高雄醫學大學 100 學年度學士後醫學系招生考試試題

科目:普通生物學　　考試時間: 80 分鐘

說明:一、選擇題用 2B 鉛筆在「答案卡」上作答，修正時應以橡皮擦擦拭，不得使用修正液(帶)，未遵照正確作答方法而致電腦無法判讀者，考生自行負責。
二、試題及答案卡必須繳回，不得攜出試場。

I.【單選題】1-50 題，每題 1 分，共計 50 分。答錯 1 題倒扣 0.25 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。

1. If the amount of enzyme in a reaction with an initial ΔG of -5 kcal/mole was doubled, what would the ΔG be?
(A) -2.5 kcal/mole (B) -5 kcal/mole (C) -10 kcal/mole (D) +5 kcal/mole (E) +10 kcal/mole

2. Which is the most common route through which a protein is secreted from a eukaryotic cell?
(A) plasmid→plasma membrane→nuclear envelope→smooth endoplasmic reticulum (ER)
(B) Golgi apparatus→lysosome→vesicles→plasma membrane
(C) nuclear envelope→vesicles→Golgi apparatus→plasma membrane
(D) rough endoplasmic reticulum→ Golgi apparatus→vesicles →plasma membrane
(E) rough endoplasmic reticulum→lysosomes→vesicles→cell membrane

3. Movement of integral membrane proteins between the apical and basolateral domains of an epithelial cell membrane is restricted by the presence of
(A) lipid rafts. (B) basal lamina. (C) desmosomes. (D) tight junctions. (E) gap juncitions.

4. Which of the following statements about feedback inhibition in metabolic pathways is most correct?
(A) The product of the pathway inhibits its own production by competitively binding to reactants in the metabolic pathway.
(B) The product of the pathway inhibits its own production by noncompetitively binding to reactants in the metabolic pathway.
(C) The product of the pathway inhibits its own production by competitively inhibiting the binding of a substrate to the active site of an enzyme within the metabolic pathway.
(D) The product of the pathway inhibits its own production by noncompetitively inhibiting the binding of a substrate to the active site of an enzyme within the metabolic pathway.
(E) All of the above

5. Which is **NOT** a microtubule-organizing center (MTOC)?
(A) centrosome (B) basal body of cilia (C) mitotic spindle pole (D) kinetochore (E) all of the above

6. An mRNA sequence is 5'-AUG-GGC-ACU-CAU-ACU-UAA-3', where AUG is the start codon and UAA is the stop codon. How many distinct aminoacyl-tRNA synthetases are required to translate the mRNA sequence?
(A) 2 (B) 3 (C) 4 (D) 5 (E) 6

7. Self-splicing of group II introns is similar to nuclear pre-mRNA splicing because
(A) both need snRNPs. (B) both need guanosine. (C) both need ATP. (D) both form lariat structure.
(E) both form spliceosome.

8. Assuming a fat molecule can be oxidized into 2 glycerol molecules, which are then converted to glyceraldehyde-3-phosphate in intermediate glycolysis, how many ATP can be produced from a fat molecule?
(A) 4 (B) 8 (C) 24 (D) 36 (E) 48

9. Which of the following proteins is **NOT** a component of focal adhesions?
(A) cadherins (B) integrins (C) actin filaments (D) linker protein (E) fibronectin/collagen

10. Why is there a need to produce Okazaki fragments on the lagging strand, but **NOT** on the leading strand of DNA?
(A) It is substantially more efficient to make several shorter strands rather than one longer strand of DNA.
(B) The two parental strands of DNA are antiparallel and DNA polymerase makes DNA in the 5' to 3' direction only.
(C) There lacks enough DNA ligase for bonding Okazaki fragments together if they were produced from both parental strands.
(D) By having one leading strand and one lagging strand the cell can limit the amount of DNA polymerase used for chromosomal replication.
(E) It is faster to make several smaller fragments than one larger fragment.

11. When observing the skeleton of a snake, you see the remains of hip and hind leg bones associated with four legged animals. These bones are called
(A) convergent traits. (B) vestigial structures. (C) homologous structures. (D) analogous structures.
(E) both homologous and analogous structures.

