

選擇題, please select the best one answer, each 2%

- Which of the intermolecular forces is the most important contributor to the high surface tension shown by water?  
(1) dipole-dipole forces (2) dispersion forces (3) hydrogen bonding (4) ion-dipole forces
- Which of the following forms an ionic solid? (1) Ag (2)  $C_7H_4NH_2$  (3) RbI (4)  $SO_3$
- The highest coordination number for spherical packing is found in the (1) body-centered cubic structure. (2) simple cubic structure. (3) body-centered cubic and face-centered cubic. (4) cubic closest-packing and hexagonal closest packing
- What is the chemical symbol for tin? (1) Fe (2) Sn (3) Ti (4) Zn
- An astronaut uses a laboratory balance and weighs an object on earth and again on the moon. Which statement below about the weight and mass of the object is TRUE? (1) The mass and weight will be identical on the earth and the moon. (2) The mass will be the same on earth and moon but the weight will be less on the moon. (3) The weight will be the same on earth and moon but the mass will be less on the moon. (4) Both the mass and weight will be different on earth and moon.
- The atoms of a particular element all have the same number of protons as neutrons. Which of the following must be true? (1) The atomic weight must be a whole number. (2) The mass number for each atom must equal the atomic weight of the element. (3) The mass number must be exactly twice the atomic number for each atom. (4) All of the above are true.
- Which of the following has the least tendency to form an ion? (1) Ca (2) K (3) Kr (4) Se.
- Which of the following statements about mass spectrometry is false? (1) Mass spectrometry can be used to determine the molecular weight of a compound. (2) The curvature of the path in a magnetic field is determined by the mass of the ion. (3) The paths of heavier ions are deflected more strongly than the paths of lighter ions. (4) The sample is changed into positively charged ions.
- When silver nitrate reacts with barium chloride, silver chloride and barium nitrate are formed. How many grams of silver chloride are formed when 10 g of silver nitrate reacts with 15 g of barium chloride? (1) 8.44 g (2) 10.3 g (3) 20.6 g (4) 29.1 g
- A student prepared a stock solution by dissolving 20.0 g of KOH in enough water to make 150 mL of solution. He took 15.0 mL of the diluted solution and added another 50.0 mL of deionized water. What is the concentration of the final solution? (1) 0.548 M (2) 0.713 M (3) 1.03 M (4) 1.66 M.
- Which one of the following compounds is soluble in water? (1)  $Ag_3PO_4$  (2) CuS (3)  $Pb(NO_3)_2$  (4)  $ZnCO_3$
- Which of the following compounds is an Arrhenius base? (1)  $CH_3OH$  (2)  $CH_3COOH$  (3) HOCl (4) KOH
- What reagent would distinguish between  $Ag^+$  and  $Fe^{3+}$ ? (1)  $NaClO_3$  (2) NaI (3)  $NaNO_3$  (4) NaOH.
- For an orbital, a node is (1) the midpoint of the orbital (2) a surface inside which there is a 90% chance of finding the electron (3) a surface where there is a maximum probability of finding the electron (4) a surface where there is no chance of finding the electron.
- How many electrons can a single orbital hold? (1)  $2n$  (2) 2 (3)  $2l + 1$  (4) 8
- Which element has the highest first ionization energy? (1) Ca (2) K (3) Li (4) Mg
- Which of these elements has the highest first electron affinity? (1) Ca (2) N (3) Ne (4) S
- The strongest reducing agent in the group 3A is (1) B (2) Al (3) Ga (4) Tl.
- Which element has the lowest electronegativity? (1) Mg (2) Cl (3) Ca (4) Ba
- How many lone pairs of electrons are on the P atom in  $PF_3$ ? (1) 0 (2) 1 (3) 2 (4) 3.

