科目：普通化學　〈請將答案寫在答案卷上〉

Multiple Choice Questions 單選題（每題 2 分，答錯不倒扣）

1. Which of the following chemical symbols represents an element?
   (A) IF　(B) HI　(C) SO　(D) C

2. Which of the following is the formula for barium chloride?
   (A) $BaCl_2$　(B) BaCl　(C) Ba_2Cl　(D) Ba_2Cl_2

3. Calculate the percent composition of Carbon in sucrose ($C_{12}H_{22}O_{11}$)
   (A) 12%　(B) 21%　(C) 42%　(D) 64%

4. How many gram of CO_2 are produced from burning 342 g of sucrose ($C_{12}H_{22}O_{11}$)?
   (A) 88 g　(B) 44 g　(C) 264 g　(D) 528 g

5. Which of the following is **not** an electrolyte?
   (A) KCl　(B) NH_4Cl　(C) Br_2　(D) CH_3COOH

6. Which of the following is **not** a weak acid?
   (A) H_2CO_3　(B) CH_3COOH　(C) HI　(D) NH_4Cl

7. How many gram of nitric acid (HNO_3) are present in 500.0 mL of 1.0 M solution?
   (A) 31.5 g　(B) 315 g　(C) 63.0 g　(D) 630 g

8. When 25.0 mL of a 10.6 M HCl solution is diluted to 100.0 mL, what is the final molarity of this acidic solution?
   (A) 1.33 M　(B) 2.65 M　(C) 3.98 M　(D) 5.30 M

9. Which of the following descriptions about ideal gas is **not** correct?
   (A) There is no intermolecular force between the molecules.
   (B) He gas is the better approximation of the ideal gas than Ar gas at the same temperature.
   (C) The ideal gas obeys Boyle's law at any temperature.
   (D) The ideal gas obeys Charles's law only when the temperature is higher than 0℃.

10. If the barometer were built using water instead of Hg, how high would the column of water be if the pressure were 1 atm, knowing that the density of water is 13.6 times lower than that of mercury?
    (A) 2.06 m　(B) 5.15 m　(C) 10.3 m　(D) 20.0 m

11. Gas A diffuse twice as fast as gas B. Gas B has a molecular weight = 60.0 g/mol. What is the molar mass of Gas A?
    (A) 15.0 g/mol　(B) 120g/mol　(C) 30g/mol　(D) 90g/mol

12. Which of the following procedures will **not** change the position of equilibrium?
    (A)Add a catalyst　　　　　(B) Remove the products
    (C) Change of the temperature　　(D) None of these

13. The frequency of an electromagnetic wave is 3.0×10^{14} Hz. What is its wavelength?
    (A) 2×10^{-6} m　(B) 0.5μm　(C) 100 nm　(D) 1000 nm

14. What is the principal quantum number of $3d_{z^2}$ orbital?
    (A) 1　(B) 2　(C) 3　(D) 4

15. What is the angular momentum quantum number of $3d_{z^2}$ orbital?
    (A) 1　(B) 2　(C) 3　(D) 4

16. How many quantum numbers are required to describe the electron of any systems?
    (A) 1　(B) 2　(C) 3　(D) 4

17. If the principal quantum number is 4, how many values of the angular momentum quantum number are possible?
    (A) 1　(B) 2　(C) 3　(D) 4

18. If the angular momentum quantum number is 4, how many values of the magnetic quantum number are possible?
    (A) 5　(B) 7　(C) 9　(D) 11

19. A f-orbital has an angular momentum value equal to 3. How many total electrons can the f-orbitals hold?
    (A) 22　(B) 18　(C) 14　(D) 10

20. How many orbitals have the principal quantum number $n = 3$?
    (A) 9　(B) 7　(C) 5　(D) 3

21. In the hydrogen atom spectrum, for which of the following transitions the light emission has the shortest wavelength?
    (A) $n = 6$ to $n = 5$　(B) $n = 3$ to $n = 2$　(C) $n = 5$ to $n = 3$　(D) $n = 6$ to $n = 4$

