

## 國立中山大學九十三年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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Multiple Choice: (每題 2 分，須在答案紙上規定的空格位置內填入答案，否則一律不予計分)

1. The cytoskeleton is composed of which type of molecule? (A) protein (B) cellulose  
(C) chitin (D) phospholipids (E) calcium phosphate
2. The innermost portion of a mature plant cell wall is the (A) primary cell wall.  
(B) secondary cell wall. (C) middle lamella. (D) plasma membrane. (E) plasmodesmata.
3. Ions diffuse across membranes down their (A) electrochemical gradient.  
(B) electrogenic gradient. (C) electrical gradient.  
(D) concentration gradient. (E) osmotic gradient.
4. A plant cell placed in a hypotonic environment will (A) plasmolyze.  
(B) shrivel. (C) become turgid. (D) become flaccid. (E) lyse.
5. The products of glycolysis are (A) 2ATP, 2 CO<sub>2</sub>, 2 ethanol. (B) 2ATP, 2 NAD<sup>+</sup>, 2 acetate.  
(C) 2ATP, 2 NADH, 2 pyruvate. (D) 38ATP, 6 CO<sub>2</sub>, 6H<sub>2</sub>O (E) 4ATP, 2 FADH<sub>2</sub>, 2 pyruvate
6. Which compound has the highest free energy (will produce the most ATP when oxidized)?  
(A) acetyl CoA (B) glucose (C) pyruvate  
(D) fructose biphosphate (E) glyceraldehydes phosphate
7. Blue light has more energy than red light. Therefore, blue light  
(A) has a longer wavelength than red light. (B) has a shorter wavelength than red light.  
(C) contains more photons than red light. (D) is absorbed faster by chlorophyll a.  
(E) has a broader electromagnetic spectrum than red light.
8. A spectrophotometer can be used to measure (A) the absorption spectrum of a substance.  
(B) the action spectrum of a substance. (C) the amount of energy in a photon.  
(D) the wavelength of visible light. (E) the efficient of photosynthesis.
9. A signal molecule that binds to a plasma membrane protein functions as a (A) ligand.  
(B) second messenger. (C) protein phosphatase. (D) protein kinase. (E) receptor protein.
10. Which of the following can activate a protein by transferring a phosphate group to it? (A) cAMP  
(B) G protein (C) phosphodiesterase (D) protein kinase (E) protein phosphatase
11. The longest part of the cell cycle is (A) prophase. (B) G1 phase.  
(C) G2 phase. (D) mitosis. (E) interphase.
12. In a plant cell, a centrosome functions in the formation of (A) the cell plate. (B) kinetochores.  
(C) duplicate chromosomes. (D) centromeres. (E) microtubules of the spindle apparatus.
13. The study of fossils is called (A) phylogeny. (B) gradualism.  
(C) paleontology. (D) anthropology. (E) biogeography.
14. The smallest unit that can evolve is (A) a genome. (B) an individual.  
(C) a species. (D) a population. (E) a community.
15. Darwinian fitness is a measure of (A) survival. (B) number of matings.  
(C) adaptation of the environment. (D) successful competition for resources.  
(E) number of viable offspring.

