

高雄醫學大學八十九學年度學士後醫學系招生考試試題

科目：化學

考試時間：八十分鐘

I. Choose the correct answer from the following questions (each 2%, total 80%).

- (D) 1. Which element has the highest electron affinity?
(A) oxygen (B) nitrogen (C) fluorine (D) chlorine
- (A) 2. Predict which of the following sets of ions would have the greatest coulombic attraction in a solid compound:
(A) Na^+ , F^- (B) Na^+ , Cl^- (C) Na^+ , Br^- (D) Na^+ , I^-
- (B) 3. Identify the following species as Lewis acids:
(A) NH_3 (B) BF_3 (C) CN^- (D) F^-
- (B) 4. On the basis of configuration for the neutral molecule O_2 , write the molecular orbital configuration of the valence molecular orbital for O_2^- , give the expected bond order.
(A) 0.5 (B) 1.0 (C) 1.5 (D) 2.0 (E) 2.5
- (A) 5. Rank the following molecules, ions and radicals in order of increasing H - C - H bond angles:
 CH_3^+ ; CH_3^- ; CH_2 ; CH_2^{2+} .
(A) $\text{CH}_2^{2+} > \text{CH}_3^+ > \text{CH}_2 > \text{CH}_3^-$ (B) $\text{CH}_3^- > \text{CH}_2 > \text{CH}_3^+ > \text{CH}_2^{2+}$ (C) $\text{CH}_2 > \text{CH}_3^+ > \text{CH}_3^- > \text{CH}_2^{2+}$
(D) $\text{CH}_3^+ > \text{CH}_2^{2+} > \text{CH}_2 > \text{CH}_3^-$ (E) $\text{CH}_3^+ = \text{CH}_2^{2+} = \text{CH}_2 = \text{CH}_3^-$
- (B) 6. Identify which kind of intermolecular forces might arise between molecules of the chloromethane:
(A) ion-ion (B) ion-dipole (C) dipole-dipole (D) hydrogen bonding
(E) dispersion
- (A) 7. A gas sample is heated in a cylinder, using 375KJ of heat. At the same time a piston compresses the gas, using 645KJ of work. What is the change in internal energy of the gas during this process?
(A) 1020KJ (B) 270KJ (C) 1.72KJ (D) 500KJ (E) 30KJ
- (B) 8. Calculate the enthalpy of the reaction $\text{P}_{4(\text{s})} + 10\text{Cl}_{2(\text{g})} \rightarrow 4\text{PCl}_{5(\text{s})}$ from the reactions:

$$\begin{array}{lll} \text{P}_{4(\text{s})} + 6\text{Cl}_{2(\text{g})} & \rightarrow & 4\text{PCl}_{3(\text{l})} \quad H = -1278.8\text{KJ} \\ \text{PCl}_{3(\text{l})} + \text{Cl}_{2(\text{g})} & \rightarrow & \text{PCl}_{5(\text{s})} \quad H = -124\text{KJ} \end{array}$$

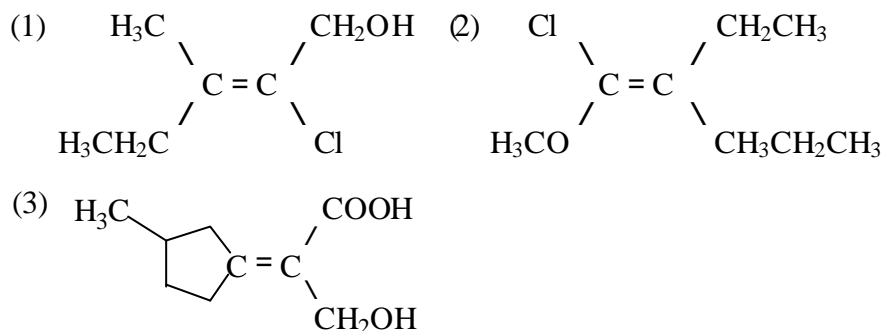
(A) 1.154 (B) -1.775 (C) -1.154 (D) 2.433 (E) 1.503MJ mol^{-1}

