I. Simple Choice (3 points each; 45 points total)

※ 注意：選擇題請於試卷之「選擇題作答區」依序作答。

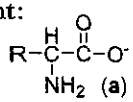
1) At which pH an amino acid has the form (**a**) shown at right:

(A) a pH of 7.0

(B) any pH other than 7.0

(C) a pH greater than its isoelectric point

(D) a pH less than its isoelectric point



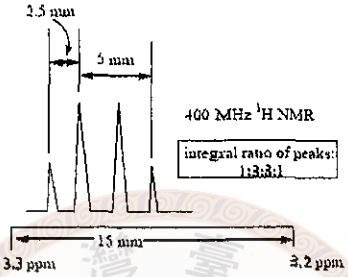
2) Base on the following signal from a 400 MHz ^{1}H NMR spectrum, what could be the coupling constant(s)

(A) 6.7 Hz and 13.3 Hz

(B) 6.7 Hz

(C) 13.3 Hz

(D) 5 Hz



3) An oxygen-containing compound which shows no IR absorption at 1630-1780 cm^{-1} or at 3200-3550 cm^{-1} is likely to be what type of compound?

(A) An alcohol (B) A carboxylic acid (C) An ether (D) A ketone

4) Which is an **incorrect** statement?

(A) *RSH compounds are stronger acids than ROH compounds.* (B) PH_3 *is a weaker base than* NH_3.

(C) NH_2^- is a stronger base than OH^-. (D) OH^- is a stronger base than OR^-.

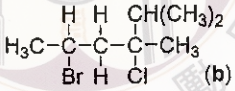
5) The correct IUPAC name for structure (**b**) is:

(A) 2-Bromo-4-chloro-4-isopropylpentane

(B) 4-Bromo-2-chloro-2-isopropylpentane

(C) 5-Bromo-3-chloro-2,3-dimethylhexane

(D) 2-Bromo-4-chloro-4,5-dimethylhexane



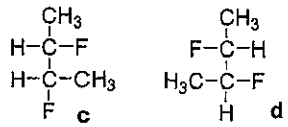
6) The compounds (**c**) and (**d**) whose molecules are shown below would have:

(A) the same melting point.

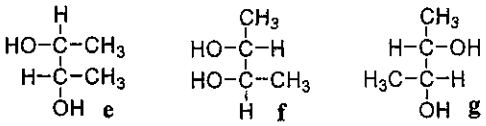
(B) different melting points.

(C) equal but opposite optical rotations.

(D) More than one of the above.

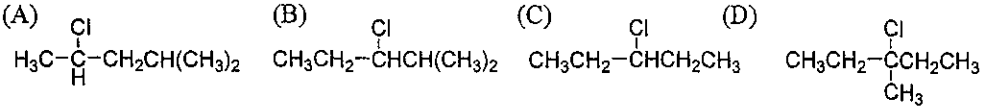


7) Which compound (or compounds) would be produced when *trans*-2-butene is treated first with a peroxy acid to form an epoxide, and then the epoxide is subjected to acid-catalyzed hydrolysis?



(A) an equimolar mixture of **e** and **f** (B) an equimolar mixture of **f** and **g** (C) **g** alone (D) **f** alone

8) The ^{1}H NMR spectrum of which of these compounds would consist of a triplet, singlet and quartet only?



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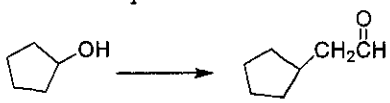
9) How could the following synthesis be accomplished?



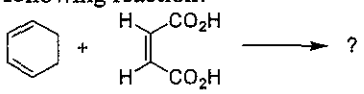
(A) (i) $SOCl_2$, (ii) Mg, ether, (iii) acetaldehyde, then H^+

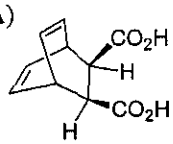
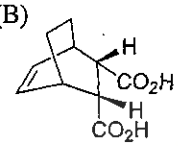
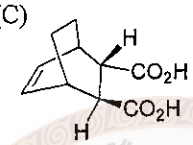
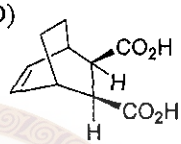
(B) (i) $SOCl_2$, (ii) Li, ether, (iii) $(CH_3CH_2)_2CuLi$, (iv) $KMnO_4$, OH^-

(C) (i) PBr_3, (ii) Mg, ether, (iii) ethylene oxide, then H^+ (iv) PCC, CH_2Cl_2

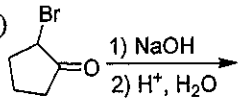
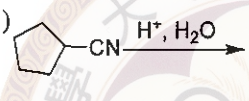
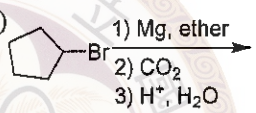
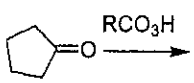
(D) None of the above

10) Which is the major product of the following reaction?

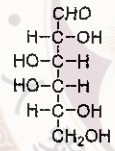


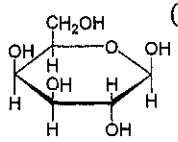
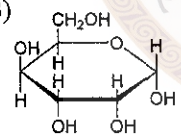
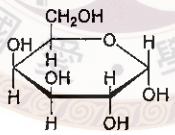
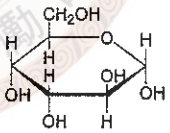
(A) 
(B) 
(C) 
(D) 

11) Which of the following reactions can **NOT** be used for the preparation of a carboxylic acid?