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16. The greatest source of genetic variation in plant and animal populations is from  
(A) mutations. (B) sexual recombination. (C) selection.  
(D) polymorphism. (E) recessive masking in heterozygotes.
17. For which of the following is the biological species concept least appropriate? (A) plants  
(B) animals (C) bacteria (D) fossils (E) both C and D
18. Which concept of species would be most useful to a field biologist identifying new species in a tropical rain forest?  
(A) biological (B) ecological (C) ecological  
(D) morphological (E) pluralistic
19. The richest source of fossils is found (A) in coal and peat moss. (B) along gorges.  
(C) within sedimentary rock strata. (D) encased in volcanic rocks. (E) in amber.
20. Related families are grouped into the next highest taxon called a (A) class.  
(B) order. (C) phylum. (D) genus. (E) kingdom.
21. Which of the following is most likely the closest relative of the vascular plants? (A) charophyceans  
(B) red algae (C) bryophytes (D) pteridophytes (E) lycophytes
22. Megaphylls (A) are large leaves. (B) are gametophyte plants that develop from megaspores.  
(C) are leaves specialized for reproduction. (D) are leaves with branching vascular systems.  
(E) were a dominant group of the great coal forests.
23. What provides food for a developing sporophyte embryo in a gymnosperm seed?  
(A) endosperm (B) female gametophyte tissue  
(C) female sporophyte tissue (D) male gametophyte tissue (E) pine cone
24. Which of the following is the correct path that a pollen tube takes to reach the female gametophyte in an angiosperm?  
(A) stigma, style, ovary, ovule, embryo sac  
(B) anther, stigma, filament, ovule, ovum (C) stigma, filament, carpel, ovary, ovule  
(D) carpel, pistil, ovary, ovule, embryo sac (E) stigma, style, pistil, ovule, ovary
25. Imperfect fungi  
(A) represent the most ancient lineage of fungi. (B) include the fungal components of lichens.  
(C) have abnormal forms of sexual reproduction. (D) are fungi that are predatory  
(E) include molds and other types of fungi whose sexual stage is lacking or unknown.
26. the major difference between fungi and plants is that fungi (A) have an absorptive form of nutrition.  
(B) do not have a cell wall. (C) are not eukaryotic.  
(D) are multinucleate but not multicellular. (E) reproduce by spores.
27. A leaf trace is (A) a petiole. (B) the outline of the vascular bundles in a leaf.  
(C) a branch from a vascular bundle that extends into a leaf.  
(D) a tiny bulge on the flank of the apical dome that grows into a leaf.  
(E) a system of plant identification based on leaf morphology.
28. Secondary xylem and phloem are produced in a root by the (A) pericycle. (B) endodermis.  
(C) vascular cambium. (D) apical meristem. (E) ray initials.

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29. Which of the following is *not* a component of the symplast? (A) sieve-tube members  
(B) xylem tracheids (C) endodermal cells (D) cortex cells (E) companion cells
30. The Casparian strip prevents water and minerals from entering the stele of root through  
(A) plasmodesmata. (B) endodermal cells. (C) symplast.  
(D) apoplast. (E) xylem vessels.
31. The effects of mineral deficiencies involving fairly mobile nutrients will first be observed in  
(A) older portions of the plant. (B) new leaves and shoots. (C) the root system.  
(D) the color of the leaves. (E) the flowers.
32. Which of the following takes the form of a mycelial sheath over plant roots with hyphae extending out that increase the surface area for absorption? (A) root nodules (B) haustoria  
(C) endomycorrhizae (D) ectomycorrhizae (E) infection threads
33. A flower on a dioecious plant would be (A) complete. (B) bisexual.  
(C) unisexual. (D) asexual. (E) carpellate.
34. In angiosperms, sperm are formed by (A) meiosis in the anther. (B) meiosis in the pollen grain.  
(C) mitosis in the anther. (D) mitosis in the pollen tube. (E) double fertilization in the embryo sac.
35. A seed consists of (A) an embryo, a seed coat, and a nutrient supply. (B) an embryo sac.  
(C) a gametophyte and a nutrient supply. (D) an enlarged ovary. (E) an ovule.
36. Flower organs have evolved from modified (A) leaves. (B) branches.  
(C) sporangia. (D) sporophytes. (E) apical meristems.
37. The growth inhibitor in seeds is usually (A) abscisic acid. (B) ethylene. (C) gibberellin.  
(D) a small amount of ABA combined with a larger concentration of gibberellins.  
(E) a high cytokinin-to-auxin ratio.
38. Which of the following hormones would be sprayed on barley seeds to speed germination in the production of malt for making beer? (A) abscisic acid (B) auxin (C) cytokinin  
(D) ethylene (E) gibberellin
39. Which level of ecology considers energy flow and chemical cycling? (A) community  
(B) ecosystem (C) organismal (D) population (E) abiotic
40. Many plant species have adaptations for dealing with the periodic fires typical of a (A) savanna.  
(B) chaparral. (C) temperate grassland. (D) temperate deciduous forest. (E) A, B, or C.
41. Animals appear to maximize their energy intake-to-expenditure ratio. What is this behavior called?  
(A) optimal foraging (B) territoriality (C) a fixed-action pattern  
(D) maturation (E) learning
42. A change in behavior as a result of experience is called (A) habituation. (B) learning.  
(C) imprinting. (D) maturation. (E) insight.
43. In a range with a heterogeneous distribution of suitable habitats, the dispersion pattern of a population probably would be (A) clumped. (B) uniform. (C) random.  
(D) unpredictable. (E) dense.

