

# 國立中山大學 95 學年度轉學生招生考試試題

科目：普通生物(上)【生科系二年級】

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## 普通生物學(1)試題 (共 50 題, 每題 2 分)

- All of the following molecules are part of the cell membrane *except*  
A) lipids. B) nucleic acids. C) proteins. D) phosphate groups. E) steroids.
- The surface of an integral membrane protein would be best described as  
A) hydrophilic. B) hydrophobic. C) amphipathic. D) completely covered with phospholipids. E) exposed on only one surface of the membrane.
- Whenever energy is transformed, there is always an increase in the  
A) free energy of the system. B) free energy of the universe. C) entropy of the system. D) entropy of the universe. E) enthalpy of the universe.
- Which of the following statements correctly describe(s) some aspect of energy in living organisms?  
A) Living organisms can convert energy among several different forms. B) Living organisms can use energy to do work. C) Organisms expend energy in order to decrease their entropy D) A and B only E) A, B, and C
- Which of the following statements is (are) correct about an oxidation-reduction (or redox) reaction?  
A) The molecule that is reduced gains electrons. B) The molecule that is oxidized loses electrons. C) The molecule that is reduced loses electrons. D) The molecule that is oxidized gains electrons. E) Both A and B are correct.
- When electrons move closer to a more electronegative atom, what happens?  
A) Energy is released. B) Energy is consumed. C) The more electronegative atom is reduced. D) The more electronegative atom is oxidized. E) A and C are correct.
- Which of the following are products of the light reactions of photosynthesis that are utilized in the Calvin cycle?  
A)  $\text{CO}_2$  and glucose B)  $\text{H}_2\text{O}$  and  $\text{O}_2$  C) ADP,  $\text{P}_i$ , and NADP<sup>+</sup> D) electrons and  $\text{H}^+$  E) ATP and NADPH
- A plant has a unique photosynthetic pigment. The leaves of this plant appear to be reddish yellow. What wavelengths of visible light are *not being absorbed by this pigment*?  
A) red and yellow B) blue and violet C) green and yellow D) blue, green, and red E) green, blue, and violet
- From the perspective of the cell receiving the message, the three stages of cell signaling are  
A) the paracrine, local, and synaptic stages. B) signal reception, signal transduction, and cellular response. C) signal reception, nucleus disintegration, and new cell generation. D) the alpha, beta, and gamma stages. E) signal reception, cellular response, and cell division.
- A small molecule that specifically binds to another molecule, usually a larger one  
A) is called a signal transducer. B) is called a ligand. C) is called a polymer. D) seldom is involved in hormonal signaling. E) usually terminates a signal reception.
- What is the name for the special region on a duplicated chromosome that holds the sister chromatids together?  
A) centrosome B) centromere C) kinetochore D) desmosome E) microtubule organizer region
- Which of the following statements about genes is *incorrect*?  
A) Genes correspond to segments of DNA. B) Many genes contain the information needed for cells to synthesize enzymes and other proteins. C) During fertilization, both the sperm and the ovum contribute genes to the resulting fertilized egg. D) Under normal circumstances, each chromosome contains precisely one gene. E) Genetic differences can result from changes in the DNA called mutations.
- Asexual reproduction and sexual reproduction are different in that  
A) individuals reproducing asexually transmit 100% of their genes to their progeny, whereas individuals reproducing sexually only transmit 50%. B) asexual reproduction produces offspring that are genetically identical to the parents, whereas sexual reproduction gives rise to genetically distinct offspring. C) asexual reproduction involves a single parent, whereas sexual reproduction involves two. D) asexual reproduction only requires mitosis, whereas sexual reproduction always involves meiosis. E) all of the above
- How do the two members of a pair of homologous chromosomes differ from each other?  
A) their length B) the identity and relative position of the genes present on each of the chromosomes C) their staining patterns D) the position of the centromere within each of the chromosomes E) the precise sequence of the DNA within each of the chromosomes

