

國立中山大學九十四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】

共3頁第1頁

單選題(每題2分)

1. An individual who has two identical alleles for a trait is said to be _____.
A) Homozygous; B) heterozygous; C) isozygous; D) a variant.
2. An individual who has two different alleles for a trait is called _____.
A) Haploid; B) homozygous; C) heterozygous; D) true-breeding
3. Skin cells and nerve cells represent _____ cells, while a sperm cell is an example of a _____ cell.
A) somatic ; somatic; B) somatic ; germ; C) germ ; germ; D) germ ; somatic
4. During this phase of the cell cycle the sister chromatids are formed.
A) G₁ phase; B) G₂ phase; C) S phase; D) prophase
5. A bivalent contains how many sister chromatids?
A) 2; B) 4; C) 8; D) depends on the cell
6. Huntington disease in humans is an example of _____.
A) essential genes; B) lethal alleles; C) semilethal alleles; D) conditional lethal alleles
7. The coat characteristics of Siamese cats and Himalayan rabbits, where proteins in the extremities function differently than in other parts of the body, is an example of _____.
A) incomplete dominance; B) multiple allele systems; C) semilethal alleles;
D) temperature-sensitive conditional allele
8. Phenylketonuria in humans is an example of _____.
A) incomplete penetrance; B) codominance; C) an environmental-influenced trait
D) incomplete dominance
9. An organism that contains patches of tissue that vary for a specific characteristic, such as a pigment, is an example of which of the following?
A) linkage; B) meiotic recombination; C) mitotic recombination; D) translocations
10. While mapping two genes in *Drosophila* you observe 30 recombinants among 200 total offspring. What is the distance between these genes?
A) 30 map units; B) 6.67 map units; C) 200 map units; D) 15 map units
11. In a given mapping experiment you expect that incidence of double crossovers is 3.5%, but you only observe 2.5%. This can be explained by _____.
A) interference; B) linkage; C) coincidence; D) segregation
12. Which of the following is correct concerning F factors?
A) Another term for a plasmid; B) It stands for fertility factor; C) It allows conjugation to occur; D) All of the answers are correct
13. The protein complex that initiates the process of conjugation following contact between two bacteria is called the _____.
A) origin of transfer; B) T DNA; C) relaxosome; D) nucleoprotein
14. Gene duplications, such as the ultra bar-eye phenotype of *Drosophila*, may be caused by which of the following?
A) the crossing over of misaligned chromosomes; B) deletion of important genetic information; C) reciprocal translocations; D) position effect
15. The production of gene families, such as the globin genes, is the result of _____.
A) inversions; B) deficiencies; C) gene duplications; D) simple translocations
16. Given the following sequence of genes on a chromosome, determine what change in chromosome structure occurred. (the * indicates the centromere)
before A B C D * E F G H
after A B G F E * D C H
A) reciprocal translocation; B) pericentric inversion; C) paracentric inversion; D) gene duplication
17. According to Chargaff's rule, if the DNA of a species contains 20% adenine, what percent of guanine will it contain?
A) 20%; B) 30%; C) 50%; D) 75%
18. The first group of researchers to correctly identify the double-helix structure of DNA were _____.
A) McClintock and Franklin; B) Hershey and Chase; C) Pauling and Avery; D) Watson and Crick
19. You have discovered a strain of *E. coli* that grows very slowly—the generation time is nearly 12 hours compared to the normal 20-30 minutes. Upon further investigation, you find a mutation in the DNA polymerase III gene. What subunit of the holoenzyme, does this mutation affect the most.
A) α ; B) β ; C) γ ; D) ψ
20. Okazaki fragments do which of the following?
A) assist in forming the replication fork; B) bind to the oriC region; C) assist in the synthesis of DNA from the lagging strand; D) reform the double-helix following replication

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21. Which of the following is an example of a processive enzyme?
A) DNA polymerase I; B) DNA polymerase III; C) DNA ligase; D) Okazaki fragments
22. Most eukaryotic genes are collinear.
A) True; B) False; C) Because they are driven by a promoter; D) B and C are right
23. An R loop experiment was performed on two different mRNA's. The first showed one R loop, while the second showed two R loops separated by a region of double-stranded DNA. What is the composition of these two mRNA's?
A) The first contains no introns and the second two introns; B) The first contains no introns and the second one intron; C) The first contains one intron and the second two introns; D) The first contains two introns and the second one intron
24. What enables the splicing of group I and II introns?
A) spliceosomes; B) ribozymes; C) snRNA; D) poly-A tail
25. Where does mRNA/tRNA codon-anticodon recognition take place?
A) 30S; B) 40S; C) 50S; D) the surface between the two ribosomal subunits
26. With regard to Chapeville's experiment, what could not be the radioactive element used to label cysteine?
A) ^{15}N ; B) ^{35}S ; C) ^{14}C ; D) ^3H
27. If a bacteria is placed in an environment that contains both glucose and lactose, the regulation of the *lac* operon will allow which nutrient to be processed first?
A) glucose; B) lactose; C) Both will be processed equally; D) Neither will be processed in this environment
28. The regulation of protein function, not gene expression, is called _____ regulation.
A) posttranslational; B) transcriptional; C) translational; D) post-transcriptional
29. Translational regulatory proteins recognize specific areas of what molecule?
A) tRNA; B) ribosome; C) rRNA; D) mRNA
30. Histone acetyltransferases would be directly involved in which of the following?
A) formation of open chromatin; B) movement of the nucleosome; C) acetylation of lysines; D) termination of gene expression
31. CpG islands are associated with which of the following?
A) nucleosome location; B) DNA methylation; C) steroid hormone activity; D) cAMP pathway
32. Genomic imprinting is a result of _____.
A) nucleosome location; B) histone activation; C) DNA methylation; D) serine to leucine changes in the genetic code
33. As a researcher you have identified a potential transposable element that contains both a transposase and resolvase enzyme. Which of the following types of transposons would you assign it to based on this information?
A) composite transposon; B) non-viral retroelement; C) viral-like retroelement; D) replicative transposon
34. Long-terminal repeats are unique to which group of transposons?
A) composite transposon; B) non-viral retroelement; C) viral-like retroelement; D) replicative transposon
35. Which of the following is technically not part of the genetic information of a transposable element?
A) long-terminal repeats; B) inverted repeats; C) direct repeats; D) transposase
36. Which of the following would contain both vector DNA and chromosomal DNA?
A) recircularized vector; B) hybrid vector; C) both vectors; D) neither vector
37. In a cloning experiment you use a vector that contains a *lacZ* gene as a selectable marker. If the competent cells are grown on X-Gal and IPTG, which colonies would contain chromosomal DNA?
A) the white colonies; B) the blue colonies; C) half the total colonies; D) none of the colonies
38. Antibodies can be used as a probe for which of the following techniques?
A) Western blotting; B) Northern blotting; C) Southern blotting; D) Eastern blotting
39. Why was the addition of methionine necessary during the production of somatostatin by recombinant bacteria?
A) so that it was compatible with the restriction enzyme; B) as a selectable marker; C) to allow the somatostatin to link to a bacterial protein; D) to increase the length of the peptide to make it more commercial
40. What is the purpose of the cyanogen bromide (CNBr) in the manufacture of insulin and somatostatin by recombinant bacteria?
A) allows for the uptake of the plasmid; B) enhances the activity of the restriction enzymes; C) creates sticky ends for integration into the plasmid; D) cleaves the protein from the β -galactosidase protein
41. Bioremediation has been used to treat which of the following?
A) oil spills; B) sewage; C) pesticides; D) all of the answers have been successfully remediated
42. Cells that have undergone homologous recombination for gene replacement would have which of the following gene combinations?

