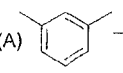
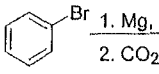
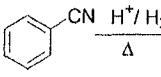
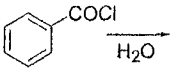
一. 單選題 (60 %) (不需抄題但請標明題號並依序作答)

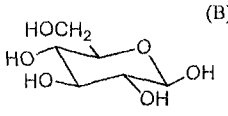
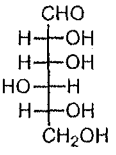
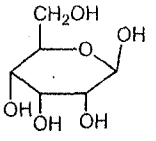
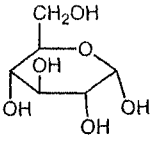
1. Which of the following reaction scheme does NOT provide the benzoic acid as the final product?

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

2. Which of the following compound would be the strongest base in aqueous solution?

(A) NH_3 (B) CH_3NH_2 (C) $(CH_3)_2NH$ (D) $(CH_3)_4NCl$

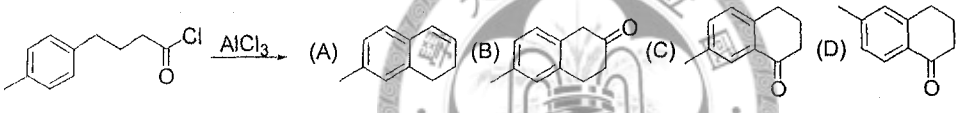
3. Which is the correct structure for α-D-glucopyranose?

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

4. Key steps of fatty acid metabolism are shown below. What kind of reaction is involved in the step c?

(A) Reduction (B) Cycloaddition (C) Reverse Claisen condensation (D) Hydration

5. Which would be the structure of the product for the following Friedel-Crafts reaction?

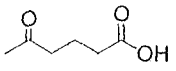


6. What would be the major product from the addition of cyclohexene with Br_2/CCl_4?

(A) cis-1,2-dibromocyclohexane (C) cis-1,4-dibromocyclohexane

(B) trans-1,2-dibromocyclohexane (D) trans-1,3-dibromocyclohexane

7. Which is the correct name for the following compound?



(A) 5-oxohexanoic acid (B) 5-oxahexanoic acid

(C) β-oxohexanoic acid (D) 2-ketopentanoic acid

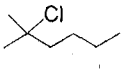
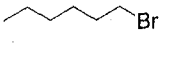
8. Which of the following compound is the least reactive toward 1-propanol in Nucleophilic Acyl Substitution?

(A) acetyl bromide (B) acetic anhydride (C) acetamide (D) ethyl acetate

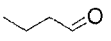
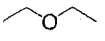
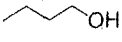
9. Cellulose, starch and glycogen are polysaccharides. What is the monomeric unit of these polymers?

(A) Sucrose (B) Glucose (C) Fructose (D) Lactose

10. Which of the following alkyl halide is the most reactive in S_N2 reaction with KI in acetone?

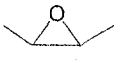
(A)  (B)  (C)  (D) 

11. Arrange the following compounds in order of increasing boiling point.

(I)  (II)  (III)  (IV) $CH_3CH_2CH_2COOH$

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

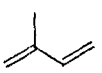
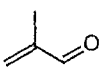
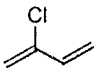
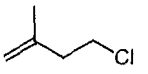
12. What would be the major product for the following reaction?

 H^+/H_2O

(A) 3-pentanol (B) 2-butanol

(C) 2,3-butanediol (D)1, 2,3-pentanetriol

13. Which of the following is the monomer for natural rubbers?

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

14. Which is the correct formula for ethyl acetoacetate?

(A) $CH_3COCH_2COOCH_2CH_3$ (B) $(CH_3CO)_2O$ (C) $CH_3COCOOCH_2CH_3$ (D) $CH_3CH_2COCH_2COOH$

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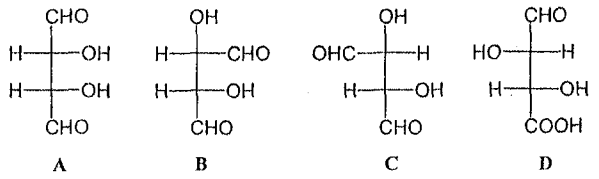
15. Which is (are) meso compound?



(A) **A** only
(B) **A, B** and **C**
(C) **A** and **C**
(D) **A, B** and **D**

16. Which of the following statement is the best to describe the isoelectric point (pI) of amino acid?
(A) The degree of ionization of the amino acid at pH = 6.5. (B) The pK_a of amino acid
(C) The pH at which the amino acid is in dipolar ion. (D) The pH at which the amino acid in anionic form.

17. How many sets of signals are there in the ^{13}C NMR spectrum for ethyl phenyl ether?
(A) 4 (B) 6 (C) 7 (D) 8

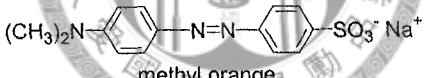
18. Which of the following halides can be used for the preparation of its Grignard reagent?
(A) *p*-$HOCH_2C_6H_4Br$ (B) $CH_3COCH_2CH_2Br$ (C) $HSCH_2CH_2CH_2CH(CH_3)Cl$ (D) $CH_2{=}CHCH_2Br$

19. Which of the following reagents is the best choice to convert $C_6H_{11}OH$ into $C_6H_{11}Cl$
(A) dilute HCl (B) $SOCl_2$, pyridine (C) CH_3COCl (D) *N*-chlorosuccinimide (NBS), Δ

20. Which of the following compound has a sharp IR absorption at 1718 cm^{-1}?
(A) CH_3COCH_3 (B) $CH_3CH_2OCH_2CH_3$ (C) CH_3CH_2OH (D) *trans*-$CH_3CH{=}CHCH_3$

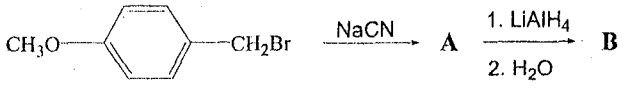
二. Please provide a simple method to separate cyclohexanol from phenol. (5%)

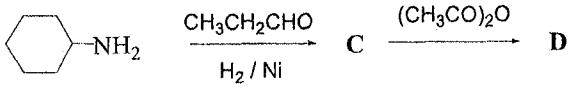
三. Methyl orange (structure shown below) is an azo dye used as an indicator in acid-base titration. Please show how to prepare this compound from *p*-aminobenzenesulfonic acid and *N,N*-dimethylaniline. (5%)



methyl orange

四. Please provide the structure for **A** - **D**. (10%)





五. Explain what is the "Secondary structure of protein". (10%)

六. Please provide a general structure for the following terms. (10%)
(A) Natural occurring amino acid. (B) Acyl bromide.
(C) Triglyceride. (D) γ-Lactone. (E) Tertiary amine.

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