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44. The carrying capacity for a population is estimated at 500; the population size is currently 400; and  $r$  is 0.01. What is  $dN/dt$ ? (A) 0.01 (B) 0.8 (C) 8 (D) 40 (E) 50.
45. According to the top-down (trophic cascade) model of community control, which trophic level would you decrease if you wanted to increase the vegetation level in a community? (A) nutrients (B) vegetation (C) secondary consumers (carnivores) (D) tertiary consumers (E) omnivores
46. A highly successful parasite (A) will not harm its host. (B) may benefit its host. (C) will be able to feed without killing its host. (D) will kill its host fairly rapidly. (E) will have coevolved into a commensalistic interaction with its host.
47. Which of the following trophic levels would have the largest numbers of individuals? (A) primary producers (B) omnivores (C) primary consumers (D) herbivores (E) tertiary consumers
48. A serious effect of the thinning of the ozone layer is (A) a reduction in species diversity. (B) global warming. (C) acid precipitation. (D) an increase in harmful UV radiation reaching earth. (E) cultural eutrophication.
49. Which of the following is the most serious threat to biodiversity? (A) competition from introduced species (B) commercial harvesting (C) habitat destruction (D) overexploitation (E) disruptions of food chains
50. Ecosystem services include all of the following except (A) pollination of crops. (B) production of antibiotics and drugs. (C) access to aesthetic beauty. (D) decomposition of wastes. (E) moderation of weather extremes.

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**Multiple Choice:** (每題 2 分，須在答案紙上規定的空格位置內填入答案，否則一律不予計分)

- Which of the following is an example of polygenic inheritance?  
(A) sex-linkage in humans  
(B) white and purple color in sweet peas  
(C) skin pigmentation in humans  
(D) the ABO blood groups in humans  
(E) pink flowers in snapdragons
- The following is a list of chromosomal alterations. Which one of these would automatically cause two of the others?  
(A) reciprocal translocation  
(B) deletion  
(C) inversion  
(D) nonreciprocal translocation  
(E) duplication
- A Barr body is normally found in the nucleus of which kind of human cell?  
(A) somatic cells of a female only  
(B) sperm cells only  
(C) unfertilized egg cells only  
(D) both male and female somatic cells  
(E) somatic cells of a male only
- What does transformation involve in bacteria?  
(A) the creation of a strand of RNA from a DNA molecule  
(B) the infection of cells by a phage DNA molecule  
(C) the transfer of DNA from one strain to another  
(D) the type of semiconservative replication shown by DNA  
(E) the creation of a strand of DNA from an RNA molecule
- Which of the following help to hold the DNA strands apart while they are being replicated?  
(A) single-stranded binding proteins  
(B) ligase  
(C) DNA polymerase  
(D) helicase  
(E) exonuclease
- What is one function of a signal peptide?  
(A) to signal the initiation of transcription  
(B) to bind RNA polymerase to DNA and initiate transcription  
(C) to attach ribosomes synthesizing secretory proteins to the ER  
(D) to terminate translation of the messenger RNA  
(E) to direct an mRNA molecule into the cisternal space of ER
- A frameshift mutation could result from  
(A) a base insertion only.  
(B) a base deletion only.  
(C) a base substitution only  
(D) deletion of three consecutive bases.  
(E) either an insertion or a deletion of a base.
- What is the function of the operator locus of an inducible operon?  
(A) producing repressor molecules  
(B) producing messenger RNA  
(C) permitting transcription  
(D) identifying the substrate lactose  
(E) binding steroid hormones
- RNA viruses appear to have higher rates of mutation because  
(A) RNA viruses respond more to mutagens.  
(B) RNA viruses replicate faster.  
(C) RNA nucleotides are more unstable than DNA nucleotides.  
(D) the enzyme reverse transcriptase does not proofread the way DNA polymerase does.  
(E) RNA viruses can incorporate a variety of nonstandard bases.
- Which of the following is an example of transcriptional control of gene expression?  
(A) mRNA is stored in the cytoplasm and needs a control signal to initiate translation.  
(B) There is an amplification of genes for rRNA.  
(C) Transcription factors bind to the enhancer and promoter regions.  
(D) mRNA exists for a specific time before it is degraded.  
(E) RNA processing occurs before mRNA exits the nucleus.
- In which of the following would you expect to find the most methylation of the DNA?  
(A) tandem arrays for ribosomal genes  
(B) globin genes  
(C) Barr bodies  
(D) pseudogenes  
(E) transposons