12. The group of protists to which humans are most closely related is:
(A) Rhizaria. (B) the choanoflagellates. (C) slime molds. (D) Foraminifera. (E) Stramenopila.

13. Which of the following is **NOT** a defining trait of the phylum Chordata?
(A) notochord (B) dorsal hollow nerve cord (C) pharyngeal slits (D) post anal tail
(E) protostome development

14. The physiologist J. Soum surgically sealed off an air sac of a pigeon and injected carbon monoxide into it. What did he observe and conclude from this experiment?
(A) The bird died demonstrating the toxicity of this gas.
(B) The bird was fine, demonstrating this gas is not actually toxic.
(C) The bird died, indicating diffusion of gases across the air sac into the blood.
(D) The bird showed no ill effects, indicating diffusion of gases from the air sac into the blood.
(E) The bird showed no ill effects, indicating gases do not diffuse from the air sac into the blood.

15. Humans cannot survive at sea by drinking salt water. However, marine vertebrates such as sea turtles and various sea birds can survive by drinking salt water. What **DO** they have that humans **DO NOT**?
(A) kidneys that are extremely good at producing a concentrated urine.
(B) body fluid concentrations that are similar to or greater than those of seawater.
(C) the ability to secrete salts and wastes into their intestinal contents like an insect.
(D) They use ammonia as their primary nitrogenous waste.
(E) salt glands.

16. Which of the following is **NOT** a feature of apoptosis?
(A) formation of apoptotic body (B) DNA fragmentation (C) cell swelling (D) activation of caspases
(E) release of cytochrome C from mitochondria

17. A nonsense suppressor tRNA may have the anticodon
(A) 5'-CAU-3' (B) 5'-UAA-3' (C) 5'-UUA-3' (D) 5'-CCC-3' (E) 5'-UAG-3'

18. Which of the following accurately gives the distribution of phenotypes produced from a cross of purple dwarf pea plants that are heterozygous for flower color and plant height?
(A) 27 purple dwarf; 28 purple tall; 31 white dwarf; 29 white tall
(B) 63 purple dwarf; 28 purple tall; 27 white dwarf; 7 white tall
(C) 132 purple dwarf; 138 white tall
(D) 54 purple dwarf; 6 white tall
(E) 100% purple dwarf

19. Which of the following components and conditions increases membrane fluidity?
(A) phospholipids with long, saturated fatty acyl chains
(B) phospholipids with short, unsaturated fatty acyl chains
(C) lower temperatures
(D) cholesterol at the usual concentrations found in biomembranes
(E) lipid rafts

20. A 400-bp covalently closed circular DNA with a linking number of 35 has 5 negative supercoils. When the linking number of this DNA is changed to 38 by a topoisomerase, this DNA will have
(A) 3 positive supercoils. (B) 3 negative supercoils. (C) 2 positive supercoil.
(D) 2 negative supercoils. (E) relaxed.

21. When a cell releases a signal molecule into the environment and a number of cells in the immediate vicinity respond, this type of signaling is
(A) typical of hormones. (B) autocrine signaling. (C) paracrine signaling. (D) endocrine signaling.
(E) synaptic signaling.

22. Which structure is **NOT** part of the endomembrane system?
(A) nuclear envelope (B) chloroplast (C) Golgi apparatus (D) plasma membrane (E) ER

23. What is a genome?
(A) An ordered display of chromosomes arranged from largest to smallest.
(B) A specific set of polypeptides within each cell.
(C) A specialized polymer of four different kinds of monomers.
(D) A specific segment of DNA that is found within a prokaryotic chromosome.
(E) The complete complement of an organism's genes.

24. Why are cattle able to survive on a diet consisting almost entirely of plant material?
(A) They are autotrophic.
(B) Cattle, like the rabbit, reingest their feces.
(C) They manufacture all 15 amino acids out of sugars in the liver.
(D) Cattle saliva has enzymes capable of digesting cellulose.
(E) They have cellulose-digesting, symbiotic microorganisms in chambers of their stomachs.

