

建國補習班 學士後西醫第一回模擬考試題

科目：化學

時間：80 分鐘

1. The term that describes the following series Ne, F⁻, O²⁻, and N³⁻ is

(A) Isotopic	(B) isoelectronic
(C) isobar	(D) allotropic
(E) anionic	

2. Which oxide of chlorine is unstable?

(A) Cl ₂ O	(B) Cl ₂ O ₃
(C) ClO ₂	(D) Cl ₂ O ₅
(E) Cl ₂ O ₇	

3. The formula for hydrosulfuric acid is

(A) H ₂ SO ₄	(B) H ₂ SO ₃
(C) HSO ₄	(D) H ₂ S
(E) H ₂ S ₂ O ₃	

4. Concentrated nitric acid is 70.0% (w/w) and a density=1.413 g/cm³. How many moles of HNO₃ are present in 300.0 mL of solution?

(A) 4.71	(B) 6.67
(C) 9.42	(D) 13.4
(E) 3.56	

5. Calculate the molarity when 18.5g of HNO₃ are dissolved in enough water to prepare 450.0 mL of solution.

(A) 0.260	(B) 6.711
(C) 1.58	(D) 0.653
(E) 0.129	

6. An unusual way to prepare ethane, C₂H₆, is by the following method:

$$\text{C(s)} + \text{CH}_4\text{(g)} + \text{H}_2\text{(g)} \longrightarrow \text{C}_2\text{H}_6\text{(g)}$$
 Calculate the H° in kJ of reaction for this most unusual preparation.

$\text{C(s)} + 2\text{H}_2\text{(g)} \longrightarrow \text{CH}_4\text{(g)}$	H° = -75 kJ/mol
$2\text{CH}_4\text{(g)} \longrightarrow \text{C}_2\text{H}_6\text{(g)} + \text{H}_2\text{(g)}$	H° = 65 kJ

(A) 10	(B) -10
(C) 140	(D) -140
(E) 70	

7. Calculate the ionization energy, in kJ/mol, of a mole of hydrogen atoms in the ground state.

$$\frac{1}{I} = R_H \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right); R_H = 1.09678 \times 10^7 \text{ m}^{-1}$$

(A) 327	(B) 654
(C) 1312	(D) 145
(E) 981	

8. The Pauli exclusion principle states that
- (A) electrons must spin
 - (B) all electrons occupy spherical orbitals
 - (C) all even number electron systems must pair their electrons
 - (D) we can never know the position of an electron exactly
 - (E) no two electrons in any system can have the same four quantum numbers
9. In what row or period of the periodic table do we first encounter an f-electron?
- (A) 3
 - (B) 4
 - (C) 5
 - (D) 6
 - (E) 7
10. Place the following atoms, N, I, Br, Cl, and F, in order of increasing electron affinity values.
- (A) $I < Br < Cl < F < N$
 - (B) $N < I < Br < Cl < F$
 - (C) $N < I < Br < F < Cl$
 - (D) $I < Br < Cl < N < F$
 - (E) $N < F < Cl < Br < I$
11. Which one of the following molecules possesses a triple bond?
- (A) CO
 - (B) C_2H_4
 - (C) N_2H_2
 - (D) SO_2
 - (E) ClF_3
12. Calculate the formal charge on carbon in $COCl_2$
- (A) 0
 - (B) +1
 - (C) -1
 - (D) +2
 - (E) -2
13. Which one of the following molecules would exhibit the greatest polarity?
- (A) CH_4
 - (B) CH_3F
 - (C) CH_2F_2
 - (D) CHF_3
 - (E) CF_4
14. Which one molecule or ion has a bond order that differs from all other molecules or ions listed below?
- (A) CO
 - (B) CN^-
 - (C) N_2
 - (D) O_2
 - (E) NO^+
15. Which of the following expressions is consistent with Dalton's Law?
- (A) $Pt = nRT/V$
 - (B) $Pt = (n_1 + n_2)RT/V$
 - (C) $Pt = n_i RT/V$
 - (D) $Pt = n_1 RTV$
 - (E) $Pt = V/n_i RT$
16. Which pair of molecules are involved in hydrogen bonding?
- (A) H_2 and HI
 - (B) CH_3OH and NH_3
 - (C) CH_4 and C_2H_6
 - (D) SO_2 and HCHO
 - (E) H_2 and F_2
17. The density of aluminum is greatest (assume equal sized cells) when the unit cell is :
- (A) simple cubic
 - (B) face-centered cubic
 - (C) body-centered cubic
 - (D) tetrahedral
 - (E) octahedral