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15. What is a karyotype?  
A) the set of unique physical characteristics that define an individual B) the collection of all the mutations present within a genome C) a unique combination of chromosomes found in a gamete D) a system of classifying cell nuclei E) a display of every pair of homologous chromosomes within a cell, organized according to size and shape
16. By examining a karyotype, it is possible to determine  
A) which of two related plant forms is a gametophyte, and which is a sporophyte. B) the sex of an animal. C) the age of a fungus. D) A and B only E) A, B, and C
17. At which stage of mitosis are chromosomes photographed in the preparation of a karyotype?  
A) prophase B) metaphase C) anaphase D) telophase E) interphase
18. The human X and Y chromosomes are  
A) both present in every somatic cell of males and females alike. B) of approximately equal size. C) almost entirely homologous, despite their different names. D) called "sex chromosomes" because they determine an individual's sex. E) all of the above
19. Which of the following is *true* of a species that has a chromosome number of  $2n = 16$ ?  
A) The species is diploid with 32 chromosomes. B) The species has 16 sets of chromosomes. C) There are 8 homologous pairs. D) During the S phase of the cell cycle there will be 32 separate chromosomes. E) A gamete from this species has 4 chromosomes.
20. In animals, meiosis results in gametes, and fertilization results in  
A) spores. B) gametophytes. C) zygotes. D) sporophytes. E) clones.
21. Referring to a plant sexual life cycle, which of the following terms describes the process that leads *directly to the formation of gametes*?  
A) sporophyte meiosis B) gametophyte mitosis C) gametophyte meiosis D) sporophyte mitosis E) alternation of generations
22. Which of the following statements about Mendel's breeding experiments is *correct*?  
A) None of the parental (P) plants were true-breeding. B) All of the  $F_2$  progeny showed a phenotype that was intermediate between the two parental (P) phenotypes. C) Half of the  $F_1$  progeny had the same phenotype as one of the parental (P) plants, and the other half had the same phenotype as the other parent. D) All of the  $F_1$  progeny resembled one of the parental (P) plants, but only some of the  $F_2$  progeny did. E) none of the above
23. A cross between homozygous purple-flowered and homozygous white-flowered pea plants results in offspring with purple flowers. This demonstrates  
A) the blending model of genetics. B) true-breeding. C) dominance. D) a dihybrid cross. E) the mistakes made by Mendel.
24. Which of the following is (are) true for alleles?  
A) They can be identical or different for any given gene in a somatic cell. B) They can be dominant or recessive. C) They can represent alternative forms of a gene. D) Only A and B are correct. E) A, B, and C are correct.
25. Two plants are crossed, resulting in offspring with a 3:1 ratio for a particular trait. This suggests  
A) that the parents were true-breeding for contrasting traits. B) incomplete dominance. C) that a blending of traits has occurred. D) that the parents were both heterozygous. E) that each offspring has the same alleles.
26. A sexually reproducing animal has two unlinked genes, one for head shape ( $H$ ) and one for tail length ( $T$ ). Its genotype is  $HhTt$ . Which of the following genotypes is possible in a gamete from this organism?  
A)  $HT$  B)  $Hh$  C)  $HhTt$  D)  $T$  E)  $tt$
27. Chromosomes and genes share all of the following characteristics *except* that  
A) they are both present in pairs in all diploid cells. B) they both undergo segregation during meiosis. C) their copy numbers in the cell decrease after meiosis, and increase during fertilization. D) they are both copied during the S phase of the cell cycle. E) they both pair up with their homologues during prophase of mitosis.
28. When Thomas Hunt Morgan crossed his red-eyed  $F_1$  generation flies to each other, the  $F_2$  generation included both red- and white-eyed flies. Remarkably, all the white-eyed flies were male. What was the explanation for this result?  
A) The involved gene was on the X chromosome. B) The involved gene was on the Y chromosome. C) The involved gene was on an autosome. D) Other male-specific factors influence eye color in flies. E) Other female-specific factors influence eye color in flies.

