

亞洲大學

109 學年度學士後獸醫學系招生考試試題紙

學系別	考試科目	考試日期	時 間
學士後獸醫學系	化學(含普通化學、有機化學)	109.05.02	10:30-12:00

- A student performs an experiment to determine the density of a sugar solution. She obtains the following results: 4.71 g/mL, 4.73 g/mL, 4.67 g/mL, 4.69 g/mL. If the actual value for the density of the sugar solution is 4.40 g/mL, which statement below best describes her results?

A) Her results are precise, but not accurate. B) Her results are accurate, but not precise. C) Her results are both precise and accurate. D) Her results are neither precise nor accurate.
- What answer should be reported, with the correct number of significant figures, for the following calculation? $(249.362 + 41) / 63.498$

A) 4.6 B) 4.57 C) 4.573 D) 4.5728
- Write the name for $\text{Ca}_3(\text{PO}_4)_2$.

A) calcium (III) phosphite B) calcium (II) phosphite C) calcium phosphate D) tricalcium phosphorustetraoxide
- Give the correct formula for aluminum sulfate.

A) Al_2SO_4 B) $\text{Al}(\text{SO}_4)_3$ C) $\text{Al}_3(\text{SO}_4)_2$ D) $\text{Al}_2(\text{SO}_4)_3$
- Determine the empirical formula for a compound that contains C, H and O. It contains 51.59% C and 35.30% O by mass. (C: 12.0 g/mol; H: 1.00 g/mol; O: 16.0 g/mol)

A) $\text{C}_2\text{H}_6\text{O}$ B) CHO C) $\text{C}_4\text{H}_{13}\text{O}_2$ D) CH_4O_3
- Give the theoretical yield, in grams, of CO_2 from the reaction of 4.000 moles of C_8H_{18} with 4.000 moles of O_2 . (C: 12.0 g/mol; H: 1.00 g/mol; O: 16.0 g/mol)

$$2 \text{C}_8\text{H}_{18} + 25 \text{O}_2 \rightarrow 16 \text{CO}_2 + 18 \text{H}_2\text{O}$$

A) 112.7 g B) 102.4 g C) 176.0 g D) 704.0 g

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7. The titration of 25.0 mL of an unknown concentration H_2SO_4 solution requires 83.6 mL of 0.12 M LiOH solution. What is the concentration of the H_2SO_4 solution (in M)?
A) 0.20 M B) 0.40 M C) 0.10 M D) 0.36 M

8. How many subshells are there in the shell with $n = 4$?
A) 3 B) 4 C) 6 D) 18

9. How many valence electrons does an atom of C have?
A) 1 B) 4 C) 2 D) 3

10. Place the following in order of increasing radius.
 Ca^{2+} S^{2-} Cl^-

A) $\text{Ca}^{2+} < \text{Cl}^- < \text{S}^{2-}$ B) $\text{Cl}^- < \text{Ca}^{2+} < \text{S}^{2-}$ C) $\text{S}^{2-} < \text{Cl}^- < \text{Ca}^{2+}$

D) $\text{Ca}^{2+} < \text{S}^{2-} < \text{Cl}^-$

11. Which of the elements listed below would most likely form a *polar covalent bond* when bonded to oxygen?
A) Mg B) H C) Al D) O

12. Assuming the octet rule is obeyed, how many covalent bonds will an oxygen atom form to give a formal charge of zero?
A) 0 B) 1 C) 2 D) 3

13. Which of the following Lewis structures is incorrect?
A) $\begin{array}{c} \text{H} - \ddot{\text{N}} - \text{H} \\ | \\ \text{H} \end{array}$ B) $\begin{array}{cc} \ddot{\text{F}} & \ddot{\text{F}} \\ : & : \\ \text{F} - & \text{F} \\ : & : \end{array}$ C) $\begin{array}{cc} \ddot{\text{N}} & \ddot{\text{N}} \\ & = \\ \ddot{\text{N}} & \ddot{\text{N}} \end{array}$ D) $\begin{array}{c} \text{H} - \ddot{\text{O}} - \text{H}^+ \\ | \\ \text{H} \end{array}$

