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國立臺灣大學 112 學年度碩士班招生考試試題

科目： 普通生物學(C)

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一、選擇題(1-10 題，每題 2 分；11-65 題，每題 1 分；共 75 分)

- Using Mendel's flower color (purple is dominant, white is recessive), if two heterozygous plant are crossed, what is the probability that the first two offspring will have purple flowers? A. 1/2; B. 1/4; C. 4/6; D. 9/16; E. 1/16.
- In a given population of *Drosophila*, curly wings (c) is recessive to the wild-type condition of straight wings (c+). You isolate a population of 35 curly winged flies; 70 flies that are heterozygous for straight wings, and 45 that are homozygous for straight wings. What is the total number alleles in the gene pool? A. 2; B. 150; C. 230; D. 300; E. None of the answers are correct.
- Polydactyly in humans is an example of _____. A. Simple Mendelian inheritance; B. Incomplete dominance; C. Incomplete penetrance; D. Codominance; E. Gene dosage.
- A suppressor mutation _____. A. can only be found in the same gene; B. can only be found in a separate gene; C. can be found in the same gene or a separate gene; D. none of the answers are correct.
- Which of the following would contain genetic material that is 100% identical? A. Homologous chromosomes; B. Sister chromatids; C. X and Y chromosomes; D. Pseudoautosomal regions.
- A series of clones that contain overlapping pieces of a chromosome are called a _____. A. artificial chromosome; B. contig; C. cosmid; D. positional clone.
- Which of the following is not correct concerning epistatic interactions? A. They are often associated with enzymatic pathways; B. They produce variations in the expected 9:3:3:1 ratio of a dihybrid cross; C. They always results in a 9:7 ratio of a dihybrid cross; D. They are due to gene interactions.
- Which of the following is paired to its correct function? A. Polar microtubule – separate the poles; B. Aster microtubule – positioning of the spindle apparatus; C. Kinetochore microtubules – bind kinetochore to centromere; D. All of the answers are correct.
- In the mouse *Igf-2* allele, which chromosome is imprinted? Which *Igf-2* allele is expressed? A. Paternal, paternal; B. Paternal, Maternal; C. Maternal, Paternal; D. Maternal, Maternal.
- Which of the following is primarily responsible for the maternal effect? A. Sperm cells; B. Oocytes; C. Nurse cells; D. Placenta.
- Which of the following techniques may be used to determine DNA-protein interactions? A. Western blotting; B. PCR; C. DNase I footprinting; D. Restriction enzyme analysis.
- Alternative splicing allows an organism to _____. A. Carry fewer genes; B. Carry more genes; C. Produce few gene products; D. More than one of the answers.
- What structural motif is most commonly used by transcription factors in binding to DNA? A. Zinc-finger; B. Helix-turn-helix; C. Leucine zipper; D. Homeodomain.
- Which of the following increases the size of proteome in relation to the genome? A. Alternative splicing; B. Posttranslational covalent modification; C. RNA editing; D. All of the answers are correct; E. None of the answers are correct.
- To identify novel DNA binding sites for a protein, it would be best to use _____. A. BLAST; B. YACs; C. Chromatin immunoprecipitation (ChIP); D. ChIP-chip; E. Time shift experiments.
- All of the following are functions of the liver except
 - Detoxification of drugs and toxins
 - Synthesis of plasma (blood) proteins
 - Interconversion of glucose and glycol
 - Synthesis of urine
 - Synthesis of bile
- Which description is NOT correct about Vitamin D
 - Diet obtaining from egg yolk
 - Deficiency resulting in bone deformities and softening
 - Liver damage and anemia while deficiency
 - Aids in absorption and use of calcium and phosphorus

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E. Important for cardiovascular functionality

18. Which is NOT the digestive enzymes in the small intestine

- A. Bile salts
- B. Lactase
- C. Dipeptidase
- D. Pancreatic amylase
- E. Cytochrome c oxidase

19. Characteristic of simple epithelium is that they

- A. are arranged indiscriminately
- B. continue to divide and help in organ function
- C. make a definite layer
- D. None of above