18. Iodine heptafluoride forms

- (A) a metallic solid (B) an amorphous solid
(C) a covalent solid (D) a molecular solid
(E) an ionic solid

19. 0.00100 mol of CaCO_3 is dissolved in 4200.0 mL.

What is the concentration in parts per million?

- (A) 23.8 (B) 2.38
(C) 0.00420 (D) 0.420

20. The vapor pressure of pure ether, at 25 °C, is 316 torr.

The vapor pressure of the solution is 285 torr. Calculate the mole fraction of solute in a diethyl ether solution.

- (A) 0.90 (B) 0.098
(C) 0.80 (D) 0.19
(E) 0.66

21. In which process does enthalpy (H) not equal or approximately equal the internal energy (E)?

- (A) $V=0$ (B) $n=0$ for gases
(C) melting of a solid (D) freezing of a liquid
(E) vaporization of a liquid

22. Which of the following systems undergoes the greatest entropy change?

- (A) $\text{Na(s)} (25^\circ\text{C}) \longrightarrow \text{Na(s)} (30^\circ\text{C})$
(B) $\text{Cl}_2(\text{g}) (25^\circ\text{C}) \longrightarrow \text{Cl}_2(\text{g}) (30^\circ\text{C})$
(C) $\text{H}_2\text{O(l)} (25^\circ\text{C}) \longrightarrow \text{H}_2\text{O(l)} (30^\circ\text{C})$
(D) $\text{H}_2\text{O(s)} (0^\circ\text{C}) \longrightarrow \text{H}_2\text{O(l)} (0^\circ\text{C})$
(E) $\text{Ca(s)} (-20^\circ\text{C}) \longrightarrow \text{Ca(s)} (-5^\circ\text{C})$

23. The first-order specific rate constant is found to be $1.37 \times 10^{-3} \text{ hr}^{-1}$. Calculate $t_{1/2}$ in hours :

- (A) 3.89×10^4 (B) 730
(C) 317 (D) 506
(E) 8.98

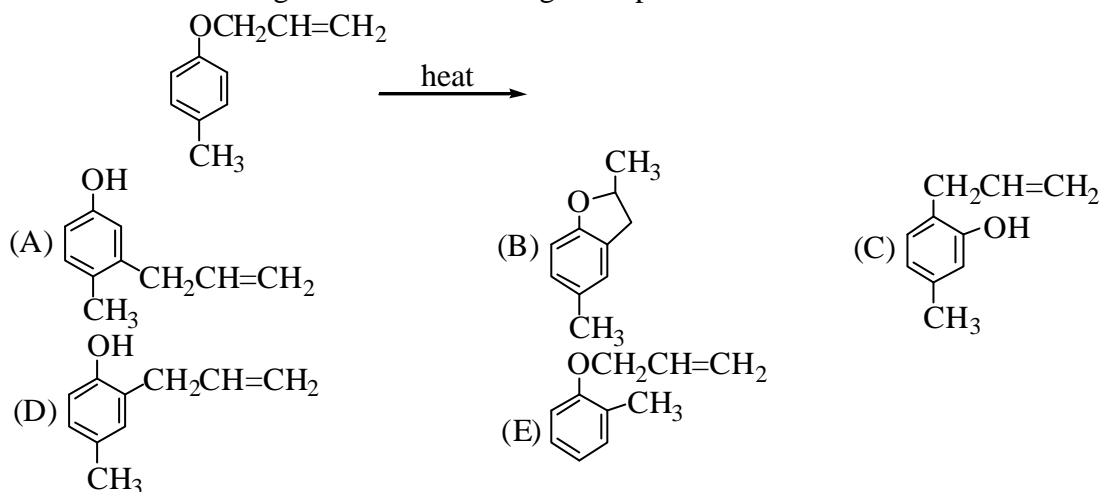
24. Which one of the following changes the numerical value of chemical equilibrium constant, K?

