

八十五學年度 化學系 化學，應用化學 組碩士班研究生入學考試
 科目 綜合化學 科號 0601 0701 共 10 頁第 1 頁 *請在試卷【答案卷】內作答

單選題，每題二分，不倒扣

- Which of the following reagent is frequently used in gas analysis to absorb carbon monoxide?
 (A) cuprous chloride (B) calcium chloride
 (C) pyrogalllic acid (D) sodium peroxide
 (E) cupric chloride
- A solution with $\text{pH} = 2$ is more acidic than one with a $\text{pH} = 6$ by a factor of
 (A) 4 (B) 12 (C) 400 (D) 10,000 (E) 8
- How many liters of air is needed to burn 8 liters of acetylene completely?
 (A) 40 (B) 60 (C) 80 (D) 100 (E) 120
- For correct results, in all acid-base titrations the indicator must change color at a pH
 (A) slightly greater than 7 (B) slightly less than 7
 (C) equal to 7 (D) equal to that at the stoichiometric point
 (E) equal to 10
- The molal freezing point depression constant for water is
 (A) 0.51 (B) 1.00 (C) zero (D) 273 (E) 1.86
- What is the important precaution that is observed in the storage of metallic sodium?
 (A) leave the container uncovered
 (B) store the sodium in kerosene
 (C) store the sodium in water
 (D) use an opaque container
 (E) store the sodium in ethanol

八十五學年度 化 學 系 化學、應用化學 組碩士班研究生入學考試

科目 綜合化學 科號 0601 共 10 頁第 2 頁 *請在試卷【答案卷】內作答

7. In using a hydrogen generator with zinc and hydrochloric acid, the thistle tube should be below the surface of the liquid in order to prevent
(A) explosion (B) oxidation of the zinc (C) evaporation of the HCl
(D) heat from escaping (E) escape of the gas
8. Solutions which distill without change in composition or temperature are called
(A) amorphous (B) azeotropic mixtures
(C) saturated (D) supersaturated (E) ideal solutions
9. Which one of the following species could be Lewis base?
(A) a positive ion (B) a molecule with an unfilled octet
(C) inorganic molecules with double bonds
(D) negative ions (E) organic molecules with sigma bonds
10. To which one of the following reason the anomalous boiling point of water is generally attributed?
(A) van der Waal's forces (B) ionic bonding
(C) covalent bonding (D) coordinate bonding
(E) hydrogen bonding
11. Assuming that at S.T.P., gas A has a density of 0.09 g/l and gas B has a density of 1.43 g/l, the relative diffusion rate of gas A to that of gas B is
(A) 1 to 16 (B) 16 to 1 (C) 2 to 1 (D) 4 to 1 (E) 1 to 2
12. From Trouton's rule, the latent heat of evaporation per gm-molecular weight of a liquid divided by its boiling point is a constant which is about,
(A) 6.3 (B) 3.0 (C) 10.0 (D) 50.0 (E) 21.0

八十五學年度 化學系 化學、應用化學組碩士班研究生入學考試

科目 綜合化學 科號 0601 0701 共 10 頁第 3 頁 *請在試卷【答案卷】內作答

13. In the first transition series, the paramagnetism is due almost entirely to the unpaired spins, and is approximately equal to $\mu = 2\sqrt{S(S+1)}$ magnetons, where S is the total spin. On this basis, the Cu^+ ion has
 (A) zero magnetons (B) 3.88 magnetons
 (C) 2.83 magnetons (D) 6.18 magnetons
 (E) 1.41 magnetons
14. How does NaH behave in the presence of water?
 (A) as an acid (B) as a base (C) as a neutral
 (D) as an oxidizing agent
15. Which one of the following hydrogen compounds violates the rule of eight?
 (A) NH_3 (B) HF (C) BH_3 (D) CH_4
16. What is the order rate of a radioactive decay?
 (A) first (B) zero (C) second (D) $1/2$
17. Which one of the following forms of radiation is least penetrative?
 (A) beta(+) (B) alpha (C) gamma (D) beta(-)
18. The constant 0.05916, at 298 K, that appears in the Nernst equation is,
 (A) nF/T (B) RT/F (C) T/F (D) $2.303RT/F$
19. Which one of the following acid is best suitable to extract Ba from BaTiO_3 ?
 (A) H_2SO_4 (B) HCl (C) $\text{H}_2\text{C}_2\text{O}_4$ (D) H_3PO_4
20. To prepare a solution with a $\text{pH}=5.00$ using NaF and HF , what should the base to acid ratio be? $K_a = 7.2 \times 10^{-4}$
 (A) 72.0:1 (B) 1.00:1 (C) 20.0:1 (D) 0.555:1