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- A) only the cloned gene; B) only the original gene; C) both the cloned and original gene; D) neither the cloned or original gene
43. Which of the following terms best describes how the components of a genome interact to produce an organism's traits?
A) proteomics; B) functional genomics; C) structural genomics; D) genomics
44. _____ involves an examination of how the proteins encoded by genes interact to produce cell and tissue types.
A) Proteomics; B) Functional genomics; C) Structural genomics; D) Genomics
45. The majority of human cancers are caused by _____.
A) viral infections; B) inherited mutations; C) spontaneous mutations; D) carcinogens
46. A gene that promotes the development of cancer is called an _____.
A) clone; B) ACV; C) mutagen; D) oncogene
47. The first acutely transforming virus to be isolated was _____.
A) RSV in chickens; B) Hepatitis B SV40 in humans; C) SSV in monkeys; D) ALV in mice
48. Who was the first to propose that species were the result of isolating mechanisms?
A) Darwin; B) Wallace; C) Dobzhansky; D) Morgan
49. The modern understanding of evolution, or the Neo-Darwinean theory, is based on the work of what individual?
A) Morgan; B) Wallace; C) Sturtevant; D) Dobzhansky
50. Which of the following is not a prezygotic isolating mechanism?
A) temporal isolation; B) habitat isolation; C) mechanical isolation; D) hybrid inviability

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I 選擇題 (共 90 分，每題 1 分)

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) The *main* explanation for the lack of a continuing abiotic origin of life on Earth today is that
 - A) there are no molten surfaces on which weak solutions of organic molecules would polymerize.
 - B) all habitable places are already filled.
 - C) our oxidizing atmosphere is not conducive to the spontaneous formation of complex molecules.
 - D) there is not sufficient lightning to provide an energy source.
 - E) much less visible light is reaching Earth to serve as an energy source.
- 2) Which of the following represents a probable order in the biological history of Earth?
 - A) an oxidizing atmosphere followed by a reducing atmosphere
 - B) metabolism before mitosis
 - C) animals before algae
 - D) DNA genes before RNA genes
 - E) eukaryotes before prokaryotes
- 3) The oxygen revolution changed Earth's environment dramatically. Which of the following adaptations took advantage of this change?
 - A) the persistence of some animal groups in anaerobic habitats
 - B) the evolution of chloroplasts when early protists engulfed photosynthetic cyanobacteria
 - C) the evolution of photosynthetic pigments that protected early algae from the corrosive effects of oxygen
 - D) the evolution of cellular respiration, which used oxygen to help harvest energy from fuel molecules
 - E) the evolution of multicellular eukaryotic colonies from symbiotic communities of prokaryotes
- 4) Which of the following statements about the domains of prokaryotes is *not* true?
 - A) The lipid composition of the plasma membrane found in archaea is different from that of bacteria.
 - B) Both archaea and bacteria have cell walls, but the walls of archaea lack peptidoglycan.
 - C) Archaea and bacteria probably diverged very early in evolutionary history.
 - D) Bacteria include the cyanobacteria.
 - E) Of the two groups, bacteria are more closely related to eukaryotes.
- 5) Which of the following groups is mismatched with its members?
 - A) Proteobacteria—diverse gram-negative bacteria
 - B) Gram-positive bacteria—diverse pathogens whose endotoxins are components of their outer membrane
 - C) Chlamydias—intracellular parasites
 - D) Cyanobacteria—solitary and filamentous colonies exhibiting oxygenic photosynthesis
 - E) Spirochetes—helical heterotrophs