- (A) addition of a catalyst (B) change in temperature
(C) addition of more reactant (D) removal of some of the products
(E) decrease of volume

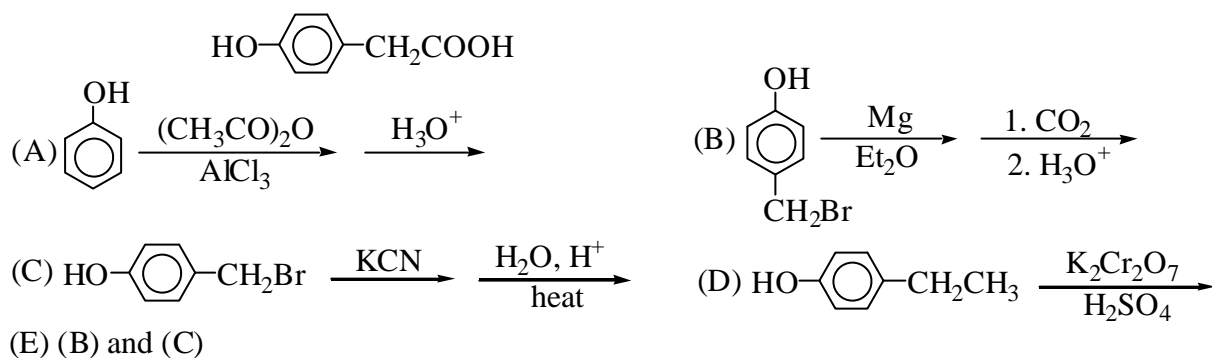
25. Calculate the approximate $[\text{PO}_4^{3-}]$ in a 0.1 M H_3PO_4 solution. ($K_{a1}=10^{-3}$; $K_{a2}=10^{-8}$; $K_{a3}=10^{-13}$)

- (A) 10^{-3} (B) 10^{-8}
(C) 10^{-13} (D) 10^{-21}
(E) 10^{-4}

26. Which of the following is the Claisen rearrangement product from the reaction below?



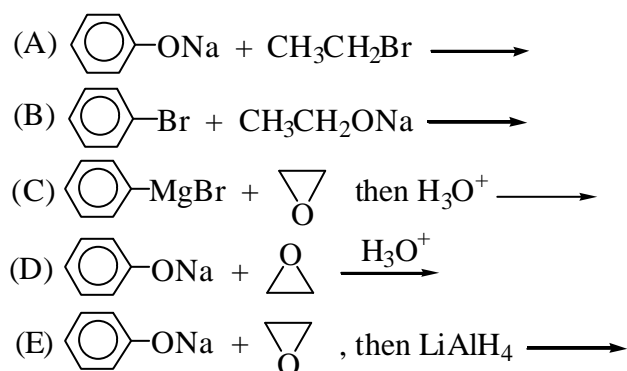
27. Which of the following methods works best to synthesize the compound shown below?



28. Which one of the following ethers is the most unreactive to cleavage with HBr?

- (A) $C_6H_5OCH_2C_6H_5$ (B) $H_2C=CHCH_2OCH_2CH=CH_2$
 (C) $C_6H_5OC_6H_5$ (D) $(CH_3)_3COC(CH_3)_3$
 (E) $CH_3OC(CH_3)_3$

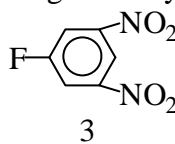
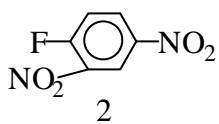
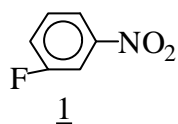
29. Which one of the following reactions gives ethyl phenyl ether, $CH_3CH_2OC_6H_5$, as the major product?



