

國立高雄大學九十七學年度轉學招生考試試題

科目：普通化學
考試時間：80 分鐘

系所：
生命科學系
本科原始成績：100 分

是否使用計算機：否

單選題 每題 2.5 分

1. What is the appropriate class for the compounds with the formula C_nH_{2n-2} ?
A) Alkanes B) Alkenes C) Alkynes D) Aldehydes
2. Which of the following are NOT functional groups with a carbonyl ($>C=O$) groups?
A) Alcohol B) Aldehyde C) Ketone D) Carboxylic acid
3. What is the purpose of a salt bridge in an electrochemical cell?
A) The salt bridge allows ions to move in order to replenish the reactants and remove products.
B) The salt bridge completes the circuit by allowing electrons to flow back to where they started.
C) The salt bridge allows solvent to flow between the compartments replenishing the solution.
D) The salt bridge allows ions to move from one cell to the other to keep them electrically neutral.
4. How is a galvanic cell different from an electrolytic cell?
A) An electrolytic cell requires energy from an external source.
B) A galvanic cell is a nonspontaneous electrochemical reaction.
C) A galvanic cell requires a source of electrical energy to occur.
D) The electrolytic cell is a spontaneous electrochemical reaction.
5. What is the oxidation number of Mn in $KMnO_4$?
A) -1 B) +3 C) +5 D) +7
6. Which of the following is NOT a difference between nuclear reactions and chemical reactions?
A) Nuclear reactions release billions of times the energy of chemical reactions.
B) The number of atoms of each element can change in a nuclear reaction.
C) Charged particles are not involved in nuclear reactions.
D) Particles are emitted from the nucleus in a nuclear reaction.
7. In the elemental notation A_ZX , what does the A represent?
A) The number of protons in the nucleus
B) The number of electrons in the atom
C) The number of neutrons in the nucleus
D) The number of protons and neutrons in the atom

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8. What is a nuclear chain reaction?
- A) A reaction that absorbs neutrons, splitting the nucleus in two unequal parts
B) A reaction that produces enough neutrons that it can induce fission in other nuclei
C) A reaction that produces enough heat to cause the fusion of other nuclei
D) A reaction that produces enough energy to vaporize water in order to generate electricity
9. In the redox reaction $\text{HCl} + 5\text{FeCl}_2 + \text{KMnO}_4 \rightarrow 5\text{FeCl}_3 + \text{MnCl}_2 + 4\text{H}_2\text{O} + \text{KCl}$, which of the reactants is oxidized?
- A) HCl B) FeCl_3 C) KMnO_4 D) FeCl_2
10. The reaction $\text{AgNO}_3(\text{aq}) + \text{NaCl}(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{NaNO}_3(\text{aq})$ can be classified as
- A) an exchange reaction. B) a cleavage reaction. C) a condensation reaction. D) an acidbase reaction.
11. How does the formation of ion pairs affect the solubility of an ionic compound?
- A) Ion pairing decreases the solubility of a compound.
B) Ion pairing does not change the solubility of a compound.
C) Ion pairing increases the solubility of a compound.
D) Ion pairing can increase or decrease the solubility.
12. When a metal complex ion forms in solution, what are the metal ion and ligands acting as?
- A) The metal ion acts as a Lewis base, and the ligand acts as a Lewis acid.
B) The metal ion is a Lewis acid, and the ligand is its conjugate base.
C) The ligand is a Lewis base, and the metal ion is its conjugate acid.
D) The metal ion acts as a Lewis acid, and the ligand acts as a Lewis base.
13. According to Bronsted and Lowry, what is the definition of a base?
- A) A base is a hydroxide donor in aqueous solution.
B) A base increases the concentration of hydroxide ion.
C) A base is a hydrogen ion acceptor in aqueous solution.
D) A base is an electron pair donor in an aqueous solution.
14. What is meant by the statement that water is *amphiprotic*?
- A) Water has more than one proton that it can donate in a chemical reaction.
B) Water can behave as either an acid or a base, depending on the other reactant.
C) Water has the ability to accept a proton from any proton donor in solution.
D) Water acts as an acid with even very weak bases in aqueous solution.