14. In the best Lewis structure for NO^+ , what is the formal charge on the N atom?
A) -1 B) 0 C) +1 D) +2

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15. Which of the elements listed below is most likely to exhibit an expanded octet in its compounds?
A) O B) S C) Na D) C
16. Give the number of lone pairs around the central atom and the molecular geometry of SCl_2 .
A) 0 lone pairs, linear B) 1 lone pair, bent C) 2 lone pairs, bent
D) 3 lone pairs, bent
17. Use VSEPR theory to predict the geometry of the BF_3 molecule.
A) linear B) bent C) trigonal planar D) trigonal pyramidal
18. Which one of the following molecules has tetrahedral geometry?
A) XeF_4 B) BF_3 C) AsF_5 D) CF_4
19. Which one of the following molecules has a non-zero dipole moment?
A) BeCl_2 B) Br_2 C) BF_3 D) IBr
20. Which one of the following molecules is polar?
A) PBr_5 B) CCl_4 C) BrF_5 D) XeF_2
21. What is the strongest type of intermolecular force present in NH_2CH_3 ?
A) dispersion B) dipole-dipole C) hydrogen bonding D) ion-dipole
22. Identify the compound that does not have hydrogen bonding.
A) $(\text{CH}_3)_3\text{N}$ B) H_2O C) CH_3OH D) HF
23. What is the type of intermolecular force for dissolving NaCl in H_2O ?
A) dispersion B) dipole-dipole C) hydrogen bonding D) ion-dipole
24. What is the type of intermolecular force for dissolving Br_2 in H_2O ?
A) dispersion B) dipole-dipole C) hydrogen bonding D) induced dipole
25. Which of the following acids will have the strongest conjugate base?
A) HCl B) HClO_4 C) HNO_3 D) HCN

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26. Which one of the following salts, when dissolved in water, produces the solution with the lowest pH?

A) NaCl B) KCl C) MgCl₂ D) AlCl₃

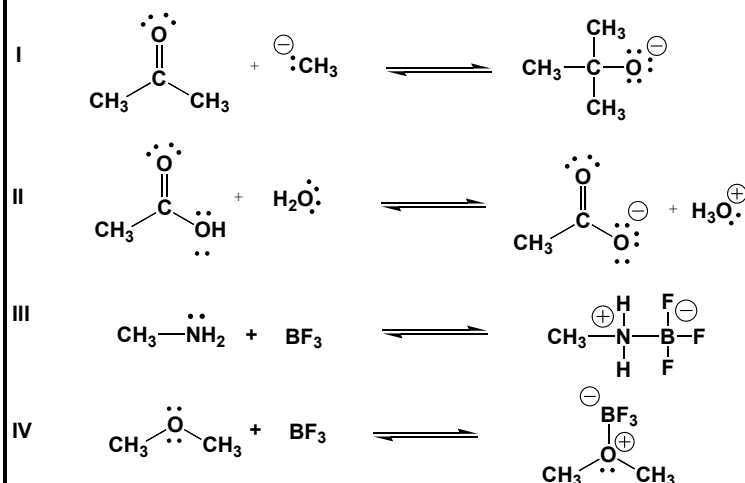
27. Which of the following is a Lewis acid?

A) BBr₃ B) CCl₄ C) NH₃ D) CHBr₃

28. Which of the following is a Lewis base?

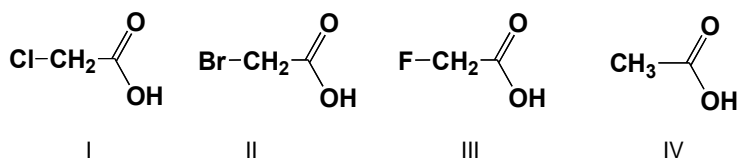
A) AlF₃ B) H₂O C) SiF₄ D) C₅H₁₂

29. Which are acid-base reactions according to Lewis theory but not according to the Brønsted-Lowry theory?



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

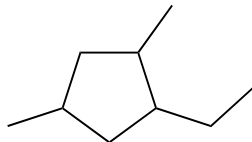
30. Which acid is the most acidic?