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- 6) An example of bioremediation is
- A) the genetic engineering of bacteria to produce human proteins and useful chemical products.
 - B) the introduction of parasitic bacteria to kill other bacteria.
 - C) the use of prokaryotes to treat sewage or clean up oil spills.
 - D) the use of antibiotics produced by cultured prokaryotes.
 - E) all of the above.
- 7) Which of the following organisms are *incorrectly* paired with their description?
- A) diplomonads—protists lacking mitochondria
 - B) rhizopods—naked and shelled amoebas
 - C) forams—flagellated algae, free-living or symbiotic
 - D) apicomplexans—parasites with complex life cycles
 - E) actinopods—planktonic with slender, raylike axopodia
- 8) You find a colorful, weblike, amoeboid mass on a rotting log. After a dry period, you note stalked fruiting bodies growing up from this multinucleate mass. What is the probable identity of this organism?
- A) water mold
 - B) plasmodial slime mold
 - C) cellular slime mold
 - D) foram
 - E) euglenoid
- 9) Which of the following characteristics supports molecular evidence for combining the dinoflagellates, apicomplexans, and ciliates in the monophyletic clade Alveolata?
- A) All are pathogenic.
 - B) Their flagella or cilia are organized with the 9 + 2 microtubular ultrastructure.
 - C) All are found exclusively in freshwater or marine habitats.
 - D) All possess mitochondria.
 - E) The three groups have small membrane-bound alveoli under their cell surfaces.
- 10) Which of the following characteristics of plants is absent in their closest relatives, the charophycean algae?
- A) formation of a cell plate during cytokinesis
 - B) chlorophyll *b*
 - C) sexual reproduction
 - D) alternation of multicellular generations
 - E) cellulose in cell walls
- 11) Which of the following is *not* common to all phyla of vascular plants?
- A) dominance of the diploid generation
 - B) alternation of generations
 - C) the development of seeds
 - D) the addition of lignin to cell walls
 - E) xylem and phloem

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- 12) A land plant that produces flagellated sperm and has a diploid-dominant generation is most likely a
- A) charophycean.
 - B) fern.
 - C) moss.
 - D) liverwort.
 - E) hornwort.
- 13) Where would you find a megasporangium in an angiosperm?
- A) within an ovule contained within an ovary of a flower
 - B) producing a megaspore within the archegonium of the female gametophyte
 - C) at the base of a sporophyll in an ovulate cone
 - D) enclosed in the stigma of a flower
 - E) packed into pollen sacs within the anthers found on a stamen
- 14) Gymnosperms and angiosperms have the following in common *except*
- A) ovules.
 - B) seeds.
 - C) vascular tissue.
 - D) pollen.
 - E) ovaries.
- 15) Which angiosperm cell is *incorrectly* paired with its chromosome count (n or $2n$)?
- A) sperm— n
 - B) egg cell— n
 - C) zygote— $2n$
 - D) megaspore— $2n$
 - E) microspore— n
- 16) Which feature seen in chytrids supports the hypothesis that they represent the most primitive fungi?
- A) flagellated spores
 - B) the absence of chitin within the cell wall
 - C) formation of resistant zygosporangia
 - D) coenocytic hyphae
 - E) all representatives are parasitic
- 17) Which of the following cells or structures are associated with *asexual* reproduction in fungi?
- A) ascogonia
 - B) zygosporangia
 - C) basidiospores
 - D) conidia
 - E) ascospores

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- 18) The adaptive advantage associated with the filamentous nature of the mycelium is primarily related to
- A) the increased probability of contact between different mating types.
 - B) the ability to form haustoria and parasitize other organisms.
 - C) avoiding sexual reproduction until environmental change occurs.
 - D) the potential to inhabit almost all terrestrial habitats.
 - E) an extensive surface area well suited for absorptive nutrition.
- 19) The distinction between the parazoans and eumetazoans is based mainly on the absence versus the presence of
- A) mesoderm.
 - B) a complete digestive tract.
 - C) body cavities.
 - D) a circulatory system.
 - E) true tissues.
- 20) Which of the following was the *least* likely factor in the Cambrian explosion?
- A) the accumulation of diverse adaptations such as shells and different modes of locomotion
 - B) the accumulation of sufficient atmospheric oxygen to support the more active metabolism of mobile animals
 - C) the movement of animals onto land
 - D) the evolution of *Hox* genes that controlled development
 - E) the emergence of predator-prey relationships between animals
- 21) Which of the following subdivisions of the animal kingdom encompasses all the others in the list?
- A) protostomes
 - B) bilateria
 - C) deuterostomes
 - D) pseudocoelomates
 - E) coelomates
- 22) Water movement through a sponge would follow what path?
- A) choanocyte → mesohyl → spongocoel
 - B) porocyte → spongocoel → osculum
 - C) colloblast → coelom → porocyte
 - D) porocyte → choanocyte → mesohyl
 - E) blastopore → gastrovascular cavity → protostome
- 23) Which of the following is *not* true of the chelicerates?
- A) They have antennae.
 - B) Their anterior appendages are modified as pincers or fangs.
 - C) The horseshoe crab is one surviving marine member.
 - D) They include ticks, scorpions, and spiders.
 - E) Their body is divided into a cephalothorax and an abdomen.