21. What is the shape of  $\text{BrF}_4^-$ ? (1) see-saw (2) square planar (3) square pyramidal (4) tetrahedral
22. What hybridization would be expected for the central atom in a molecule with square planar geometry? (1)  $sp^2$  (2)  $sp^3$  (3)  $sp^3d$  (4)  $sp^3d^2$
23. Which of the following can be interpreted as a measure of randomness? (1) enthalpy (2) entropy (3) free energy (4) temperature.
24. The first law of thermodynamics (1) defines chemical energy. (2) defines entropy. (3) is a statement of conservation of energy. (4) provides a criterion for the spontaneity of a reaction.
25. Carbon dioxide is a gas which causes environmental concern because of the greenhouse effect. What is the approximate percentage (by volume) of  $\text{CO}_2$  in the atmosphere? (1) less than 0.1% (2) about 1% (3) about 5% (4) 21%
26. An unknown gas effuses 2.3 times faster than  $\text{N}_2\text{O}_4$  at the same temperature. What is the identity of the unknown gas? (1)  $\text{CN}_2$  (2)  $\text{NH}_3$  (3)  $\text{N}_2\text{O}$  (4)  $\text{O}_3$
27. Which has the smallest dipole-dipole forces? (1)  $\text{CH}_3\text{Cl}$  (2)  $\text{HCl}$  (3)  $\text{N}_2$  (4)  $\text{CO}$
28. The change in the Gibbs free energy for dissolving solute in a saturated solution is (1) negative. (2) zero. (3) positive. (4) positive at low temperatures and negative at high temperatures.
29. Which concentration varies with temperature? (1) molality (2) molarity (3) mole fraction (4) wt%
30. What is the overall reaction order for the reaction represented by the rate law:  $\text{Rate} = k[\text{H}_2][\text{NO}]^2$ ? (1) zero (2) first (3) second (4) third.
31. Which statement about the equilibrium constant is true? The value of  $K_c$  (1) changes as product concentration changes. (2) changes as reactant concentration changes. (3) changes as temperature changes. (4) never changes.
32. Which of the following changes in reaction conditions will not alter the equilibrium concentrations? (1) Addition of an inert gas to the reaction mixture. (2) Addition of reactants or products. (3) Decreasing the pressure or volume. (4) Increasing the temperature.
33. Commercially oxygen is usually obtained by (1) decomposition of mercury (II) oxide. (2) decomposition of potassium chlorate. (3) electrolytic decomposition of water. (4) fractional distillation of air.
34. Which of the following chemical reagent is not used in the purification of water (1)  $\text{NaNO}_3$  (2)  $\text{Cl}_2$  (3)  $\text{CaO}$  (4)  $\text{Al}_2(\text{SO}_4)_3$
35. What is the strongest acid among the following? (1)  $\text{CH}_3\text{COOH}$  (2)  $\text{ClCH}_2\text{COOH}$  (3)  $\text{Cl}_2\text{CHCOOH}$  (4)  $\text{Cl}_3\text{CCOOH}$
36. Which one of the following is not considered to be a Lewis base (1)  $\text{H}_2\text{O}$  (2)  $\text{NH}_3$  (3)  $\text{NH}_4^+$  (4)  $\text{Cl}^-$