八十五學年度 化學系 化學、應用化學 組碩士班研究生入學考試

科目 綜合化學 科號 0601 0701 共 10 頁第 4 頁 *請在試卷【答案卷】內作答

21. Which oxide, when dissolved in water, produces an acidic solution?
(A) d-block oxide (B) s-block oxide (C) f-block oxide
(D) nonmetal oxide
22. Which one of the following ions contributes to water hardness?
(A) H^+ (B) Fe_3^+ (C) OH^- (D) NO_3^-
23. Electromagnetic radiation is characterized by all but one of the following properties?
(A) charge (B) frequency (C) velocity (D) amplitude
24. Which of the solvent cannot be used with a GC-ECD?
(A) hexane (B) methylene chloride (C) isobutane
(D) propane
25. Which alkali metal halide would be least ionic?
(A) LiF (B) LiI (C) CaI_2 (D) $MgBr_2$
26. The limit of detection is independent of
(A) noise (B) sensitivity (C) accuracy (D) precision
27. Of the following, the element possessing the highest first ionization energy is
(A) B (B) C (C) N (D) O
28. Of the following, the aquated metal ion possessing the largest rate constant for water exchange is
(A) Ni^{2+} (B) Cu^{2+} (C) Co^{2+} (D) Fe^{2+}
29. Of the following, the metal with the highest melting point is
(A) Ti (B) Cr (C) Mo (D) W

八十五學年度 化 學 系 化學・應用化學 組碩士班研究生入學考試

科目 綜合化學 科號 0601 0701 共 10 頁第 5 頁 *請在試卷【答案卷】內作答

30. Of the following, the reagent which can separate Fe^{3+} from Al^{3+} ions is
(A) NaOH (B) KCNS (C) NH_4OH (D) H_2S
31. Which of the following correctly describes a body-centered cubic structure?
(A) coordinate number = 8, 2 atom per unit cell
(B) coordinate number = 6, 2 atom per unit cell
(C) coordinate number = 12, 2 atom per unit cell
(D) coordinate number = 12, 4 atom per unit cell
32. The point group of PCl_3 is
(A) C_{3v} (B) D_{3h} (C) D_{3d} (D) none of the above
33. Which of the following oxides of nitrogen is a brown gas that dimerizes at low temperature to form a colorless liquid?
(A) N_2O (B) NO (C) NO_2 (D) N_2O_3
34. The energy (E) of an electron according to the Bohr's model of the hydrogen atom depends on a proportionality constant (k) and a quantum number (n) which describes the size of the orbit. Which of the following equations describes the dependence of E on n?
(A) $E = -k/n$ (B) $E = -k/n^2$ (C) $E = -kn$ (D) $E = -kn^2$
35. Of the following, the ion that is least likely to form a complex with ammonia is
(A) Mg^{++} (B) Ni^{++} (C) Ag^+ (D) Na^+
36. Which of the following reactions would have a negative ΔS° ?
(A) $\text{H}_2(\text{g}) \rightarrow 2\text{H}(\text{g})$ (B) $\text{H}_2(\text{l}) \rightarrow \text{H}_2(\text{g})$
(C) $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{HCl}(\text{g})$ (D) $2\text{H}_2(\text{g}) + \text{CO}(\text{g}) \rightarrow \text{CH}_3\text{OH}(\text{g})$

八十五學年度 化學系 化學、應用化學組碩士班研究生入學考試
 科目 綜合化學 科號 0601 共 10 頁第 6 頁 *請在試卷【答案卷】內作答

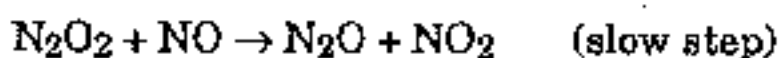
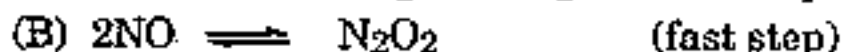
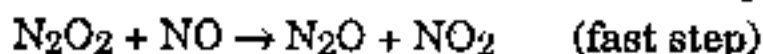
37. The reaction



has the following experimental rate law.

$$\text{rate} = k(\text{NO})^3$$

Which of the following mechanisms is consistent with this rate law?



(C) Both of these mechanisms are consistent with this rate law.

(D) Neither of these mechanisms are consistent with this rate law.

38. Which statement is true?

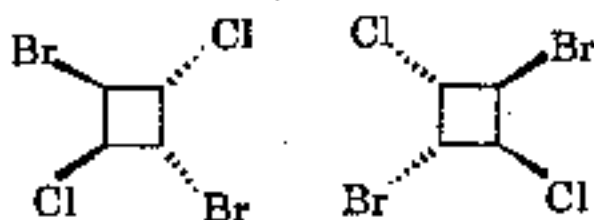
(A) the rate of appearance of products of a chemical reaction is always equal to the rate of disappearance of reactants.