30. Which one of the following is most acidic?

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

31. Arrange the following compounds in order of increasing reactivity with sodium methoxide?



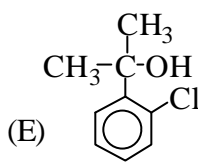
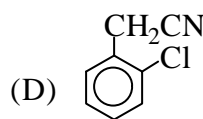
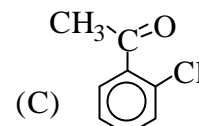
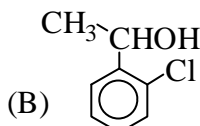
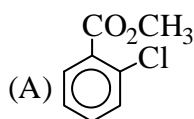
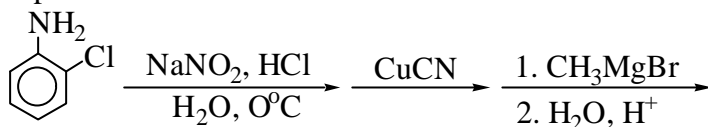
(A) $1 < 2 < 3$

(B) $1 < 3 < 2$

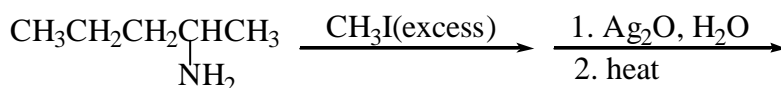
(C) $2 < 1 < 3$

(D) $3 < 2 < 1$

32. What is the product of the reaction series shown below?



33. What is the major product of the reaction sequence below?

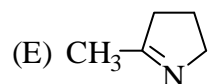


(A) CC(C)C=C

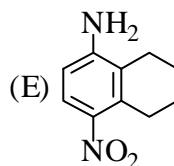
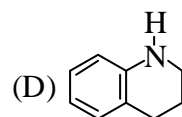
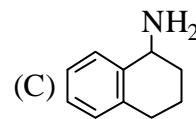
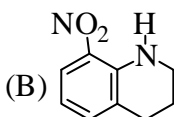
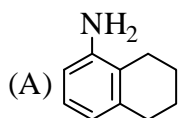
(B) CC(C)C(O)C

(C) CC=CC(C)C

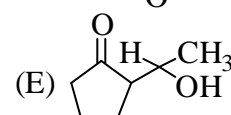
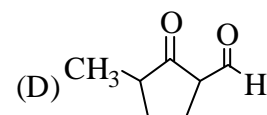
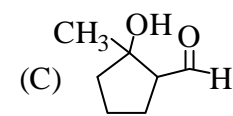
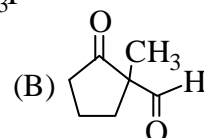
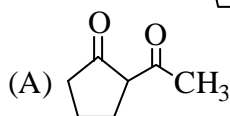
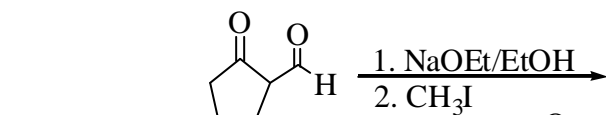
(D) CC(C)C(O)C(N)C



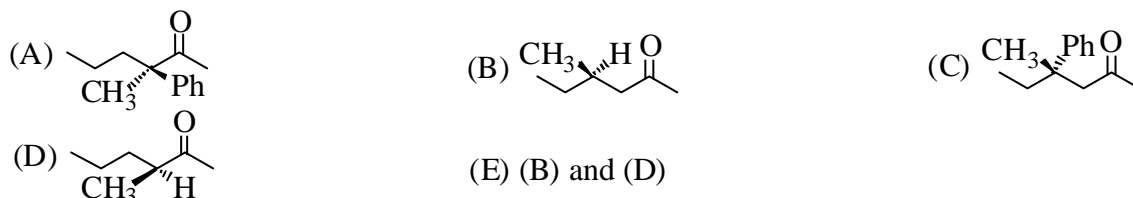
34. Which one of the following is the strongest base?



