

- 一、選擇題。共五十題，每題兩分。答錯一題倒扣零點四分。
二、請將答案寫在試卷上

1

1. How many significant figures are there in the number 0.00060420 ?
a) 7 b) 3 c) 8 d) 4 e) 5
2. The state of matter for an objective that has a definite volume but not a definite shape is
a) solid state b) liquid state c) gaseous state d) element state e) mixed state
3. An example of pure substance is a) elements b) compounds c) pure water d) CO₂
e) all of these
4. The correct name for NaBr is a) monosodium bromide b) monosodium monobromide
c) sodium(I) bromide e) sodium bromide
5. Naturally occurring copper exists in two isotopic forms: ⁶³Cu and ⁶⁵Cu. The atomic mass of copper is 63.55 amu. What is the approximate natural abundance of ⁶³Cu?
a) 63% b) 90% c) 70% d) 50% e) 30%
6. When 20.0 g C₂H₆ and 60.0 g O₂ react to form CO₂ and H₂O, how many grams of water are formed? a) 14.5 b) 18.0 c) 58.0 d) 20.0 e) none of these
7. In which of the following does nitrogen have an oxidation number of +4?
a) HNO₃ b) NO₂ c) N₂O d) NH₄Cl e) NaNO₂
8. Which gas has the highest density? a) He b) Cl₂ c) CH₄ d) NH₃ e) all gas the same
9. Calculate the ratio of the effusion rates of N₂ and N₂O.
a) 0.637 b) 1.57 c) 1.25 d) 0.798 e) 1.61
10. Which of the following are state functions? I. energy II. work III. enthalpy IV. heat
a) I, II b) I, III c) II, III d) I, II, III e) All
11. For the reaction H₂O(l) → H₂O(g) at 298K, 1.0 atm, ΔH is more positive than ΔE by 2.5 kJ/mol. This quantity of energy can be considered to be a) the heat flow required to maintain a constant temperature b) the work done in pushing back the atmosphere c) the difference in the H-O bond energy in the two states d) the value of ΔH itself e) none of these
12. On a planet where the temperature is so high, the ground state of an electron in the hydrogen atom is n=4. What is the ratio of IE on this planet compared to earth?
a) 1:4 b) 4:1 c) 1:16 d) 16:1 e) none of these
13. Which of the following pairs is isoelectronic?
a) Li⁺, K⁺ b) Na⁺, Ne c) I⁻, Cl⁻ d) S²⁻, Ne e) Al³⁺, B³⁺
14. How many of the following molecules-SF₂, SF₄, SF₆, SiO₂ - are polar?
a) 0 b) 1 c) 2 d) 3 e) 4
15. According to VSEPR theory, which of the following species has a square planar molecular structure? a) TeBr₄ b) BrF₃ c) IF₅ d) XeF₄ e) SCl₂

(背面仍有題目,請繼續作答)

16. What is the bond order of C_2^{+} ? a) 0 b) $1/2$ c) 1 d) 1.5 e) 2
17. The fact that O_2 is paramagnetic can be explain by a) the lewis structure. b) resonance. c) a violation of the octet rule. d) the molecular orbital diagram for O_2 . e) hybridization of atomic orbitals in O_2 .
18. Which of the following statements is true about p-type silicon?
a) It is produced by doping Si with P or As. b) Electron are the mobile charge carriers.
c) It does not conduct electricity as well as pure Si. d) All are true e) None is true
19. A solution of hydrogen peroxide is 30% by mass and has a density of 1.11 g/cm^3 . The molarity of the solution is a) 7.94 M b) 8.82 M c) 9.79 M d) 0.98 M e) none of these
20. All the following are colligative properties except a) osmotic pressure b) boiling point elevation c) freezing point depression d) density elevation e) none of these
21. Determine the molecularity of the following elementary reaction: $O_3 \rightarrow O_2 + O$.
a) unimolecular b) bimolecular c) termolecular d) quadmolecular e) can't be determined
22. If the reaction $2HI \rightarrow H_2 + I_2$ is second order, which of the following will yield a linear plot? a) $\log [HI]$ vs time b) $1/[HI]$ vs time c) $[HI]$ vs time d) $\ln [HI]$ vs time e) none
23. The pH of a 0.100 M solution of an aqueous weak acid (HA) is 3.20. The K_a for the weak acid is a) 6.3×10^{-4} b) 7.2×10^{-5} c) 4.0×10^{-6} d) 3.2 e) none of these
24. How many moles of solid NaF would have to be added to 1.0 L of 1.90 M HF solution to achieve a buffer of pH 3.35? Assume there is no volume change. (K_a for HF = 7.2×10^{-4})
a) 3.1 b) 2.3 c) 1.6 d) 1.0 e) 4.9
25. Which of the following compounds has the lowest solubility in water? a) $Al(OH)_3$, $K_{sp} = 2 \times 10^{-32}$ b) CdS, $K_{sp} = 1 \times 10^{-28}$ c) $PbSO_4$, $K_{sp} = 1.3 \times 10^{-8}$ d) $Sn(OH)_2$, $K_{sp} = 3 \times 10^{-27}$ e) MgC_2O_4 , $K_{sp} = 8.6 \times 10^{-5}$
26. Which of the following shows a decrease in entropy? a) precipitation b) gaseous reactants forming a liquid c) a burning piece of wood d) melting ice e) two of these
27. Assume that the enthalpy of fusion of ice is 6020 J/mol and does not vary appreciably over the temperature range 270-290 K. If one mole of ice is melted by heat supplied from surroundings at 280 K, what is the entropy change in the surroundings, in J/K?
a) +22.0 b) +21.5 c) 0.0 d) -21.5 e) -22.0
28. In which case must a reaction be spontaneous at all temperatures ?
a) ΔH is positive, ΔS is positive b) $\Delta H = 0$, ΔS is negative c) $\Delta S = 0$, ΔH is positive
d) ΔH is negative, ΔS is positive e) none of these