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15. The ion product of water is defined as the
- A) product of the concentration of hydrogen ion times the concentration of oxide ion.
 - B) product of hydronium ion times hydroxide ion divided by the concentration of water squared.
 - C) hydronium ion concentration squared times the oxide ion concentration.
 - D) product of the hydroxide ion concentration times the hydronium ion concentration.
16. What is the systematic name for $\text{Ag}_2\text{Cr}_2\text{O}_7$?
- A) Silver dichromium oxide
 - B) Silver chromate
 - C) Silver(I) dichromate
 - D) Silver dichromate
17. Consider the equation $\text{PCl}_5(\text{g}) \rightarrow \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$. Which of the following initial conditions will result in the same equilibrium composition as a reaction starting with 1 mole of PCl_5 in a 1 liter container?
- A) 1 mole PCl_5 and 1 mole Cl_2
 - B) 1 mole PCl_3
 - C) 1 mole Cl_2
 - D) 1 mole PCl_3 and 1 mole Cl_2
18. Why is fluoroacetic acid ($\text{CF}_3\text{CO}_2\text{H}$) a stronger acid than acetic acid ($\text{CH}_3\text{CO}_2\text{H}$)?
- A) Fluorine is electron withdrawing, stabilizing the conjugate base.
 - B) The fluoroacetate ion is a stronger base than the acetate ion.
 - C) The fluorine atoms have more electrons to donate to the acid.
 - D) The carbon-fluorine bond is stronger than the carbon-hydrogen bond.
19. A reaction of A that is thought to be second order with respect to A is studied by measuring concentration as a function of time. How would the rate constant (k) for this reaction be determined?
- A) The slope of a graph of $1/[\text{A}]$ versus time is equal to k.
 - B) The slope of a graph of $\ln[\text{A}]$ versus time is equal to -k.
 - C) The slope of a graph of $\ln[\text{A}]$ versus time is equal to k.
 - D) The slope of a graph of $[\text{A}]$ versus time is equal to k.
20. What volume of 0.0485 M KOH is needed to neutralize a 25.00 ml sample of 0.0597 M HBr?
- A) 20.3 ml
 - B) 72.4 ml
 - C) 30.8 ml
 - D) 44.8 ml
21. Why is it unlikely for an ionic compound to be a gas at STP?
- A) Ionic compounds are held together by strong electrostatic attractions.
 - B) Ionic compounds have high molecular weights.
 - C) Ionic compounds do not easily form molecules.
 - D) Ionic compounds are held together by weak forces.

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22. In an ionic solid, the energy that holds the ions in a three-dimensional array is the
A) bond energy. B) ionization energy. C) lattice energy. D) interaction energy.
23. Resonance structures are structures that differ in
A) the connection pattern of the atoms. B) the total number of electrons.
C) the position of the electrons. D) the central atom of the structure.
24. Which of the following substances are in their standard states?
A) H(g) B) O₃(g) C) Hg(s) D) F₂(g)
25. A buffer is prepared by using 0.253 moles of phenol ($K_a = 1.3 \times 10^{-10}$) and 0.186 moles of sodium phenolate. What is the pH of the solution? ($\log 2 = 0.30$)
A) 10.26 B) 9.75 C) 4.25 D) 3.98
26. When a system is at equilibrium, which of the following is NOT true?
A) The composition of the system is not changing.
B) The forward reaction is occurring at a faster rate than the reverse.
C) Reactants are being converted to products and product converted back to reactants.
D) The forward and reverse chemical reactions are in balance.
27. The rate law for the reaction $2\text{NO}(\text{g}) + \text{Br}_2(\text{g}) \rightarrow 2\text{NOBr}(\text{g})$ is $\text{rate} = k[\text{NO}]^2[\text{Br}_2]$. How would the initial rate change if the concentration of NO was doubled?
A) The initial rate would not change.
B) The initial rate would double.
C) The initial rate would increase by a factor of three.
D) The initial rate would increase by a factor of four.
28. The correct name for the compound KMnO_4 is _____.
A) permanganate potassium
B) manganesetetroxide potassium
C) potassium permanganate
D) potassium manganesetetroxide
29. Which of the following molecules has a net dipole moment?
A) CO₂ B) SO₂ C) CH₄ D) SF₆