20. Cytotoxic T cells are able to recognize and attack cancer cells because

- A. Cancer changes the surfaces of cancerous cells
- B. B cells help them
- C. Cancer is the bacterial infection
- D. Cancer cells release antibodies into the blood
- E. Cancer is an autoimmune disease

21. Negative-feedback mechanisms are:

- A. Most often involved in maintaining homeostasis
- B. Activated only when a variable rises above a set point
- C. Analogous to a furnace that produces heat
- D. Involved in contractions during childbirth
- E. Found only in birds and mammals

22. What is the function of the cilia in the trachea and bronchi

- A. to sweep air into and out of the lungs
- B. to increase the surface area for gas exchange
- C. to vibrate when air is exhaled to produce sounds
- D. to dislodge food that may has slipped past the epiglottis
- E. to sweep mucus with trapped particles up and out of the respiratory track

23. Which of the following initiates the process of blood clotting

- A. Damage to the lining of a blood vessel
- B. Exposure of blood to the air
- C. Conversion of fibrinogen to fibrin
- D. Attraction of leukocytes to a site of infection

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E. Conversion of fibrin to fibrinogen

24. Foreign molecules that evoke an immune response are called

- A. Pathogens
- B. Antibodies
- C. Lymphocytes
- D. Histamines
- E. Antigens

25. Which of the following is mismatched with its function?

- A. Most B vitamins – coenzymes
- B. Vitamin E – antioxidant
- C. Vitamin K – blood clotting
- D. Iron – component of thyroid hormones
- E. Phosphorous –bone formation, nucleotide synthesis

26. Which of the following is NOT part of the body's innate defense system?

- A. Natural killer cells
- B. Antibodies
- C. Interferons
- D. Complement system
- E. Inflammation

27. In each nephron of the kidney, the glomerulus and Bowman's capsule

- A. filter the blood and capture the filtrate
- B. reabsorb water into the blood
- C. break down harmful toxins and poisons
- D. reabsorb ions and nutrients
- E. refine and concentrate the urine for excretion

28. All of the following are functions of the liver except

- A. Detoxification of drugs and toxins
- B. Synthesis of plasma (blood) proteins
- C. Interconversion of glucose and glycol
- D. Synthesis of urine
- E. Synthesis of bile

29. The pancreas increases its output of insulin in response to

- A. an increase in body temperature
- B. changing cycles of light and dark
- C. a decrease in blood glucose
- D. a hormone secreted by the anterior pituitary

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E. an increase in blood glucose

30. Which of the following hormones have antagonistic effects?

- A. Parathyroid hormone and calcitonin
- B. Glucagon and thyroxine
- C. Growth hormone and epinephrine
- D. ACTH and cortisone
- E. Epinephrine and norepinephrine

31. The energy content of fats

- A. is released by bile salts
- B. may be lost unless an herbivore eats some of its feces
- C. is more than two times that of carbohydrates or proteins
- D. can reverse the effects of malnutrition
- E. Both C and D are correct

32. Which organ receives only oxygenated blood?

- A. Lung
- B. Liver
- C. Spleen
- D. Gill

33. The functional unit of contractile system in striated muscle is

- A. myofibril
- B. cross bridges
- C. Z band
- D. Sarcomere

34. Major cytoskeletal protein in microvilli, filopodia, contractile rings, and growth cones

- A. Actin
- B. Tubulin
- C. Troponin
- D. Calmodulin
- E. Fibronectin

35. Type I diabetes mellitus is caused by a deficiency of

- A. exercise
- B. glucagon
- C. glucose
- D. glycol
- E. insulin

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36. Nerve impulses are normally carried toward a neuron cell body by the neuron's

- A. Synaptic cleft
- B. Axon
- C. Hormones
- D. Dendrites

37. What is the name of the iron-containing protein that gives red blood vessel their color?

- A. Hemocyanin
- B. Pyrite
- C. Hemoglobin
- D. Myoglobin

38. Cornea transplant in humans is almost never rejected. This is because

- A. it is composed of enucleated cells
- B. it is a non living layer
- C. it has no blood supply
- D. its cells are least penetrable by bacteria

