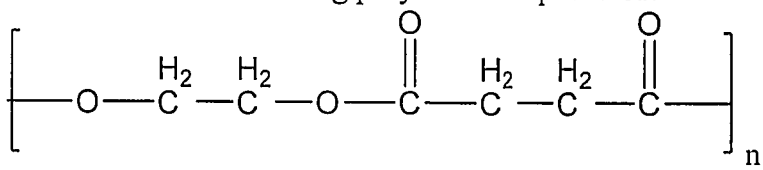
國立中山大學104學年度轉學考招生考試試題

科目名稱：普通化學【海資系二年級】　　題號：752001

※本科目依簡章規定「不可以」使用計算機　　

一、單選題 (50% total，2% each)

1. What kinds of monomer units are the following polymers composed of?



I. $HOCH_2CH_2OH$ II. $HOOCCH_2CH_2COOH$ III. $HOCH_2CH_2COOH$ IV. HOCH=CHOH

(a) II (b) III (c) IV (d) I 和 II (e) II 和 III。

2. The affinity of CO for hemoglobin is about 210 times that of O_2. Assume that a person is inhaling air that contains 86 ppm of CO. If all the hemoglobin leaving the lungs carries either oxygen or CO, what is the fraction in carboxyl hemoglobin? The O_2 is present in the atmosphere to the extent of 209000 ppm .

(a) 10% (b) 7.9% (c) 3% (d) 0.8% (e) 8.6%

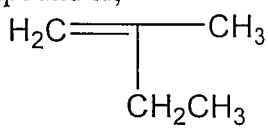
3. Which of the following is a tertiary amine?

(a) $(CH_3)_2NH$ (b) $(CH_3)_3CNH_2$ (c) CH_3CONH_2 (d) $CH_3CON(CH_3)_2$

4. Which of the following aqueous has the strongest acidity?

(a) 1M HI (b) 1M HNO_3 (c) 1M $HClO_4$ (d) 1M HCl (e) all of the above solution have the same acidity

5. The correct systematic name of the compound is,



(a) 2-ethyl-1-propene (b) 2-methyl-1-ethyl-ethylene (c) 2-ethyl-2-propene (d) 2-methyl-1-butene

6. In the following oxidation-reduction reaction

$8H^+ + 4NO_3^- + 6Cl^- + Sn \rightarrow SnCl_6^{2-} + 4NO^2 + 4H^2O$

The reducing agent is

(a) Sn (b) Cl^- (c) NO_3^- (d) H^1

7. Syrup is a concentrated solution of sucrose ($C_{12}H_{22}O_{11}$) used for many culinary applications. What volume of a 5.84 M syrup solution is needed to produce 5.40×10^{-1} L of a 1.00 M sucrose solution?

(a) 92.5 mL (b) 46.3 mL (c) 13.9 mL (d) 3.15 mL

8. Use the enthalpies of formation (provided in the table) to calculate the ΔH^o_{rxn} of the reaction:

$$C_8H_{18}(l) + 12.5\ O_2(g) \rightarrow 8\ CO_2(g) + 9\ H_2O(g)$$

Given:

Substance	ΔH_f^o (kJ/mol)
$C_8H_{18}(l)$	250.1
H_2O (g)	241.8
CO_2 (g)	393.5

(a) 2537 kJ (b) –7611 kJ (c) –2537 kJ (d) –5074 kJ

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9. The spin quantum number, m_s, was introduced as a result of the discovery of:
(a) the Heisenberg uncertainty principle.
(b) the Aufbau principle.
(c) Hund's rule.
(d) the Pauli exclusion principle.

10. Which shows the correct order of increasing radius?
(a). $Cl^- < Ca^{2+} < S^{2-}$ (b) $Ca^{2+} < Cl^- < S^{2-}$ (c) $S^{2-} < Cl^- < Ca^{2+}$ (d) $Ca^{2+} < S^{2-} < Cl^-$

11. Which bond is most polar?
(a) N–O (b) F–F (c) Si–O (d) Br–C

12. Determine the volume of an object that has a mass of 4.556×10^2 g and a density of 19.3 g/cm^3.
(a). 8.79×10^2 mL (b). 2.36×10^1 mL (c). 2.36×10^2 mL (d). 8.79×10^3 mL

13. Write the molecular equation for the precipitation reaction that occurs (if any) when solutions of calcium nitrate and ammonium sulfate are mixed.
(a) $Ca(NO_3)_2(aq) + (NH_4)_2SO_4(aq) \rightarrow 2\ NH_4NO_3(s) + CaSO_4(aq)$
(b) $2\ Ca(NO_3)_2(aq) + 2\ (NH_4)_2SO_4(aq) \rightarrow 4\ NH_4NO_3(aq) + CaSO_4(s)$
(c) $Ca(NO_3)_2(aq) + (NH_4)_2SO_4(aq) \rightarrow 2\ NH_4NO_3(aq) + CaSO_4(s)$
(d) No reaction occurs.