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12. A DNA fingerprint is produced by (A) treating selected segments of DNA with restriction enzymes.  
(B) electrophoresis of restriction fragments. (C) oligonucleotides from PCRs.  
(D) electroporation of cDNAs. (E) Both A and B are correct.
13. What is a cloning vector? (A) the sticky end of a DNA fragment  
(B) the enzyme that cuts DNA into restriction fragments  
(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) a DNA probe used to locate a particular gene in the genome
14. "Becoming specialized in structure and function" is a definition for (A) induction.  
(B) development. (C) pattern formation. (D) morphogenesis. (E) differentiation.
15. The product of the bicoid gene in *Drosophila* provides essential information about  
(A) the dorsal-ventral axis. (B) segmentation. (C) the head-tail axis.  
(D) the left-right axis. (E) paired wings
16. What were the earliest bacteria like? (A) aerobic heterotrophs (B) parasites  
(C) photoautotrophs (D) chemoautotrophs (E) anaerobic heterotrophs
17. A biologist finds a new unicellular organism that possesses an endoplasmic reticulum, a simple cytoskeleton, and two small nuclei that are each surrounded by a membrane. The organism has neither mitochondria nor chloroplasts. This organism most probably is a(n) (A) ciliate.  
(B) apicomplexan. (C) *Chlamydomonas*. (D) diplomonad. (E) prokaryote.
18. Eukaryotic organisms are responsible for all of the following human diseases EXCEPT (A) malaria.  
(B) syphilis. (C) giardiasis. (D) African sleeping sickness. (E) tuberculosis.
19. The blastopore denotes the presence of an endoderm-lined tube in the developing embryo known as the  
(A) blastula. (B) coelom. (C) archenteron. (D) diploblast. (E) germ layer.
20. You have before you an unknown organism that you examine carefully. Which of the following would convince you it is NOT an aceolomate? (A) It exudes a fluid when you make an incision in its side  
(B) It is triploblastic. (C) It has bilateral symmetry.  
(D) It responds to food by moving towards it. (E) It possesses sensory structures at the anterior end.
21. Which of the following are NOT found in sponges? (A) spicules (B) oscula  
(C) cnidocytes (D) spongocoels (E) amoebocytes
22. While working in your garden, you uncover an animal with many legs, mostly as two pairs per segment. The animal must be a  
(A) sow bug. (B) millipede.  
(C) centipede. (D) caterpillar. (E) polychaete worm.
23. *Caenorhabditis elegans*, like the fly *Drosophila melanogaster*, has become a model research organism in developmental biology. To which phylum does it belong? (A) Annelida  
(B) Platyhelminthes (C) Nematoda (D) Rotifera (E) Arthropoda
24. In which class did jaws first occur? (A) Agnatha (B) Placodermi  
(C) Chondrichthyes (D) Ostracodermi (E) Osteichthyes
25. Why do many reptiles thrive in deserts?  
(A) Their cartilaginous endoskeleton provides needed flexibility.  
(B) The protein keratin helps prevent dehydration.  
(C) They have an acute sense of sight.  
(D) A large number of prey and a limited number of predators are available in the desert.  
(E) Their bright coloration distracts enemies.