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29. New combinations of linked genes are due to which of the following?  
A) nondisjunction B) crossing over C) independent assortment D) mixing of sperm and egg E) both A and C
30. What does a frequency of recombination of 50% indicate?  
A) The two genes likely are located on different chromosomes. B) All of the offspring have combinations of traits that match one of the two parents. C) The genes are located on sex chromosomes. D) Abnormal meiosis has occurred. E) Independent assortment is hindered.
31. In his transformation experiments, Griffith observed that  
A) mutant mice were resistant to bacterial infections. B) mixing a heat-killed pathogenic strain of bacteria with a living nonpathogenic strain can convert some of the living cells into the pathogenic form. C) mixing a heat-killed nonpathogenic strain of bacteria with a living pathogenic strain makes the pathogenic strain nonpathogenic. D) infecting mice with nonpathogenic strains of bacteria makes them resistant to pathogenic strains. E) mice infected with a pathogenic strain of bacteria can spread the infection to other mice.
32. Avery and his colleagues purified various chemicals from pathogenic bacteria and showed that \_\_\_\_\_ was (were) the transforming agent.  
A) DNA B) protein C) lipids D) carbohydrates E) phage
33. In trying to determine whether DNA or protein is the genetic material, Hershey and Chase made use of which of the following facts?  
A) DNA does not contain sulfur, whereas protein does. B) DNA contains phosphorus, but protein does not. C) DNA contains nitrogen, whereas protein does not. D) A and B only E) A, B, and C
34. Tobacco mosaic virus has RNA rather than DNA as its genetic material. In a hypothetical situation where RNA from a tobacco mosaic virus is mixed with proteins from a related DNA virus, the result could be a hybrid virus. If that virus were to infect a cell and reproduce, what would the resulting "offspring" viruses be like?  
A) tobacco mosaic virus B) the related DNA virus C) a hybrid: tobacco mosaic virus RNA and protein from the DNA virus D) a hybrid: tobacco mosaic virus protein and nucleic acid from the DNA virus E) a virus with a double helix made up of one strand of DNA complementary to a strand of RNA surrounded by viral protein
35. If A, B, and C are all required for growth, a strain mutant for the gene encoding enzyme B would be capable of growing on which of the following media?  
A) minimal medium B) minimal medium supplemented with "A" C) minimal medium supplemented with "B" D) minimal medium supplemented with "C" E) answers B and C
36. The nitrogenous base adenine is found in all members of which group?  
A) proteins, triglycerides, and testosterone B) proteins, ATP, and DNA C) ATP, RNA, and DNA D) alpha glucose, ATP, and DNA E) proteins, carbohydrates, and ATP
37. If proteins were composed of only 12 different kinds of amino acids, what would be the smallest possible codon size in a genetic system with four different nucleotides?  
A) 1 B) 2 C) 3 D) 4 E) 12
38. A particular triplet of bases in the template strand of DNA is AGT. The corresponding codon for the mRNA transcribed is  
A) AGT. B) UGA. C) TCA. D) ACU. E) either UCA or TCA, depending on wobble in the first base
39. Which of the following is (are) *true* about viruses?  
A) Viruses are classified below the cellular level of biological organization. B) A single virus particle contains both DNA and RNA. C) Even small virus particles are visible with light microscopes. D) Only A and B are true. E) A, B, and C are true.
40. Which of the following is a characteristic of all viruses?  
A) a nucleic acid genome B) a protein capsid C) a viral envelope D) A and B only E) A, B, and C
41. The host range of a virus is determined by  
A) the proteins on its surface. B) whether its nucleic acid is DNA or RNA. C) the proteins on the surface of the host cell. D) the enzymes produced by the virus before it infects the cell. E) both A and C
42. Virulent phages undergo a(n) \_\_\_\_\_ life cycle, whereas temperate phages are capable of undergoing a(n) \_\_\_\_\_ cycle.  
A) infective; retroviral B) lysogenic; lytic C) lytic; lysogenic D) retroviral; infective E) infective; benign

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43. The condensed chromosomes observed in mitosis include all of the following structures *except*

A) nucleosomes. B) 30-nm fibers. C) 300-nm fibers. D) looped domain. E) ribosomes.

Answer: E

44. Which of the following statements about histones is *incorrect*?

A) Each nucleosome consists of two molecules, each of four types of histone. B) Histone H1 is not present in the nucleosome bead; instead it is involved in the formation of higher-level chromatin structures. C) The amino end of each histone extends outward from the nucleosome and is called a "histone tail." D) Histones are found in mammals, but not in other animals or in plants. E) The mass of histone in chromatin is approximately equal to the mass of DNA.

45. Muscle cells and nerve cells in one species of animal owe their differences in structure to

A) having different genes. B) having different chromosomes. C) using different genetic codes. D) differential gene expression. E) having unique ribosomes.

46. What is a cloning vector?

A) an enzyme that cuts DNA into restriction fragments B) a DNA probe used to locate a particular gene in the genome C) an agent, such as a plasmid, used to transfer DNA from an *in vitro* solution into a living cell D) the laboratory apparatus used to clone genes E) the sticky end of a DNA fragment

47. Bacteria containing recombinant plasmids are often identified by which process?

A) examining the cells with an electron microscope B) using radioactive tracers to locate the plasmids C) exposing the bacteria to an antibiotic that kills cells lacking the plasmid D) removing the DNA of all cells in a culture to see which cells have plasmids E) producing antibodies specific for each bacterium containing a recombinant plasmid

48. Bacteria containing a plasmid into which the eukaryotic gene has integrated would grow in

A) the nutrient broth only. B) the nutrient broth and the tetracycline broth only. C) the nutrient broth, the ampicillin broth, and the tetracycline broth. D) all four types of broth. E) the ampicillin broth and the nutrient broth.

49. The nematode *Caenorhabditis elegans* is used as a model organism for genetic studies. One of the key advantages of using *C. elegans* for such studies is that

A) it is hermaphroditic, making it easy to detect recessive mutations. B) it has a great variety of somatic cells. C) its genome is as large as ours. D) its development is extremely variable. E) morphogenesis and growth occur throughout its life.