- (A) 9. List the following substances in order of increasing molar entropy at 298K: (1) $\text{H}_2\text{O}_{(l)}$, (2) $\text{H}_2\text{O}_{(g)}$, (3) $\text{H}_2\text{O}_{(s)}$, (4) $\text{C}_{(s)}$.
 (A)(2) > (1) > (3) > (4) (B)(4) > (3) > (2) > (1) (C)(1) = (2) = (3) = (4)
 (D)(1) > (2) > (3) > (4) (E)(3) > (1) > (2) > (4)
- (A) 10. Which of the following compounds become less stable with respect to the elements as the temperature is raised? (1) $\text{PCl}_{5(g)}$, (2) $\text{HCN}_{(g)}$, (3) $\text{NO}_{(g)}$, (4) $\text{SO}_{2(g)}$
 (A)(1) (B)(3) (C)(1), (2) (D)(3), (4) (E)(2)
- (E) 11. The following groups are found in some organic molecules. Which are hydrophilic?
 (1) - NH_2 ; (2) CH_3 ; (3) - Br; (4) - COOH .
 (A)(1), (3) (B)(2), (4) (C)(1), (2) (D)(2), (3) (E)(1), (4)
- (C) 12. Estimate the boiling-point elevation of saturated solution of LiF at 100 (the solubility of LiF is 230 mg / 1.00×10^2 g of water at 100). Assume that the ionic compounds undergo complete dissociation.
 (A)0.051 (B)0.22 (C)0.09 (D)0.030 (E)0.11
- (D) 13. Arrange the following bases in order of increasing basicity strength: (1)ammonia, (2)ethylamine, (3)aniline.
 (A)(2) < (1) < (3) (B)(1) < (2) < (3) (C)(1) < (3) < (2) (D)(3) < (1) < (2)
 (E)(3) < (2) < (1)
- (B) 14. Calculating the pH of the solution resulting when 5.00mL of 0.150M NaOH(aq) is added to 25.00mL of 0.100M HCOOH(aq) . Use $K_a = 1.8 \times 10^{-4}$ for HCOOH .
 (A)3.75 (B)3.38 (C)4.20 (D)7.5 (E)5.30
- (B) 15. Arrange the following metals in order of increasing strength as reducing agents: Li, Na, K, Mg.
 (A) $\text{Na} > \text{K} > \text{Li} > \text{Mg}$ (B) $\text{K} > \text{Mg} > \text{Na} > \text{Li}$ (C) $\text{Li} > \text{K} > \text{Na} > \text{Mg}$
 (D) $\text{Li} > \text{Na} > \text{K} > \text{Mg}$ (E) $\text{Mg} > \text{K} > \text{Na} > \text{Li}$
- (E) 16. Which of the following atoms has the greatest polarizability?
 (A)manganese (B)iron (C)nitrogen (D)oxygen (E)tellurium
- (C) 17. Xenon hexafluoride exists as the ionic solid XeF_5^+F^- . Based on the Lewis structure for XeF_5^+ from VSEPR theory, predict XeF_5^+ shape.
 (A)octahedral (B)trigonal bipyramidal (C)square pyramidal (D)tetrahedral
 (E)distorted octahedral

- (B) 18. What can a tetrahedral complex show?(1)stereoisomerism (2)geometrical isomerism (3)optical isomerism
(A)(1), (2) (B)(1), (3) (C)(2), (3) (D)(1) (E)(3)
- (E) 19 .Determine the type of structural isomerism that exists in the following pairs of compounds:
[Co(NO₂)(NH₃)₅]Br₂ and [Co(ONO)(NH₃)₅]Br₂.
(A)ionization isomers (B)geometrical isomers (C)optical isomers
(D)coordination isomers (E)linkage isomers
- (A) 20. Indicate which molecules display optical inactive: (1)CH₃CHBrCH₂CH₃, (2)CH₃CH₂CHCl₂,
(3)1-bromo-2chloropropane, (4)1,2-dichloropentane
(A)(2) (B)(1), (2) (C)(3) (D)(1) (E)(4)
- (A) 21.What mass of AgNO₃ (169.9g / mol) is needed to convert 2.33g of Na₂CO₃ (106.0g / mol) to Ag₂CO₃?
(A)7.47g (B)0.044g (C)0.022g (D)3.73g (E)1.57g
- (D) 22. Calculate the molar concentration of HNO₃ (63.0 g / mol) in the solution that has a specific gravity of 1.42 and is 70% HNO₃ (w / w).
(A)8M (B)4M (C)13M (D)16M (E)12M
- (E) 23. Exactly 50.00mL of an HCl solution requires 29.71mL of 0.01963 M Ba(OH)₂ to reach an end point with bromocresol green indicator. Calculate the molarity of the HCl.
(A)0.0133M (B)0.0196M (C)0.029M (D)0.0046M (E)0.0233M
- (C) 24.Calculate the hydronium ion concentration of pure water at 25 .
(A)1.0×10⁻⁶M (B)1.0×10⁻⁴M (C)1.0×10⁻⁷M (D)1.0×10⁻¹⁴M (E)1.0×10⁻⁸M
- (C) 25. Calculate the hydronium ion concentration in 0.200M aqueous NaOH
(A)0.020M (B)1.0 ×10⁻¹⁴M (C)5.0 ×10⁻¹⁴M (D)0.1M (E)1.0 ×10⁻⁷M
- (E) 26. Which of the followings are Lewis acids?
- (1)CH₃CH₂ - O - H (B)CH₃ - NH - CH₃ (3)MgBr₂ (4)CH₃ - B - CH₃
CH₃
- (5)H - C⁺ - H (6)CH₃ - P - CH₃
H CH₃
- (A)(1), (2) (B)(2), (4), (5) (C)(1), (4), (5) (D)(4), (5), (6) (E)(3), (4), (5)