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26. Which of the following fibers has the greatest tensile strength?  
(B) spindle fibers (C) reticular fibers (D) elastin fibers (A) fibrin fibers  
(E) collagenous fibers
27. The body's automatic tendency to maintain a constant internal environment is termed  
(A) static equilibrium. (B) homeostasis. (C) physiologic control.  
(D) negative feedback. (E) organ system function.
28. The source of trypsinogen and chymotrypsinogen is the (A) mouth.  
(B) pancreas. (C) appendix. (D) gallbladder. (E) liver.
29. Digestive systems are not needed by (A) herbivores. (B) heterotrophs.  
(C) autotrophs. (D) carnivores. (E) omnivores.
30. Breathing is usually regulated by (A) the concentration of red blood cells.  
(B) erythropoietin levels in the blood. (C) CO<sub>2</sub> and O<sub>2</sub> concentration and pH-level sensors.  
(D) hemoglobin levels in the blood. (E) the lungs and the larynx.
31. The velocity of blood flow is lowest in (A) arteries. (B) capillaries.  
(C) the aorta. (D) veins. (E) arterioles.
32. The sinoatrial node in humans (A) is found in the lymphatic system.  
(B) is the heart's pacemaker. (C) is the valve between the left atrium and the left ventricle.  
(D) delays transmission in the cardiac conduction system after the pacemaker has fired.  
(E) monitors blood pressure in the aorta.
33. The MHC (major histocompatibility complex) is important in (A) distinguishing self from nonself.  
(B) identifying bacterial pathogens. (C) recognizing parasitic pathogens.  
(D) identifying abnormal cells. (E) Both A and D are correct.
34. In the inflammatory response, the absence of which of the following would prevent all the others from happening?  
(A) increased population of phagocytes in the area  
(B) dilation of arterioles (C) increased permeability of blood vessels  
(D) release of histamine (E) leakage of plasma to the affected area
35. Naturally acquired passive immunity would involve the  
(A) absorption of pathogens through mucous membranes. (B) injection of vaccine.  
(C) ingestion of interferon. (D) placental transfer of antibodies. (E) injection of antibodies.
36. The advantage of excreting wastes as urea rather than ammonia is that  
(A) Both B and C are advantages. (B) urea is less toxic than ammonia.  
(C) urea requires less water for excretion than ammonia.  
(D) urea can be exchanged for Na<sup>+</sup>. (E) urea does not affect the osmolar gradient.
37. The thermostat of vertebrates is located in the (A) hypothalamus.  
(B) subcutaneous layer of the skin. (C) liver. (D) medulla oblongata. (E) thyroid gland.
38. In vertebrates, urea and uric acid are made in (A) the liver. (B) the bladder.  
(C) all of the organism's cells. (D) the kidneys. (E) the pancreas.
39. A varying response to a common chemical messenger is possible because  
(A) the circulatory system regulates responses to hormones by routing the hormones to specific targets.  
(B) the hormone is chemically altered in different ways as it travels through different branches of the circulatory system.  
(C) various target cells have different genes.  
(D) each cell knows how it fits into the body's master plan.  
(E) various target cells differ in their receptors to the same hormone.