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- 24) Which of the following characteristics is probably *most* responsible for the incredible diversification of insects on land?
- A) segmentation
 - B) flight
 - C) exoskeleton
 - D) tracheal system
 - E) metamorphosis
- 25) Some 530-million-year-old Chinese fossils resemble lancelets but have a more elaborate brain and a brain case (cranium). These fossils may represent
- A) an early vertebrate.
 - B) a non-tetrapod gnathostome.
 - C) a primitive bony fish.
 - D) a "missing link" between the urochordates and cephalochordates.
 - E) the first chordate.
- 26) If you were to observe a monkey in a zoo, which characteristic would indicate a New World origin for that monkey species?
- A) occasional bipedal walking
 - B) eyes close together on the front of the skull
 - C) distinct "seat pads"
 - D) downward orientation of the nostrils
 - E) use of the tail to hang from a tree limb
- 27) Unlike eutherian (placental) mammals, both monotremes and marsupials
- A) have some embryonic development outside the mother's uterus.
 - B) are found in Australia and Africa.
 - C) lay eggs.
 - D) lack nipples.
 - E) include only insectivores and herbivores.
- 28) Which of the following is *not* part of an older tree's bark?
- A) lenticels
 - B) secondary xylem
 - C) cork cambium
 - D) secondary phloem
 - E) cork
- 29) Which of the following cell types is least likely to have a secondary wall?
- A) tracheid
 - B) sclerenchyma cell
 - C) fiber cell
 - D) sclereid
 - E) parenchyma cell

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- 30) Based on the hypothesis presented in Figures 21.20 and 35.36 in your textbook, predict the floral morphology of a mutant lacking activity of the B genes.
- A) sepal-carpel-carpel-sepal
 - B) sepal-sepal-carpel-carpel
 - C) petal-petal-petal-petal
 - D) carpel-petal-petal-carpel
 - E) carpel-carpel-carpel-carpel
- 31) Which of the following does *not* appear to involve active transport across membranes?
- A) the movement of sugar from mesophyll cells into sieve-tube members in corn
 - B) the movement of mineral nutrients into cells of the root cortex
 - C) K^+ uptake by guard cells during stomatal opening
 - D) the movement of mineral nutrients from the apoplast to the symplast
 - E) the movement of sugar from one sieve-tube member to the next
- 32) Imagine cutting a live twig from a tree and examining the cut surface of the twig with a magnifying glass. You locate the vascular tissue and observe a growing droplet of fluid exuding from the cut surface. This fluid is probably
- A) cell sap from the broken vacuoles of cells.
 - B) phloem sap.
 - C) xylem sap.
 - D) fluid of the transpiration stream.
 - E) guttation fluid.
- 33) Stomata open when guard cells
- A) close aquaporins, preventing uptake of water.
 - B) flop open because of a decrease in turgor pressure.
 - C) accumulate water by active transport.
 - D) sense an increase in CO_2 in the air spaces of the leaf.
 - E) become more turgid because of an influx of K^+ , followed by the osmotic entry of water.
- 34) Micronutrients are needed in very small amounts because
- A) most function as cofactors of enzymes.
 - B) only the growing regions of the plants require them.
 - C) most are supplied in large enough quantities in seeds.
 - D) they play only a minor role in the health of the plant.
 - E) most of them are mobile in the plant.
- 35) A mineral deficiency is likely to affect older leaves more than younger leaves if
- A) the mineral is very mobile within the plant.
 - B) the mineral is required for chlorophyll synthesis.
 - C) the mineral is a micronutrient.
 - D) the older leaves are in direct sunlight.
 - E) the deficiency persists for a long time.

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- 36) The specific relationship between a legume and its symbiotic *Rhizobium* species probably depends on
- A) each *Rhizobium* species having a form of nitrogenase that only works in the appropriate legume host.
 - B) destruction of all incompatible *Rhizobium* species by enzymes secreted from the legume's roots.
 - C) each legume being found where the soil has only the *Rhizobium* specific to that legume.
 - D) each legume having a specific set of early nodulin genes.
 - E) specific recognition between the chemical signals and signal receptors of the *Rhizobium* and legume species.
- 37) Germinated pollen grain is to _____ as _____ is to female gametophyte.
- A) male gametophyte; embryo sac
 - B) embryo sac; ovule
 - C) petal; sepal
 - D) anther; seed
 - E) ovule; sporophyte
- 38) A plant that is self-incompatible has a genotype of S_5S_9 for the S-locus. It receives pollen from a plant that is S_3S_9 . Which of the following is most likely to occur?
- A) About half of the pollen will germinate.
 - B) Fertilization will occur in about half of the flowers of the pollinated plant.
 - C) None of the pollen will germinate.
 - D) Pollen from the S_3S_9 plant will secrete ribonuclease that destroys epidermal cells of the S_5S_9 stigma.
 - E) All of the pollen will germinate, forming pollen tubes.
- 39) "Golden Rice" is a transgenic variety that
- A) contains daffodil genes that increase the vitamin A content of the rice.
 - B) is resistant to a virus that commonly attacks rice fields.
 - C) is resistant to various herbicides and thus rice fields can be weeded with those herbicides.
 - D) includes bacterial genes that produce a toxin that reduces damage from insect pests.
 - E) produces much larger, golden grains that increase crop yields.
- 40) Which of the following is *not* a typical component of a signal-transduction pathway such as the one involved in producing the greening response?
- A) activation of enzymes that produce second messengers such as cGMP
 - B) G-proteins acting as transcription factors that activate specific genes
 - C) activation of a G-protein by an activated receptor protein
 - D) phosphorylation of transcription factors
 - E) protein kinase cascades
- 41) Buds and sprouts often form on tree stumps. Which of the following hormones would you expect to stimulate their formation?
- A) cytokinins B) auxin C) abscisic acid D) gibberellins E) ethylene