50. The perpetually embryonic regions of plants responsible for continual growth and formation of new organs are called the

A) stamens. B) nurse cells. C) myoblasts. D) apical meristems. E) anchor cells.

**I. Multiple Choices: Select the best answer. One point each.**

1. Which of these is a consequence of uniformitarianism? (A) Earth is round, not flat. (B) Populations evolve. (C) Populations reproduce faster than their food supply. (D) A Creator made Earth. (E) Earth is old.
2. In a Hardy-Weinberg population with two alleles,  $A$  and  $a$ , that are in equilibrium, the frequency of the allele  $a$  is 0.7. What is the percentage of the population that is homozygous for this allele? (A) 3 (B) 9 (C) 30 (D) 42 (E) 49
3. Natural selection is most nearly the same as (A) diploidy. (B) gene flow. (C) genetic drift. (D) nonrandom mating. (E) differential reproductive success.
4. All the genes in a population are the population's (A) phenotype. (B) fitness. (C) genotype. (D) gene flow. (E) gene pool.
5. Which of the following applies to *both* anagenesis and cladogenesis? (A) branching (B) increased diversity (C) adaptive radiation (D) more species (E) speciation
6. Shared derived characters (A) nonadaptive (B) analogous (C) homologous (D) polyphyletic (E) monophyletic
7. We are living during the \_\_\_\_\_ era. (A) Neogene (B) Cenozoic (C) Paleozoic (D) Paleogene (E) Mesozoic
8. *Panthera* is a taxon at which level? (A) order (B) family (C) phylum (D) genus (E) class
9. The first genetic material was most likely a(n) (A) DNA polymer. (B) DNA oligonucleotide. (C) RNA polymer. (D) protein. (E) protein enzyme.
10. Which gas was probably *least* abundant in Earth's early atmosphere? (A)  $O_2$  (B)  $CO$  (C)  $CH_4$  (D)  $H_2O$  (E)  $NH_3$
11. How many half-lives should have elapsed if 12.5% of the parent isotope remains in a fossil at the time of analysis? (A) one (B) two (C) three (D) four (E) five
12. Members of which kingdom have cell walls and are all heterotrophic? (A) Plantae (B) Fungi (C) Animalia (D) Protista (E) Monera
13. The first prokaryotic cells appeared during the (A) Jurassic. (B) Cretaceous. (C) Paleozoic. (D) Triassic. (E) Precambrian.
14. Which of the following is the *most* common compound in the cell walls of gram-positive bacteria? (A) cellulose (B) lipopolysaccharide (C) lignin (D) peptidoglycan (E) protein
15. Which structure is the outermost component of a bacterium? (A) nucleoid region (B) capsule (C) cell wall (D) ribosome (E) plasma membrane
16. Protists are alike in that all are (A) multicellular. (B) photosynthetic. (C) marine. (D) nonparasitic. (E) eukaryotic.
17. The largest seaweeds belong to which group? (A) cyanobacteria (B) red algae (C) green algae (D) brown algae (E) golden algae
18. A paramecium is a (A) diatom. (B) apicomplexan. (C) ciliate. (D) metazoan. (E) dinoflagellate.
19. Microphylls are characteristic of which types of plants? (A) mosses (B) liverworts (C) lycophytes (D) ferns (E) hornworts
20. Angiosperms are most closely related to (A) green algae. (B) charophyceans. (C) bryophytes. (D) seedless vascular plants. (E) gymnosperms.
21. In pine trees, pollen grains get to the ovule via the (A) micropyle. (B) eggs. (C) megaspore. (D) pollen cone. (E) integument.
22. In flowering plants the integuments of the ovule develop into a(n) (A) endosperm. (B) cotyledon. (C) fruit. (D) sporophyte. (E) seed coat.
23. A stamen consists of a(n) (A) anther and filament. (B) stigma and style. (C) stigma and anther. (D) stigma and filament. (E) ovary and sepal.
24. Basidia produce spores by a process known as (A) decomposition. (B) mitosis. (C) meiosis. (D) hyphae. (E) binary fission.
25. All fungi share which of the following characteristics? (A) symbiotic (B) heterotrophic (C) flagellated (D) pathogenic (E) saprobic
26. At the phylum level, you are most closely related to a(n) (A) clam. (B) sea star. (C) earthworm. (D) jelly. (E) planarian.
27. Echinoderms are (A) deuterostomes. (B) parazoans. (C) protostomes. (D) radiata. (E) acoelomates.
28. Which of the following are *not* associated with sponges? (A) oscula (B) spongocoels (C) cnidocytes (D) spicules (E) amoebocytes
29. A land snail, a clam, and an octopus all share (A) a mantle. (B) a radula. (C) gills. (D) embryonic torsion. (E) distinct cephalization.