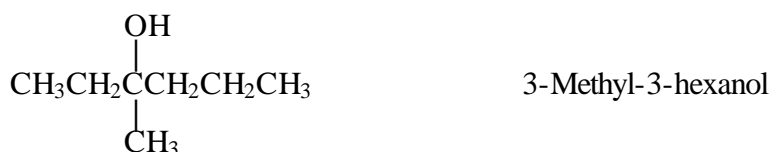
- (A) 27. Which of the following compounds can exist as pairs of cis-trans isomers?
 (1) $\text{CH}_3\text{CH}=\text{CH}_2$
 (2) $(\text{CH}_3)_2\text{C}=\text{CHCH}_3$ (3) $\text{CH}_3\text{CH}_2\text{CH}=\text{CHCH}_3$ (4) $(\text{CH}_3)_2\text{C}=\text{C}(\text{CH}_3)\text{CH}_2\text{CH}_3$
 (5) $\text{ClCH}=\text{CHCl}$ (6) $\text{BrCH}=\text{CHCl}$
 (A) 3, 5, 6 (B) 2, 3, 6 (C) 3, 4, 5 (D) 1, 2, 4 (E) 2, 5, 6

- (B) 28. Assign E or Z configuration to these alkenes, respectively:



- (A) E, Z, E (B) Z, E, Z (C) Z, Z, E (D) E, E, Z (E) Z, Z, Z

- (B) 29. How many alkene products, including E,Z isomers, might be obtained by dehydration of 3-methyl-3-hexanol with aqueous sulfuric acid?

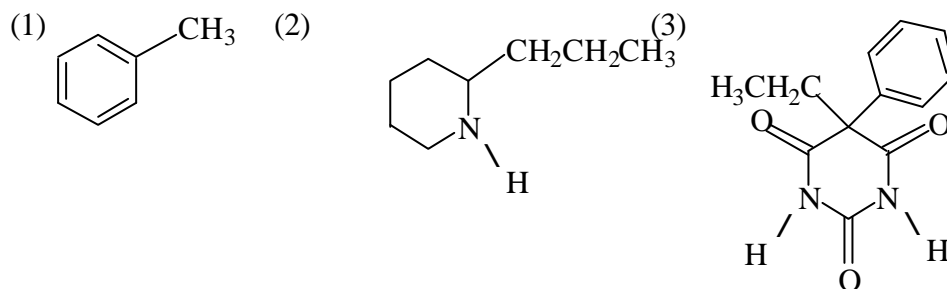


- (A) 6 (B) 5 (C) 4 (D) 3 (E) 2

- (B) 30. What product would you obtain from catalytic hydrogenation of this alkene, $(\text{CH}_3)_2\text{C}=\text{CHCH}_2\text{CH}_3$?

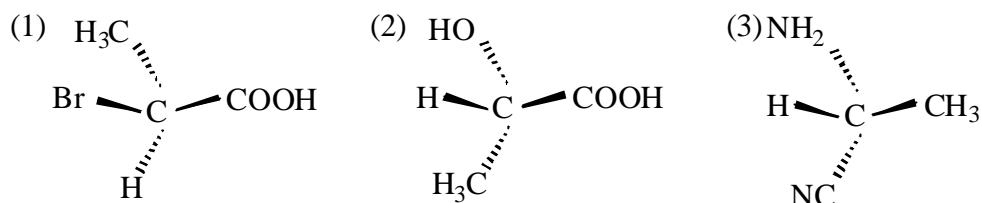
- (A) 1-methylpentane (B) 2-methylpentane (C) 4-methylpentane
 (D) 1,2-dimethylpentane (E) 3-methylpentane

- (A) 31. Which of these compounds are chiral?



- (A) (2) (B) (1) (C) 3 (D) 1, 2 (E) 1, 3

(E) 32. Assign R, S configurations to these molecules, respectively:



(A)R, S, S (B)S, S, S (C)R, R, R (D)R, R, S (E)S, S, R

(B)33. Which of these substances have a meso form, respectively? (1)2, 3-Dibromobutane, (2)2, 3-Dibromopentane, (3)2, 4-Dibromopentane.