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40. The endocrine system and the nervous system are structurally related. Which of the following cells best illustrates this relationship?  
(A) a neuron in the spinal cord (B) a brain cell in the cerebral cortex  
(C) a neurosecretory cell in the hypothalamus (D) a cell in the pancreas that produces digestive enzymes  
(E) a steroid-producing cell in the adrenal cortex
41. Which of the following glands shows both endocrine and exocrine activity? (A) parathyroid  
(B) salivary (C) adrenal (D) pancreas (E) pituitary
42. The hormone progesterone is produced (A) in the ovary and acts directly on the uterus.  
(B) in the pituitary and acts directly on the uterus. (C) in the ovary and acts directly on the testes.  
(D) by the pituitary and acts directly on the ovary. (E) in the uterus and acts directly on the pituitary.
43. Which substance can be detected in the urine of females and is a positive test for pregnancy?  
(A) estrogen (B) hypothalamus releasing factors (C) progesterone  
(D) follicle-stimulating hormone (E) human chorionic gonadotropin
44. After sperm cells are produced, they are mainly stored in the (A) prostate.  
(B) epididymis. (C) bulbourethral gland. (D) seminal vesicles. (E) urethra.
45. In a frog embryo, gastrulation (A) produces a blastocoel displaced into the animal hemisphere.  
(B) proceeds by involution as cells roll over the dorsal lip of the blastopore.  
(C) is impossible because of the large amount of yolk in the ovum.  
(D) occurs along the primitive streak in the animal hemisphere.  
(E) occurs within the inner cell mass that is embedded in the large amount of yolk.
46. What part of the sperm first contacts the egg plasma membrane? (A) the posterior plasma membrane  
(B) the fertilization membrane (C) the posterior acrosomal membrane  
(D) the anterior acrosomal membrane (E) the anterior plasma membrane
47. Which of the following offers the best description of neural transmission across a mammalian synaptic gap?  
(A) Neural impulses involve the flow of  $K^+$  and  $Na^+$  across the gap.  
(B) Neural impulses cause the release of chemicals that diffuse across the gap.  
(C) The calcium within the axons and dendrites of nerves adjacent to a synapse acts as the neurotransmitter.  
(D) Neural impulses travel across the gap as electrical currents.  
(E) Neural impulses travel across the gap in both directions.
48. The major inhibitory neurotransmitter of the brain is (A) dopamine. (B) acetylcholine.  
(C) GABA. (D) cholinesterase. (E) norepinephrine.
49. A muscle cell is properly referred to as a (A) belly of the muscle. (B) sarcomere.  
(C) myofibril. (D) muscle fiber. (E) myofilament.
50. What is the role of calcium in muscle contractions?  
(A) to break the cross-bridges as a cofactor in the hydrolysis of ATP  
(B) to reestablish the polarization of the plasma's membrane following an action potential  
(C) to spread the action potential through the T tubules  
(D) to bind with troponin, changing its shape so that the actin filament is exposed  
(E) to transmit the action potential across the neuromuscular junction



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一、單選題(每題三分，共二十題。)

- Aluminum and oxygen react according to the following equation:  
 $4 \text{Al}(s) + 3 \text{O}_2(g) \rightarrow 2 \text{Al}_2\text{O}_3(s)$   
In a certain experiment, 4.6 g Al was reacted with excess oxygen and 6.8 g of product was obtained. What was the percent yield of the reaction? (The atomic weight of Al is 27)  
(a) 78 (b) 74 (c) 68 (d) 63 (e) 34
- Calculate the density of ammonia gas at 24.0°C and 738 torr.  
(a) 0.678 g L<sup>-1</sup> (b) 1.48 g L<sup>-1</sup> (c) 0.836 g L<sup>-1</sup> (d) 514 g L<sup>-1</sup> (e) 8.38 g L<sup>-1</sup>
- Use the following thermochemical equations  
 $\text{C}_2\text{H}_2(g) + 5/2 \text{O}_2(g) \rightarrow 2 \text{CO}_2(g) + \text{H}_2\text{O}(g) \quad \Delta H^\circ = -1300\text{kJ}$   
 $\text{C}_2\text{H}_6(g) + 7/2 \text{O}_2(g) \rightarrow 2 \text{CO}_2(g) + 3 \text{H}_2\text{O}(g) \quad \Delta H^\circ = -1560\text{kJ}$   
 $\text{H}_2(g) + 1/2 \text{O}_2(g) \rightarrow \text{H}_2\text{O}(l) \quad \Delta H^\circ = -286\text{kJ}$   
to calculate  $\Delta H^\circ$  for the following reaction:  
 $\text{C}_2\text{H}_2(g) + 2 \text{H}_2(g) \rightarrow \text{C}_2\text{H}_6(g)$   
(a) -3146kJ (b) -16kJ (c) +1560kJ (d) -312kJ (e) -2860kJ
- How many elements in the second row of the Periodic Table are diamagnetic in atomic form?  
(a) 1 (b) 2 (c) 3 (d) 6 (e) 7
- Which of the following molecules would be nonpolar?  
(a) N<sub>2</sub>O (b) SCO (c) HCCl<sub>3</sub> (d) H<sub>2</sub>O (e) AlCl<sub>3</sub>
- According to molecular orbital theory and assuming a molecular orbital diagram similar to that for O<sub>2</sub>. Predict the bond order for NO.  
(a) 0.5 (b) 1 (c) 1.5 (d) 2 (e) 2.5
- Which notion is incorrect?  
(a) Dispersion forces are present in all molecular substances.  
(b) The greater the dipole moment, the stronger the dipole-dipole forces.  
(c) The polarizability of elongated molecules is greater than that of compact, more spherical molecules.  
(d) Polar molecules always have higher boiling points than nonpolar molecules.  
(e) Hydrogen bonding leads to the strongest intermolecular forces.
- Which statement is incorrect?  
(a) When 40.0 mL of ethanol and 60.0 mL of water are mixed, the volume of the mixture is 100.0 mL.  
(b) When ethanol and water are mixed, the solution warms slightly. Therefore, the solvation process is exothermic.  
(c) Ideal solutions form when the intermolecular forces of the solvent and solute are similar.  
(d) For an ideal solution, the  $\Delta H$  of solution is zero.  
(e) When an ionic compound dissolves in water, the positive and negative ions separate from each other.

