

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

共 2 頁第 1 頁

- Write the names (in English) of the following compounds :
a. KCl b. CaSO₄ c. PbCrO₄ d. Fe₃(PO₄)₂ e. TiO₂
(10% total, 2% each.)
- A sample of a gaseous substance at 25°C and 0.862 atm has a density of 2.26 g/L.
What is the molecular weight of the substance ? (10%)
- State whether each of the following sets of quantum numbers is permissible for an electron in an atom. If a set is not permissible, explain why. (10% total, 2% each.)
 - $n = 1, l = 1, m_l = 0, m_s = +\frac{1}{2}$
 - $n = 3, l = 1, m_l = -2, m_s = -\frac{1}{2}$
 - $n = 2, l = 1, m_l = 0, m_s = +\frac{1}{2}$
 - $n = 2, l = 0, m_l = 0, m_s = 1$
 - $n = 2, l = 1, m_l = 0, m_s = 0$
- What kind of intermolecular forces (London, dipole—dipole, hydrogen bonding) are expected in the following substances ? (10% total, 2% each.)
 - methane, CH₄
 - chloroform, CHCl₃
 - butanol, CH₃CH₂CH₂CH₂OH
 - carbon dioxide, CO₂
 - sulfur dioxide, SO₂
- Order each of the following pairs by acid strength, giving the weaker acid first. Explain your answer.
 - HNO₃, HNO₂
 - HCO₃⁻, H₂CO₃
 - H₂S, H₂Te
 - HCl, H₂S
 - H₃PO₄, H₃AsO₄(10% total, 2% each.)
- What is the concentration of formate ion, CHO₂⁻, in a solution at 25°C that is 0.10M HCHO₂ and 0.20 M HCl ? What is the degree of ionization of formic acid, HCHO₂ ? (K_a for formic acid is 1.0 x 10⁻⁴ at 25°C) (10%)
- Calculate the pH of the solution at the equivalence point when 25 mL of 0.20 M nicotinic acid is titrated by 0.20 M sodium hydroxide. K_a for nicotinic acid equals 1.0 x 10⁻⁵. (10%)

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8. What is the concentration of $\text{Ag}^+(aq)$ ion in $0.010 M \text{AgNO}_3$ that is also $1.00 M \text{NH}_3$? K_f for $\text{Ag}(\text{NH}_3)_2^+$ ion is 1.7×10^7 . (10%)
9. Predict the sign of ΔS° for each of the following reactions. Explain your answer.
- $\text{CaCO}_3(s) \rightarrow \text{CaO}(s) + \text{CO}_2(g)$
 - $\text{CS}_2(l) \rightarrow \text{CS}_2(g)$
 - $2\text{Hg}(l) + \text{O}_2(g) \rightarrow 2\text{HgO}(s)$
 - $2\text{Na}_2\text{O}_2(s) + 2\text{H}_2\text{O}(l) \rightarrow 4\text{NaOH}(aq) + \text{O}_2(g)$
 - $2\text{NH}_3(g) + \text{CO}_2(g) \rightarrow \text{NH}_2\text{CONH}_2(aq) + \text{H}_2\text{O}(l)$
- (10% total, 2% each.)
10. Define the following terms of electrochemistry :
- voltaic(galvanic) cell
 - electrolytic cell
 - standard electrode potential
 - cathode
 - anode
- (10% total, 2% each.)

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第一部份、單選題(共75分，每題1.5分，不倒扣)

- 1) If one strand of a DNA molecule has the sequence of bases 5'ATTGCA3', the other complementary strand would have the sequence A) 5'UGCAAU3'. B) 3'UAACGU5'. C) 5'TAACGT3'. D) 3'TAACGT5'. E) 5'UAACGU3'.
- 2) Which of the following is *true* of both starch and cellulose? A) They are geometric isomers of each other. B) They can both be digested by humans. C) They are both polymers of glucose. D) They are both structural components of the plant cell wall. E) They are both used for energy storage in plants.
- 3) Neurons at rest are not at the equilibrium potential for K^+ because the cell membrane is A) only permeable to Na^+ . B) slightly permeable to Na^+ . C) not permeable to K^+ . D) not permeable to Na^+ . E) only permeable to K^+ .
- 4) A codon A) consists of discrete amino acid regions. B) catalyzes RNA synthesis. C) is found in all eukaryotes, but not in prokaryotes. D) consists of two nucleotides. E) may code for the same amino acid as another codon.
- 5) Unlimited population growth is often prevented when death rates increase as population density increases. This is an example of A) negative feedback. B) the Allee effect. C) positive feedback. D) *r*-selection. E) *K*-selection.
- 6) Starting with a fertilized egg (zygote), a series of five cell divisions would produce an early embryo with how many cells? A) 8 B) 32 C) 64 D) 16 E) 4
- 7) What controls the heart rate? A) neocortex B) cerebellum C) pituitary D) medulla E) thalamus
- 8) In models of sigmoidal (logistic) population growth, A) population growth rate slows dramatically as *N* approaches *K*. B) density-dependent factors affect the rate of population growth. C) new individuals are added to the population most rapidly at intermediate population sizes. D) All of the above are true. E) Only A and C are true.
- 9) Which of the following is *not* a part of the eukaryotic transcription initiation complex? A) TATA box B) transcription factors C) snRNP D) RNA polymerase E) promoter
- 10) The somatic cells derived from a single-celled zygote divide by which process? A) binary fission B) meiosis C) replication D) mitosis E) cytokinesis alone
- 11) What is a chromatid? A) a chromosome found outside the nucleus B) another name for the chromosomes found in genetics C) a replicated chromosome D) a special region that holds two centromeres together E) a chromosome in G1 of the cell cycle