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30. Which of these properties are NOT needed to describe the physical state of a gas?
A) Temperature (K) B) Pressure C) Volume D) Molecular structure
31. Boyle's law states that
A) pressure is proportional to volume. B) pressure is proportional to temperature.
C) the product of pressure and volume is a constant. D) volume is proportional to temperature.
32. The temperature intercept in plots of volume versus temperature is referred to as
A) the critical point. B) lowest temperature. C) freezing point. D) absolute zero.
33. The ideal gas law adequately describes the behavior of real gases when
A) the temperature is low and the pressure is low. B) the pressure is high and the temperature is low.
C) the pressure is high and the temperature is high. D) the temperature is high and the pressure is low.
34. A chemical reaction has an equilibrium constant of 3.6×10^6 . What will be true about the system when equilibrium is achieved?
A) There will be more reactants than products present at equilibrium.
B) There will be significant concentrations of both reactants and products.
C) The product concentration will be much smaller than the reactant concentration.
D) The product concentration will be much larger than the reactant concentration.
35. What two orbitals can be formed from the linear combination of two 1s orbitals on two hydrogen atoms?
A) A σ bonding orbital and a σ^* bonding orbital
B) A σ^* antibonding orbital and a π bonding orbital
C) A σ bonding orbital and a σ^* antibonding orbital
D) A σ bonding orbital and a π bonding orbital
36. Based on the following cell diagram what reaction occurs at the anode? $Pt|Fe^{2+}, Fe^{3+}||Cu^{2+}|Cu$
A) $Fe^{2+} \rightarrow Fe^{3+}$ B) $Fe^{3+} \rightarrow Fe^{2+}$ C) $Cu \rightarrow Cu^{2+}$ D) $Cu^{2+} \rightarrow Cu$
37. An unknown gas has a density of 2.35 g/L at a pressure of 750.1 mmHg and 25°C. What is the molecular weight of the gas? $R = 0.082(L \cdot atm)/(K \cdot mol)$
A) 58.3 g/mol B) 76.7 g/mol C) 4.89 g/mol D) 5.80 g/mol

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38. What is the electron pair geometry and molecular geometry of the SF₄ molecule?
- A) Octahedral, square planar B) Tetrahedral, tetrahedral
C) Trigonal bipyramidal, seesaw shaped D) Octahedral, tetrahedral
39. What is the systematic name for Fe₃(PO₄)₂?
- A) Iron(III) phosphate B) Iron phosphate C) Iron(II) phosphate D) Iron diphosphate
40. In a heterogeneous reaction, why are the concentrations of solids not included in the equilibrium constant expression?
- A) The concentration of the solid does not vary.
B) Solids do not take part in chemical reactions.
C) The surface area is more important than the concentration.
D) Reactions involving solids do not go to equilibrium.

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一、單選題（每題 2 分，共 68 分）

1) A codon

- A) consists of two nucleotides.
- B) may code for the same amino acid as another codon.
- C) consists of discrete amino acid regions.
- D) catalyzes RNA synthesis.
- E) is found in all eukaryotes, but not in prokaryotes.

2) "Nuclear transplantation" refers to a(n)

- A) cloning method involving the transfer of a nucleus from a differentiated cell into an enucleated egg cell or zygote.
- B) form of gene therapy involving the transfer of nuclei from a healthy individual to the cells of a patient with a genetic disorder.
- C) method of creating new species by injecting diploid nuclei into diploid zygotes in order to produce tetraploid embryos.
- D) method of gene therapy in which nuclei are isolated from cells of an individual with a genetic disorder, transfected with recombinant DNA, and reintroduced into the individual's cells.
- E) experimental method involving transferring nuclei from cells of an organism of one species into cells of an organism from another species, and examining the resulting phenotype.

3) A gene that contains introns can be made shorter (but remain functional) for genetic engineering purposes by using

- A) RNA polymerase to transcribe the gene.
- B) a restriction enzyme to cut the gene into shorter pieces.
- C) reverse transcriptase to reconstruct the gene from its mRNA.
- D) DNA polymerase to reconstruct the gene from its polypeptide product.
- E) DNA ligase to put together fragments of the DNA that codes for a particular polypeptide.