(A) 
(B) 
(C) 
(D) 

12) The Haworth projection formula for the pyranose form of β-D-galactose is



(A) 
(B) 
(C) 
(D) 

13) Which sequence of reagents constitutes the best method to convert toluene into aniline?

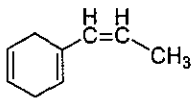
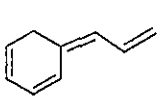
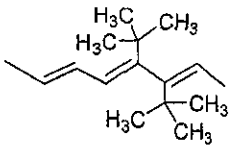
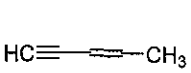
(A) $NaNH_2$ and heat

(B) NBS/CCl_4; then NH_3; then Br_2/OH^-

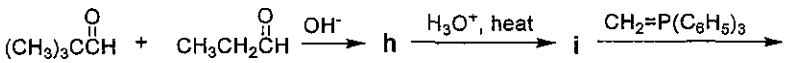
(C) $KMnO_4$, OH^-, heat; then H_3O^+; then PCl_5; then NH_3; then Br_2/OH^-

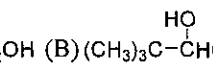
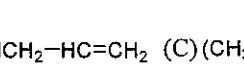
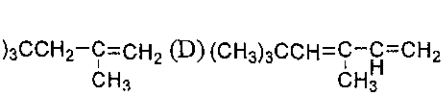
(D) $KMnO_4$, OH^-, heat; then H_3O^+; then NH_3 with H_2/Ni

14) Which compound would have an UV absorption band at longest wavelength?

(A) 
(B) 
(C) 
(D) 

15) What would be the product, **j**, of the following reaction sequence?



(A) $(CH_3)_3CCH_2CH_2CH_2OH$ (B)  (C)  (D) 

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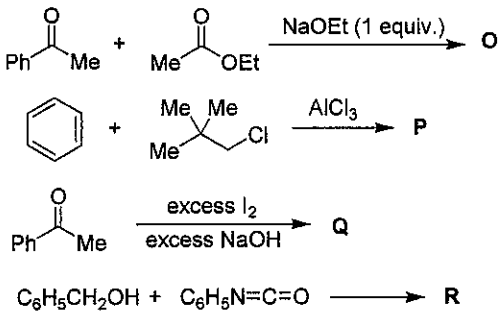
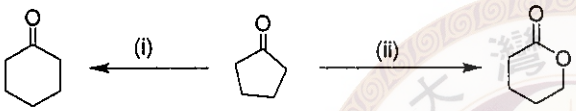
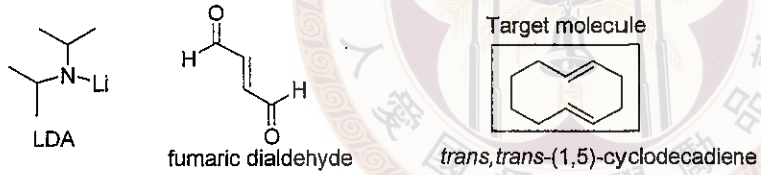
II. Please provide chemical structures for the products (**O**, **P**, **Q**, and **R**) of the following reactions. If no reaction is expected, write "NR" (16 points).



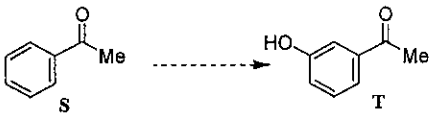
III. Please provide the reagents (i) and (ii) for the illustrated transformations. More than one step may be required for each transformation (10 points).



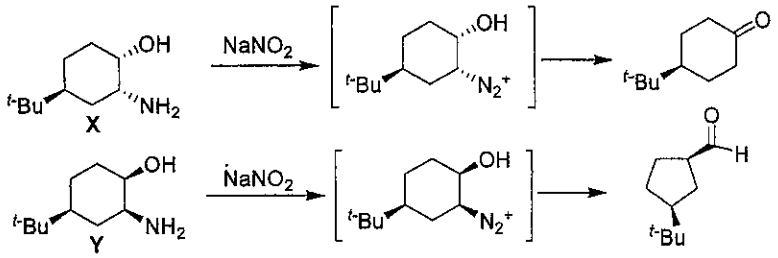
IV. Using only lithium diisopropylamide (LDA), 1,3-butadiene, iodomethane, fumaric dialdehyde, triphenylphosphine, and any other inorganic reagents, propose a synthesis of *trans,trans*-(1,5)-cyclodecadiene. Write your synthesis in the forward direction (not retrosynthetic analysis), with the reagents (if any) required for each step above each arrow (14 points).



V. Provide a synthesis that will selectively convert **S** to **T**. Show all of the key intermediates and furnish all of the important reagents (9 points). Note: This is not a one-step process.



VI. Diastereomers **X** and **Y** provide different products upon diazotization. Please explain why only one product is formed selectively in each reaction. Your explanation should include a **3-dimensional** mechanism for the formation of each product from the corresponding diazonium salt (6 points).



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