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30. Grasshoppers respire via (A) their skin. (B) nephridia. (C) book lungs. (D) spiracles and trachea (E) Malpighian tubules.
31. Which one of these chordate groups lacks a post-anal tail and a notochord as adults? (A) lancelets (B) tunicates (C) amphibians (D) mammals (E) reptiles.
32. \_\_\_\_\_ are the oldest known primate group. (A) Apes (B) Prosimians (C) Anthropoids (D) Hominids (E) Monkeys
33. Evidence indicates that \_\_\_\_\_ was the first hominid to use fire. (A) *Australopithecus* (B) *Homo erectus* (C) *Ardipithecus* (D) *Homo habilis* (E) *Homo sapiens*
34. \_\_\_\_\_ provides cells for primary growth. (A) Lateral meristems (B) Apical meristems (C) Vascular cambium (D) Cork cambium (E) Xylem
35. What tissue makes up most of the wood of a tree? (A) primary xylem (B) secondary xylem (C) secondary phloem (D) mesophyll cells (E) vascular cambium
36. Which of these involves a symbiotic relationship? (A) root hairs (B) apoplasts (C) Casparian strips (D) mycorrhizae (E) symplasts
37. The water pressure that pulses water and sugar from sugar source to sugar sink is referred to as \_\_\_\_\_. (A) translocation (B) bulk flow (C) transpiration (D) root pressure (E) solute pressure
38. Most of the mass of organic material of a plant comes from (A) water. (B) carbon dioxide. (C) soil minerals. (D) atmospheric oxygen. (E) nitrogen.
39. Carnivorous adaptations of plants mainly compensate for soil that has a relatively low content of (A) potassium. (B) nitrogen. (C) calcium. (D) water. (E) phosphate.
40. The products of meiosis in plants are always which of the following? (A) spores (B) eggs (C) sperm (D) seeds (E) both B and C
41. Fruits develop from (A) microsporangia. (B) receptacles. (C) fertilized eggs. (D) ovaries. (E) ovules.
42. Flower parts are made of modified (A) roots. (B) stems. (C) leaves. (D) ovules. (E) shoots.
43. The breakdown of chlorophyll reveals the \_\_\_\_\_ pigments of a leaf. (A) carotenoid (B) xanthophyll (C) anthocyanin (D) melanin (E) phycoerythrin
44. What is the specific term that refers to seasonal changes in the relative lengths of night and day? (A) photoperiod (B) circadian rhythm (C) chemotaxis (D) gravitropism (E) phototaxis
45. Collagenous fibers are primarily found in what type of animal tissue? (A) connective (B) striated muscle (C) nerve (D) epithelial (E) bone
46. What joins muscles to bones? (A) ligaments (B) tendons (C) loose connective tissue (D) Haversian systems (E) spindle fibers
47. Air flows in only one direction through the lungs of which animals? (A) frogs (B) birds (C) mammals (D) crocodiles (E) flying insects
48. Blood pressure is highest in the (A) aorta. (B) posterior vena cava. (C) anterior vena cava. (D) pulmonary artery. (E) capillaries.
49. Pulse is a direct measure of (A) blood pressure. (B) stroke volume. (C) cardiac output. (D) heart rate. (E) breathing rate.
50. Each indication below is a clinical characteristic of inflammation *except* (A) decreased temperature. (B) edema. (C) redness. (D) pain. (E) increased blood flow.
51. The genetic material of HIV consists of (A) single-stranded DNA. (B) single-stranded RNA. (C) double-stranded DNA. (D) double-stranded RNA. (E) none of the above
52. The outer part of the kidney is the (A) medulla. (B) nephron. (C) lacteal. (D) cortex. (E) Bowman's capsule.
53. Which one of the following, if present in a urine sample, would likely be caused by trauma? (A) amino acids (B) glucose (C) salts (D) erythrocytes (E) vitamins
54. A cell that contains proteins enabling a hormone to selectively bind to its plasma membrane is called a(n) (A) secretory cell. (B) plasma cell. (C) endocrine cell. (D) target cell. (E) regulatory cell.
55. Steroid hormone-receptor complexes act in (A) the nucleus. (B) the plasma membrane. (C) the cytoplasm. (D) lysosomes (E) vesicles
56. In men, the excretory and reproductive systems share which structure? (A) vas deferens (B) urinary bladder (C) seminal vesicle (D) urethra (E) ureter
57. Which pituitary secretion stimulates sperm production? (A) LH (B) ACTH (C) TSH (D) PRL (E) FSH