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

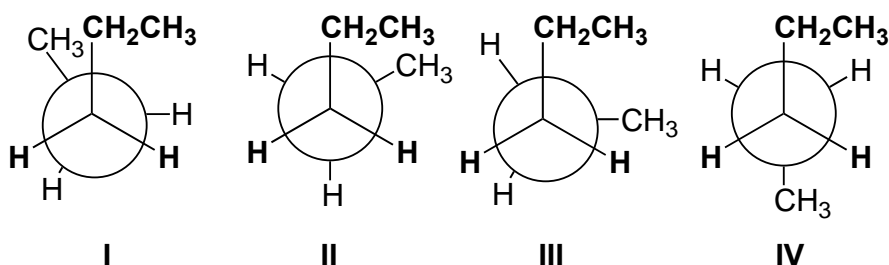
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31. Which is the IUPAC name for the following cycloalkane?



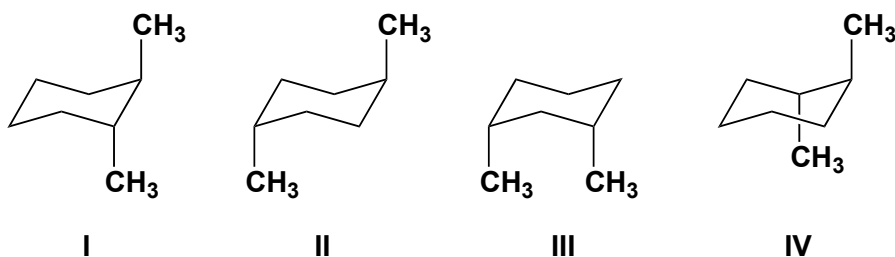
- A) 2,4-dimethyl-1-ethylcyclopentane B) 1,3-dimethyl-5-ethylcyclopentane
C) 1-ethyl-2,4-dimethylcyclopentane D) 1-ethyl-3,5-dimethylcyclopentane

32. Which conformation of pentane is most stable?



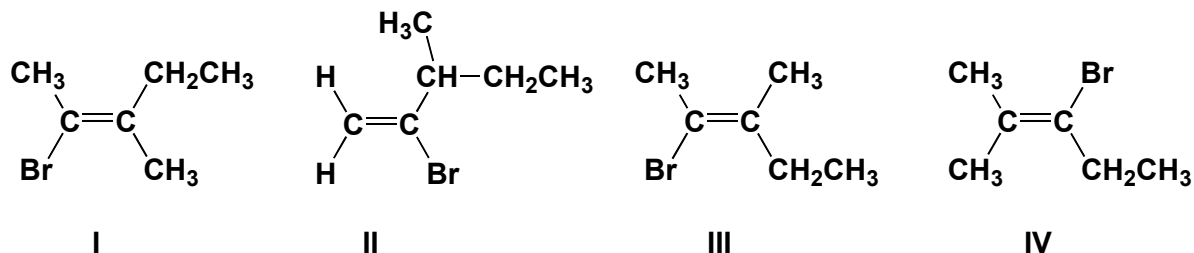
- A) I B) II C) III D) IV

33. Which of these diaxial conformations has the highest energy?



- A) I B) II C) III D) IV

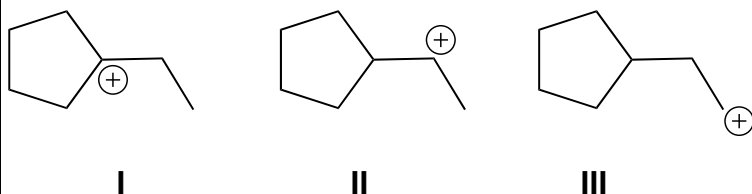
34. Which structure is Z-2-bromo-3-methyl-2-pentene?



- A) I B) II C) III D) IV

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35. Arrange these carbocations in order of increasing stability (least to most).



