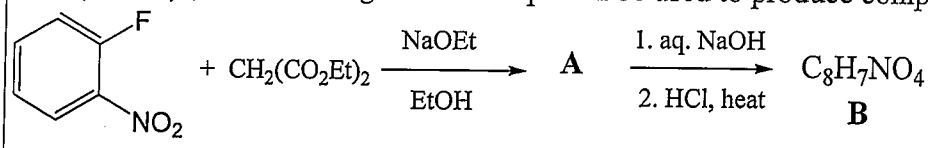
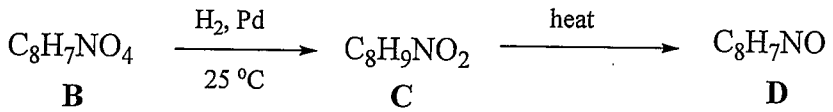
國立中山大學106學年度碩士暨碩士專班招生考試試題

科目名稱：有機化學【材光系碩士班甲組】　　題號：439003

※本科目依簡章規定「不可以」使用計算機(問答申論題)　　

1. (Total: 30%) Starting from the substitution reaction between *o*-nitrofluorobenzene and diethylmalonate ($CH_2(CO_2Et)_2$, the following reaction steps can be used to produce compounds A, B, C and D.





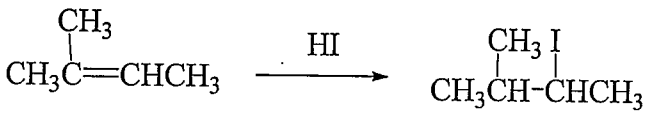
(a) Give structures for compounds A, B, C and D. (20%, each 5%)

(b) Instead of single substitution reaction step, the reaction between *o*-nitrofluorobenzene and diethylmalonate actually involved two mechanistic steps to result in the substituted product of **A**. Why this reaction took place in two steps instead of one? (5%)

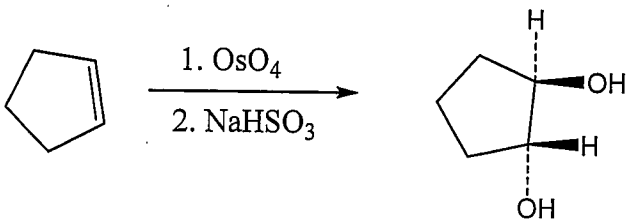
(c) Without the *o*-nitro group, simple fluorobenzene cannot react with diethylmalonate to result in th desired substituted product. The *o*-nitro group of *o*-nitrofluorobenzene is therefore essential for the substitution reaction between *o*-nitrofluorobenzene and diethylmalonate. Why? (5%)

2. (Total: 20%, each 5%) In planning the synthesis of one compound from another, it's just as important to know what not to do as know what to do. The following reactions all have serious drawbacks to them. Explain the potential problems of each:

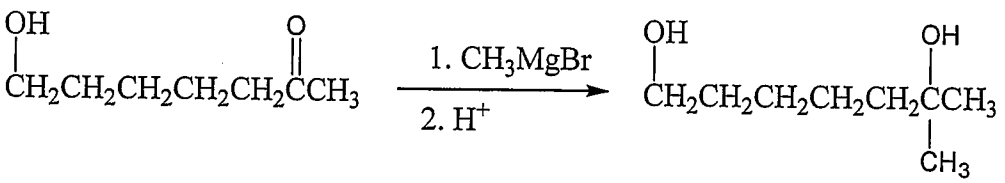
(a) (5%)



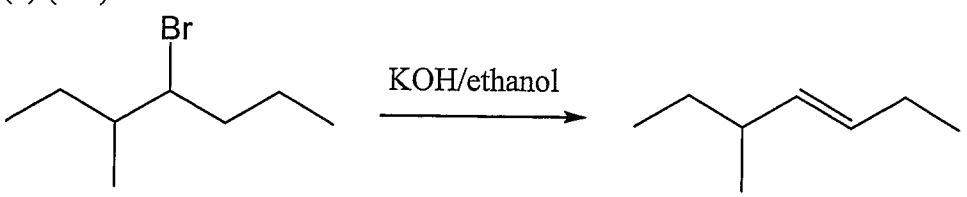
(b) (5%)



(c) (5%)



(d) (5%)



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3. (Total: 20%, each 5%) What are the structures of compounds with the following molecular formula and spectral data in (a) to (d).

(a) $C_{10}H_{12}O_2$, ^{1}H NMR, δ 1.2 triple (3H), 2.9 quartet (2H), 3.9 singlet (3H), 7.0, 8.0 pair of doublets (4H). (5%)

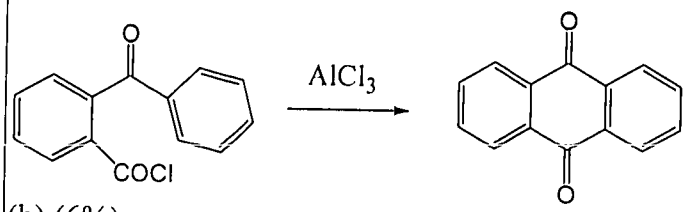
(b) C_4H_8O, ^{1}H NMR, δ 1.1 doublet (6H), 2.4 multiplet (1H), 9.6 finely split doublet (1H). (5%)

(c) $C_7H_{14}O$, ^{1}H NMR, δ 1.1 doublet (12H). 2.8 septet (2H). (5%)

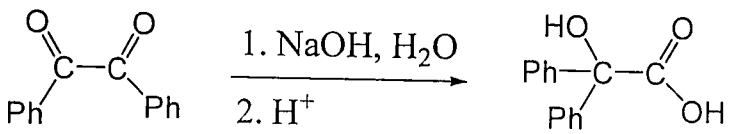
(d) $C_5H_{10}O_2$, FTIR, 1710 cm^{-1} and broad absorbance at 3400 - 2500 cm^{-1}, ^{1}H NMR, δ 1.3 singlet (9H), 11.3 singlet (1H). (5%)

4. (Total: 30%, Each 6%) Write down the mechanistic steps involved in reactions (a) to (e):

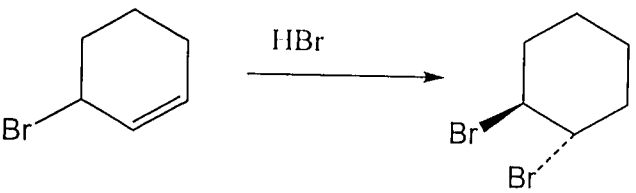
(a) (6%)



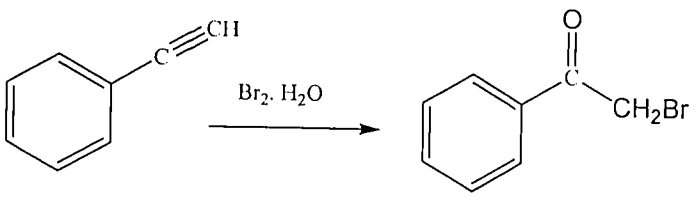
(b) (6%)



(c) (6%)



(d) (6%)



(e) (6%)