22. Which of the following molecules has a dipole moment equal to 0?
    (A) CH_4　(B) H_2O　(C) HF　(D) H_2O_2

23. Calculate the formal charge on carbon in CO.
    (A) +2　(B) 0　(C) -1　(D) -2

24. Find the oxidation state of carbon in CO_2.
    (A) +2　(B) +4　(C) -2　(D) -4

25. Find the oxidation state of chlorine in ClO_3^-.
    (A) +1　(B) +3　(C) +5　(D) +7

26. Which of the following molecules possesses a triple bond?
    (A) SF_6　(B) PCl_5　(C) C_2H_2　(D) CH_3COOH

27. What hybridization describes a square planer geometry?

  (A) sp^3 (B) spd (C) sp^2d (D) sp^2

28. Which of the following molecules has a bond order that differs from the others?

  (A) O_2 (B) NO^- (C) BN (D) CO

29. Which of the following molecules has the unpaired electron?

  (A) O_2 (B) N_2 (C) F_2 (D) CO

30. Which of the following molecules has the highest boiling point?

  (A) H_2S (B) CO_2 (C) C_2H_6 (D) H_2O

31. The change from a solid to a gas state is known as:

  (A) Sublimation (B) Evaporation (C) Condensation (D) Gas-state melting

32. The solubility of a certain compound is 29.3 g/ 100 g of water. How many grams of this solute will dissolve in 200 g of water?

  (A) 341 g (B) 29.3 g (C) 682 g (D) 58.6 g

33. At STP, Which gas has the highest density?

  (A) O_2 (B) N_2 (C) He (D) C_2H_6

34. What volume of solution is required to prepared 0.01 M solution containing 1.8 g $C_6(H_2O)_6$?

  (A) 10 mL (B) 100 mL (C) 1L (D) 10 L

35. 0.01 M glucose ($C_6(H_2O)_6$) solution with density of 1.0 g/cm^3, what is the weight percent of $C_6(H_2O)_6$ in the solution?

  (A) 1.8 % (B) 18 % (C) 0.18 % (D) none of these

36. For a reaction to take place, the molecules that are reacting:

  (A) Must have more energy than the products

  (B) Must have less energy than the products

  (C) Must be able to reach the activation energy

  (D) Must be in considerable numbers

37. Which of the following is **not** a factor determining the energy of activation according to the Arrhenius equation?

  (A) Orientation of molecules   (B) temperature

  (C) Frequency factors   (D) None of these choices

38. A 0.5 M HX solution is 0.3 % ionized. What is its pH?

  (A) 0.30 (B) 0.0015 (C) 0.65 (D) 2.8

39. What is the pH of a 0.1 M phosphoric acid solution? $K_{a1} = 7.5 \times 10^{-3}$, $K_{a2} = 6.2 \times 10^{-8}$, and $K_{a3} = 4.8 \times 10^{-13}$

  (A) 4.0 (B) 1.5 (C) 2.5 (D) 0.8

40. A Lewis acid:

  (A) accepts a proton   (B) releases hydrogen

  (C) accepts electrons   (D) donates electrons

41. 1 mole of NaF and 1mole of HF are mixed in 900.0 mL of solution. What is the pH of this buffer pair? K_a for HF = 7.2×10^{-4}

  (A) 2.2 (B) 3.1 (C) 4.2 (D) 6.2

42. Which of the following exhibits the greatest metallic character?

  (A) Mg (B) Cs (C) Na (D) Ba

43. Which of the following elements has the smallest atomic radius?

  (A) Be (B) Li (C) C (D) O

44. Which of the following elements has the largest first ionization energy?

  (A) He (B) Ne (C) Ar (D) Kr

45. Which of the following ions has the smallest hydration energy?

  (A) F^- (B) Cl^- (C) Br^- (D) I^-

46. Identify the missing particle in the following equation:

$$^{238}_{92}U \rightarrow\, ^4_2He + ?$$

  (A) $^{242}_{94}Pu$ (B) $^{234}_{90}Th$ (C) $^{242}_{90}Th$ (D) $^{234}_{92}U$

47. The radius of hydrogen atom is about:

  (A) 0.5 $\overset{\circ}{A}$ (B) 0.5 nm (C) 0.5 μm (D) 0.5 pm

48. The ratio of the atomic radius to the nuclear radius is approximately:

  (A) 10^{-5} (B) 10^5 (C) 10^{15} (D) 10^{-15}

49. How many isomers of C_6H_{14} are there?

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

50. Which of the following has the lowest boiling point?

  (A) methane (B) butane (C) ethane (D) propane