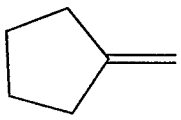
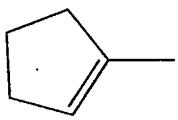
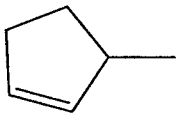
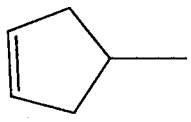
國立中山大學101學年度碩士暨碩士專班招生考試試題

科目：有機化學【材光系碩士班甲組】

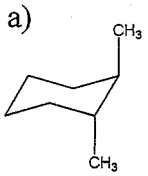
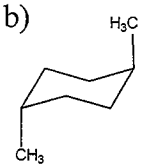
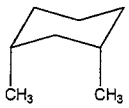
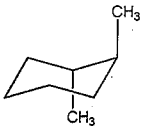
題號：4102

1. **選擇題** (單選, Each 2%, Total: 30%)

1) ( ) Which compound does not give two isomers when reacted with Cl_2/CCl_4?

a)  b)  c)  d) 

2) ( ) Which of the diaxial compounds has the highest energy (unstable)?

a)  b)  c)  d) 

3) ( ) What is the role of diethyl ether in the following reaction?

$$CH_3CH_2OCH_2CH_3 + BF_3 \rightleftharpoons (CH_3CH_2)_2\overset{\oplus}{O}\,\overset{\ominus}{BF_3}$$

a) Lewis acid, b) Lewis base, c) Brønsted acid, d) Brønsted base

4) ( ) Which molecules contain both covalent and ionic bonds?

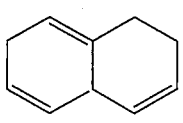
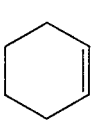
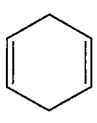
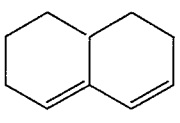
(I) CH_3OH, (II) Na_2CO_3, (III) NH_4Cl, (IV) NaCl

a) I, II; b) II, IV; c) I, II, IV; d) II, III

5) ( ) Which of the statements below correctly describes an achiral molecules? a) The molecule has a non-superimposable mirror image. b) The molecule exhibits optical activity when it interacts with plane-polarized light. c) The molecule has an enantiomer. d) The molecule might be a meso form. e) none of the above.

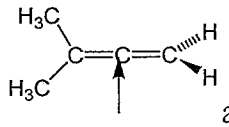
6) ( ) When an organic molecule is irradiated with ultraviolet radiation, the energy absorbs by the molecule corresponds to a) the amounts of energy to increase molecular motions in functional groups, b) the amounts of energy to excite electrons from one molecular orbital to another, c) the amounts of energy to "flip" the spin of atomic nuclei, d) the amounts of energy to strip a molecule of one electron to generate one radical cation.

7) ( ) Which of the following compounds would show the longest wavelength in its UV spectrum?

(a)  (b)  (c)  (d) 

8) ( ) Which of the following additions to alkene occur(s) specifically in a syn fashion? a) dihydoxylation using OsO_4, b) addition of H_2. c) addition of HCl, d) both a and b, e) none of the above.

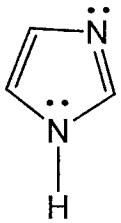
9) ( ) Choose the correct hybridization for the atom indicated in the molecule below:



a) sp, b) sp^2, c) sp^3, d) none of the above.

10) ( ) Treatment of cyclopentene with *m*-chloroperoxybenzoic acid (MCPBA): a) results in oxidative cleavage of the ring to produce an acyclic compound. b) yields a meso epoxide. c) yields an equimolar mixture of enantiomeric epoxides. d) none of the above.

11) ( ) How many π-orbital electrons are in the following molecule? a) 4; b) 6; c) 8; d) 10.



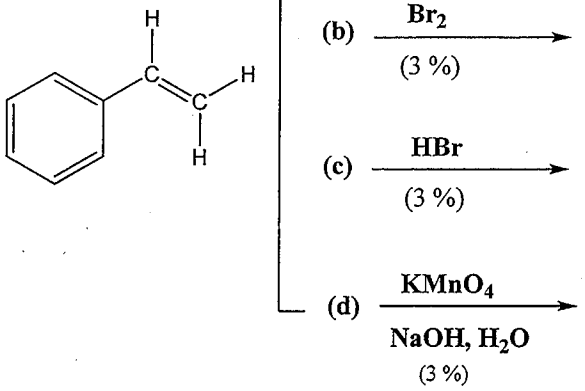
12) ( ) A meso compound is a) an achiral molecule that contains chirality centers. b) contains a plane of symmetry or a center of symmetry. c) is optically inactive. d) is characterized by all of above.

13) ( ) Which statements apply to an S_N1 reaction? a) I, II; b) III, IV; c) I, IV; d) III, I. (see the statements I, II, III and IV shown below)
I) The rate limiting step of the reaction involves the alkyl halide and the nucleophile; II) The order of reactivity is methyl > 1°>2°>3°; III) The rate limiting step of the reaction involves the alkyl halide; IV) There is an intermediate carbocation.

