一. 選擇題，共四十題，每題二點五分。答錯，每題倒扣零點五分。
二. 答案請寫在答案卷上。

1. Measured quantities, such as length, mass, or time, can be described as :
a) sometimes certain. b) always certain. c) always uncertain. d) sometimes uncertain.

2. How many significant figures are there in the number 0.0050320 ?
a) 7 b) 3 c) 8 d) 4 e) 5

3. An example of pure substance is a) pure water b) compounds c) elements d) CO
e) all of these

4. The correct name for NaF is a) monosodium fluoride b) monosodium monofluoride
c) sodium(I) fluoride d) sodium fluoride

5. Naturally occurring copper exists in two isotopic froms: ^{63}Cu and ^{65}Cu. The atomic mass of copper is 63.55 amu. What is the approximate natural aboundance of ^{63}Cu?
a) 90% b) 63% c) 70% d) 50% e) 30%

6. In which of the following does nitrogen have an oxidation number of +4?
a) HNO_3 b) NO_2 c) N_2O d) NH_4Cl e) $NaNO_2$

7. Which gas has the highest density? a) He b) Cl_2 c) CH_4 d) NH_3 e) all gas the same

8. Calculate the ratio of the effusion rates of N_2 and N_2O.
a) 0.637 b) 1.57 c) 1.25 d) 0.798 e) 1.61

9. 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

10. For the reaction $H_2O(l)$ ---> $H_2O(g)$ 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

11. Which of the following pairs is isoelectronic?
a) Li^+, K^+ b) Na^+, Ne c) I^-, Cl^- d) S^{2-}, Ne e) Al^{3+}, B^{3+}

12. How many of the following molecules-SF_2, SF_4, SF_6, SiO_2 - are polar?
a) 0 b) 1 c) 2 d) 3 e) 4

13. According to VSEPR theory, which of the following species has a square plannar molecular structure? a) $TeBr_4$ b) CH_4 c) IF_5 d) XeF_4 e) $SiCl_4$

14. What is the bond order of C_2^+? a) 0 b) 1/2 c) 1 d) 1.5 e) 2

15. 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 .

16. 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) 0.98 M b) 8.82 M c) 9.79 M d) 7.94 M e) none of these

(背面仍有題目,請繼續作答)

17. 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

18. Determine the molecularity of the following elementary reaction: $O_3 \rightarrow O_2 + O$.
a) unimolcular b) bimolecular c) termolecular d) quadmolecular e) can't be determined

19. If the reaction $2HI \rightarrow H_2 + I_2$ is second order, which of the following will yield a linear plot? a) [HI] vs time b) 1/[HI] vs time c) log [HI] vs time d) ln [HI] vs time e) none

20. 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

21. 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

22. Which of the following compounds has the lowest solubility in water? a) $Al(OH)_3$, Ksp=2×10^{-32} b) CdS, Ksp=1×10^{-28} c) $PbSO_4$, Ksp=1.3×10^{-8} d) $Sn(OH)_2$, Ksp=3×10^{-27} e) MgC_2O_4, Ksp=8.6×10^{-5}

23. 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

24. In which case must a reaction be spontaneous at all temperatures ?
a) ΔH is positive, ΔS is positve 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

25. At constant presssure, the following reaction $2\,NO_2(g) \rightarrow N_2O_4(g)$ 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

26. How many electrons are transferred in the following reaction ?
$2\,ClO_3^- + 12\,H^+ + 10\,I^- \rightarrow 5\,I_2 + Cl_2 + 6\,H_2O$
a) 12 b) 5 c) 2 d) 30 e) 10

27. Which of the following is true for the cell shown here ? $Zn(s)|Zn^{2+}(aq)||Cr^{3+}(aq)|Cr(s)$
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

28. 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 $\Delta G°=0$. e) has a negative $\Delta G°$.

29. Which oxide of a Group 2A element is not highly ionic ?
a) Be b) Mg c) Ca d) Sr e) Ba

30. 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

31. The process of transforming N_2 to a form usable by animals and plants is called a) nitrogen fixation. b) nitrogenation. c) denitrification. d) fertilization.

32. Which compound shows geomeric isomers ? a) $[Co(NH_3)_6]Cl_3$ b) $[Co(NH_3)_5Cl]Cl_2$ c) $CoCl_2Br_2^{2-}$ (tetrahedral) d) $Co(NH_3)_3Cl_3$ e) none of these

33. Which is paramagnetic ? a) $Zn(H_2O)_6^{2+}$ b) $Co(NH_3)_6^{3+}$ (strong field) c) $Cu(CN)_3^{2-}$ d) $Mn(CN)_6^{2-}$ (strong field) e) none of these

34. Which of the following process increases the atomic number by 1 ? a) alpha-particle production b) elctron capture c) beta-particle production d) positron production e) gamma-ray production

35. 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) 4.3 years b) 9 half-lives c) 93 years d) 5.7×10^{-3} years e) none of these

36. How many isomers of C_4H_8 are there ? a) 6 b) 2 c) 1 d) 5 e) 3

37. Which of the following is not a structure isomer of 1-pentene ? a) 2-pentene b) 1-methyl-cyclobutene c) cyclopentane d) 3-methyl-1-butene e) 2-methyl-2-butene

38. Which ion is planar ? a) SO_3^{2-} b) CO_3^{2-} c) NH_4^+ d) ClO_3^- e) all are

39. 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 alkane e) an aromatic hydrocarbon

40. Which of the following will yield a carboxylic acid upon oxidation ? a) a secondary alcohol b) tertiary alcohol c) a cycloalkane d) a ketone e) an aldehyde