25. Which one of the following, if present in a urine sample, would likely be caused by trauma?
(A) amino acids (B) glucose (C) salts (D) erythrocytes (E) vitamins

26. The main source of energy for producers in an ecosystem is
(A) light energy. (B) kinetic energy. (C) thermal energy. (D) chemical energy. (E) ATP.

27. Trace elements are those required by organisms in only minute quantities. Which of the following is a trace element that is required by humans and other vertebrates?
(A) nitrogen (B) calcium (C) iodine (D) sodium (E) phosphorus

28. Which of the following pieces of evidence most strongly supports the common origin of all life on Earth?
(A) All organisms require energy. (B) All organisms show heritable variation.
(C) All organisms reproduce. (D) All organisms use essentially the same genetic code.
(E) All organisms have undergone evolution.

29. Which of these is the smallest unit upon which natural selection directly acts?
(A) a species' gene frequency (B) a population's gene frequency
(C) an individual's genome (D) an individual's genotype
(E) an individual's phenotype

30. The higher the proportion of loci that are "fixed" in a population, the lower is that population's
(A) nucleotide variability. (B) genetic polyploidy. (C) average heterozygosity.
(D) A, B, and C (E) A and C only

31. Which of these should decline in hybrid zones where reinforcement is occurring?
(A) gene flow between distinct gene pools (B) speciation
(C) the genetic distinctness of two gene pools (D) mutation rate
(E) hybrid sterility

32. The largest unit within which gene flow can readily occur is a
(A) population. (B) species. (C) genus. (D) hybrid. (E) phylum.

33. Which statement represents the best explanation for the observation that the nuclear DNA of wolves and domestic dogs has a very high degree of homology?
(A) Dogs and wolves have very similar morphologies.
(B) Dogs and wolves belong to the same order.
(C) Dogs and wolves are both members of the order Carnivora.
(D) Dogs and wolves shared a common ancestor very recently.
(E) Convergent evolution has occurred.

34. Which of these statements about prokaryotes is correct?
(A) Bacterial cells conjugate to mutually exchange genetic material.
(B) Their genetic material is confined within a nuclear envelope.
(C) They divide by binary fission, without mitosis or meiosis.
(D) The persistence of bacteria throughout evolutionary time is due to their genetic homogeneity (i.e., sameness).
(E) Genetic variation in bacteria is not known to occur, nor should it occur, because of their asexual mode of reproduction.

35. If all prokaryotes on Earth suddenly vanished, which of the following would be the most likely and most direct result?
(A) The number of organisms on Earth would decrease by 10—20%.
(B) Human populations would thrive in the absence of disease.
(C) Bacteriophage numbers would dramatically increase.
(D) The recycling of nutrients would be greatly reduced, at least initially.
(E) There would be no more pathogens on Earth.

36. Which of the following is an ongoing trend in the evolution of land plants?
(A) decrease in the size of the leaf (B) reduction of the gametophyte phase of the life cycle
(C) elimination of sperm cells or sperm nuclei (D) increasing reliance on water to bring sperm and egg together
(E) replacement of roots by rhizoids

37. Cephalization is primarily associated with
(A) adaptation to dark environments. (B) method of reproduction. (C) fate of the blastopore.
(D) type of digestive system. (E) bilateral symmetry.

38. The distinction between sponges and other animal phyla is based mainly on the absence versus the presence of
(A) a body cavity. (B) a complete digestive tract. (C) a circulatory system.
(D) true tissues. (E) mesoderm.

39. What would be the most effective method of reducing the incidence of blood flukes in a human population?
(A) Reduce the mosquito population. (B) Reduce the freshwater snail population.
(C) Purify all drinking water. (D) Avoid contact with rodent droppings.
(E) Carefully wash all raw fruits and vegetables.

