國立中山大學９６學年度碩士班招生考試試題

科目：生物學【生科系碩士在職專班】

選擇題: 請選擇最好的一個答案。1－20 題每題 1.5 分；21－50 題每題 1 分。

1. All of the following are part of a prokaryotic cell except A) DNA. B) a cell wall. C) a plasma membrane. D) ribosomes. E) an endoplasmic reticulum.
2. All of the following molecules are part of the cell membrane except A) lipids. B) nucleic acids. C) proteins. D) phosphate groups. E) steroids.
3. Which of the following statements correctly describe(s) catabolic pathways? A) They do not depend on enzymes. B) They consume energy to build up polymers from monomers. C) They release energy as they degrade polymers to monomers. D) They lead to the synthesis of catabolic compounds. E) both A and B
4. What is the term used for the metabolic pathway in which glucose (C6H12O6) is degraded to carbon dioxide (CO2) and water? A) cellular respiration B) glycolysis C) fermentation D) citric acid cycle E) oxidative phosphorylation
5. Which of the following are products of the light reactions of photosynthesis that are utilized in the Calvin cycle? A) CO2 and glucose B) H2O and O2 C) ADP, Pi, and NADP+ D) electrons and H+ E) ATP and NADPH
6. What is the primary function of the light reactions of photosynthesis? A) to produce energy-rich glucose from carbon dioxide and water B) to produce ATP and NADPH C) to produce NADPH used in respiration D) to convert light energy to the chemical energy of PGAL E) to use ATP to make glucose
7. The old saying "one rotten apple spoils the whole barrel" is due to chemical signaling in plants via A) an increased uptake of carbon dioxide during respiration in target cells. B) a local regulator for apple development. C) release of ethylene gas, a plant hormone for ripening. D) an a/α cell signal system in the rotten apple. E) a signal transduction pathway involving glycogen phosphorylase.
8. If cells in the process of dividing are subjected to colchicine, a drug that interferes with the functioning of the spindle apparatus, at which stage will mitosis be arrested? A) anaphase B) prophase C) telophase D) metaphase E) interphase
9. How do the two members of a pair of homologous chromosomes differ from each other? A) their length B) the identity and relative position of the genes present on each of the chromosomes C) their staining patterns D) the position of the centromere within each of the chromosomes E) the precise sequence of the DNA within each of the chromosomes
10. Which of the following is true of a species that has a chromosome number of $2n = 16$? A) The species is diploid with 32 chromosomes. B) The species has 16 sets of chromosomes. C) There are 8 homologous pairs. D) During the S phase of the cell cycle there will be 32 separate chromosomes. E) A gamete from this species has 4 chromosomes.
11. A cross between homozygous purple-flowered and homozygous white-flowered pea plants results in offspring with purple flowers. This demonstrates A) the blending model of genetics. B) true-breeding. C) dominance. D) a dihybrid cross. E) the mistakes made by Mendel.
12. New combinations of linked genes are due to which of the following? A) nondisjunction B) crossing over C) independent assortment D) mixing of sperm and egg E) both A and C
13. What is the mechanism for the production of genetic recombinants? A) X inactivation B) methylation of cytosine C) crossing over and independent assortment D) nondisjunction E) deletions and duplications during meiosis
14. What does transformation involve in bacteria? A) the creation of a strand of DNA from an RNA molecule B) the creation of a strand of RNA from a DNA molecule C) the infection of cells by a phage DNA molecule D) the type of semiconservative replication shown by DNA E) assimilation of external DNA into a cell