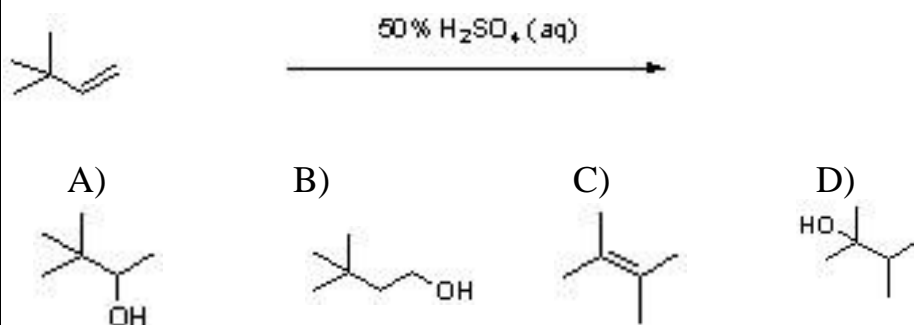
A) I, II, III B) I, III, II C) II, I, III D) III, II, I

36. Which of the following alkenes is the major product when 2-bromo-2-methylpentane is treated with sodium ethoxide in ethanol?
 A) 2-methylpent-1-ene B) 2-methylpent-2-ene C) (*E*)-4-methylpent-2-ene
 D) (*Z*)-4-methylpent-2-ene

37. Which of the following alkenes is the major product when 2-bromo-2-methylpentane is treated with potassium *tert*-butoxide in *tert*-butanol?
 A) 2-methylpent-1-ene B) 2-methylpent-2-ene C) (*E*)-4-methylpent-2-ene
 D) (*Z*)-4-methylpent-2-ene

38. Which of the following statements applies to the E2 mechanism?
 A) It occurs with inversion of stereochemistry.
 B) It occurs with racemization of stereochemistry.
 C) It proceeds through the more stable carbocation intermediate.
 D) The C-H and C-X bonds that break must be anti.

39. What is the major product of the following reaction?



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40. Provide the reagents necessary to complete the following transformation.



- A) 1. $\text{BH}_3 \cdot \text{THF}$ 2. $\text{H}_2\text{O}_2, \text{HO}^-$ B) $\text{H}_2\text{O}, \text{H}_2\text{SO}_4$ C) $\text{OsO}_4, \text{H}_2\text{O}_2$
D) $\text{CH}_3\text{CO}_3\text{H}$

41. Which of the following reagents will convert 1 mole of 3-methylpent-1-yne into 3-methylpentane?

- A) 1 mole of Br_2 in CCl_4 B) 2 moles of Cl_2 in CCl_4 C) 2 moles of HCl
D) 2 moles H_2 , Ni and heat

42. Which of the following reagents should be used to convert hex-3-yne to (Z)-hex-3-ene?

- A) H_2 , Pt B) Na, NH_3 C) H_2 , Lindlar's catalyst D) $\text{H}_2\text{SO}_4, \text{H}_2\text{O}$

43. Which of the following statements correctly pertains to a pair of enantiomers?

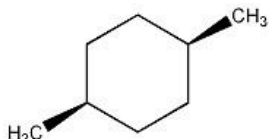
- A) They rotate the plane of polarized light by exactly the same amount and in opposite directions.
B) They rotate the plane of polarized light by differing amounts and in opposite directions.
C) They rotate the plane of polarized light by differing amounts and in the same direction.
D) They have different melting points.

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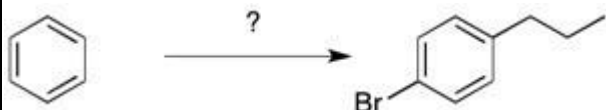
44. Predict the specific rotation of the compound shown.