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58. Ovulation usually occurs on or about day \_\_\_\_\_ of a 28-day ovarian cycle. (A) 1 (B) 7 (C) 14 (D) 21 (E) 28
59. After ovulation, high levels of \_\_\_\_\_ inhibit \_\_\_\_\_ secretion. (A) estrogen and progesterone; FSH and LH (B) FSH and LH; estrogen and progesterone (C) HCG; estrogen and progesterone (D) estrogen; FSH (E) androgens; FSH and LH
60. As cleavage continues, a zygote forms into a solid multicellular ball called a(n) (A) endometrium. (B) morula. (C) trophoblast. (D) gastrula. (E) blastula.
61. During gastrulation, invagination occurs at the (A) archenteron. (B) blastocoel. (C) endometrium. (D) blastopore. (E) trophoblast.
62. The blood-brain barrier (A) is formed by tight junctions. (B) is formed by oligodendrocytes. (C) tightly regulates the intracellular environment of the CNS. (D) uses chemical signals to communicate with the spinal cord. (E) provides support to the brain tissue.
63. What type of cell makes up the myelin sheath of a motor neuron? (A) astrocytes (B) microglial cells (C) Ranvier cells (D) ependymal cells (E) Schwann cells
64. Which of the following are shared by skeletal, cardiac, and smooth muscle? (A) A bands and I bands (B) transverse tubules (C) gap junctions (D) motor units (E) thick and thin filaments
65. A single muscle cell is referred to as a (A) myofibril. (B) muscle fiber. (C) muscle neuron. (D) sarcolemma. (E) sarcomere.
66. In temperate lakes, the surface water is replenished with nutrients during turnovers that occur in the (A) autumn and spring. (B) autumn and winter. (C) spring and summer. (D) summer and winter. (E) summer and autumn.
67. Generally speaking, deserts are located in places where air masses are usually (A) cold. (B) humid. (C) rising. (D) falling. (E) expanding.
68. Phytoplankton is most frequently found in which of the following zones? (A) oligotrophic (B) photic (C) benthic (D) abyssal (E) aphotic
69. Biomes are (A) all of the populations of a particular species. (B) recognized on the basis of the dominant animal life. (C) a major type of ecosystem. (D) unaffected by climatic factors. (E) limited to aquatic regions.
70. Which of the following areas of study focuses on the exchange of energy, organisms, and materials between ecosystems? (A) population ecology (B) organismal ecology (C) landscape ecology (D) ecosystem ecology (E) community ecology

II. Essay. Draw a life cycle diagram for a moss plant. 10 points.

III. Essay. Use equilibrium model of island biogeography to explain how an island size and distance from the mainland affect the island's species richness. 20 points.

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選擇題（單選；共 40 題；每題 2.5 分；答錯不倒扣分數）

數據： $R = 0.082 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K} = 8.31 \text{ J}/\text{mol}\cdot\text{K}$ ； $N = 6.022 \times 10^{23} \text{ mol}^{-1}$

原子量：C = 12；H = 1；O = 16；Cl = 35.45；Ne = 20.2；N = 14；He = 4；Kr = 83.8；F = 16

- Vitamin C contains the elements C, H, and O. It is known to contain 40.9% C and 4.58% H by mass. The molar mass of vitamin C has been found to be about 180. The molecular formula for vitamin C is:
  - $\text{C}_2\text{H}_3\text{O}_2$
  - $\text{C}_3\text{H}_4\text{O}_3$
  - $\text{C}_4\text{H}_6\text{O}_4$
  - $\text{C}_6\text{H}_8\text{O}_6$
  - none of these
- Which one of the following basic solutions will not neutralize 25.0 mL of a 1.0 M sulfuric acid solution?
  - 25.0 mL of 1.0 M NaOH
  - 25.0 mL of 2.0 M KOH
  - 50.0 mL of 1.0 M NaOH
  - 100.0 mL of 0.50 M NaOH
  - All of these (a-d) will neutralize 25.0 mL of a 1.0 M sulfuric acid solution.
- In the following reaction, which species is the reducing agent?  
 $3\text{Cu} + 6\text{H}^+ + 2\text{HNO}_3 \rightarrow 3\text{Cu}^{2+} + 2\text{NO} + 4\text{H}_2\text{O}$ 
  - $\text{H}^+$
  - Cu
  - N in NO
  - $\text{Cu}^{2+}$
  - N in  $\text{HNO}_3$
- Which of the following is not an oxidation-reduction reaction?
  - A precipitation reaction.
  - A reaction in which a metal reacts with a nonmetal.
  - A combustion reaction.
  - A metal reacting with an acid.
  - All of the above are oxidation-reduction reactions.
- The valve between a 5.00-L tank containing  $\text{O}_2$  (g) at 9.00 atm and a 7.00-L tank containing Ne (g) at 6.00 atm is opened. Calculate the ratio of partial pressures ( $\text{O}_2:\text{Ne}$ ) in the container.
  - 0.933
  - 1.00
  - 1.07
  - 1.50
  - none of these
- How many of the following gases at STP are less dense than air at STP:  $\text{NH}_3$ , He, Kr, and  $\text{F}_2$ ?
  - 0
  - 1
  - 2
  - 3
  - 4
- Which statement about kinetic energy (K.E.) is true?
  - All objects moving with the same velocity have the same K.E.
  - As the velocity of a body increases, its K.E. decreases.
  - The K.E. of a body will double if its velocity doubles.
  - The K.E. of a body is independent of its mass.
  - none of these
- How does the observed pressure of a gas relate to the ideal pressure?
  - The observed pressure is less than the ideal pressure.
  - The observed pressure is greater than the ideal pressure.
  - They are equal.
  - The relationship depends on the gas.
  - None of these.
- The conjugate base of a weak acid is
  - a strong base
  - a weak base
  - a strong acid
  - a weak acid
  - none of these