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- 42) Which of the following is *not* part of the acid-growth hypothesis?
- A) The wall fabric becomes looser (more plastic).
 - B) Auxin stimulates proton pumps in cell membranes.
 - C) The turgor pressure of the cell exceeds the restraining pressure of the loosened cell wall, and the cell takes up water and elongates.
 - D) Lowered pH results in the breakage of cross-links between cellulose microfibrils.
 - E) Auxin-activated proton pumps stimulate cell division in meristems.
- 43) Which of the following statements about bioenergetics is *true*?
- A) A BMR can be determined only at a specific temperature.
 - B) Endotherms are warmed by metabolic heat.
 - C) Ectotherms and endotherms use the same basic energy "strategy."
 - D) Every animal has a specific metabolic rate that does not change.
 - E) An SMR is best measured just after an ectotherm has eaten.
- 44) Which of the following vertebrate organ systems does *not* open directly to the external environment?
- A) circulatory system
 - B) excretory system
 - C) respiratory system
 - D) digestive system
 - E) reproductive system
- 45) Which of the following physiological responses is an example of *positive* feedback?
- A) Stimulation of a nerve cell causes sodium ions to leak into the cell, and the sodium influx triggers the inward leaking of even more sodium.
 - B) The pituitary gland secretes a hormone called TSH, which stimulates the thyroid gland to secrete another hormone called thyroxine; a high concentration of thyroxine suppresses the pituitary's secretion of TSH.
 - C) The body's production of red blood cells, which transport oxygen from the lungs to other organs, is stimulated by a low concentration of oxygen.
 - D) A high concentration of carbon dioxide in the blood causes deeper, more rapid breathing, which expels carbon dioxide.
 - E) An increase in the concentration of glucose in the blood stimulates the pancreas to secrete insulin, a hormone that lowers blood glucose concentration.
- 46) The mammalian trachea and esophagus both open into the
- A) stomach.
 - B) pharynx.
 - C) epiglottis.
 - D) rectum.
 - E) large intestine.

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- 47) Individuals whose diet consists primarily of corn would likely become
- A) malnourished.
 - B) overnourished.
 - C) undernourished.
 - D) anorexic.
 - E) obese.
- 48) If you were to jog a mile a few hours after lunch, which stored fuel would you probably tap?
- A) muscle proteins
 - B) fats stored in adipose tissue
 - C) muscle and liver glycogen
 - D) blood proteins
 - E) fat stored in the liver
- 49) Blood returning to the mammalian heart in a pulmonary vein will drain first into the
- A) right ventricle.
 - B) vena cava.
 - C) left atrium.
 - D) right atrium.
 - E) left ventricle.
- 50) In negative-pressure breathing, inhalation results from
- A) using muscles of the lungs to expand the alveoli.
 - B) relaxing the muscles of the rib cage.
 - C) contracting the diaphragm.
 - D) contracting the abdominal muscles.
 - E) forcing air from the throat down into the lungs.
- 51) Which of the following reactions prevails in red blood cells traveling through pulmonary capillaries?
(Hb = hemoglobin)
- A) $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3$
 - B) $\text{Hb}(\text{O}_2)_4 \rightarrow \text{Hb} + 4 \text{O}_2$
 - C) $\text{Hb} + 4 \text{CO}_2 \rightarrow \text{Hb}(\text{CO}_2)_4$
 - D) $\text{H}_2\text{CO}_3 \rightarrow \text{H}^+ + \text{HCO}_3^-$
 - E) $\text{Hb} + 4 \text{O}_2 \rightarrow \text{Hb}(\text{O}_2)_4$
- 52) Which of the following molecules is *incorrectly* paired with a source?
- A) interferons—virus-infected cells
 - B) interleukin-1—macrophages
 - C) perforins—cytotoxic T cells
 - D) lysozyme—tears
 - E) immunoglobulins—helper T cells

- 53) Which of the following is a characteristic of the early stages of local inflammation?
- A) precapillary arteriole constriction
 - B) attack by cytotoxic T cells
 - C) fever
 - D) antibody-complement - mediated lysis of microbes
 - E) release of histamine
- 54) An epitope associates with which part of an antibody?
- A) the antibody tail
 - B) the antibody-binding site
 - C) the variable regions of a heavy chain and light chain combined
 - D) the light-chain constant regions only
 - E) the heavy-chain constant regions only
- 55) Which of the following is *not* true about helper T cells?
- A) They function in both cell-mediated and humoral immune responses.
 - B) They recognize polysaccharide fragments presented by class II MHC molecules.
 - C) They bear surface CD4 molecules.
 - D) When activated, they secrete IL-2 and other cytokines.
 - E) They are subject to infection by HIV.
- 56) The majority of water and salt filtered into Bowman's capsule is reabsorbed by
- A) diffusion from the descending limb of the loop of Henle into the hyperosmotic interstitial fluid of the medulla.
 - B) active transport across the transport epithelium of the thick upper segment of the ascending limb of the loop of Henle.
 - C) selective secretion and diffusion across the distal tubule.
 - D) diffusion from the collecting duct into the increasing osmotic gradient of the renal medulla.
 - E) the transport epithelia of the proximal tubule.
- 57) Select the pair in which the nitrogenous waste is incorrectly matched with the benefit of its excretion.
- A) uric acid—minimal loss of water when excreted
 - B) urea—very insoluble in water
 - C) uric acid—can be stored as a precipitate
 - D) ammonia—very soluble in water
 - E) urea—low toxicity relative to ammonia
- 58) Which of the following correctly describes a case of osmoregulation?
- A) secretion of drugs and reabsorption of nutrients by the proximal tubule
 - B) discharge of excess water in a hypoosmotic environment
 - C) excretion of salt in a hypoosmotic environment
 - D) expenditure of energy to convert ammonia to less toxic wastes
 - E) body fluids that are isoosmotic with the external environment