- A) It is impossible to predict; it must be determined experimentally.
 B) Because both asymmetric centers are R, the compound is dextrorotatory.
 C) Because both asymmetric centers are S, the compound is levorotatory.
 D) Zero; the compound is achiral.
45. What is the major difference between an antiaromatic and aromatic compound?
 A) Only aromatic compounds follow Huckle's rule.
 B) Antiaromatic compounds have at least one sp^3 hybridized atom in the ring.
 C) Antiaromatic compounds can assume a chair-like structure while aromatic compounds are nearly flat.
 D) Aromatic compounds cannot have a charged atom in the structure.
46. Which of the following is an incorrect statement about the bromination of benzene by Br_2 and $FeBr_3$?
 A) $FeBr_3$ functions to increase the electrophilicity of Br_2 .
 B) Formation of the sigma complex is the rate-determining step of the mechanism.
 C) The carbanionic intermediate is resonance stabilized.
 D) There is one carbon-containing intermediates in the mechanism.
47. Which of the following species is attacked by benzene in the electrophilic nitration reaction?
 A) HNO_3 B) NO_2^+ C) NO_2 D) NO^+
48. Which of the following compounds will not undergo Friedel-Crafts acylation when treated with CH_3CH_2COCl , $AlCl_3$?
 A) toluene B) *p*-xylene C) benzophenone D) ethoxybenzene

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49. Which series of reagents would be required to perform the following synthesis?



- A) 1. $\text{ClCH}_2\text{CH}_2\text{CH}_3$, AlCl_3 2. FeBr_3 , Br_2
 B) 1. $\text{ClCOCH}_2\text{CH}_3$, AlCl_3 2. FeBr_3 , Br_2
 C) 1. $\text{ClCOCH}_2\text{CH}_3$, AlCl_3 2. FeBr_3 , Br_2 3. Zn(Hg) , HCl
 D) 1. $\text{ClCOCH}_2\text{CH}_3$, AlCl_3 2. Zn(Hg) , HCl 3. FeBr_3 , Br_2

50. What are the expected products of the reaction of PhOCH_3 with concentrated HI ?

- A) phenol and methanol B) phenol and iodomethane
 C) iodobenzene and methanol D) iodobenzene and iodomethane

51. Which of the following is produced by the reaction of $(\text{CH}_3\text{CH}_2)_2\text{S}$ with $\text{CH}_3\text{CH}_2\text{I}$?

- A) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{I}$ B) $(\text{CH}_3\text{CH}_2)_3\text{S}^+ \text{I}^-$
 C) $(\text{CH}_3\text{CH}_2)_3\text{S}$ D) $\text{CH}_3\text{SCH}_2\text{CH}_2\text{CH}_3$

52. Through what basic mechanism is 1-methylcyclohexanol converted to 1-bromo-1-methylcyclohexane upon treatment with HBr ?

- A) $\text{S}_\text{N}1$ B) $\text{S}_\text{N}2$ C) $\text{E}1$ D) $\text{E}2$

53. What is the major organic product of the following reaction?



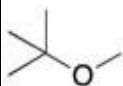
- A) B) C) D) Both A and B



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54. What is the best way to make the ether shown below using a Williamson Ether Synthesis reaction?

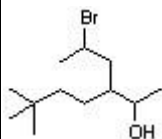


- A) $(\text{CH}_3)_3\text{CO}^- + \text{BrCH}_3$ B) $(\text{CH}_3)_3\text{CBr} + ^-\text{OCH}_3$ C) $(\text{CH}_3)_3\text{COH} + \text{BrCH}_3$
D) $(\text{CH}_3)_3\text{CBr} + \text{HOCH}_3$

55. When an aldehyde is treated with LiAlH_4 followed by addition of H_2O , what general class of product results?

- A) primary alcohol B) secondary alcohol C) tertiary alcohol D) ether

56. What is the correct IUPAC name of the compound below?



- A) 3-(2-bromopropyl)-6,6-dimethylheptan-2-ol
B) 5-bromo-3-(3,3-dimethylbutyl)hexan-2-ol
C) 5-(2-bromopropyl)-2,2-dimethylheptan-6-ol
D) 7-bromo-5-(1-hydroxyethyl)-2,2-dimethyloctane

57. The reaction of $\text{CH}_3\text{CH}_2\text{MgBr}$ with $\text{CH}_3\text{COCH}_2\text{CH}_3$ gives _____.

- A) an achiral product
B) a mixture of diastereomers
C) the racemate of a chiral product
D) a single enantiomer

58. The acidity of a thiol proton most closely resembles which of the following acids?

- A) pheno B) ethanol C) acetic acid D) ammonia

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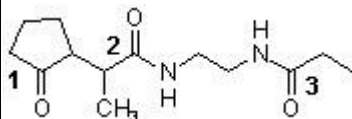
59. The positively polarized carbon atom of a carbonyl group acts as _____.