# 國立中山大學九十三年度轉學生招生考試試題

科目：普通化學【生科系二年級】

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9. Which of the following is not a binary molecular compound?

- (a) HI (b) CO (c) NO (d) KBr (e) N<sub>2</sub>O<sub>4</sub>

10. Initial rate data were obtained for the following reaction:



Experiment	[A], Mol/L	[B], Mol/L	Rate
1	0.20	0.10	$2.2 \times 10^{-3}$
2	0.40	0.10	$4.4 \times 10^{-3}$
3	0.20	0.20	$8.8 \times 10^{-3}$

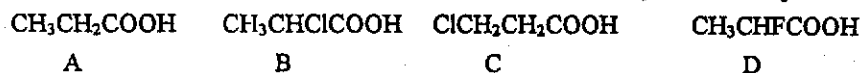
What would be the initial rate if [A] = 0.10 M and [B] = 0.30 M?

- (a)  $3.3 \times 10^{-3}$  (b)  $1.7 \times 10^{-3}$  (c)  $1.4 \times 10^{-2}$  (d)  $9.9 \times 10^{-3}$  (e)  $3.3 \times 10^{-2}$

11. Which of the following steps isn't a possible outcome when an inhibitor is added to an enzyme?

- (a) The enzyme becomes less active.  
 (b) The enzyme becomes inactive.  
 (c) The inhibitor binds to the active site of the enzyme.  
 (d) The inhibitor changes the shape of the enzyme.  
 (e) All of the above are possible.

12. Arrange the following carboxylic acids in the order in which you would expect their K<sub>a</sub> values to increase.



- (a) A > B > C > D (b) D > C > A > B (c) A > C > B > D (d) D > B > C > A  
 (e) C > B > D > A

13. What will be the pH of a CH<sub>3</sub>COOH / CH<sub>3</sub>COONa buffer at pH = 4.74, if the concentration of CH<sub>3</sub>COONa is increased from 0.500 M to 1.00 M? (pK<sub>a</sub> = 4.74)

- (a) 4.74 (b) 5.04 (c) 4.44 (d) 4.14 (e) Not enough information is provided to answer this question.

14. Which of the following statements is incorrect?

- (a) The more atoms in its molecules, the greater will be the entropy of a substance.  
 (b) If a process is spontaneous the reverse process is nonspontaneous.  
 (c) The greater the degree of disorder in a system, the more negative is its entropy.  
 (d) The entropy of a pure, perfect crystal is zero at 0 K.  
 (e) The entropy of universe must always increase for a spontaneous process.