39. During the propagate ion of a nerve ion of a nerve impulse, the action potential results from the movement of

- A. K^+ ions from intracellular fluid to extracellular fluid
- B. K^+ ions from extracellular fluid to intracellular fluid
- C. Na^+ ions from extracellular fluid to intracellular fluid
- D. Na^+ ions from intracellular fluid to extracellular fluid

40. Which of the following statements about prostaglandins is true?

- A. They are one of the types of target cells
- B. They are produced by endocrine glands.
- C. They travel throughout the body by circulating in the blood.
- D. All of the above are true.
- E. None of the above is true.

41. The change in populations over time

- A. Evolution
- B. Genetic Drift
- C. Punctuated equilibrium
- D. Natural Selection

42. Evidence of evolution

- A. Fossil
- B. Anatomical

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- C. Embryological
 - D. Biochemical
 - E. All of the above
43. Which of the following is true of evolution?
- A. Evolutionary changes increase the ability of a species to survive and reproduce in a specific environment
 - B. Evolutionary changes increase the ability of a species to survive and reproduce under any circumstances
 - C. Evolutionary changes result in a species becoming more and more abundant over time
 - D. Evolutionary changes result in animals becoming larger over time and having larger numbers of offspring
44. According to natural selection, birds such as cardinals, eagles, and ducks have differently shaped feet due to
- A. random changes in foot structure
 - B. adaptations to different environments and feeding habits
 - C. differences inherited from their ancestors
 - D. inheritance of acquired characteristics
45. The structural similarities between the flippers of whales and the arms of humans are used to show that:
- A. the human species began life in the ocean
 - B. humans and whales have a common ancestor
 - C. whales are older than the human species
 - D. whales evolved from humans
46. The process of biological evolution
- A. is not supported by scientific evidence
 - B. requires biological diversity in a population
 - C. results in changes in allele frequencies over generations
 - D. both b and c
47. All species present today evolved from a common ancestor. This relationship is an example of:
- A. Descent with Modification
 - B. Natural selection
 - C. Hardy-Weinberg Equilibrium
 - D. Mendelian Mutation
48. Most new species arise from a common ancestor when
- A. Many mutations occur
 - B. The ancestral species decides to evolve
 - C. There is no natural selection
 - D. Populations of the ancestral species become isolated from one another
49. In which way are we considerably dissimilar from our 50,000-years old ancestors
- A. We use tools
 - B. We have collected more information
 - C. We are much cleverer
 - D. We are more sensitive

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50. The first unicellular organisms to form on Earth were

- A. Eukaryotes
- B. Prokaryotes
- C. Protocells
- D. Endosymbionts

51. Which is the correct order of appearance on Earth?

- A. photosynthetic prokaryotes, eukaryotes, primordial soup, non-photosynthetic prokaryotes
- B. primordial soup, non-photosynthetic prokaryotes, photosynthetic prokaryotes, eukaryotes
- C. primordial soup, eukaryotes, photosynthetic prokaryotes, non-photosynthetic prokaryotes
- D. non-photosynthetic prokaryotes, photosynthetic prokaryotes, primordial soup, eukaryotes

52. Which group consists of eukaryotic single celled organisms that often form the basis of aquatic ecosystems?

- A. fungi
- B. plants
- C. protists
- D. animals

53. Which group consists of organisms whose body is formed of thread-like structures called hyphae, and which contribute greatly to forest ecosystem productivity?

- A. plants
- B. bacteria
- C. animals
- D. fungi

54. When populations with different ancestors adapt in the same way to similar environments (for example wings in birds and beetles), it is referred to as

- A. neutral evolution
- B. natural selection
- C. convergent evolution
- D. coevolution

55. When two or more species mutually affect each other's evolution, known as

- A. neutral evolution
- B. natural selection
- C. convergent evolution
- D. coevolution

56. A population in which the frequency of alleles remains the same over generations

- A. Genetic Equilibrium
- B. Genetic Drift
- C. Gene Pool
- D. Allelic Frequency

57. Which of the following is the correct term for a single nucleotide mutation that does not alter the amino acid sequence of the resultant protein?