- A) an electrophile and a Lewis base
- B) a nucleophile and a Lewis base
- C) an electrophile and a Lewis acid
- D) a nucleophile and a Lewis acid

60. What reagent can be used to convert 2-methylbutan-1-ol into 2-methylbutanal?

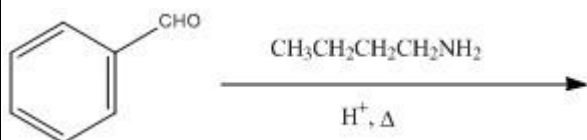
- A) LiAlH_4 B) $\text{Na}_2\text{Cr}_2\text{O}_7$ C) PCC D) KMnO_4

61. Which sequence ranks the following carbonyl compounds in order of increasing rate of nucleophilic addition?



- A) $2 < 3 < 1$ B) $3 < 2 < 1$ C) $2 < 1 < 3$ D) $1 < 3 < 2$

62. What product will result from the reaction shown?



- A) imine
- B) amino acid
- C) amino alcohol
- D) hydrazine

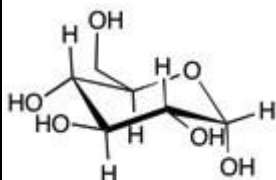
63. What product will result from the reaction shown?



- A) acetal B) hydrazine C) ester D) ylide

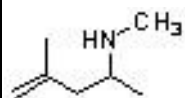
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64. The cyclic structure of glucose is shown below. What functional groups are present in this molecule?



A) acetal B) hemiacetal C) oxime D) hydrate

65. Provide the correct IUPAC name for the following amine.



A) 4-(methylamino)-2-methyl-1-pentene
 B) 2,*N*-dimethyl-1-penten-4-amine
 C) 4,*N*-dimethyl-4-penten-2-amine
 D) 1,3,*N*-trimethyl-3-buten-1-amine

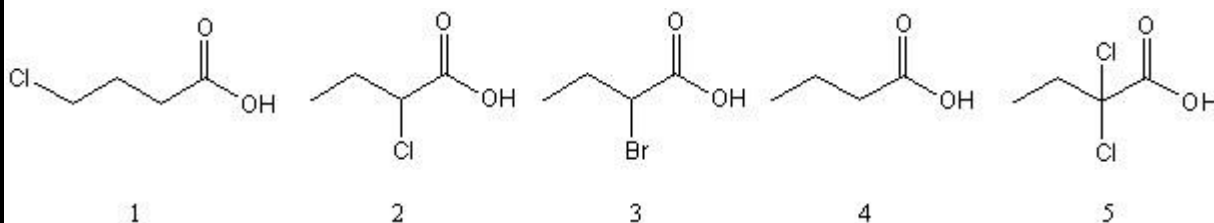
66. What compound results from the reaction below?



A) imine
 B) amide
 C) primary amine
 D) quaternary ammonium salt

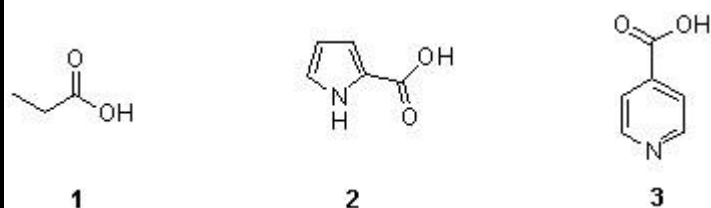
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67. List the following weak acids in order of increasing acidity (from lowest to highest.).



- A) $4 < 3 < 2 < 1 < 5$ B) $4 < 1 < 3 < 2 < 5$ C) $5 < 2 < 3 < 1 < 4$
 D) $4 < 1 < 2 < 5 < 3$

68. Which of the following sequences ranks the structures below in order of increasing acidity?



- A) $1 < 2 < 3$ B) $2 < 3 < 1$ C) $3 < 1 < 2$ D) $2 < 1 < 3$

69. What compound is produced when $(\text{CH}_3)_2\text{CHCH}_2\text{Br}$ is subjected to the following sequence of steps?