國立中山大學九十四學年度轉學生招生考試試題

科目：普通生物(下)【生科系二年級】

共16頁 第11頁

- 59) A distinctive feature of the mechanism of action of thyroid hormones and steroid hormones is that
- A) target cells react more rapidly to these hormones than to local regulators.
 - B) these hormones affect metabolism.
 - C) these hormones are regulated by feedback loops.
 - D) these hormones bind to receptors inside cells.
 - E) these hormones bind with specific receptor proteins on target-cell plasma membranes.
- 60) Which of the following hormones is *incorrectly* paired with its action?
- A) melatonin—affects biological rhythms, seasonal reproduction
 - B) oxytocin—stimulates uterine contractions during childbirth
 - C) thyroxine—stimulates metabolic processes
 - D) insulin—stimulates glycogen breakdown in the liver
 - E) ACTH—stimulates the release of glucocorticoids by the adrenal cortex
- 61) The main target organs for tropic hormones are
- A) blood vessels.
 - B) endocrine glands.
 - C) muscles.
 - D) nerves.
 - E) kidneys.
- 62) Which of the following characterizes parthenogenesis?
- A) An egg develops without being fertilized.
 - B) An individual may change its sex during its lifetime.
 - C) Specialized groups of cells may be released and grow into new individuals.
 - D) An organism is first a male and then a female.
 - E) Both members of a mating pair have male and female reproductive organs.
- 63) Which of the following male and female structures are *least* alike in function?
- A) Leydig cells of testes—follicle cells of ovaries
 - B) testes—ovaries
 - C) seminiferous tubules—vagina
 - D) spermatogonia—oogonia
 - E) vas deferens—oviduct
- 64) Fertilization of human eggs most often takes place in the
- A) vas deferens.
 - B) ovary.
 - C) vagina.
 - D) oviduct (fallopian tube).
 - E) uterus.

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科目：普通生物(下)【生科系二年級】

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- 65) Which of the following is common to both avian and mammalian development?
- A) gray crescent
 - B) epiblast and hypoblast
 - C) holoblastic cleavage
 - D) trophoblast
 - E) yolk plug
- 66) In a frog embryo, the blastocoel is
- A) the cavity that becomes the coelom.
 - B) lined with endoderm during gastrulation.
 - C) completely obliterated by yolk platelets.
 - D) located primarily in the animal hemisphere.
 - E) the cavity that later forms the archenteron.
- 67) In the early development of an amphibian embryo, an important "organizer" is the
- A) dorsal lip of the blastopore.
 - B) notochord.
 - C) neural tube.
 - D) dorsal ectoderm.
 - E) archenteron roof.
- 68) Receptor sites for neurotransmitters are located on the
- A) tips of axons.
 - B) axon membranes in the regions of the nodes of Ranvier.
 - C) membranes of synaptic vesicles.
 - D) presynaptic membrane.
 - E) postsynaptic membrane.
- 69) Of the following components of the nervous system, which is the *most inclusive*?
- A) central nervous system
 - B) neuron
 - C) brain
 - D) spinal cord
 - E) gray matter
- 70) Action potentials are usually propagated in only one direction along an axon because
- A) ions can flow along the axon only in one direction.
 - B) the brief refractory period prevents opening of voltage-gated Na^+ channels.
 - C) the nodes of Ranvier conduct only in one direction.
 - D) the axon hillock has a higher membrane potential than the tips of the axon.
 - E) both sodium and potassium voltage-gated channels open in one direction.

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科目：普通生物(下)【生科系二年級】

共16頁 第13頁

- 71) Some sharks close their eyes just before they bite. Although they cannot see their prey, their bites are on target. Researchers have noted that sharks often misdirect their bites at metal objects, and they can find batteries buried under the sand of an aquarium. This evidence suggests that sharks keep track of their prey during the split second before they bite in the same way that
- A) a male silkworm moth locates a mate.
 - B) a platypus locates its prey in a muddy river.
 - C) a bat can find moths in the dark.
 - D) a flatworm avoids light places.
 - E) a rattlesnake finds a mouse in its burrow.
- 72) The transduction of sound waves to action potentials takes place
- A) as the basilar membrane becomes more permeable to sodium ions and depolarizes, initiating an action potential in a sensory neuron.
 - B) when hair cells are bent against the tectorial membrane, causing them to depolarize and release neurotransmitter molecules that stimulate sensory neurons.
 - C) within the middle ear as the vibrations are amplified by the malleus, incus, and stapes.
 - D) within the tectorial membrane as it is stimulated by the hair cells.
 - E) as the basilar membrane vibrates at different frequencies in response to the varying volume of sounds.
- 73) Clams and lobsters both have exoskeletons, but lobsters have much greater mobility. Why?
- A) The lobster skeleton can actively contract, while the clam skeleton lacks its own contractile mechanism.
 - B) Clams only have adductor muscles that hold the shell closed, whereas lobsters have both abductor and adductor muscles.
 - C) Clams can only grow by adding to the outer edge of the shell, whereas lobsters molt and repeatedly replace their exoskeleton with a larger, more flexible one.
 - D) Lobsters have a jointed exoskeleton, allowing for the flexible movement of appendages and body parts at the joints.
 - E) The paramyosin of clam muscles holds them in a low-energy state of contraction, whereas lobster muscles are very similar to vertebrate striated muscles.
- 74) Which of the following biomes is *correctly* paired with the description of its climate?
- A) savanna—cool temperature, precipitation uniform during the year
 - B) temperate deciduous forest—relatively short growing season, mild winters
 - C) tropical forests—nearly constant photoperiod and temperature
 - D) temperate grasslands—relatively warm winters, most rainfall in summer
 - E) tundra—long summers, mild winters
- 75) Which of the following do all terrestrial biomes have in common?
- A) clear boundaries between adjacent biomes
 - B) annual average rainfall in excess of 25 cm
 - C) cold winter months
 - D) a distribution predicted almost entirely by rock and soil patterns
 - E) vegetation demonstrating vertical stratification