37. Which of the following sets of compounds is not characteristic of a buffer? (1)  $\text{NaH}_2\text{PO}_4$  with  $\text{Na}_2\text{HPO}_4$  (2)  $\text{NH}_3$  with  $\text{NH}_4\text{Cl}$  (3)  $\text{CH}_3\text{COOH}$  with  $\text{CH}_3\text{COONa}$  (4)  $\text{HNO}_3$  and  $\text{NaNO}_3$
38. What is the most soluble salt of the following set? (1)  $\text{Ba}(\text{OH})_2$  with  $K_{sp} = 5.0 \times 10^{-3}$  (2)  $\text{Ca}(\text{OH})_2$  with  $K_{sp} = 4.7 \times 10^{-6}$  (3)  $\text{Cd}(\text{OH})_2$  with  $K_{sp} = 5.3 \times 10^{-15}$  (4)  $\text{Fe}(\text{OH})_2$  with  $K_{sp} = 2.5 \times 10^{-37}$
39. The Boltzmann formula is  $S = k \ln W$ . A perfect crystal has a molar entropy of 0 at absolute zero because (1)  $W = 0$ . (2)  $W = 1$ . (3)  $W = N_A$  (4)  $k = 1$ .
40. Which provides the greatest increase in entropy? (1)  $\text{H}_2\text{O}(\text{s}, 0^\circ\text{C}) \rightarrow \text{H}_2\text{O}(\text{l}, 0^\circ\text{C})$  (2)  $\text{H}_2\text{O}(\text{l}, 0^\circ\text{C}) \rightarrow \text{H}_2\text{O}(\text{l}, 25^\circ\text{C})$  (3)  $\text{H}_2\text{O}(\text{g}, 0.1^\circ\text{C}) \rightarrow \text{H}_2\text{O}(\text{s}, 0.1^\circ\text{C})$  (4)  $\text{H}_2\text{O}(\text{l}, 100^\circ\text{C}) \rightarrow \text{H}_2\text{O}(\text{g}, 100^\circ\text{C})$
41. If the cell reaction involves ions in solution, as the cell reaction in a galvanic cell continues, (1)  $E$  for the cell increases. (2)  $E$  for the cell decreases. (3)  $E^\circ$  for the cell increases. (4)  $E^\circ$  for the cell decreases.
42. When a cell reaction reaches equilibrium, (1)  $E^\circ = 0$ . (2)  $E = 0$ . (3) both  $E^\circ$  and  $E = 0$ . (4) neither  $E^\circ$  or  $E = 0$ .
43. Which carbon containing compound is an inorganic compound? (1)  $\text{C}_7\text{H}_7\text{NO}_2$  (2)  $\text{CO}_2$  (3)  $\text{CH}_3\text{COOH}$  (4)  $\text{C}_6\text{H}_5\text{CN}$
44. Which of the following is the strongest acid? (1)  $\text{HClO}$  (2)  $\text{HClO}_2$  (3)  $\text{HClO}_3$  (4)  $\text{HClO}_4$
45. What is the strongest oxidizing agent of the following set? (1)  $\text{MnCl}_2$  (2)  $\text{Mn}(\text{OH})_3$  (3)  $\text{MnO}_2$  (4)  $\text{KMnO}_4$
46. Which substance is a good conductor? (1) carbon (2) germanium (3) gold (4) phosphorus
47. Which substance is a good semiconductor? (1) diamond (2) germanium (3) gold (4) phosphorus
48. How many isomers are there of  $\text{C}_3\text{H}_7\text{Cl}$ ? (1) 3 (2) 4 (3) 5 (4) 6
49. Which one of the following compounds is not a possible product of the reaction of methane with chlorine gas? (1)  $\text{CH}_3\text{Cl}$  (2)  $\text{CH}_2\text{Cl}_2$  (3)  $\text{CHCl}_3$  (4)  $\text{CCl}_4$
50. Which amino acid has the simplest structure? (1) alanine (2) glycine (3) leucine (4) valine