4) Why do histones bind tightly to DNA?

- A) Histones are positively charged, and DNA is negatively charged.
- B) Histones are negatively charged, and DNA is positively charged.
- C) Both histones and DNA are strongly hydrophobic.

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- D) Histones are covalently linked to the DNA.
E) Histones are highly hydrophobic, and DNA is hydrophilic.
- 5) Which of the following can be effective against viral diseases?
A) vaccination
B) nucleoside analogs that inhibit DNA synthesis
C) antibiotics
D) A and B only
E) A, B, and C
- 6) It became apparent to Watson and Crick after completion of their model that the DNA molecule could carry a vast amount of hereditary information in its
A) sequence of bases.
B) phosphate-sugar backbones.
C) complementary pairing of bases.
D) side groups of nitrogenous bases.
E) different five-carbon sugars.
- 7) 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) 0%
B) 25%
C) 50%
D) 75%
E) 100%
- 8) A 9:3:3:1 phenotypic ratio is characteristic of which of the following?
A) a monohybrid cross
B) a dihybrid cross
C) a trihybrid cross
D) linked genes
E) both A and D

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- 9) Which of the following is an example of alternation of generations?
- A) A grandparent and grandchild each have dark hair, but the parent has blond hair.
 - B) A diploid plant (sporophyte) produces, by meiosis, a spore that gives rise to a multicellular, haploid pollen grain (gametophyte).
 - C) A diploid animal produces gametes by meiosis, and the gametes undergo fertilization to produce a diploid zygote.
 - D) A haploid mushroom produces gametes by mitosis, and the gametes undergo fertilization, which is immediately followed by meiosis.
 - E) A diploid cell divides by mitosis to produce two diploid daughter cells, which then fuse to produce a tetraploid cell.
- 10) All of the following are criteria for maintaining Hardy-Weinberg equilibrium involving two alleles *except*
- A) the frequency of all genotypes must be equal.
 - B) there should be no natural selection.
 - C) matings must be random.
 - D) populations must be large.
 - E) gene flow from other populations must be zero.
- 11) Two species of frogs belonging to the same genus occasionally mate, but the offspring do not complete development. What is the mechanism for keeping the two frog species separate?
- A) the postzygotic barrier called hybrid inviability
 - B) the postzygotic barrier called hybrid breakdown
 - C) the prezygotic barrier called hybrid sterility
 - D) gametic isolation
 - E) adaptation
- 12) Ultimately, which of these is the basis for both the principle of maximum parsimony and the principle that shared complexity indicates homology rather than analogy?
- A) the laws of thermodynamics
 - B) Boyle's law
 - C) the laws of probability
 - D) chaos theory
 - E) Hutchinson's law

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- 13) One important difference between the anatomy of roots and the anatomy of leaves is that
- A) only leaves have phloem and only roots have xylem.
 - B) the cells of roots have cell walls and leaf cells do not.
 - C) a waxy cuticle covers leaves but is absent in roots.
 - D) vascular tissue is found in roots but is absent from leaves.
 - E) leaves have epidermal tissue but roots do not.
- 14) Root hairs are most important to a plant because they
- A) anchor a plant in the soil.
 - B) store starches.
 - C) increase the surface area for absorption.
 - D) provide a habitat for nitrogen-fixing bacteria.
 - E) contain xylem tissue.
- 15) Which of the following best describes the general role of micronutrients in plants?
- A) They are cofactors in enzymatic reactions.
 - B) They are necessary for essential regulatory functions.
 - C) They prevent chlorosis.
 - D) They are components of nucleic acids.
 - E) They are necessary for the formation of cell walls.
- 16) Which of the following types of plants is *not* able to self-pollinate?
- A) dioecious
 - B) monoecious
 - C) complete
 - D) wind-pollinated
 - E) insect-pollinated
- 17) Which of the following hormones would be most useful in promoting the rooting of plant cuttings?
- A) oligosaccharins
 - B) abscisic acid
 - C) cytokinins

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- D) gibberellins
- E) auxins

18) What joins muscles to bones?