(B) if a reaction follows a second-order rate law, it must have two steps in its reaction mechanism.

(C) the half-life for a first-order reaction is independent of the initial concentration of the reactant.

(D) the half-life for a second-order reaction is independent of the initial concentration of the reactant.

39. Give the relationship of the following two structures.



(A) same compound

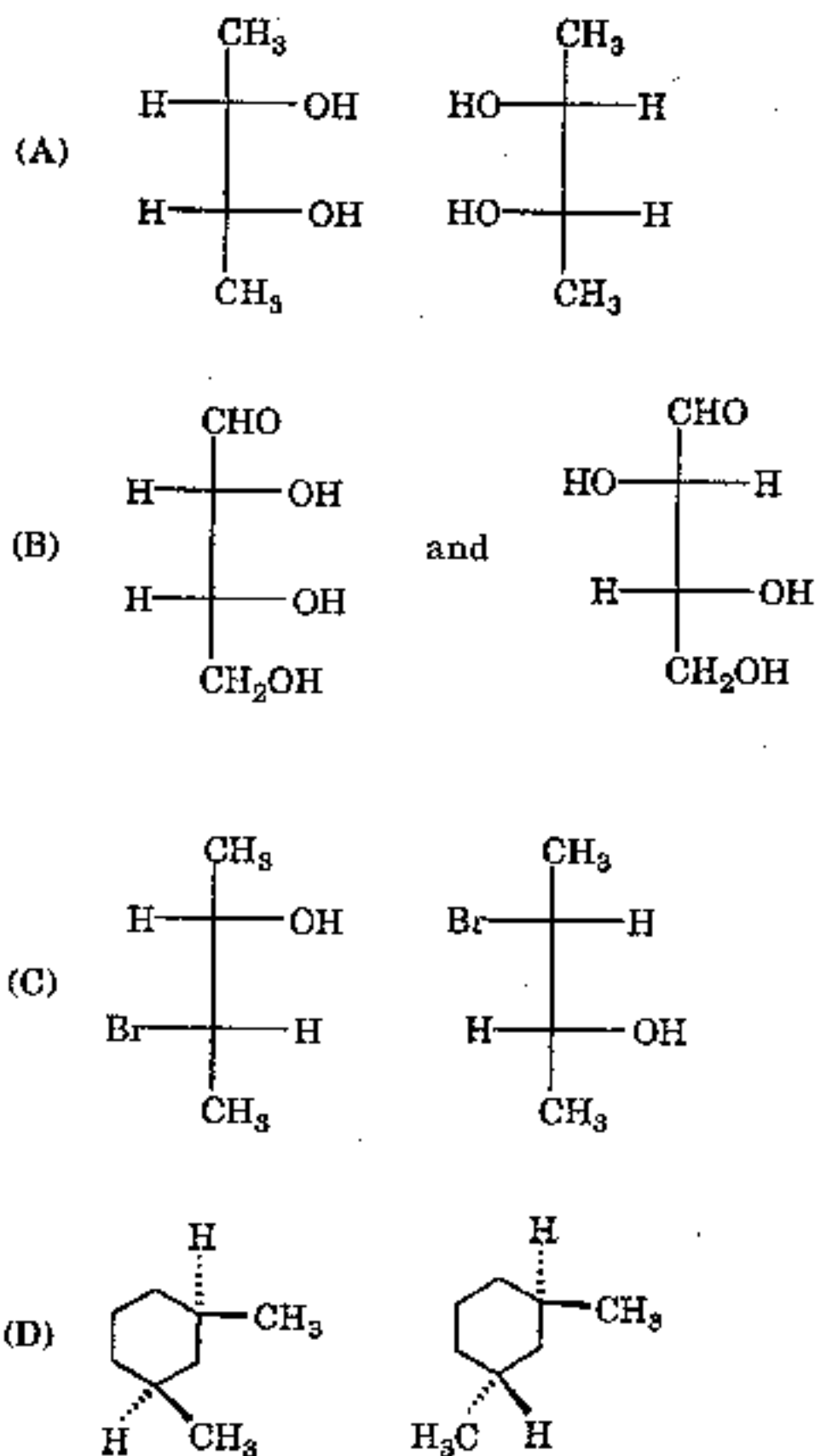
(B) structural isomers

(C) enantiomers

(D) diastereomers

八十五學年度 化學系 化學、應用化學 組碩士班研究生入學考試
 科目 綜合化學 科號 0601 0701 共 10 頁第 7 頁 *請在試卷【答案卷】內作答

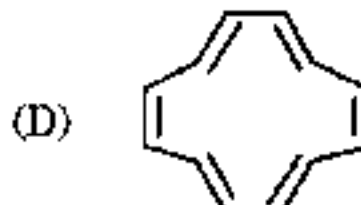
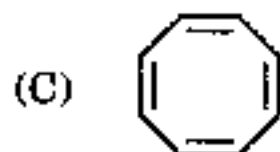
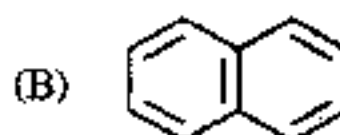
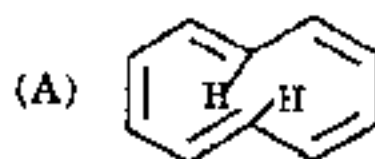
40. Which of the following pairs of compounds are enantiomers?