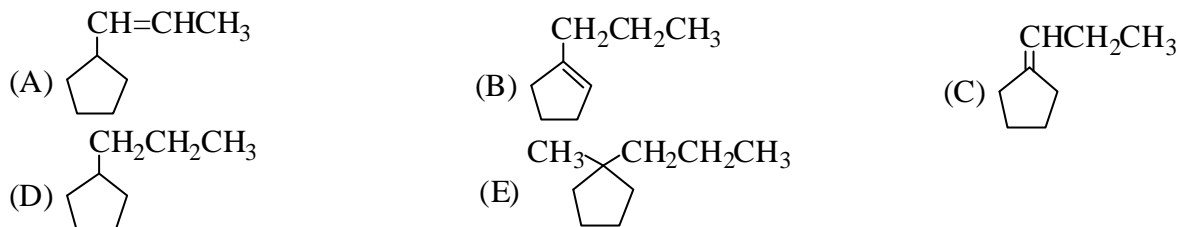
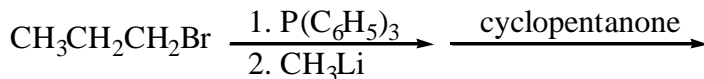
35. What is the product of the following reaction?



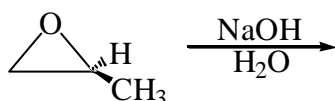
36. Which one of the following optically active compounds racemizes in dilute KOH/CH₃OH solution?



37. What is the product of the following reaction sequence?



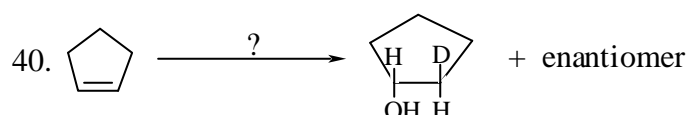
38. What is the product of the following reaction?



- (A) (S)-1, 2-propanediol (B) racemic-1, 2-propanediol
 (C) (R)-1, 2-propanediol (D) 1, 3-propanediol
 (E) acetone

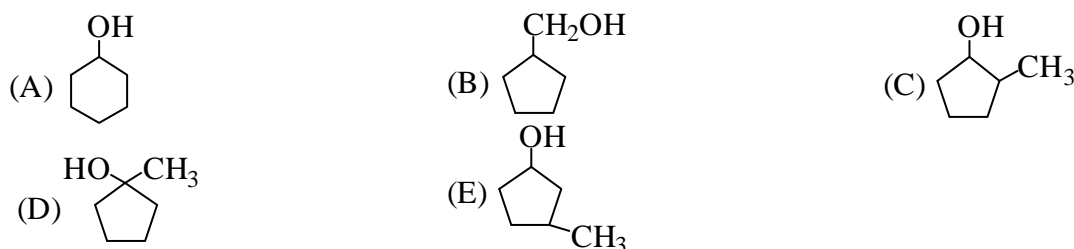
39. What reagents and/or reaction sequence below would convert trans-3-hexene to meso-3,4-hexanediol?

- (A) OsO₄, (CH₃)₃COOH, (CH₃)₃COH, NaOH (B) O₃ then Zn/H₂O
 (C) B₂H₆, diglyme then H₂O₂, OH⁻ (D) CH₃CO₃H, then H₂O, NaOH
 (E) dilu, KMnO₄, OH⁻, cold

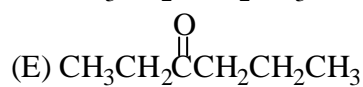
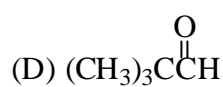
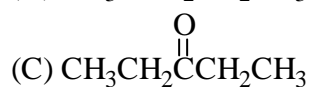
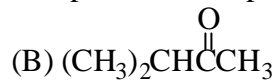
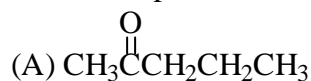


- (A) 1. CH₃CO₂H 2. LiAlH₄ 3. H₂O (B) 1. B₂D₆, THF 2. H₂O₂, OH⁻
 (C) 1. D₂/Pt 2. Br₂, hv 3. NaOH, H₂O (D) 1. DCl 2. H₂O, CH₃OH, heat
 (E) 1. mCPBA 2. LiAlD₄ 3. H₃O⁺