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- 12) Cells that are in a nondividing state are in which phase? A) S B) G₂ C) M D) G₁
E) G₀
- 13) Which of the following is associated with the evolution of a central nervous system? A) radial symmetry B) bilateral symmetry C) excitable membranes D) a complete gut E) a closed circulatory system
- 14) A biologist reported that a sample of ocean water had 5 million diatoms of the species *Coscinodiscus centralis* per cubic meter. What was the biologist measuring? A) range B) dispersion C) quadrats D) carrying capacity E) density
- 15) A polypeptide can best be described as a A) monomer of a protein polymer. B) polymer of amino acids. C) polymer containing 19 peptide bonds. D) polymer containing 20 amino acid molecules. E) polymer containing 20 peptide bonds.
- 16) The total biomass of photosynthetic autotrophs present in an ecosystem is known as A) trophic efficiency. B) gross primary productivity. C) secondary productivity. D) standing crop. E) net primary productivity.
- 17) What part of the sperm first contacts the egg plasma membrane? A) the cortical granules B) the actin proteins C) the vitelline membrane D) the acrosomal membrane E) the fertilization membrane
- 18) A cow's herbivorous diet indicates that it is a(n) A) secondary consumer. B) decomposer. C) primary consumer. D) autotroph. E) producer.
- 19) Aquatic ecosystems are unlikely to be limited by insufficient A) iron. B) phosphorus. C) carbon. D) nitrogen. E) sodium.
- 20) Integration of simple responses to certain stimuli, such as the patellar reflex, is accomplished by which of the following? A) hypothalamus B) cerebellum C) corpus callosum D) medulla E) spinal cord
- 21) Which term most precisely describes the cellular process of breaking down large molecules into smaller ones? A) catabolism B) metabolism C) dehydration D) catalysis E) anabolism
- 22) Where do synaptic vesicles discharge their contents by exocytosis? A) nodes of Ranvier B) presynaptic membrane C) axon hillock D) dendrite E) postsynaptic membrane
- 23) What is the functional unit of the kidney? A) vasa recta B) nephron C) bladder D) glomerulus E) cortex

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- 24) A marine sea star was mistakenly placed in freshwater and it died. What is the most likely explanation for its death? A) The osmoregulatory system of the sea star could not handle the change in ionic content presented by the freshwater. B) The sea star was stressed and needed more time to adapt to new conditions. C) The contractile vacuoles used to regulate water content ruptured in the freshwater. D) The cells of the sea star dehydrated and lost the ability to metabolize. E) The sea star is hypertonic to the freshwater, and it could not osmoregulate.
- 25) The producers in ecosystems include organisms in which of the following groups? A) plants B) prokaryotes C) algae D) B and C only E) A, B, and C
- 26) Triacylglycerol is a A) lipid that makes up much of the plasma membrane. B) molecule formed from three alcohols by dehydration reactions. C) lipid made with three fatty acids and glycerol. D) protein with tertiary structure. E) carbohydrate with three sugars joined together by glycosidic linkages.
- 27) How does an EPSP facilitate depolarization of the postsynaptic membrane? A) by insulating the hillock region of the axon B) by increasing the permeability of the membrane to K^+ C) by increasing the permeability of the membrane to Na^+ D) by allowing Cl^- to enter the cell E) by stimulating the sodium-potassium pump
- 28) All of the following are found in prokaryotic mRNA *except* A) cytosine. B) the UGA codon. C) introns. D) the AUG codon. E) uracil.
- 29) The centromere is a region in which A) the nucleus is located prior to mitosis. B) metaphase chromosomes become aligned. C) chromosomes are grouped during telophase. D) new spindle microtubules form. E) chromatids are attached to one another.
- 30) Which of the following is *true* of cellulose? A) It is a polymer composed of sucrose monomers. B) It is a major structural component of plant cell walls. C) It is a storage polysaccharide for energy in animal cells. D) It is a major structural component of animal cell plasma membranes. E) It is a storage polysaccharide for energy in plant cells.
- 31) Which of the following terms includes all of the others? A) ecosystem diversity B) species diversity C) biodiversity D) genetic diversity E) species richness
- 32) From the perspective of the cell receiving the message, the three stages of cell signaling are A) signal reception, cellular response, and cell division. B) the alpha, beta, and gamma stages. C) signal reception, nucleus disintegration, and new cell generation. D) the paracrine, local, and synaptic stages. E) signal reception, signal transduction, and cellular response.
- 33) Production, consumption, and decomposition are important ecosystem processes. Which of the following could be decomposers? A) vertebrates B) invertebrates C) bacteria D) A and

