選擇題，共 25 題，每題 4 分，共 100 分，答錯不倒扣。

1. Round off 00507506 to four significant figures (有效數字).
   (a) 0051, (b) 5076, (c) 5100, (d) 5.075×10^5.

2. Which of the following is a part of Dalton's atomic theory (道耳頓的原子說)?
   (a) atoms are rearranged but not changed during a chemical reaction,
   (b) atoms break down during radioactive decay,
   (c) atoms contain protons, neutrons, and electrons,
   (d) isotopes of the same element have different masses.

3. How many electrons are in the ion Zn^{2+} ?
   (a) 28, (b) 30, (c) 32, (d) 65.

4. The most likely charge on an ion of phosphorus, P, is
   (a) 3-, (b) 2-, (c) 2+, (d) 5+.

5. What is the sum of the coefficients when the following equation is balanced using the lowest, whole numbered coefficients ?

   ___$PH_3(g)$ + ___$O_2(g)$ → ___$P_4O_{10}(s)$ + ___$H_2O(g)$
   (a) 10, (b) 12, (c) 19, (d) 22.

6. Which pair of reactants will produce a gas when mixed together ?
   (a) $HCl(aq)$ and $Au(s)$,
   (b) $HCl(aq)$ and $Na_2CO_3(aq)$,
   (c) $HCl(aq)$ and $NaOH(aq)$,
   (d) $HCl(aq)$ and $Pb(NO_3)_2$ (aq).

7. Mendeleev (門得列夫) arranged the elements according to
   (a) atomic number and atomic weight,
   (b) atomic weight and chemical reactivity,
   (c) electron configuration and atomic weight,
   (d) physical state and relative abundance.

8. Which ionic compound would be expected to have the highest lattice energy (晶格能) ?
   (a) $NaCl$, (b) MgO, (c) AlF_3, (d) Al_2O_3.

9. At the equilibrium bond length
   (a) the attractive forces holding the atoms together are greater than the repulsive forces,
   (b) the potential energy is a maximum,
   (c) the potential energy is a minimum,
   (d) the repulsive forces are greater than the attractive forces holding the atoms together.

10. The greater the electronegativity (電負度) difference between two bonded atoms, the
    (a) greater the bond order,
    (b) greater the covalent character of the bond,
    (c) greater the ionic character of the bond,
    (d) more unstable the bond.

11. Which of the following contains an atom that does **NOT** obey the octet rule (八隅體) ?
    (a) KBr, (b) CO_2, (c) ClF_3, (d) ICl.

12. Given $S(s) + O_2(g) \rightarrow SO_2(g)$ $\Delta H° = -296.1$ kJ
        $2 SO_3(g) \rightarrow 2 SO_2(g) + O_2(g)$ $\Delta H° = 198.2$ kJ
    Find $\Delta H°$ for : $2 S(s) + 3O_2(g) \rightarrow 2 SO_3(g)$
    (a) –790.4 kJ, (b) –394.0 kJ, (c) –97.9 kJ, (d) +97.9 kJ.

13. A process by which gas molecules escape through a tiny hole in a membrane (薄膜) without collisions (碰撞) is called,
    (a) Boyle's law, (b) diffusion, (c) effusion, (d) sublimation.

14. Which of the following is most likely to have the highest viscosity (黏滯性) at 25°C ?
    (a) C_4H_{10}, (b) $HOCH_2CH_2OH$, (c) C_8H_{18}, (d) $C_2H_5NH_2$.

15. Given the following hypothetical reaction : $2 E(g) + F(g) + G(g) \rightarrow$ products. If the rate law is :
    Rate= $k[E]^2[F]^{-1}$, what is the overall order of reaction ?
    (a) zero, (b) first, (c) second, (d) third.

16. Which of the following changes in reaction conditions will **NOT** alter the equilibrium concentrations ?
    (a) addition of an inert gas to the reaction mixture,
    (b) addition of reactants or products,
    (c) decreasing the pressure or volume,
    (d) increasing the temperature.

17. If the ionization constant of water, K_w, at 40°C is 2.92×10^{-14} then what is the hydronium ion concentration for a neutral solution ?
    (a) $[H_3O^+] > 1.00 \times 10^{-7}$ M,
    (b) $[H_3O^+] > 1.71 \times 10^{-7}$ M,
    (c) $[H_3O^+] = 1.71 \times 10^{-7}$ M,
    (d) $[H_3O^+] < 1.71 \times 10^{-7}$ M.

18. Which of the three laws of thermodynamics provides a criterion for spontaneity (自發) ?
    (a) the first law of thermodynamics,
    (b) the second law of thermodynamics,
    (c) the third law of thermodynamics,
    (d) both the second and third laws of thermodynamics.

19. What is the number of spherical nodes in a 4 s orbital ?
    (a) 0, (b) 2, (c) 3, (d) 4.

20. The complex $[Ni(CN)_4]^{2-}$ is diamagnetic and the complex $[NiCl_4]^{2-}$ is paramagnetic (順磁性的).
    What can you conclude about their molecular geometries ?
    (a) both complexes have square planar geometries,
    (b) both complexes have tetrahedral geometries,
    (c) $[NiCl_4]^{2-}$ has a square planar geometry while complex $[Ni(CN)_4]^{2-}$ has a tetrahedral geometry,
    (d) $[NiCl_4]^{2-}$ has a tetrahedral geometry while complex $[Ni(CN)_4]^{2-}$ has a square planar geometry.

21. What is the ground-state electron configuration of Se^{2-} ?
   (a) $[Ar]3d^{10}4s^24p^3$,
   (b) $[Ar]3d^{10}4s^24p^4$,
   (c) $[Ar]3d^{10}4s^24p^5$,
   (d) $[Ar]3d^{10}4s^24p^6$.
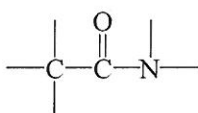
22. What is the hybridization (混成) of the starred carbon in $(CH_3)_2C^*=CHCN$?
   (a) sp, (b) sp^2, (c) sp^3, (d) dsp^3.

23. How many isomers are there of C_5H_{12} ?
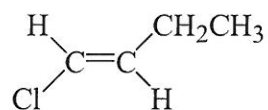   (a) 3, (b) 4, (c) 5, (d) 6.

24. Identify the functional group:

   $$-\overset{|}{\underset{|}{C}}-\overset{O}{\overset{||}{C}}-\overset{|}{N}-$$

   (a) an alcohol, (b) an amine, (c) an amide, (d) an ester.

25. What is the name of the following structure ?

   (a) *cis*-1-ethyl-2-chloroethane,
   (b) *trans*-1-chloro-1-butene,
   (c) *trans*-1-chloro-2-butene,
   (d) *trans*-1-chloro-2-ethylethane.