15. If A, B, and C are all required for growth, a strain that is mutant for the gene encoding enzyme A would be able to grow on which of the following media? A) minimal medium B) minimal medium supplemented with nutrient "A" C) minimal medium supplemented with nutrient "B" D) minimal medium supplemented with nutrient "C" E) Answers C and D are correct.
16. Which of the following is not a reason scientists suspected that something other than bacteria was the cause of tobacco mosaic disease? A) Passing infectious sap through a fine filter failed to remove the infectious agent. B) Treating infectious sap with alcohol failed to remove the infectious agent. C) No cells could be seen in the infectious sap using a light microscope. D) The infectious agent in the sap could reproduce, as its ability to cause disease was undiluted even after many transfers from plant to plant. E) The infectious agent could not be cultivated on nutrient media in petri dishes or in test tubes.
17. Under the electron microscope, unfolded chromatin resembles "beads on a string." What do the "beads" represent? A) nucleosomes B) ribosomes C) beadosomes D) molecules of DNA polymerase E) molecules of RNA polymerase
18. How does a bacterial cell protect its own DNA from restriction enzymes? A) by adding methyl groups to adenines and cytosines B) using DNA ligase to seal the bacterial DNA into a closed circle C) adding histones to protect the double-stranded DNA D) by forming "sticky ends" of bacterial DNA to prevent the enzyme from attaching E) by reinforcing the bacterial DNA structure with covalent phosphodiester bonds
19. Which of the following is (are) involved in embryonic development?
    A) cell division B) cell differentiation C) morphogenesis D) A and B only E) A, B, and C
20. What is the term for the physical processes that give rise to the shape of an organism?
    A) morphogenesis B) differentiation C) totipotency D) pluripotency E) mitosis
21. Damage to which of the following brain structures is most likely to result in difficulty in being able to remember meeting new people? A) thalamus B) hippocampus C) hypothalamus D) corpus callosum E) Broca's area
22. The hormone insulin enhances the transport of glucose into most of the body's cells. Its secretion is controlled by a negative-feedback system between the concentration of glucose in the blood and the cells that secrete insulin. Which of the following statements is most likely to be correct? A) A decrease in blood glucose concentration will stimulate insulin secretion, which will in turn lower the blood glucose concentration still further. B) An increase in blood glucose concentration will stimulate insulin secretion, which will in turn lower the blood glucose concentration. C) A decrease in blood glucose concentration will stimulate insulin secretion, which will in turn increase the blood glucose concentration. D) An increase in blood glucose concentration will stimulate insulin secretion, which will in turn increase the blood glucose concentration still further. E) None of the choices are correct.
23. In a diploid set of chromosomes, one member of each pair of homologous chromosomes is derived from the father (paternal), and the other comes from the mother (maternal). If $2n = 6$, what is the probability of obtaining a gamete in which all the chromosomes are paternal ones? A) 1/4 B) 1/8 C) 1/16 D) 1/32 E) cannot be determined from these data
24. If it takes solute A 1 second to diffuse 1 millimeter, how long will it take solute A to diffuse 10 millimeters under the same conditions? A) 1 second B) 10 seconds C) 50 seconds D) 100 seconds E) 1000 seconds
25. There is about 1,000 times as much DNA in a human cell as in an *E. coli* cell, but only about 10 times as many genes. What accounts for this discrepancy? A) Most of the genes in a human cell are turned off. B) The DNA packing is much more complex in a prokaryotic cell. C) A human cell has much more noncoding DNA. D) *E. coli* bacteria are less able to respond to their environment than humans. E) Human cells are much larger than *E. coli* cells.