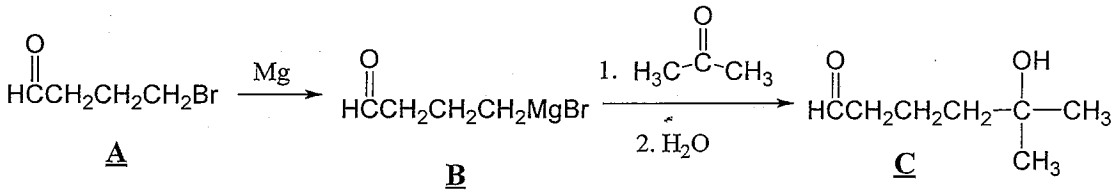
14) ( ) How many isomers, including stereoisomers, can be formed from the hydroxylation of 4-methylcyclohexene using osmium tetroxide (OsO_4)? a) 2; b) 4; c) 6; d) 8.

15) ( ) Which of the following additions to alkene occur(s) specifically in a anti fashion? a) addition of Br_2, b) Addition of H_2, c) Addition of H_2O in dilute solution, d) Both a and b, e) none of the above.

2. (Each 3%, Total: 12 %) Predict the products of the following reactions. Also, indicate regioselectivity (*syn* or *anti*-addition) where relevant. (Suppose that the aromatic ring is inert to all the indicated reagents.)



3. (Total: 18 %) As one of the most frequently-used reagents in organic chemistry, Grignard reagents are commonly prepared from the reaction of alkyl halides with magnesium metal. Reaction scheme shown below also follows the same way by reacting alkyl bromide A with magnesium metal to generate the desired Grignard reagent B. The reagent B was then served as nucleophile to attack acetone to yield the final product C:



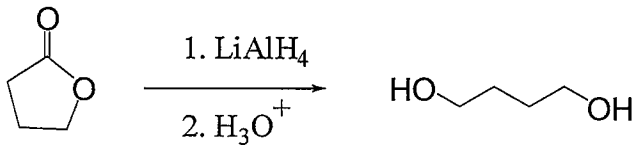
A B C

1) However, product C actually can not be obtained from the above reaction pathway. What is the problem in the above reaction pathway? (6 %)

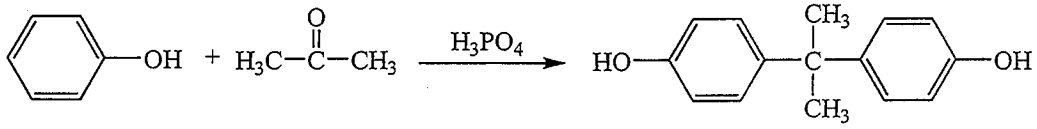
2) Write alternative reaction pathway for the successful preparation of compound C. (12 %)

4. (Each 8%, Total 40%) Write the mechanistic steps for the following reactions:

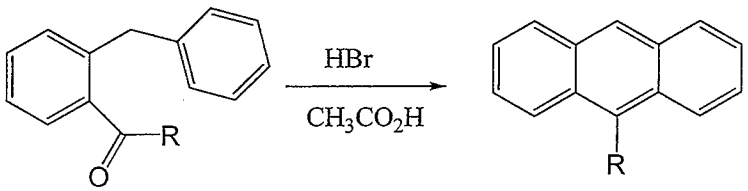
1)



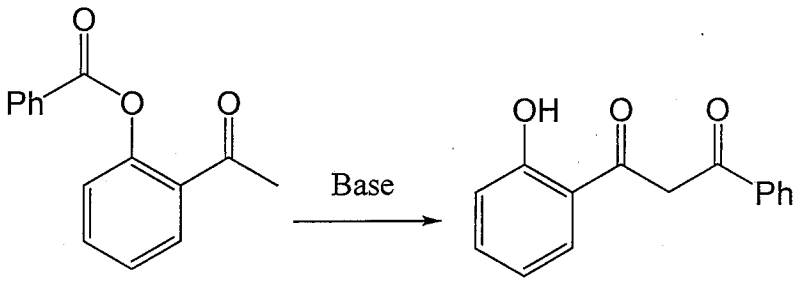
2)


OH
+ H3C—C(=O)—CH3
H3PO4
HO
CH3
C
CH3
OH

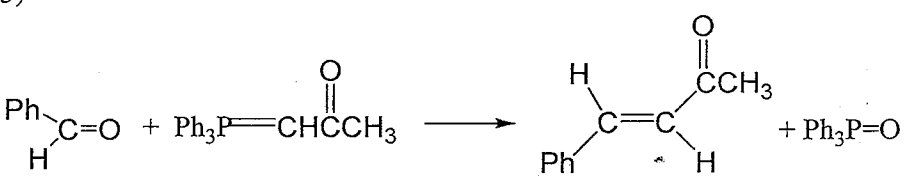
3)


R
O
HBr
CH3CO2H
R

4)


Ph
O
O
O
Base
OH
O
O
Ph

5)


Ph
C=O
H
+ Ph3P=CHCCH3
O
H
CCH3
C=C
Ph
H
+ Ph3P=O