40. Which of these is **NOT** considered an amniote?
(A) amphibians (B) nonbird reptiles (C) birds (D) egg-laying mammals (E) placental mammals

41. Which of the following is true in plants?
(A) Mitosis occurs in gametophytes to produce gametes. (B) Meiosis occurs in sporophytes to produce spores.
(C) The gametophyte is within the flower in angiosperms. (D) A and B only (E) A, B, and C

42. We tend to think of plants as immobile when, in fact, they can move in many ways. All of the following are movements plants can accomplish **EXCEPT**
(A) growth movements up or down in response to gravity.
(B) folding and unfolding of leaves using muscle-like tissues.
(C) growth movements toward or away from light.
(D) changes in plant growth form in response to wind or touch.
(E) rapid responses using action potentials similar to those found in the nervous tissue of animals.

43. Which of the following is **NOT** true about estuaries?
(A) Estuaries are often bordered by mudflats and salt marshes.
(B) Estuaries contain waters of varying salinity.
(C) Estuaries support a variety of animal life that humans consume.
(D) Estuaries usually contain no or few producers.
(E) Estuaries support many semiaquatic species.

44. Carrying capacity is
(A) seldom reached by marine producers and consumers because of the vast resources of the ocean.
(B) the maximum population size that a particular environment can support.
(C) fixed for most species over most of their range most of the time.
(D) determined by density and dispersion data.
(E) the term used to describe the stress a population undergoes due to limited resources.

45. The emergence of 14 species of Galápagos finches from a common ancestor that finds itself in a new environment is called
(A) adaptive radiation. (B) jumping selection. (C) disruptive selection. (D) sympatric speciation. (E) hybridization.

46. The life history strategy of an *k*-selected species is to
(A) take advantage of human activity, such as clearing woodlots.
(B) allocate energy to their own survival and to the survival of their descendants.
(C) produce thousands of eggs.
(D) become prey.
(E) reproduce at early age.

47. Which of the following mechanisms is essential for animal navigation?
(A) a time keeping mechanism (B) a color recognition mechanism
(C) a scent recognition mechanism (D) a sound discrimination mechanism
(E) a touch discrimination mechanism

48. The sexually mature organism retains traits of the juvenile stage of the organism's ancestor. This is called_____.
(A) metamorphosis (B) pesudomorphosis (C) paedomorphosis (D) premorphosis (E) adultery

49. Which of the following statements regarding balancing selection is **FALSE**?
(A) The balancing selection maintains genetic diversity in a population.
(B) The balancing selection can create a balanced polymorphism.
(C) Homozygote advantage is usually favored by the balancing selection.
(D) The balancing selection is a type of natural selection which does not always cause the elimination of weaker alleles.
(E) The balancing selection can occur through negative frequency-dependent selection.

50. Isolated populations will lose a percentage of their original diversity over time, approximately at the rate of 1/(2N) per generation, where N= population size. After 20 generations, the original population of 500 will lose ___ of its original genetic variation.
(A) 20% (B) 2% (C) 4% (D) 8% (E) 16%.

Ⅱ.【單選題】51-75 題，每題 2 分，共計 50 分。答錯 1 題倒扣 0.5 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。

51. Which of the following statements about umbrella species is correct?
(A) Umbrella species are species whose habitat requirements are critical to a certain small area.
(B) The Northern spotted owl (*Strix occidentialis*) is considered to be an important umbrella species.
(C) The gopher tortoises (*Gopherus polyphemus*) is considered to be an important umbrella species.
(D) Umbrella species must be attractive and more readily engendered support from the public for their conservation.
(E) Formosan macaques are considered to be an important umbrella species in Taiwan.

52. In present populations of Taiwan Hwa-Mei (*Leucodioptron taewanum*) in Taiwan, genetic diversity has been
(A) lost through mutation and restored by natural selection.
(B) lost through stabilizing selection and restored by balancing selection.
(C) lost through directional selection and restored by balancing selection.
(D) lost through hybridization and restored by natural selection.
(E) lost through artificial selection and restored by natural selection.

53. The Morakot typhoon inflicted catastrophic damages on rivers and wiped out entire population of fishes in the river. This is an example of
(A) a density-dependent effect.
(B) the effects of abiotic factors.
(C) the interaction between density-dependent and abiotic factors.
(D) founder effect.
(E) dispersal effect.