14. Which of the following will have the greatest volume at STP?
(a) 22g CO (b) 22g O_2 (c) 22g He (d) 22g Cl_2

15. What is the wavelength of the blue light emitted by a mercury lamp with a frequency of 6.88×10^{14} Hz?
(a) 436 nm (b) 229 nm (c) 485 nm (d) 206 nm

16. Which of the following is a possible set of quantum numbers [n, l, ml, m_s] for an electron in a 3p orbital?
(a) [3,3,3,1/2] (b) [3,1,−2,−1/2] (c) [3,2,0,1] (d) [3,1,0,−1/2]

17. Which of the following N–N bonds is the strongest?
(a) the N–N bond in N_2(g)
(b) the N–N bond in N_2H_2(g)
(c) the N–N bond in N_2H_4(g)
(d) The N–N bonds in A–C have about the same strengths

18. How many sigma (σ) and pi (π) bonds are in a CH_2CHCH_3 molecule?
(a) 9 σ, 0 π (b) 7 σ, 2 π (c) 8 σ, 1 π (d) 8 σ, 2 π

19. 12.0 kJ of heat is supplied to a 150.0-g sample of ethanol initially at 25.0 °C. What is the final temperature of the ethanol? The specific heat capacity of ethanol is 2.42 J/g·°C.
(a) 21.7 °C (b) 28.3 °C (c) 58.1 °C (d) 35.7 °C

20. Which of the following is a redox reaction?
(a) $NaOH(aq) + HCl(aq) \rightarrow H_2O(l) + NaCl(aq)$
(b) $Mg(s) + 2\ H_2O(l) \rightarrow Mg(OH)_2(s) + H_2(g)$
(c) $K_2CO_3(aq) + NiCl_2(aq) \rightarrow 2\ KCl(aq) + NiCO_3(s)$

(d) $H_2SO_4(aq) + 2\ LiOH(aq) \rightarrow Li_2SO_4(aq) + 2\ H_2O(l)$

21. What is the pH of a 0.25 M NaF, sodium fluoride, solution?
K_a for HF, hydrofluoric acid, is 3.5×10^{-4}.
(a) 8.43 (b) 5.87 (c) 9.71 (d) 9.28

22. Calculate the molar solubility of $Ca(OH)_2$ in pure water. The K_{sp} of $Ca(OH)_2$ is 4.68×10^{-6} M.
(a) 4.05×10^{-3} M (b) 3.05×10^{-1} M (c) 2.05×10^{-4} M (d) 1.05×10^{-2} M

23. Three solutions (listed below) are combined. Assuming the volumes are additive, what is the chloride concentration in the combined solution?
I. 25.0 mL of 0.100 M $MgCl_2$
II. 40.0 mL of 0.250 M LiCl
III. 30.0 mL of 0.400 M KBr
(a) 0.158 M (b) 0.284 M (c) 0.223 M (d) 0.258 M

24. Which statement is FALSE with regard to protons, neutrons and electrons?
(a) Protons and electrons have the same magnitude of charge but opposite in sign.
(b) Electrons were the first subatomic particle discovered.
(c) Protons and neutrons are located in the nucleus.
(d) Protons and electrons have approximately the same mass.

25. Which of the following statements is TRUE?
(a) The total number of molecular orbitals formed does not always equal the number of atomic orbitals combined.
(b) In H_2 molecules, the two 1*s* orbitals combine constructively, which results in one bonding orbital and one nonbonding orbital
(c) Electrons placed in antibonding orbitals stabilize the species.
(d) When filling degenerate π orbitals, electrons will fill the orbitals singly, and with parallel spin, before pairing.