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C only E) A, B, and C

- 34) If an egg cell contained EDTA, a chemical that binds calcium and magnesium, what effect would this have on reproduction?
A) The fertilization envelope would not be formed. B) The acrosomal reaction would be blocked. C) The zygote would not contain maternal and paternal chromosomes. D) The fusion of sperm and egg nuclei would be blocked. E) The fast block to polyspermy would not occur.
- 35) When a cell releases a signal molecule into the environment and a number of cells in the immediate vicinity respond, this type of signaling is A) synaptic signaling. B) paracrine signaling. C) typical of hormones. D) autocrine signaling. E) endocrine signaling.
- 36) Which of the following is a nitrogenous waste that requires hardly any water for its excretion? A) uric acid B) nitrogen gas C) ammonia D) urea E) amino acid
- 37) What is the term for metabolic pathways that release stored energy by breaking down complex molecules? A) thermodynamic pathways B) catabolic pathways C) bioenergetic pathways D) anabolic pathways E) fermentation pathways
- 38) Which of the following is *not* one of the four major groups of macromolecules found in living organisms? A) proteins B) carbohydrates C) glucose D) lipids E) nucleic acids
- 39) Chemical signal pathways A) operate in animals, but not in plants. B) are absent in bacteria, but are plentiful in yeast. C) use hydrophilic molecules to activate enzymes. D) involve the release of hormones into the blood. E) often involve the binding of signal molecules to a protein on the surface of a target cell.
- 40) When making monoclonal antibodies, which of the following is a blood cell tumor type that is fused to B lymphocytes? A) Hybridoma B) Myostatin C) Myeloma D) Protoplast E) ES cell
- 41) Apoptosis is discovered from A) human B) nematode C) zebrafish D) yeast E) Fruitfl
- 42) Animals contain an inserted and functional gene from another source: A) Transgenic B) Knockout C) Polyploid D) Selectively bred E) Cloned
- 42) Which of the following genetic disorders is created by a translocation between chromosome 9 and chromosome 22? A) Cystic fibrosis B) Chronic myelogenous leukemia C) Sickle cell anemia D) Adenosine deaminase deficiency E) None of these choices
- 43) Transplanting a tissue or organ from one species into another species is known as: A) Autotransplantation B) Xenotransplantation C) Transformation D) Transgenesis E) Regenerative medicine
- 44) This form of gene therapy involves direct injection of DNA into cells within the body.

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- A) *Ex vivo* B) Liposome mediated C) *In situ* hybridization D) *In vitro* E) *In vivo*
- 45) Which of the following is *not* a part of the eukaryotic transcription initiation complex? A) snRNP B) TATA box C) transcription factors D) RNA polymerase E) promoter
- 46) The advantage of light microscopy over electron microscopy is that A) light microscopy provides for higher resolving power than electron microscopy. B) light microscopy allows one to view dynamic processes in living cells. C) light microscopy provides for higher magnification than electron microscopy. D) both A and B E) both B and C
- 47) All of the following are found in prokaryotic mRNA *except* A) introns. B) cytosine. C) uracil. D) the AUG codon. E) the UGA codon.
- 48) Which of the following are prokaryotic cells? A) fungi B) animals C) plants D) bacteria E) B and C only
- 49) All of the following molecules are part of the cell membrane *except* A) lipids. B) phosphate groups. C) proteins. D) steroids. E) nucleic acids.
- 50) Grana, thylakoids, and stroma are all components found in A) lysosomes. B) mitochondria. C) chloroplasts. D) nuclei. E) vacuoles.

第二部份、簡答題 (共25分，每題5分)

1. 浮游動物在海洋生態系之功能。
2. Red tide形成的原因及扮演之角色。
3. coral 在海洋中的重要性。
4. Proteome 和 proteomics的差異。
5. 何謂 *Ex vivo* gene therapy。