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科目：普通生物(下)【生科系二年級】

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- 76) The nature-versus-nurture controversy centers on
- A) the distinction between proximate and ultimate causes of behavior.
 - B) the role of genes in learning.
 - C) whether animals have conscious feelings or thoughts.
 - D) the importance of good parental care.
 - E) the extent to which an animal's behavior is innate or learned.
- 77) According to the inequality known as Hamilton's rule ($rB > C$),
- A) natural selection is more likely to favor altruistic acts when the beneficiary is an offspring than when it is a sibling.
 - B) natural selection would favor altruistic acts when the benefit to the receiver, reduced by the coefficient of relatedness, exceeds the cost to the altruist.
 - C) natural selection could not favor altruism if the altruist loses its life.
 - D) kin selection is a stronger selection factor than the individual reproductive success favored by natural selection.
 - E) altruism must always be reciprocal.
- 78) Which of the following is *least* likely to involve cognition?
- A) being aware of your neighbor's lawn care
 - B) positive rheotaxis of a fish in a current
 - C) optimal foraging
 - D) territoriality
 - E) navigation of a sparrow during seasonal migration
- 79) A uniform dispersion pattern for a population may indicate that
- A) the population is spreading out and increasing its range.
 - B) resources are heterogeneously distributed.
 - C) the density of the population is low.
 - D) individuals of the population are competing for some resource, such as water and minerals for plants or nesting sites for animals.
 - E) there is an absence of strong attractions or repulsions among individuals.
- 80) Which life history strategy would be favored by natural selection if survival of offspring is quite low and unpredictable?
- A) big-bang reproduction, or semelparity
 - B) repeated reproduction, or iteroparity
 - C) very early age of first reproduction
 - D) production of a large number of large eggs and a great deal of parental care
 - E) relatively late age of first reproduction

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科目：普通生物(下)[生科系二年級]

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- 81) All these descriptions are characteristic of human populations in industrialized countries *except*
- A) relatively small family size.
 - B) Type I survivorship curve.
 - C) *r*-selected life history.
 - D) several potential reproductions per lifetime.
 - E) relatively even age structure.
- 82) According to the concept of competitive exclusion,
- A) two species cannot coexist in the same habitat.
 - B) competition within a population results in the success of the best-adapted individuals.
 - C) two species cannot share the exact same niche in a community.
 - D) extinction or emigration are the only possible results of competitive interactions.
 - E) resource partitioning will allow a species to utilize all the resources of its niche.
- 83) An example of cryptic coloration is the
- A) green color of a plant.
 - B) mottled coloring of moths that rest on lichens.
 - C) bright colors of an insect-pollinated flower.
 - D) bright markings of a poisonous tropical frog.
 - E) stripes of a skunk.
- 84) According to the hypothesis of island biogeography, species richness would be greatest on an island that is
- A) large and remote.
 - B) small and close to a mainland.
 - C) environmentally homogeneous.
 - D) small and remote.
 - E) large and close to a mainland.
- 85) Which of the following organisms is *incorrectly* paired with its trophic level?
- A) cyanobacteria—primary producer
 - B) eagle—tertiary consumer
 - C) fungi—detritivore
 - D) zooplankton—secondary consumer
 - E) grasshopper—primary consumer
- 86) The recent increase in atmospheric CO₂ concentration is mainly a result of an increase in
- A) the burning of fossil fuels and wood.
 - B) cellular respiration by the exploding human population.
 - C) the biosphere's biomass.
 - D) the absorption of infrared radiation escaping from Earth.
 - E) primary production.

- 87) Quantities of mineral nutrients in soils of tropical rain forests are relatively low because
- A) the decomposition of organic refuse and reassimilation of chemicals by plants occur rapidly.
 - B) nutrient cycles occur at a relatively slow rate in tropical soils.
 - C) the standing crop is small.
 - D) microorganisms that recycle chemicals are not very abundant in tropical soils.
 - E) the high temperatures destroy the nutrients.
- 88) The application of ecological principles to return a degraded ecosystem to its natural state is specifically characteristic of
- A) landscape ecology.
 - B) restoration ecology.
 - C) resource conservation.
 - D) conservation ecology.
 - E) population viability analysis.
- 89) Which of the following statements about the declining-population approach to conservation is *not* correct?
- A) Humans may not be the cause of every population decline.
 - B) We need information on whether or not the population in question is in decline.
 - C) We need to do something quickly, even if we have no information, because conservation biology is a crisis discipline.
 - D) A proposed reason for the decline should be tested experimentally.
 - E) Several hypotheses about why the population is declining should be evaluated.
- 90) Which of the following statements about protected areas is *not* correct?
- A) National parks are only one type of protected area.
 - B) Biodiversity hot spots are important areas to protect.
 - C) We now protect 25% of the land areas of the planet.
 - D) Protected area management must be coordinated with management of lands outside the protected zone.
 - E) Most protected areas are small in size.

II 申論題 (共 10 分)

1. 試論述影響島嶼生物多樣性的因素。

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科目：普通化學【生科系二年級】

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一、單選題(每題三分，共二十題。)