【背面還有試題】



# 國立中山大學 95 學年度轉學生招生考試試題

科目：普通化學【生科系二年級、化學系二年級】

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10. At  $0^\circ\text{C}$ , the ion-product constant of water,  $K_w$ , is  $1.2 \times 10^{-15}$ . What is the pH of pure water at  $0^\circ\text{C}$ ?
- 7.00
  - 6.88
  - 7.56
  - 7.46
  - none of these
11. If an acid, HA, is 10.0% dissociated in a 1.0 M solution, what is the  $K_a$  for this acid?
- $9.1 \times 10^{-2}$
  - $1.1 \times 10^{-2}$
  - $8.1 \times 10^{-1}$
  - $6.3 \times 10^{-2}$
  - none of these
12. Calculate  $\Delta E$  for a system that releases 28 J of heat while 63 J of work is done on it.
- 35 J
  - 91 J
  - 35 J
  - 91 J
  - none of the above
13. The enthalpy of formation of an element in its standard state is
- the enthalpy of its reaction with hydrogen.
  - the enthalpy of its reaction with oxygen.
  - determined by its melting point.
  - zero.
  - none of these
14. Choose the correct statement.
- Exothermic reactions are always spontaneous.
  - Free energy is independent of temperature.
  - A reaction that exhibits a negative value of  $\Delta S$  cannot be spontaneous.
  - At constant pressure and temperature, a decrease in free energy ensures an increase in the entropy of the system.
  - none of these
15. Which of the following is the strongest oxidizing agent?
- |   |                            |
|---|----------------------------|
| $\text{MnO}_4^- + 4\text{H}^+ + 3\text{e}^- \rightarrow \text{MnO}_2 + 2\text{H}_2\text{O}$ | $E^\circ = 1.68\text{ V}$  |
| $\text{I}_2 + 2\text{e}^- \rightarrow 2\text{I}^-$  | $E^\circ = 0.54\text{ V}$  |
| $\text{Zn}^{2+} + 2\text{e}^- \rightarrow \text{Zn}$  | $E^\circ = -0.76\text{ V}$ |
- $\text{MnO}_4^-$
  - $\text{I}_2$
  - $\text{Zn}^{2+}$
  - Zn
  - $\text{MnO}_2$
16. How many electrons are transferred in the following reaction?
- $$\text{SO}_3^{2-}(\text{aq}) + \text{MnO}_4^-(\text{aq}) \rightarrow \text{SO}_4^{2-}(\text{aq}) + \text{Mn}^{2+}(\text{aq})$$
- 6
  - 2
  - 10
  - 4
  - 3
17. In which of the following cases can  $E^\circ$  be equal to zero?
- In any cell at equilibrium.
  - In a concentration cell.
  - $E^\circ$  can never be equal to zero.
  - Choices a and b are both correct.
18. Which of the following statements is false?
- An orbital can accommodate at most two electrons.
  - The electron density at a point is proportional to  $\psi^2$  at that point.
  - The spin quantum number of an electron must be either  $+1/2$  or  $-1/2$ .
  - A 2p orbital is more penetrating than a 2s; i.e., it has a higher electron density near the nucleus and inside the charge cloud of a 1s orbital.
  - In the usual order of filling, the 6s orbital is filled before the 4f orbital.