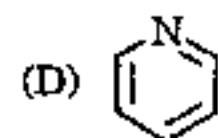
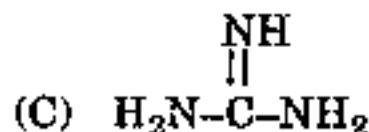
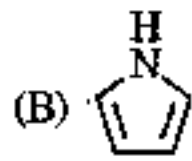
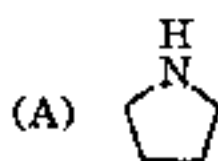
八十五學年度 化學系 化學、應用化學 組碩士班研究生入學考試

科目 綜合化學 科號 0601 0701 共 10 頁第 8 頁 *請在試卷【答案卷】內作答

41. Which of the following compounds will give the lowest heat of hydrogenation?
 (A) $\text{CH}_3\text{CH}_2\text{C}=\text{CH}$ (B) $\text{CH}_3\text{C}=\text{CCH}_2$ (C) $\text{CH}_3\text{CH}=\text{C}=\text{CH}_2$
 (D) $\text{CH}_2=\text{CH}-\text{CH}=\text{CH}_2$
42. Which of the following compounds has the most acidic hydrogen?
 (A) Benzene (B) ethylene (ethene)
 (C) acetylene (ethyne) (D) ethane
43. Which of the following compounds is aromatic and most stable?



44. Which of the following compounds is the strongest base?




45. Which of the following compounds is the strongest nucleophile?
 (A) $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$ (B) $(\text{CH}_3\text{CH}_2)_3\text{P}$
 (C) $\text{CH}_3\text{CH}_2\text{SCH}_2\text{CH}_3$ (D) $(\text{CH}_3\text{CH}_2)_3\text{N}$

八十五學年度 化學系 化學、應用化學 組碩士班研究生入學考試
 科目 綜合化學 科號 0601 0701 共 10 頁第 9 頁 *請在試卷【答案卷】內作答

46. Which of the following compounds absorbs most strongly in the infrared radiation between 1600 and 1800 cm^{-1} ?

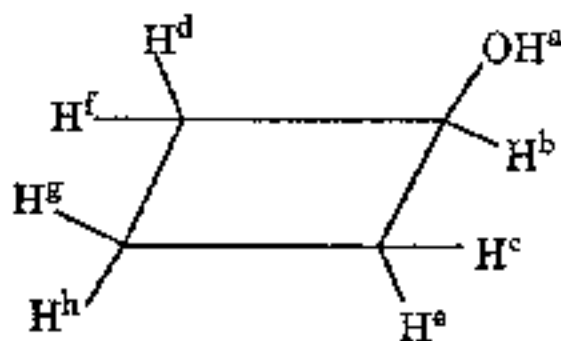
- (A) $\text{HN}=\text{CHCH}_2\text{CH}_3$ (B) $\text{CH}_2=\text{CHCH}_2\text{CH}_3$
 (C) $\text{CH}_3\text{CH}=\text{CHCH}_3$ (D) $\text{O}=\text{CHCH}_2\text{CH}_3$

47. Which of the protons in the following compounds is the most deshielded in the NMR spectra?

- (A) $\text{CH}_3-\text{CO}-\text{CH}_3$ (B)  (C) $\text{HC}=\text{CH}$
 (D) $\text{CH}_2=\text{CH}_2$

48. Which of the following pairs of protons in cyclobutanol is diastereotopic and chemically nonequivalent?

- (A) H^a-H^b (B) H^c-H^d (C) H^e-H^f (D) H^g-H^h



49. Show the most stable carbanion in the following:

- (A) $^-\text{CH}(\text{CO}_2\text{Me})_2$ (B) $^-\text{CH}(\text{COMe})_2$ (C) $^-\text{CH}(\text{CN})_2$
 (D) $\begin{array}{c} ^-\text{CHCOMe} \\ | \\ \text{CO}_2\text{Me} \end{array}$

八十五學年度 化學系 化學、應用化學 組碩士班研究生入學考試

科目 綜合化學 科號 0601 0701 共 10 頁第 10 頁 *請在試卷【答案卷】內作答

50. Predict the product of the elimination of vicinal dibromide with potassium iodide.