二、問答題 (50% total)

1. Write the names (in English) of the following compounds：(15% total, 3% each.)
a. $K_2Cr_2O_7$ b. $KMnO_4$ c. $Fe(NO_3)_3$ d. HCOOH e. TiO_2

2. Describe the origin of ozone (O_3) in atmosphere, why it is desirable in upper atmosphere and not desirable in lower atmosphere. (20%)

3. Define the following terms of electrochemistry：(15% total, 3% each.)
a. Free Energy Change b. Free Radical
c. Configurational Isomers d. Chromatography e. BOD (biological oxygen demand)

國立中山大學103學年度轉學考招生考試試題

科目名稱：普通生物學【海資系二年級】　　題號：752002

※本科目依簡章規定「不可以」使用計算機　　

第一部份、單選題(共60分，每題1.5分，不倒扣)

1) All of the following are part of a prokaryotic cell EXCEPT _____.
A) an endoplasmic reticulum B) a plasma membrane C) ribosomes D) a cell wall

2) Which structure is common to plant *and* animal cells?
A) central vacuole B) cell wall C) chloroplast D) mitochondrion

3) A cell with an extensive area of smooth endoplasmic reticulum is specialized to _____.
A) synthesize large quantities of lipids B) play a role in storage
C) import and export protein molecules D) actively export protein molecules

4) The liver is involved in detoxification of many poisons and drugs. Which of the following structures is primarily involved in this process and, therefore, abundant in liver cells?
A) rough ER B) nuclear envelope C) Golgi apparatus D) smooth ER

5) Cells require which of the following to form cilia or flagella?
A) tubulin B) actin C) intermediate filaments D) laminin

6) Ions can travel directly from the cytoplasm of one animal cell to the cytoplasm of an adjacent cell through _____.
A) desmosomes B) plasmodesmata C) gap junctions D) tight junctions

7) Which of these are NOT embedded in the hydrophobic portion of the lipid bilayer at all?
A) peripheral proteins B) integral proteins C) transmembrane proteins D) All of these are embedded in the hydrophobic portion of the lipid bilayer.

8) What kinds of molecules pass through a cell membrane most easily?
A) large polar B) ionic C) large and hydrophobic D) small and hydrophobic

9) The sodium-potassium pump is called an electrogenic pump because it _____.
A) contributes to the membrane potential
B) is used to drive the transport of other molecules against a concentration gradient
C) pumps equal quantities of Na^+ and K^+ across the membrane
D) ionizes sodium and potassium atoms

10) The voltage across a membrane is called the _____.
A) osmotic potential B) electrochemical gradient C) membrane potential D) chemical gradient

11) Which of the following is characteristic of a steroid hormone action? _
A) protein phosphorylation B) internal receptor binding
C) second messenger activation D) cell-surface receptor binding

12) Caffeine is an inhibitor of phosphodiesterase. Therefore, the cells of a person who has recently consumed coffee would have increased levels of _____.
A) cAMP B) activated G proteins C) adenylyl cyclase D) phosphorylated proteins

13) Viagra causes dilation of blood vessels and increased blood flow to the penis, facilitating erection. Viagra acts by inhibiting _____.
A) the hydrolysis of cGMP to GMP B) the removal of GMP from the cell
C) the dephosphorylation of cGMP D) the hydrolysis of GTP to GDP

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14) Apoptosis involves all but which of the following? 14) _____
A) digestion of cellular contents by scavenger cells
B) activation of cellular enzymes
C) lysis of the cell
D) fragmentation of the DNA

15) Which of the following has both endocrine and exocrine activity?
A) the pancreas B) the pituitary gland C) salivary glands D) parathyroid glands

16) Fight-or-flight reactions include activation of the _____.
A) pancreas, leading to a reduction in the blood sugar concentration
B) adrenal medulla, leading to increased secretion of epinephrine
C) anterior pituitary gland, leading to cessation of gonadal function
D) parathyroid glands, leading to increased metabolic rate

17) Which of the following organs is correctly paired with its function? 17) _____
A) small intestine — starch digestion B) pancreas — starch digestion
C) stomach — protein digestion D) large intestine — bile production

18) After surgical removal of an infected gallbladder, a person must be especially careful to restrict dietary intake of _____.
A) fat B) sugar C) water D) protein

19) Countercurrent exchange in the fish gill helps to maximize _____.
A) osmosis B) blood pressure C) active transport D) diffusion

20) Which of the following is the correct sequence of blood flow in birds and mammals?
A) vena cava → right atrium → right ventricle → pulmonary vein
B) pulmonary vein → left atrium → left ventricle → pulmonary circuit
C) left ventricle → aorta → lungs → systemic circulation
D) vena cava → right atrium → right ventricle → pulmonary artery

21) The body fluids of an osmoconformer would be _____ with its _____ environment
A) hyperosmotic; saltwater B) isoosmotic; saltwater C) hypoosmotic; saltwater D) isoosmotic; freshwater