54. Which of the following mating systems does the Pheasant-tailed Jacana (*Hydrophasianus chirurgus*) exhibit in paddy fields in Tainan?
(A) monogamy (B) polyandry (C) polygyny (D) promiscuity (E) none of the above

55. When Thomas Hunt Morgan crossed his red-eyed F1 generation flies to each other, the F2 generation included both red- and white-eyed flies. Remarkably, all the white-eyed flies were male. What was the explanation for this result?
(A) The gene involved is on the X chromosome.
(B) The gene involved is on the Y chromosome.
(C) The gene involved is on an autosome.
(D) Other male-specific factors influence eye color in flies.
(E) Other female-specific factors influence eye color in flies.

56. Sequencing an entire genome, such as that of *Caenorhabditis elegans*, a nematode, is most important because
(A) it allows researchers to use the sequence to build a "better" nematode, resistant to disease.
(B) it allows research on a group of organisms we do not usually care much about.
(C) the nematode is a good animal model for trying out cures for viral illness.
(D) a sequence that is found to have a particular function in the nematode is likely to have a closely related function in vertebrates.
(E) a sequence that is found to have no introns in the nematode genome is likely to have acquired the introns from higher organisms.

57. Countercurrent exchange in the fish gill helps to maximize which of the following?
(A) endocytosis (B) blood pressure (C) diffusion (D) active transport (E) osmosis

58. Sexual reproduction
(A) allows animals to conserve resources and reproduce only during optimal conditions.
(B) can produce diverse phenotypes that may enhance survival of a population in a changing environment.
(C) yields more numerous offspring more rapidly than is possible with asexual reproduction.
(D) enables males and females to remain isolated from each other while rapidly colonizing habitats.
(E) guarantees that both parents will provide care for each offspring.

59. Members of two different species possess a similar-looking structure that they use in a similar fashion to perform the same function. Which information would best help distinguish between an explanation based on homology versus one based on convergent evolution?
A) The two species live at great distance from each other.
B) The two species share many proteins in common, and the nucleotide sequences that code for these proteins are almost identical.
C) The sizes of the structures in adult members of both species are similar in size.
D) Both species are well adapted to their particular environments.
E) Both species reproduce sexually.

60. The recessive allele that causes phenylketonuria (PKU) is harmful, except when an infant's diet lacks the amino acid, phenylalanine. What maintains the presence of this harmful allele in a population's gene pool?
(A) heterozygote advantage
(B) stabilizing selection
(C) diploidy
(D) balancing selection
(E) kin selection

61. Bagworm moth caterpillars feed on evergreens and carry a silken case or bag around with them in which they eventually pupate. Adult female bagworm moths are larval in appearance; they lack the wings and other structures of the adult male and instead retain the appearance of a caterpillar even though they are sexually mature and can lay eggs within the bag. This is a good example of
(A) allometric growth. (B) paedomorphosis. (C) sympatric speciation. (D) adaptive radiation.
(E) changes in homeotic genes.

62. Hypothetical mutation in a squirrel population produces organisms with eight legs rather than four. Further, these mutant squirrels survive, successfully invade new habitats, and eventually give rise to a new species. The initial event, giving rise to extra legs, would be a good example of
(A) punctuated equilibrium. (B) species selection. (C) habitat selection.
(D) changes in homeotic genes. (E) allometry.

63. Species that are not closely related and that do not share many anatomical similarities can still be placed together on the same phylogenetic tree by comparing their
(A) plasmids. (B) chloroplast genomes. (C) mitochondrial genomes.
(D) homologous genes that are poorly conserved. (E) homologous genes that are highly conserved.

64. Animal communication involves what type of sensory information?
A) visual B) auditory C) chemical D) A and C only E) A, B, and C

65. Which of the following statements about histone acetylation is **WRONG**?
(A) Histone acetylation usually occurs within the tail region.
(B) Histone acetylation decreases the positive charge of histones.
(C) Histone acetylation reduces the histone-DNA affinity.
(D) Histone acetylation promotes the 30-nm fiber formation.
(E) Histone acetylation is usually associated with activation of gene expression.