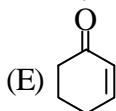
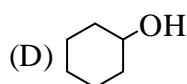
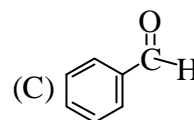
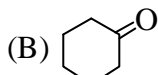
41. Compound A, C₆H₁₂O, is readily oxidized with K₂Cr₂O₇, in H₂SO₄/H₂O to give compound B, C₆H₁₀O, compound B has four peaks in its ¹³C NMR (broadband decoupling), which one of the following fits the data for compound A?



42. Which compound would be expected to show an intense peak in mass spectrum at m/z 58?



43. Which compound would be expected to show intense IR absorption at 1780 cm^{-1} ?



44. The conversion of benzoic acid to phenylacetic acid is best accomplished with



(E) none of these

45. Which of the following alkenes show geometric isomerism?

1-chloropropene 3-methylcyclohexene 2,6-dimethyl-2,5-octadiene 3-ethyl-3-methyl-1-pentene

1

2

3

4

(A) 1 and 2

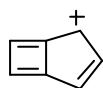
(B) 2 and 3

(C) 3 and 4

(D) 1 and 3

(E) 2 and 4

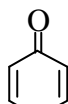
46. Which of the following structures would you expect to be aromatic?



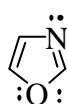
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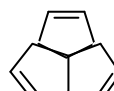
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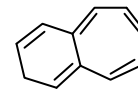
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4



5



6

(A) 1, 2, and 5

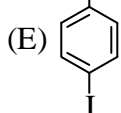
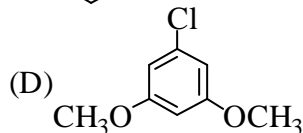
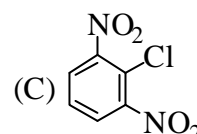
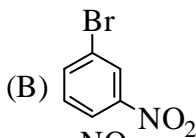
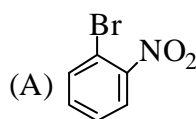
(B) 1, 4, and 6

(C) 2, 3, and 4

(D) 1 and 4

(E) 2, 3, and 6

47. Which of the following benzene derivatives could be expected to react rapidly with sodium methoxide at 40°C ?

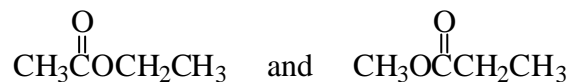


48. An unknown compound is soluble in cold concentrated H_2SO_4 , but insoluble in sodium hydroxide.

It does not decolorize bromine and does not react with sodium metal. The class of compounds to which the unknown belongs:

- (A) alkanes (B) alkenes
(C) alcohols (D) ethers
(E) phenols

49. Which of the following technique(s) can readily distinguish between:



- (A) NMR (B) IR
(C) MS (D) (A) and (B)
(E) (A) and (C)

50. Which of the following are more stable isomers?

I. cis or trans-1,4-dibromocyclohexane

II. cis or trans-1,3-dibromocyclohexane

- (A) I cis and II trans (B) I cis and II cis
(C) I trans and II cis (D) I trans and II trans
(E) I trans and II cis = trans

解答

1.(B) 2.(C) 3.(D) 4.(A) 5.(D) 6.(B) 7.(C) 8.(E) 9.(D) 10.(C)
11.(A) 12.(A) 13.(D) 14.(D) 15.(C) 16.(B) 17.(B) 18.(D) 19.(A) 20.(B)
21.(E) 22.(D) 23.(D) 24.(B) 25.(D) 26.(D) 27.(C) 28.(C) 29.(A) 30.(E)
31.(B) 32.(C) 33.(A) 34.(C) 35.(B) 36.(D) 37.(C) 38.(A) 39.(D) 40.(E)
41.(A) 42.(A) 43.(A) 44.(A) 45.(D) 46.(D) 47.(C) 48.(D) 49.(E) 50.(C)