15. The following reaction is exothermic. CO<sub>2</sub> (g) + 2 H<sub>2</sub> (g) → CH<sub>3</sub>OH (l). The reaction is

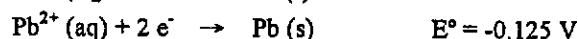
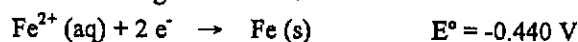
- (a) spontaneous at all temperatures. (b) non-spontaneous at all temperatures.  
 (c) spontaneous at low temperatures. (d) spontaneous at high temperatures.  
 (e) always at equilibrium.

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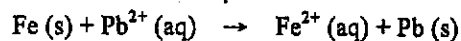
科目：普通化學【生科系二年級】

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16. Given the following information:



Calculate the value of  $K_{\text{eq}}$  at 25°C for the reaction:



- (a) 24.5      (b)  $4.8 \times 10^{-6}$       (c)  $4.4 \times 10^{-10}$       (d)  $2.3 \times 10^{-11}$       (e)  $2.1 \times 10^5$

17. What is the ground state electron configuration of  $\text{Fe}^{3+}$ ?

- (a)  $[\text{Ar}] 4s^2 3d^3$       (b)  $[\text{Ar}] 3d^5$       (c)  $[\text{Ar}] 4s^1 3d^4$       (d)  $[\text{Ar}] 3d^3$       (e)  $[\text{Ar}] 4s^2 4d^3$

18. What is the coordination number of copper in the  $[\text{Cu}(\text{en})_2(\text{H}_2\text{O})_2]^{2+}$  complex?

- (a) 0      (b) 2      (c) 4      (d) 6      (e) none of these

19. Name the following compound:  $[\text{Cr}(\text{NH}_3)_2(\text{en})\text{Cl}_2]\text{Cl}$

- (a) chromium(III)diammineethylenediamine trichloride  
 (b) diammineethylenediaminodichlorochromium(III) chloride  
 (c) diamminedichloroethylenediaminechromium(III) chloride  
 (d) diammineethylenediaminetrichlorochromium(III)  
 (e) trichlorodiamminoethylenediaminechromate(III)

20. Given the spectrochemical series (increasing  $\Delta$ ),  $\text{Cl}^{-} < \text{H}_2\text{O} < \text{NH}_3 < \text{CN}^{-}$ , which of the following species would absorb light of the shortest wavelength?

- (a)  $[\text{CoCl}_6]^{3-}$       (b)  $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$       (c)  $[\text{Co}(\text{NH}_3)_6]^{3+}$       (d)  $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$   
 (e)  $[\text{Co}(\text{CN})_6]^{3-}$

二、 填空题(每格四分, 共五格)

- The pH at which the amino acid exists mainly as the dipolar ion is called the \_\_\_\_\_ point.
- The hydrolysis of fats and oils in basic solutions yields \_\_\_\_\_-metal salts of fatty acids.
- The pacemaker cells controlling the heart rate have a natural voltage across the membrane. If an abnormal pacemaker cell with a ratio of  $[\text{K}^{+}]$  between the inside and outside of this cell is 100:1, the voltage developed across the membrane is \_\_\_\_\_ volt.
- Hydrogen sulfide is used as a reagent to precipitate cations in qualitative analysis. The hydrolysis of thioacetamide may produce the desired hydrogen sulfide in solution. The molecular structural formula of thioacetamide may be expressed as \_\_\_\_\_.
- Tooth enamel is composed principally of the mineral hydroxyapatite,  $\text{Ca}_5(\text{PO}_4)_3\text{OH}$ . Fluorides containing toothpastes or drinking water may convert some of the hydroxyapatite in enamel to fluorapatite. The chemical formula of fluorapatite is \_\_\_\_\_.

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## 三、簡答題

1. Draw the most stable Lewis structure of the following species and describe the shape of them, then indicate the formal charge of each atoms. (十二分)  
(a)  $\text{N}_3^-$       (b)  $\text{OF}_2$
2. Draw the electron density contour of  $d_{z^2}$  and  $d_{x^2-y^2}$  orbitals. (八分)