22) Urea is produced in the _____.
A) kidneys from glycerol and fatty acids B) bladder from uric acid and water
C) liver from NH_3 and carbon dioxide D) liver from glycogen

23) As cleavage continues during frog development, the size of the blastomeres _____.
A) decreases as the number of the blastomeres decreases
B) decreases as the number of the blastomeres increases
C) increases as the number of the blastomeres decreases
D) increases as the number of the blastomeres increases

24) Which of the following correctly displays the sequence of developmental milestones?
A) blastula → gastrula → cleavage B) cleavage → blastula → gastrula
C) gastrula → blastula → cleavage D) cleavage → gastrula → blastula

25) Which of the following choices includes all of the others in creating global terrestrial climates?

A) global wind patterns B) Earth's rotation on its axis C) differential heating of Earth's surface D) ocean currents

26) Coral reefs can be found on the southeast coast of the United States but not at similar latitudes on the southwest coast. Differences in which of the following most likely account for this?
A) salinity B) day length C) precipitation D) ocean currents

27) The proximate causes of behavior are interactions with the environment, but behavior is ultimately shaped by _____.
A) the nervous system B) pheromones C) evolution D) hormones

28) Which of the following is true of innate behaviors? Innate behaviors _____.
A) are limited to invertebrate animals
B) occur in invertebrates and some vertebrates but not mammals
C) are expressed in most individuals in a population
D) are only weakly influenced by genes

29) If two species are close competitors, and one species is experimentally removed from the community, the remaining species would be expected to _____.
A) become the target of specialized parasites B) change its fundamental niche
C) decline in abundance D) expand its realized niche

30) Approximately how many kilograms (kg) of carnivore (secondary consumer) biomass can be supported by a field plot containing 1000 kg of plant material?
A) 1000 B) 100 C) 10 D) 1

31) In eukaryotic cells, chromosomes are composed of _____.
A) DNA and proteins B) DNA and RNA C) DNA only D) DNA and phospholipids

32) Which of the following defines a genome?
A) the complete set of an organism's polypeptides
B) the complete set of a species' polypeptides
C) the complete set of an organism's genes and other DNA sequences
D) a karyotype

33) Healthy corals are brightly colored because they _____.
A) host symbionts with colorful photosynthetic pigments
B) secrete colorful pigments to attract mates
C) build their skeletons from colorful minerals
D) secrete colorful pigments to protect themselves from ultraviolet light

34) All arthropods _____. 1) undergo complete metamorphose 2) have jointed appendages 3) molt 4) have segmented bodies 5) have an exoskeleton or cuticle
A) 3 and 5 B) 1, 4, 5 C) 1, 2, and 4 D) 2, 3, 4, 5

35) Transpiration in plants requires _____. I)adhesion of water molecules to cellulose II) cohesion between water molecules III) evaporation of water molecules IV) active transport through xylem cells
V)transport through tracheids
A) I, II, III, and IV B) I, III, IV, and V C) I, II, III, and V D) I, II, IV, and V

36) Cinnabar eyes is a sex-linked, recessive characteristic in fruit flies. If a female having cinnabar eyes is crossed with a wild-type male, what percentage of the F1 males will have cinnabar eyes?
A) 50% B) 25% C) 100% D) 0%

37) Recombination between linked genes comes about for what reason?
A) Nonrecombinant chromosomes break and then rejoin with one another.
B) Crossovers between these genes result in chromosomal exchange.
C) Linked genes travel together at anaphase.
D) Independent assortment sometimes fails.

38) A cell is considered to be differentiated when it _____.
A) produces proteins specific to a particular cell type
B) appears to be different from the surrounding cells
C) replicates by the process of mitosis
D) loses connections to the surrounding cells

39) Sponges _____.
A) have a nerve net but not a central nervous system
B) are the simplest diploblastic animals
C) have larvae which are motile and move via the motion of cilia
D) have feeding cells called dinoflagellates

40) The water vascular system of echinoderms _____.
A) is analogous to the gastrovascular cavity of flatworms
B) functions in locomotion and feeding
C) is bilateral in organization, even though the adult animal is not bilaterally symmetrical
D) functions as a circulatory system that distributes nutrients to body cells

第二部份、解釋名詞(共40分，每題4分)

1. Red tide
2. Mangroves
3. Single nucleotide polymorphism (SNP)
4. System biology
5. Ecosystem ecology
6. Endosymbiont theory
7. Small interfering RNA (RNAi)
8. Tetrapod
9. Cnidarians
10. Metabotropic receptor