66. Which of the following statements is true?
(A) miRNAs are made from long dsRNAs, whereas siRNAs are made from large hairpin precursors.
(B) miRNAs are made from large hairpin precursors, whereas siRNAs are made from long dsRNAs.
(C) Both miRNAs and siRNAs are made from long dsRNAs.
(D) Both miRNAs and siRNAs are made from large hairpin precursors.
(E) none of the above

67. Attaching the activation domain of Gal4 to the Tet (tetracycline) repressor creates a hybrid protein that will
(A) bind to the Gal4 binding site in response to galactose. (B) bind to the Gal4 binding site in response to tetracycline.
(C) bind to the *tet* operator in response to tetracycline. (D) bind to the *tet* operator in response to galactose.
(E) all of the above

68. In a neuron at rest, which of the following is true?
(A) Leakage of sodium ions into the neuron is greater than leakage of potassium ions out of the neuron.
(B) Leakage of sodium ions out of the neuron is greater than leakage of potassium ions into the neuron.
(C) Leakage of potassium ions into the neuron is greater than leakage of sodium ions out of the neuron.
(D) Leakage of potassium ions out of the neuron is greater than leakage of sodium ions into the neuron.
(E) Leakage of potassium ions out of the neuron is equivalent to leakage of sodium ions into the neuron.

69. Which is **NOT** involved in RNA editing?
(A) site-specific deamination of adenines (B) site-specific deamination of cytosines
(C) guide RNA-directed uridine insertion (D) guide RNA-directed uridine deletion
(E) snoRNA-directed 2'-OH methylation

70. The effect of 5-Azacytosine on gene expression is to
(A) prevent chromatin remodeling. (B) prevent RNA editing. (C) remove DNA methylation.
(D) enhance DNA recombination. (E) remove histone acetylation.

71. Influenza virus has pH-sensitive, acidic fusogenic proteins. Based on this, influenza virus would be expected to fuse with
(A) plasma membrane. (B) membrane of trans-Golgi network. (C) membrane of late endosomes.
(D) membrane of mitochondria. (E) membrane of peroxisomes.

72. Which of the following statements best compares a pseudocoelom and a coelom?
(A) A pseudocoelom is completely enclosed by mesoderm whereas a coelom has an outer covering of mesoderm and an inner one of endoderm.
(B) A coelom is completely enclosed by mesoderm whereas a pseudocoelom has an outer covering of mesoderm and an inner one of endoderm.
(C) The coelom is enclosed by ectoderm and the pseudocoelom is enclosed by endoderm.
(D) The pseudocoelom is enclosed by ectoderm and the coelom is enclosed by endoderm.
(E) The coelom is enclosed by ectoderm and the pseudocoelom is enclosed by mesoderm.

73. A partial diploid *E. coli* with which of the following genotypes would turn blue on the plate containing X-Gal in the presence or absence of the inducer IPTG?
(A) $I^+O^+lacZ^+$ / $I^+O^+lacZ^-$ (B) $I^-O^+lacZ^+$ / $I^+O^+lacZ^-$ (C) $I^+O^clacZ^-$ / $I^+O^+lacZ^+$
(D) $I^+O^clacZ^+$ / $I^+O^+lacZ^+$ (E) $I^+O^clacZ^-$ / $I^-O^+lacZ^+$

74. A mutant cell does not have mannose 6-phosphate receptor. Lysosomal enzymes in this cell will
(A) not be synthesized. (B) be in the cytosol. (C) be in the ER.
(D) be secreted. (E) be in the lysosome.

75. Place the following events of mitosis in the correct order.
I. Sister chromatids align on the metaphase plate. II. The cleavage furrow forms.
III. The nuclear membrane breaks up. IV. Sister chromatids condense.
V. Sister chromatids separate.
(A) I, II, III, IV, V (B) III, IV, I, V, II (C) IV, III, I, V, II (D) III, II, I, IV, V (E) IV, I, III, V, II