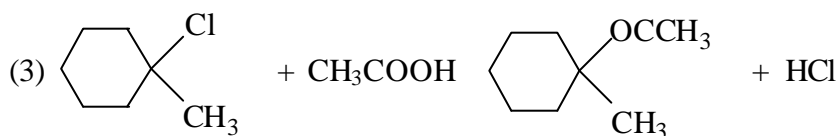
(A)1, 2 (B)1, 3 (C)2 (D)2, 3

(A)34. Which reagent in the following compounds is more nucleophilic?

(A)(CH₃)₂N⁻ (B)(CH₃)₂NH (C)(CH₃)₃B (D)(CH₃)₃N (E)CH₃NH₂

(E)35. Tell whether these reactions are S_N1:

(1)1-Bromobutane + NaN₃ → 1-Azidobutane

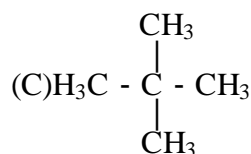
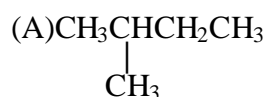


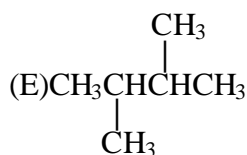
(A)1, 2 (B)1, 3 (C)2, 3 (D)2 (E)3

(E)36. How many nonequivalent kinds of protons are present in this compound, 2-methyl-1-butene?

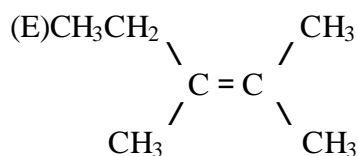
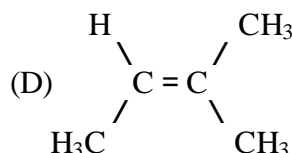
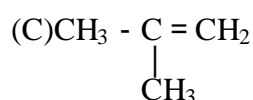
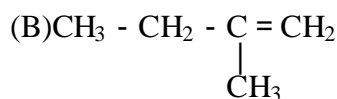
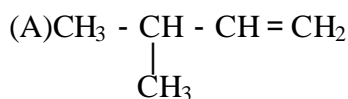
(A)1 (B)2 (C)3 (D)4 (E)5

(E)37. Which of the following has the greatest Van der Waal's attraction for other molecules of the same kind?

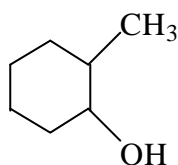
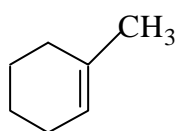




(A)38. Which of the following alkenes reacts with HCl at the slowest rate?

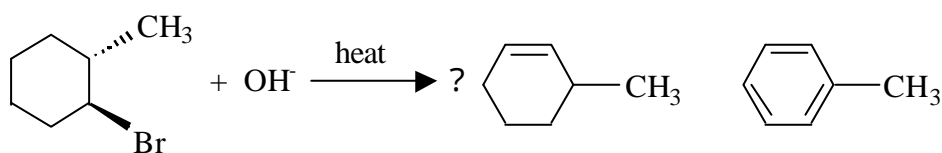


(E)39. What are the reagents needed to accomplish the following transformation?



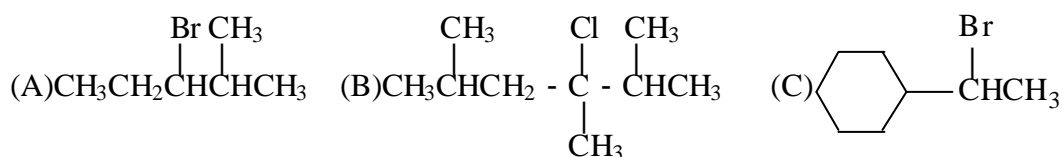
- (A) $\text{H}_2\text{O} / \text{H}^+$ (B) $\text{H}_2\text{O} / \text{Peroxide}$ (C) $\text{Hg}(\text{OAc})_2, \text{H}_2\text{O} / \text{NaBH}_4$ (D) BH_3
 (E) $\text{BH}_3 / \text{OH}^-, \text{H}_2\text{O}_2, \text{H}_2\text{O}$

(A)40. Which of the following compounds shown below is/are the product(s) of this reaction:

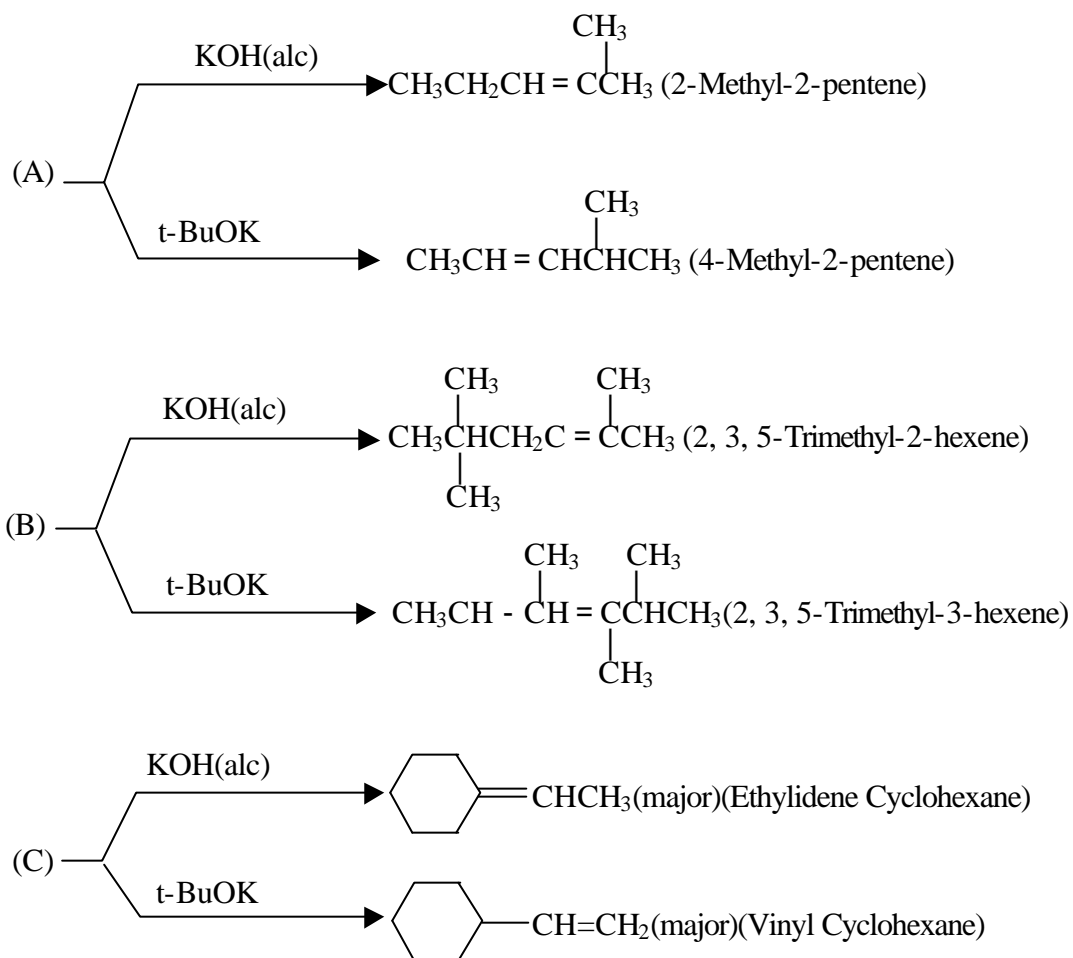


- (A) only (B) only (C) and of equal yield (D) is major, is minor
 (E) is minor, is major

. What major products (give the name of product) would you expect from elimination reactions of these alkyl halides?(6%)



解：



. An unknown compound (A), $\text{C}_4\text{H}_7\text{ClO}_2$, gave the following proton NMR data:(4%)

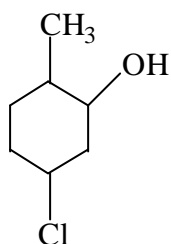
- (a)triplet, at 1.31 ppm (3H)
 - (b)singlet, at 3.95 ppm (2H)
 - (c)quartet, at 4.20 ppm (2H)
- Propose a structure for A.

解： O

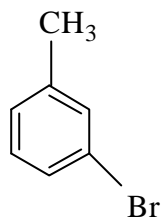


. Give the IUPAC name for each of the following compounds.(2%each, total 10%)

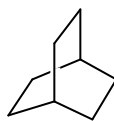
(a)



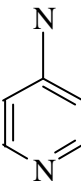
(b)



(c)



(d) $\text{CH}_3\text{CH}_2\text{CH}_2 - \text{COOH}$

(e) H_3C  CH_3

解：(a) 5-Chloro-2-methyl Cyclohexanol

(b) 3-Bromotoluene

(c) Bicyclo [2.2.2.] Octane

(d) Butanoic acid

(e) 4-(N.N-dimethylamino)pyridine