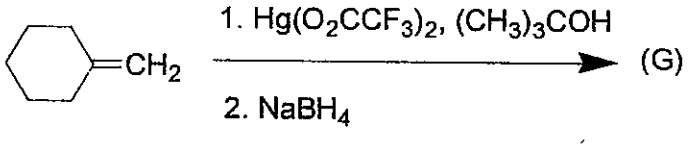


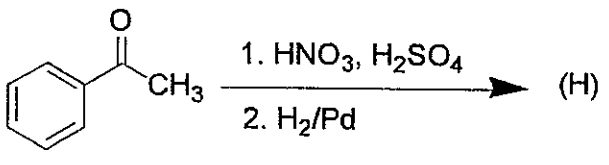












(12) Draw structures corresponding to each of the given names. (12%, 3% each)
(A) (2*E*,4*E*)-5-ethyl-6-methyl-2,4-heptadiene
(B) N-methyl pyrrole
(C) 1-ethynyl-2-methylcyclopentane
(D) 3,4-diethylcyclohexanoic acid

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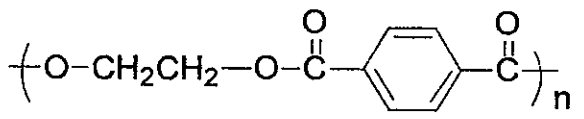
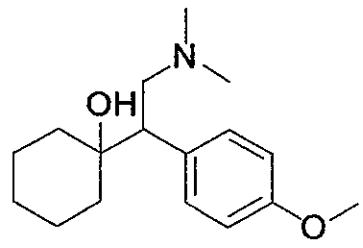
(13) Poly(ethylene terephthalate), PET, is the polymeric material of Mylar® and Dacron®. What are the monomers from which PET is prepared? (6%)



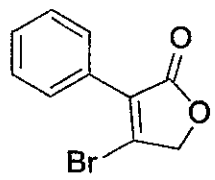
PET

(14) What Grignard reagent and carbonyl compound can be used to prepare the antidepressant venlafaxine (trade name Effexor)? (8%)



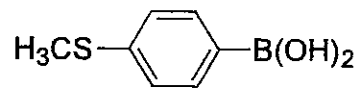
venlafaxine

(15) One step in the synthesis of the nonsteroidal anti-inflammatory drug rofecoxib (trade name Vioxx) involves Suzuki coupling of A and B. What product is formed in this reaction? (4%)



A

+



B

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