29. At constant pressure, the following reaction $2 \text{NO}_2(\text{g}) \rightarrow \text{N}_2\text{O}_4(\text{g})$ is exothermic. The reaction is a) always spontaneous b) spontaneous at low temperatures, but not high temperatures c) spontaneous at high temperatures, but not low temperature d) never spontaneous
30. Which of the following is not a state function ?
a) q b) G c) H d) E e) P
31. How many electrons are transferred in the following reaction ?
 $2 \text{ClO}_3^- + 12 \text{H}^+ + 10 \text{I}^- \rightarrow 5 \text{I}_2 + \text{Cl}_2 + 6 \text{H}_2\text{O}$
a) 12 b) 5 c) 2 d) 30 e) 10
32. Which of the following is true for the cell shown here ? $\text{Zn}(\text{s}) | \text{Zn}^{2+}(\text{aq}) || \text{Cr}^{3+}(\text{aq}) | \text{Cr}(\text{s})$
a) The electrons flow from the cathode to the anode b) The electrons flow from the zinc to the chromium c) The electrons flow from the chromium to the zinc d) The chromium is oxidized e) The zinc is reduced
33. A voltaic cell has an E° value of +1.00 V. The reaction a) is not spontaneous. b) has $K=1$. c) has $K>1$. d) has $\Delta G^\circ=0$. e) has a negative ΔG° .
34. Which type of battery has been designed for use in space vehicles ?
a) lead storage b) alkaline dry cell c) mercury cell d) fuel cell e) silver cell
35. Which oxide of a Group 2A element is not highly ionic ?
a) Be b) Mg c) Ca d) Sr e) Ba
36. The compound SiO_2 does not exist as a discrete molecule while CO_2 does. This can be explained because a) the Si-O bond is unstable. b) The Lewis structure of SiO_2 has an even number of electrons. c) The SiO_2 is a solid while CO_2 is a gas. d) the 3p orbital of the Si has little overlap with the 2p of the O. e) none of these
37. The process of transforming N_2 to a form usable by animals and plants is called
a) nitrogen fixation. b) fertilization. c) denitrification. d) nitrogenation.
38. Which of the following is a d^9 ion ? a) Fe(II) b) Zn(II) c) Mn(V) d) Cu(II) e) Hg(II)
39. Which compound shows geometric isomers ? a) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ b) $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ c) $\text{CoCl}_2\text{Br}_2^{2-}$ (tetrahedral) d) $\text{Co}(\text{NH}_3)_3\text{Cl}_3$ e) none of these
40. Which is paramagnetic ? a) $\text{Zn}(\text{H}_2\text{O})_6^{2+}$ b) $\text{Co}(\text{NH}_3)_6^{3+}$ (strong field) c) $\text{Cu}(\text{CN})_3^{2-}$ d) $\text{Mn}(\text{CN})_6^{2-}$ (strong field) e) none of these
41. Which of the following process increases the atomic number by 1 ?
a) gamma-ray production b) electron capture c) beta-particle production
d) positron production e) alpha-particle production

(背面仍有題目,請繼續作答)

42. The half-life of ^{90}Sr is 28 years. How long will it take for a given sample of ^{90}Sr to be 90% decomposed ?
a) 9 half-lives b) 4.3 years c) 93 years d) 5.7×10^{-3} years e) none of these
43. How many isomers of C_4H_8 are there ? a) 1 b) 2 c) 3 d) 5 e) 6
44. Which of the following is not a structure isomer of 1-pentene ? a) 2-pentene
b) 2-methyl-2-butene c) cyclopentane d) 3-methyl-1-butene e) 1-methyl-cyclobutene
45. Which of the following molecules exhibits chirality ? a) CH_2Cl_2 b) CH_3OH
c) $\text{CH}_3\text{CH}_2\text{OH}$ d) $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$ e) none of these
46. Which of the following will yield a carboxylic acid upon oxidation ?
a) a secondary alcohol b) an aldehyde c) a cycloalkane d) a ketone e) tertiary alcohol
47. Which of the following becomes more soluble in water upon addition of NaOH ?
a) an amine b) a carboxylic acid c) an aldehyde d) an aromatic hydrocarbon
e) an alkane
48. A poly peptide is a) an condensation polymer of amino acids. b) a condensation polymer of amino acids. c) a polymer of sugar molecules. d) a part of nucleic acids.
e) none of these
49. The bond angle in H_2Se is about a) 120° b) 60° c) 180° d) 109° e) 90°
50. Which ion is planar ? a) NH_4^+ b) CO_3^{2-} c) SO_3^{2-} d) ClO_3^- e) all are planar