1. Mg, Et_2O 2. CO_2

- A) 2-methylpropanoic acid B) 3-methylpropanoic acid
 C) 2-methylbutanoic acid D) 3-methylbutanoic acid

70. Acid chlorides can be prepared from carboxylic acids by treatment with _____.

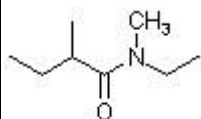
- A) $(\text{COCl})_2$
 B) SOCl_2
 C) KCl
 D) both A and B

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71. Cyclic amides are called _____.

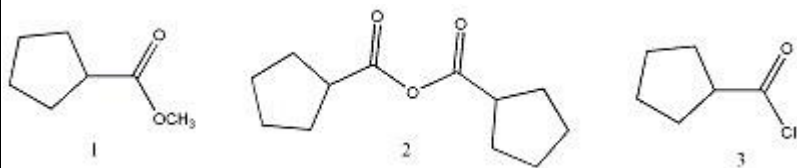
- A) lactones B) lactams C) amins D) animals

72. What is the correct IUPAC name for the following compound?



- A) N-ethyl-2,2-dimethylbutanamide
 B) N-ethyl-N-methylisobutyramide
 C) 2,2-dimethyl-N-ethylbutanamide
 D) 1-(ethylmethanimino)-2-methylbutanamide

73. Arrange the carboxylic acid derivatives below in order of increasing reactivity towards nucleophilic acyl substitution.



- A) 1 < 2 < 3 B) 1 < 3 < 2 C) 2 < 1 < 3 D) 2 < 3 < 1

74. The hydrolysis of esters in base is called _____.

- A) the Fischer esterification
 B) saponification
 C) the Dieckmann condensation
 D) transesterification

75. Lithium aluminum hydride reduces carboxylic acids, acid chlorides, and esters to _____.

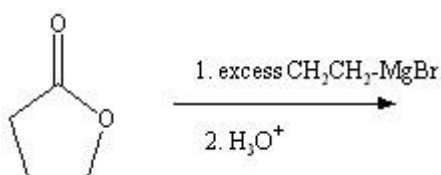
- A) aldehydes B) primary alcohols C) secondary alcohols
 D) tertiary alcohols

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76. What compound is produced when *N,N*-dimethylpropanamide is treated with LiAlH_4 ?

- A) $\text{CH}_3\text{CH}_2\text{CONH}_2$
- B) $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$
- C) $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- D) $\text{CH}_3\text{CH}_2\text{CH}_2\text{N}(\text{CH}_3)_2$

77. What is the predicted major product of the following reaction?

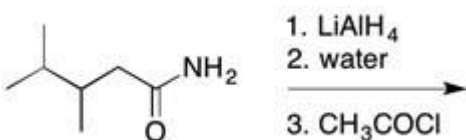


- A)

B)
- C)

D)

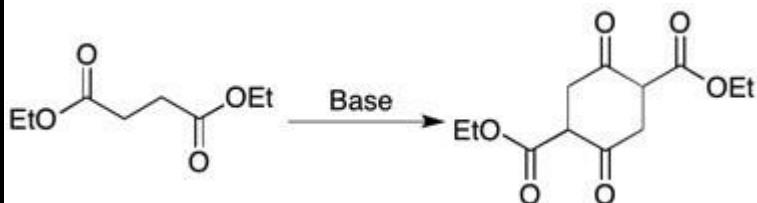
78. Predict the major organic product from the following reaction.



- A) carboxylic acid B) ester C) nitrile D) 2° amide

學系別	考試科目	考試日期	時 間
學士後獸醫學系	化學(含普通化學、有機化學)	109.05.02	10:30-12:00

79. What type of reaction is shown below?



- A) Aldol condensation B) Claisen Condensation C) Michael Addition
D) Alkylation

80. Which of the pairs shown below are tautomers?

A)



B)



C)



D)