- A) ligaments
- B) tendons
- C) loose connective tissue
- D) Haversian systems
- E) spindle fibers

19) Some nutrients are considered "essential" in the diets of certain animals because

- A) only those animals use the nutrients.
- B) they are subunits of important polymers.
- C) they cannot be manufactured by the organism.
- D) they are necessary coenzymes.
- E) only some foods contain them.

20) Countercurrent exchange in the fish gill helps to maximize

- A) endocytosis.
- B) blood pressure.
- C) diffusion.
- D) active transport.
- E) osmosis.

21) In men, the excretory and reproductive systems share which structure?

- A) vas deferens
- B) urinary bladder
- C) seminal vesicle
- D) urethra
- E) ureter

22) At the time of implantation, what is the human embryo called?

- A) blastocyst
- B) gastrula
- C) fetus

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- D) somite
- E) zygote

23) What is the major inhibitory neurotransmitter of the brain?

- A) acetylcholine
- B) cholinesterase
- C) norepinephrine
- D) dopamine
- E) GABA

24) If a stimulus is to be perceived by the nervous system, which part of the sensory pathway must occur *first*?

- A) integration
- B) transmission
- C) transduction
- D) reception
- E) amplification

25) Which of the following characteristics generally applies to protostome development?

- A) radial cleavage
- B) determinate cleavage
- C) enterocoelous
- D) blastopore becomes the anus
- E) archenteron absent

26) All of the following are characteristics of adult arthropods *except*

- A) an exoskeleton.
- B) hemolymph.
- C) jointed appendages.
- D) a heart.
- E) a coelom.

27) Which are the most abundant and diverse of the extant vertebrates?

- A) bony fishes
- B) avian reptiles

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- C) amphibians
- D) non-avian reptiles
- E) mammals

28) Which marine zone would have the lowest rates of primary productivity (photosynthesis)?

- A) pelagic
- B) abyssal
- C) neritic
- D) continental shelf
- E) intertidal

29) Which of the following most directly relates to the current biodiversity crisis?

- A) increased atmospheric carbon dioxide
- B) ozone depletion
- C) overexploitation of species
- D) habitat destruction
- E) zoned reserves

30) Which of the following is correct about integral membrane proteins?

- A) They lack tertiary structure.
- B) They are loosely bound to the surface of the bilayer.
- C) They are usually transmembrane proteins.
- D) They are not mobile within the bilayer.
- E) They serve only a structural role in membranes.

31) The ATP made during glycolysis is generated by

- A) substrate-level phosphorylation.
- B) electron transport.
- C) photophosphorylation.
- D) chemiosmosis.
- E) oxidation of NADH to NAD⁺.

32) All of the following statements are correct regarding the Calvin cycle *except*:

- A) The energy source utilized is the ATP and NADPH obtained through the light

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reaction.

- B) These reactions begin soon after sundown and end before sunrise.
- C) The 5-carbon sugar RuBP is constantly being regenerated.
- D) One of the end products is glyceraldehyde phosphate.
- E) Rubisco attaches carbon dioxide to ribulose biphosphate.

33) Which of the following would be inhibited by a drug that specifically blocks the addition of phosphate groups to proteins?

- A) G-protein-linked receptor signaling
- B) ligand-gated ion channel signaling
- C) adenylyl cyclase activity
- D) phosphatase activity
- E) receptor tyrosine kinase activity

34) Imagine looking through a microscope at a squashed onion root tip. The chromosomes of many of the cells are plainly visible. In some cells, replicated chromosomes are aligned along the center (equator) of the cell. These particular cells are in which stage of mitosis?

- A) telophase
- B) prophase
- C) anaphase
- D) metaphase
- E) prometaphase

二、解釋名詞（每題 4 分，共 16 分）

1. endosymbiosis
2. seedless vascular plants
3. innate immunity
4. melanocyte-stimulating hormone (MSH)

三、問答題（每題 8 分，共 16 分）

1. Describe in detail, what is the generalized life cycle of fungi?
2. Describe the nervous and hormonal controls involved in the regulation of the kidney.