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- A. Non-synonymous substitution
- B. Silent mutation
- C. Synonymous substitution
- D. Both A and B
- E. Both B and C

58. Which of the following is NOT believed to be true of the conditions on Earth before life evolved?

- A. The atmosphere contained many gasses toxic to most life.
- B. There were high levels of ultraviolet radiation.
- C. Oxygen was present in the atmosphere
- D. Water was absent

59. What do mitochondria and chloroplasts have that suggest they came from endosymbiotic cells?

- A. DNA
- B. enzymes
- C. membranes
- D. cell walls

60. During a study session about evolution, one of your fellow student's remarks, "The giraffe stretched its neck while reaching for higher leaves; its offspring inherited longer necks as a result." To correct your friend's misconception, what would you say?

- A. Spontaneous mutations can result in the appearance of new traits.
- B. Only favourable adaptations have survival value.
- C. Overproduction of offspring leads to a struggle for survival.
- D. Characteristics acquired during an organism's life are not passed on through genes
- E. None of the above

61. What is the most likely effect of killing 80% of a colony of bacteria with a certain antibiotic?

- A. The remaining bacteria will re-grow into a new colony more resistant to the antibiotic
- B. The remaining bacteria will die because of the drastic decimation
- C. The bacteria will not cause any further infections because their numbers have been drastically reduced
- D. The bacteria will try to start a new colony where the antibiotic will not be found

62. Some species of Anopheles mosquito live in brackish water, some in running freshwater, and others in stagnant water. What type of reproductive barrier is separating these different species?

- A. ecological isolation
- B. chemical incompatibility
- C. behavioral isolation
- D. postzygotic isolation

63. Two organisms in the same Class must also be grouped in the same

- A. Order
- B. Genus
- C. Species
- D. Phylum

64. What is the basic unit of classification and a taxonomic rank of an organism

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- A. Order
- B. Genus
- C. Species
- D. Kingdom
- E. Family

65. Which of the following grouping includes the largest number of species

- A. Invertebrates
- B. Vertebrates
- C. Insects
- D. Chordates
- E. Arthropods

二、Match the terms to the following descriptions (10 pts).

(1) Starch

(2) Glycogen

(3) Cellulose

(4) Chitin

(5) Fat

(6) Unsaturated
fatty acid

(7) Saturated fatty
acid

(8) Phospholipids

(9) Steroids

(10) Cholesterol

(A) A fatty acid whose hydrocarbon chain contains one or more double bonds.

(B) A common component in animal cell membranes and is also the precursor for making other steroids.

(C) A fatty acid that has no double bonds in its hydrocarbon chain has the maximum number of hydrogen atoms attached to each carbon atom.

(D) Animals store glucose in a polysaccharide called.

(E) Structurally similar to fats, except they contain only two fatty acids attached to glycerol instead of three.

(F) Lipids in which the carbon skeleton contains four fused rings.

(G) A large lipid is made from two smaller molecules: glycerol and fatty acids.

(H) A storage polysaccharide in plants, consists of long chains of glucose monomers.

(I) The most abundant organic compound on Earth, is a major component of the tough walls that enclose plant cells.

(J) A structural polysaccharide used by insects and crustaceans to build their exoskeleton.

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三、Match the terms to the following descriptions (5 pts).

- | | |
|----------------------|--|
| (1) Phytochrome | (A) Bending of a shoot toward the light. |
| (2) Photoperiod | (B) Growth response to touch. |
| (3) Circadian rhythm | (C) Cycle with a period of about 24 hours. |
| (4) Thigmotropism | (D) Pigment that helps control flowering. |
| (5) Phototropism | (E) Relative lengths of night and day. |

四、Name the following chemical groups in English or Chinese (10 pts):

Example: —OH is a Hydroxyl group

- (1) —COOH is a _____ group.
- (2) —NH_2 is a _____ group.
- (3) —OPO_3^{2-} is a _____ group.
- (4) —CH_3 is a _____ group.
- (5) —C=O is a _____ group.

試題隨卷繳回