下列選擇題為單選，每題 2 分，答錯者倒扣 0.5 分

- 1、 後述之那一種並不是 connective tissue (a) epithelium (b) cartilage (c) bone (d) blood (e) 以上皆非。
- 2、 Bone 上的 Haversian canal 是指 (a) marrow cavity 之導管 (b) spongy bone 上的空隙 (c) compact bone 上之同心圓中心 (d) osteocytes 聚合處 (e) 以上皆非。
- 3、 C<sub>4</sub> pathway 之植物較 C<sub>3</sub> pathway 為有利是因為 (a) 耗能低 (b) 耐低溫 (c) 生長快 (d) 生長組織緊密 (e) 以上皆非。
- 4、 Viruses 為 (a) basic of life (b) cellular (c) 可行 metabolism (d) 可行 reproduction (e) 以上皆非。
- 5、 Monera 之生物包含 (a) red algae (b) green algae (c) blue green algae (d) brown algae (e) 以上皆非。
- 6、 Protista 生物是屬於 (a) multicellular eukaryotes (b) multicellular prokaryotes (c) unicellular or colonial eukaryotes (d) unicellular or colonial prokaryotes (e) 以上皆非。
- 7、 可固氮之藻類是 (a) red algae (b) green algae (c) blue green algae (d) brown algae (e) 以上皆非。
- 8、 Development of protostomes 是 (a) spiral cleavage, determinate (b) spiral cleavage, indeterminate (c) radial cleavage, determinate (d) radial cleavage, indeterminate (e) 以上皆非。
- 9、 海星是屬於 (a) Mollusca (b) Annelida (c) Arthropoda (d) Echinodermata (e) 以上皆非。
- 10、 Chloride shift 是指 (a) 氯離子離開血管 (b) 氯離子進入血管 (c) 氯離子離開紅血球 (d) 氯離子進入紅血球 (e) 以上皆非。

- 11、為調節呼吸作用，在血管上之 chemoreceptor 所接受之物質為 (a) carbon dioxide (b) hydrogen ion (c) oxygen (d) chloride (e) 以上皆非。
- 12、某些動物可將代謝後之廢物形成 uric acid，下面那一個原因為假 (a) 節省須水量 (b) 節省能量 (c) 直接產生 (d) 不會中毒 (e) 以上皆非。
- 13、Ectoderm 可形成 (a) skeleton (b) excretory system (c) nervous system (d) respiratory system (e) 以上皆非。
- 14、Evolution 與下列何者意義不同 (a) 其結果為適應 (b) 單一突變因子造成 (c) 產生的後代生存力強 (d) 天擇之結果 (e) 以上皆非。
- 15、Photosynthesis 會進行 cyclic photophosphorylation 是因為缺乏 (a) ADP (b) ATP (c)  $H^+$  (d) NADPH (e) 以上皆非。
- 16、Glucose 轉變為  $CO_2$  及  $H_2O$  是稱為 (a) glycolysis (b) glycogenesis (c) glycogenolysis (d) gluconeogenesis (e) 以上皆非。
- 17、研究某一環境內，構成一個共同功能為單位的許多不同種生物之關係為 (a) community (b) autecology (c) synecology (d) ecosystem (e) 以上皆非。
- 18、Cyanobacteria 之營養合成是由 (a) absorption (b) chloroplast (c) photosynthetic lamella (d) heterotrophic (e) 以上皆非。
- 19、Coenzyme 是 (a) 高效能蛋白質觸媒 (b) 維生素 (c) 受基因控制 (d) 對受質具有專一性 (e) 以上皆非。
- 20、由兩個細菌相連傳遞遺傳物質是為 (a) transformation (b) transduction (c) translation (d) conjugation (e) 以上皆非。
- 21、在合成新的 DNA 時一開始須要什麼？ (a) DNA (b) protein (c) ligase (d) primase (e) 以上皆非。



- 22、下列那一種 organelle 在動、植物中均會有 (a) centrioles (b) chloroplasts (c) mitochondria (d) cell wall (e) 以上皆非。
- 23、在 leukocyte 中具有 phagocytosis 功能者為 (a) eosinophils (b) neutrophils (c) basophils (d) monocytes (e) 以上皆非。
- 24、為何某些營養對動物來說是屬 essential nutrients (a) 只有這種動物可以利用 (b) 只有某些食物中含有 (c) 該動物所須的 coenzyme (d) 該動物無法合成 (e) 以上皆非。
- 25、那一種 enzyme 在低 pH 下才能活化作用 (a) amylase (b) lipase (c) pepsin (d) trypsin (e) 以上皆非。

問答題：

1. 繪圖說明人類和草蝦之血液循環系統的異同。(20分)
2. 繪圖說明影響微血管濾過速率(filtration rate)的因子。(10分)
3. 繪圖說明細胞膜的構造。(10分)
4. 承上題，並詳述膜的蛋白質的功能。(10分)