1. The concentration of OH^- in a saturated solution of $\text{Mg}(\text{OH})_2$ is $3.6 \times 10^{-4}\text{M}$. The K_{sp} of $\text{Mg}(\text{OH})_2$ is
 (a) 1.3×10^{-7} (b) 4.7×10^{-11} (c) 1.2×10^{-11} (d) 3.6×10^{-4} (e) none of these
2. The equilibrium constant for the reaction $\text{NH}_4^+ + \text{OH}^- \rightleftharpoons \text{NH}_3 + \text{H}_2\text{O}$ is
 (a) $1/K_b$ (b) $1/K_a$ (c) K_w/K_a (d) K_w/K_b (e) K_b/K_w
3. Which of the following molecules exhibits the greatest bond energy?
 (a) F_2 (b) Cl_2 (c) Br_2 (d) I_2 (e) all the same
4. How many elements in the second row of the Periodic Table are paramagnetic in atomic form?
 (a) 1 (b) 2 (c) 3 (d) 6 (e) 7
5. The hybridization of the central atom in SF_4 is:
 (a) sp (b) sp^2 (c) sp^3 (d) dsp^3 (e) d^2sp^3
6. According to molecular orbital theory and assuming a molecular orbital diagram similar to that for N_2 , predict the bond order for CN.
 (a) 0.5 (b) 1 (c) 1.5 (d) 2 (e) 2.5
7. 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.
8. Elemental magnesium crystallizes in a face-centered cubic lattice. The density of magnesium is $1.738\text{g}/\text{cm}^3$. The unit cell length is 4.80×10^2 pm. What is the atomic radius of magnesium? (M.W. of Mg = 24.3)
 (a) 242 pm. (b) 170 pm. (c) 126 pm. (d) 215 pm (e) 340 pm.
9. Which of the following is not a binary molecular compound?
 (a) HI (b) CO (c) KBr (d) NO (e) N_2O_4
10. Initial rate data were obtained for the following reaction:

$$\text{A}(\text{g}) + \text{B}(\text{g}) \rightarrow \text{C}(\text{g}) + \text{D}(\text{g})$$

Experiment	[A], Mol/L	[B], Mol/L	Rate, mol/L·s
1	0.10	0.10	1.0×10^{-3}
2	0.20	0.10	2.0×10^{-3}
3	0.10	0.20	1.0×10^{-3}

 What would be the initial rate if $[\text{A}] = 0.30\text{M}$ and $[\text{B}] = 0.20\text{M}$?
 (a) 3.0×10^{-3} (b) 6.0×10^{-3} (c) 9.0×10^{-3} (d) 18×10^{-3} (e) none of these
11. The pH of a 0.6 M solution of a weak acid is 4.0. What percent of the acid has ionized?
 (a) 0.02 (b) 2 (c) 7 (d) 4 (e) 0.06

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12. Choose the right answer according to base strength.
 (a) $C_2H_3O_2^- > F^- > Cl^- > H_2O$ (b) $C_2H_3O_2^- > F^- > H_2O > Cl^-$ (c) $Cl^- > F^- > C_2H_3O_2^- > H_2O$
 (d) $F^- > C_2H_3O_2^- > H_2O > Cl^-$ (e) $H_2O > Cl^- > F^- > C_2H_3O_2^-$
13. A solution containing 10.0 mmol of CO_3^{2-} and 5.0 mmol of HCO_3^- is titrated with 1.0M HCl. What total volume of HCl must be added to reach the second equivalent point?
 (a) 5.0 mL (b) 10 mL (c) 20 mL (d) 25 mL (e) 30 mL.
14. Given the following data, calculate the normal boiling point for formic acid(HCOOH)?
- | | $\Delta H_f^\circ(kJ/mol)$ | $S^\circ(J/mol \cdot K)$ |
|----------|----------------------------|--------------------------|
| HCOOH(l) | -410 | 130 |
| HCOOH(g) | -363 | 251 |
- (a) 2.57K (b) 1730°C (c) 388°C (d) 82°C (e) 115°C.
15. The following reaction is endothermic. $2 NH_3(g) \rightarrow N_2(g) + 3 H_2(g)$. 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.
16. Given the following information:
 $Cu^+(aq) + e^- \rightarrow Cu(s) \quad E^\circ = +0.520 V$
 $Cu^{2+}(aq) + e^- \rightarrow Cu^+(aq) \quad E^\circ = +0.159 V$
 Calculate the E° value of $Cu^{2+}(aq) + 2 e^- \rightarrow Cu(s)$ at 25°C
 (a) +0.679 V (b) +0.340 V (c) -0.361 V (d) +0.361 V (e) -0.679V
17. Which of the following will increase the ionization of formic acid, HCOOH(aq)?
 I. KI, II. NaOH(aq) III. HNO₃(aq) IV. HCOONa V. NaCN
 (a) II (b) II & IV (c) II & V (d) I & III (e) III
18. In a process called flash photolysis, a flash of strong light decomposes Cl_2 into Cl atoms. The Cl atoms recombine according to a second-order rate law. The first half-life is 12 ms. How long will it take for the [Cl] to drop to one-eighth its initial value?
 (a) 24 ms (b) 44 ms (c) 84 ms (d) 96 ms (e) none of these
19. Which of the following is an incorrect name?
 (a) trans-1,2-dichloroethene (b) propylene (c) ethylene (d) cis-1,2-dichloroethane
 (e) At least two of the above are incorrect.
20. Given the spectrochemical series (increasing Δ), $I^- < Cl^- < H_2O < NH_3 < en < CN^-$, which of the following species would absorb light of the shortest wavelength?
 (a) $[CoCl_6]^{3-}$ (b) $[Co(H_2O)_6]^{3+}$ (c) $[Co(NH_3)_6]^{3+}$ (d) $[Co(NH_3)_5Cl]^{2+}$
 (e) $[Co(en)_3]^{3+}$

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二、 填空題(每格四分，共五格)

1. The effect of temperature and activation energy on the rate constant of a reaction can be expressed through the _____ equation.
2. A substance like water that can act either as an acid or a base is _____.
3. The essence of chemical _____ is the study of the rates of chemical reactions, the factors that affect these rates, and the chemical mechanisms of those chemical reactions.
4. _____ are optical isomers that rotate the plane of polarized light to the same degree but in opposite directions.
5. An _____ is derived from a carboxylic acid and an alcohol.

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 atom. (十二分)
(a) NCO (b) N₂H₄
2. Make a sketch to show the hydrogen bonding between two acetic acid molecules. (二分)
3. The complex ion NiCl₄²⁻ is tetrahedral. Draw the d orbital splitting diagram and fill in the valence electrons to show the number of unpaired electrons. (六分)