26. In a laboratory experiment with three groups, one group of people drinks pure water, a second group drinks an equal amount of beer, and a third group drinks an equal amount of concentrated salt solution all during the same time period. Their urine production is monitored for several hours. At the end of the measurement period, which group will have produced the greatest volume of urine and which group the least? A) beer the most, salt solution the least B) salt solution the most, water the least C) water the most, beer the least D) beer the most, water the least E) There will be no significant difference between these groups.
27. Which of the following is a local regulator responsible for activating an enzyme that relaxes smooth muscle cells? A) epinephrine B) prostaglandin F C) nitric oxide D) A and B only E) A, B, and C
28. The primary reason steroid hormones usually act slowly is that _____. A) they are produced at very low concentrations B) acting via a signal transduction pathway makes for slower responses than does directly interacting with a cell's DNA C) they are too large to enter a cell and therefore must first bind to a plasma membrane receptor before having an effect on a cell D) target cells tend to ignore steroid hormones in favor of nonsteroid hormones E) they turn genes on or off and it takes time for gene products to build up or become depleted
29. The space between an axon of one neuron and the dendrite of another neuron is called a(n) _____. A) synaptic cleft B) node of Ranvier C) internodes D) synapse E) synaptic terminal
30. Proto-oncogenes can change into oncogenes that cause cancer. Which of the following best explains the presence of these potential time bombs in eukaryotic cells? A) Proto-oncogenes first arose from viral infections. B) Proto-oncogenes normally help regulate cell division. C) Proto-oncogenes are genetic "junk." D) Proto-oncogenes are mutant versions of normal genes. E) Cells produce proto-oncogenes as they age.
31. As a young girl, Maria suffered a head injury that damaged her pituitary. An injury to the pituitary is particularly serious because of all the functions controlled by this gland. As Maria got older, she and her doctors found that all of the following **except** her _____ were affected. A) metabolic rate B) blood sugar level C) menstrual cycle D) water regulation E) growth
32. Which is a true statement about the adrenal medulla? A) The hormone it produces causes the kidney to reabsorb sodium and water. B) It produces steroid hormones. C) It cannot function in hormone production without releasing hormone (RH) from the hypothalamus. D) The gland is stimulated by nerve signals carried from the brain. E) It secretes hormones that suppress inflammation and control pain.
33. Which statement about reproduction in invertebrates is *incorrect*? A) Many invertebrates have separate sexes. B) Many invertebrates utilize external fertilization. C) A few species split open to release gametes to the environment. D) Some invertebrates have structures that store sperm. E) Invertebrates do not engage in internal fertilization.
34. If the concentration of potassium in the cytoplasm of a nerve cell with a resting membrane potential of -70 mV were elevated above normal, the new resting potential would A) still be -70 mV. B) be -69 mV or higher. C) be -71 mV or lower. D) be 0 mV. E) reverse polarity.
35. As you start to pick up your biology book, you suddenly realize that it is much heavier than you expected. Which of the following brain regions is responsible for the rapid adjustment of muscle force that allows you to pick up the book smoothly? A) medulla oblongata B) cerebrum C) pituitary D) hypothalamus E) cerebellum
36. Why are we able to differentiate tasts and smells? A) The action potentials initiated by taste receptors are transmitted to a separate region of the brain than those initiated by receptors for smell. B) The sensory region of the cerebral cortex distinguishes something we taste from something we smell by the difference in the action potential. C) The brain distinguishes between taste, arising from interoreceptors, from smell arising from exteroreceptors. D) Because we are able to see what we are tasting, the brain uses this

information to distinguish taste from smell. E) Taste receptors are able to detect fewer molecules of the stimulus, which means these receptors will initiate a receptor potential before smell receptors do.

37. Given the steps shown below, which of the following is the correct sequence for transmission at a chemical synapse? 1. Neurotransmitter binds with receptors associated with the postsynaptic membrane. 2. Ca_2^+ ions rush into neuron's cytoplasm. 3. Action potential depolarizes the synaptic terminal membrane. 4. Ligand-gated ion channels open. 5. Synaptic vesicles release neurotransmitter into the synaptic cleft. A) 1, 2, 3, 4, 5 B) 2, 3, 5, 4, 1 C) 3, 2, 5, 1, 4 D) 4, 3, 1, 2, 5 E) 5, 1, 2, 4, 3
38. Which of the following is true concerning the rate limiting step in a metabolic pathway? A) It is likely to be the slowest reaction in the pathway. B) It is likely to be the fastest reaction in the pathway. C) It may be subject to end-product inhibition. D) Both it is likely to be the slowest reaction in the pathway and it may be subject to end-product inhibition are correct. E) Both it is likely to be the fastest reaction in the pathway and it may be subject to end-product inhibition are correct.
39. Cocaine lowers the levels of a chemical messenger in the brain called enkephalin. Researchers have found the number of enkephalin receptors to be higher in cocaine addicts than non addicted people. This is an example of A) saturation. B) up regulation. C) antagonism. D) affinity. E) down regulation.
40. Amplification during a second messenger cascade is beneficial because amplification A) takes small molecules and makes polymers out of them. B) results in the production of more of the first messenger. C) allows a cell to respond to more different hormones. D) allows small amounts of hormones to produce large responses in target cells. E) None of the choices are correct.
41. Action potentials are said to be "all-or-none" in character because A) the rate of propagation of an action potential down an axon is independent of stimulus strength. B) they are associated with an absolute refractory period. C) the amplitude of an action potential generated in any given neuron is the same, regardless of the stimulus strength. D) a supra-threshold stimulus is required to stimulate an action potential during the relative refractory period. E) All of these statements describe the "all-or-none" character of action potentials.
42. The major known classes of neurotransmitters and/or neuromodulators include each of the following *except* A) amino acids. B) ACh. C) neuropeptides. D) cyclic nucleotides. E) biogenic amines.
43. In sexually reproducing species, the chromosome number remains stable over time because _____ and _____ always alternate. A) meiosis ... fertilization B) meiosis ... mitosis C) mitosis ... fertilization D) meiosis ... interphase E) meiosis I ... meiosis II
44. A laboratory rat has an electrode implanted in its brain. By pressing a metal bar in its cage, the animal can activate the electrode. Which of the following is most likely to be true? A) If the animal presses the bar repeatedly, then the electrode is probably in an area associated with appetitive motivation. B) If the animal presses the bar once, then never touches it again, then the electrode is probably in an area associated with aversive motivation. C) Such an experiment has no relevance to emotional states in humans or human behavior. D)Both if the animal presses the bar repeatedly, then the electrode is probably in an area associated with appetitive motivation and if the animal presses the bar once, then never touches it again, then the electrode is probably in an area associated with aversive motivation are correct. E) All of the choices are correct.
45. Which of the following statements regarding higher brain functions is true? A) A person with damage only to Wernicke's area of the brain will have motor aphasia. B) A person with damage only to Broca's area of the brain will understand spoken or written speech but will have difficulty speaking. C) A person with damage only to Wernicke's area of the brain will lose the ability to recognize faces. D) Both a person with damage only to Broca's area of the brain will understand spoken or written speech but will have