# 國立中山大學 95 學年度轉學生招生考試試題

科目：普通化學【生科系二年級、化學系二年級】

共 5 頁 第 3 頁

19. How many electrons in an atom can have the quantum numbers  $n = 3, l = 2$ ?
  - a) 2
  - b) 5
  - c) 10
  - d) 18
  - e) 6
20. Which form of electromagnetic radiation has the shortest wavelengths?
  - a) gamma rays
  - b) microwaves
  - c) radio waves
  - d) infrared radiation
  - e) x-rays
21. In Bohr's atomic theory, when an electron moves from one energy level to another energy level more distant from the nucleus
  - a) energy is emitted.
  - b) energy is absorbed.
  - c) no change in energy occurs.
  - d) light is emitted.
  - e) none of these
22. Which of the following has a zero dipole moment?
  - a)  $\text{NH}_3$
  - b)  $\text{NO}_2$
  - c)  $\text{PF}_5$
  - d)  $\text{SO}_2$
  - e)  $\text{HCN}$
23. Which of the following has the central atom that is  $\text{dsp}^3$  hybridized?
  - a)  $\text{SF}_4$
  - b)  $\text{SCl}_4$
  - c)  $\text{CCl}_4$
  - d)  $\text{SF}_6$
  - e) none of the above
24. Which of the following statements is correct?
  - a) A triple bond is composed of two  $\sigma$  bonds and one  $\pi$  bond.
  - b)  $\sigma$  bonds result from the head-to-head overlap of atomic orbitals.
  - c) Free rotation may occur about a double bond.
  - d)  $\pi$  bonds have electron density on the internuclear axis.
  - e) More than one of these statements are correct.
25. Which of the following is diamagnetic?
  - a)  $\text{N}_2^-$
  - b)  $\text{N}_2^+$
  - c)  $\text{O}_2$
  - d)  $\text{N}_2$
  - e) At least two of the above are diamagnetic.
26. Which of the following statements is true?
  - a) Electrons are never found in an antibonding MO.
  - b) All antibonding MOs are higher in energy than the atomic orbitals of which they are composed.
  - c) Antibonding MOs have electron density mainly outside the space between the two nuclei.
  - d) None of the above is true.
  - e) Two of the above statements are true.
27. The reaction rate constant  $k$  is dependent on
  - a) the concentration of the reactant.
  - b) the concentration of the product.
  - c) the temperature.
  - d) the order of the reaction.
  - e) none of these
28. A first-order reaction is 42% complete at the end of 17 minutes. What is the value of the rate constant?
  - a)  $3.2 \times 10^{-2} \text{ min}^{-1}$
  - b)  $20 \text{ min}^{-1}$
  - c)  $31 \text{ min}^{-1}$
  - d)  $5.1 \times 10^{-2} \text{ min}^{-1}$
  - e) none of these

【背面還有試題】

國立中山大學 95 學年度轉學生招生考試試題

科目：普通化學【生科系二年級、化學系二年級】

共 5 頁 第 4 頁

29. For which order reaction is the half-life of the reaction proportional to  $1/k$  ( $k$  is the rate constant)?  
a) zero order  
b) first order  
c) second order  
d) all of the above  
e) none of the above
30. The resistance of a liquid to an increase in its surface area is called  
a) capillary action.  
b) surface tension.  
c) vapor pressure  
d) viscosity.  
e) none of these
31. Which one of the following is the strongest intermolecular force experienced by Noble gases?  
a) London dispersion forces  
b) Dipole-dipole interactions  
c) Hydrogen bonding  
d) Ion-ion  
e) Polar covalent bonds
32. The net number of face-centered atoms contained in a face-centered cubic unit cell is  
a) 1  
b) 3  
c) 4  
d) 6  
e) none of these
33. Which of the following chemical or physical changes is an endothermic process?  
a) the evaporation of water  
b) the combustion of gasoline  
c) the mixing of sulfuric acid and water  
d) the freezing of water  
e) none of these
34. The destruction of a colloid is called  
a) degeneration  
b) coagulation  
c) denaturation  
d) reconfiguration  
e) none of these
35. What is the expected osmotic pressure in torr of a 0.0100 M solution of NaCl in water at 25°C?  
a) 0.245  
b) 15.6  
c) 372  
d) 186  
e) none of these
36. The Haber process  
a) is used to manufacture ammonia.  
b) transforms nitrogen to other nitrogen-containing compounds.  
c) is used to recover sulfur from underground deposits.  
d) is used to produce nitric acid.  
e) none of these
37. Which of the following complexes shows geometric isomerism?  
a)  $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{SO}_4$   
b)  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$   
c)  $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$   
d)  $\text{K}[\text{Co}(\text{NH}_3)_2\text{Cl}_4]$   
e) none of these
38. Which of the following is true about coordination complexes?  
a) The metal is a Lewis base and the ligands are Lewis acids.  
b) Only complexes with coordination number six are found in nature.  
c) When the ligands approach a transition metal ion in an octahedral field, the  $d_{xz}$ ,  $d_{yz}$ , and  $d_{xy}$  atomic orbitals are affected the least by the ligands.  
d) None of the above is true.  
e) All of the above are true.