difficulty speaking and a person with damage only to Wernicke's area of the brain will have motor aphasia are true. E) Both a person with damage only to Broca's area of the brain will understand spoken or written speech but will have difficulty speaking and a person with damage only to Wernicke's area of the brain will lose the ability to recognize faces are true.

46. Myasthenia gravis is an autoimmune disease - that is, a disease in which one's immune system gradually attacks a part of one's own body, in this case the receptors for acetylcholine at the neuromuscular junction. Which of the following drugs might be useful in treating this disease? A) a drug that inhibits acetylcholinesterase B) a drug that inhibits release of acetylcholine C) curare D) atropine (a muscarinic antagonist) E) all of the choices.
47. Which of the following would be a consequence of touching a hot object with one's right hand? A) A stretch reflex would be triggered that would cause contraction of extensor muscles in the right arm. B) A withdrawal reflex would be triggered by nociceptors that would stimulate contraction of flexor muscles in the right arm. C) Reflex mechanisms would inhibit contraction of the extensor muscles of the right arm. D) Both a stretch reflex would be triggered that would cause contraction of extensor muscles in the right arm and a withdrawal reflex would be triggered by nociceptors that would stimulate contraction of flexor muscles in the right arm would be consequences. E) Both a withdrawal reflex would be triggered by nociceptors that would stimulate contraction of flexor muscles in the right arm and reflex mechanisms would inhibit contraction of the extensor muscles of the right arm would be consequences.
48. Which of the following statements concerning control of blood flow through arterioles is true?
A) Beta-adrenergic receptors are more abundant on most arteriolar smooth muscle than are alpha-adrenergic receptors. B) Binding of epinephrine to alpha-adrenergic receptors causes vasodilation. C) Increased stimulation of vascular smooth muscle by the parasympathetic nervous system causes increased vasoconstriction. D) If the arterial blood pressure to an organ suddenly decreases, arterioles in the organ will dilate in response. E) All of the choices are true.
49. During an unforced exhalation/expiration, all of the following are true *except* A) alveolar pressure is greater than atmospheric pressure. B) the diaphragm relaxes. C) transpulmonary pressure decreases. D) intrapleural pressure is greater than alveolar pressure. E) lung volume decreases.
50. Andalusian chickens with the genotype C^BC^B are black, those with the genotype C^WC^W are white, and those with the genotype C^BC^W are gray. What is the expected genotypic ratio of a C^BC^W x C^BC^W cross?
A) 1 C^BC^B : 1 C^BC^W B) 3 C^BC^B : 1 C^WC^W C) 9 C^BC^B : 3 C^BC^W : 3 C^WC^B : 1 C^WC^W
D) 2 C^BC^B : 1 C^BC^W : 2 C^WC^W E) 1 C^BC^B : 2 C^BC^W : 1 C^WC^W

問答題:

1. How are brophytes, fern, conifers and flowering plants different from each other? (15 points)
2. Describe the major terrestrial biomes (vegetations) on earth, and discuss their rrelationships with climatic factor. (15 points)
3. What is the Hardy-Weinberg theorem, and what conditions are requried to maintain the original equilibrium? (10 points)