國立中山大學104學年度碩士暨碩士專班招生考試試題

科目名稱：普通生物學【海資系碩士班甲組】　　題號：452003

※本科目依簡章規定「不可以」使用計算機(選擇題)　　

單選題(50題，每題2分，共100分)

1) Which of the following statements is FALSE? Saturated fats _____.
(A) contain more hydrogen than unsaturated fats that consist of the same number of carbon atoms
(B) have many double bonds in the carbon chains of their fatty acids
(C) are more common in animals than in plants
(D) usually solidify at room temperature

2) Plasmodesmata in plant cells are most similar in function to which of the following structures in animal cells?
(A) gap junctions (B) tight junctions (C) extracellular matrix (D) desmosomes

3) The extracellular matrix is thought to participate in the regulation of animal cell behavior by communicating information from the outside to the inside of the cell via which of the following?
(A) gap junctions (B) integrins (C) DNA and RNA (D) the nucleus

4) Researchers tried to explain how vesicular transport occurs in cells by attempting to assemble the transport components. They set up microtubular tracks along which vesicles could be transported, and they added vesicles and ATP (because they knew the transport process requires energy). Yet, when they put everything together, there was no movement or transport of vesicles. What were they missing?
(A) motor proteins (B) contractile microfilaments (C) endoplasmic reticulum (D) an axon

5) Transcription factors _____.
(A) regulate the synthesis of lipids in the cytoplasm
(B) regulate the synthesis of DNA in response to a signal
(C) control gene expression
(D) transcribe ATP into cAMP

6) Which of the following is a correct association?
(A) GTPase activity and hydrolysis of GTP to GDP
(B) adenylyl cyclase activity and the conversion of cAMP to AMP
(C) kinase activity and the addition of a tyrosine
(D) phosphodiesterase activity and the removal of phosphate groups

7) What is the final result of mitosis in a human?
(A) genetically identical 1n somatic cells (B) genetically different 2n somatic cells
(C) genetically identical 2n gamete cells (D) genetically identical 2n somatic cells

8) Which of the following can occur by the process of meiosis but not mitosis?
(A) Haploid cells multiply into more haploid cells.
(B) Diploid cells form haploid cells.
(C) A diploid cell combines with a haploid cell.
(D) Haploid cells fuse to form diploid cells.

9) Homologous pairs of chromosomes align opposite of each other at the equator of a cell during _____.
(A) meiosis telophase II (B) meiosis metaphase II (C) mitosis metaphase (D) meiosis metaphase I

10) Quaking aspen can send out underground stems for asexual reproduction. Sexual reproduction is not as common, but when it does happen, the haploid gametes have 19 chromosomes. How many chromosomes are in the cells of the underground stems?
(A) 38 (B) 19 (C) 9 (D) 10

11) In some parts of Africa, the frequency of heterozygosity for the sickle-cell anemia allele is unusually high, presumably because this reduces the frequency of malaria. Such a relationship is related to which of the following?
(A) Darwin's explanation of natural selection (B) the malarial parasite changing the allele
(C) Mendel's law of independent assortment (D) Mendel's law of segregation

12) There is still some controversy among biologists about whether Neanderthals should be placed within the same species as modern humans or into a separate species of their own. Most DNA sequence data analyzed so far indicate that there was probably little or no gene flow between Neanderthals and *Homo sapiens*. Which species concept is most applicable in this example?
(A) biological (B) ecological (C) phylogenetic (D) morphological

13) Environmental influences appear to contribute to cellular mutations that lead to tumor growth. For example, certain diets lead to higher incidence of colon cancers, and overexposure to sunlight leads to higher incidence of skin cancers. The tissues in closest contact with a carcinogen or mutagen (anything that causes genetic mutations) are obviously the ones most likely to develop tumors. Carcinomas and melanomas account for well over half of all cancers. What type of tissue would you guess the term *carcinoma* and *melanoma* is most closely associated with?
(A) epithelial (B) muscle (C) nervous (D) connective

14) Cardiac muscle cells are both _____.
(A) striated and under voluntary control (B) striated and interconnected by intercalated disks
(C) smooth and under voluntary control (D) smooth and under involuntary control

15) In response to stress, the adrenal gland promotes the synthesis of glucose from non-carbohydrate substrates via the action of the steroid hormone _____.
(A) thyroxine (B) glucagon (C) cortisol (D) adrenocorticotropic hormone (ACTH)

16) The reason that the steroid hormone aldosterone affects only a small number of cells in the body is that _____.
(A) only its target cells get exposed to aldosterone
(B) only its target cells contain aldosterone receptors
(C) nontarget cells destroy aldosterone before it can produce any effect
(D) it is unable to enter nontarget cells

17) A significant contribution of intestinal bacteria to human nutrition is the benefit of bacterial _____.
(A) absorption of organic materials (B) production of vitamins A and C
(C) production of vitamin K (D) recovery of water from fecal matter

18) You are most likely to observe coprophagy in _____.
(A) herbivores (B) suspension feeders (C) carnivores (D) fluid feeders

19) Among the following choices, which organism likely has the highest systolic pressure?
(A) giraffe (B) mouse (C) hippopotamus (D) human

20) A patient with a blood pressure of 120/75, a pulse rate of 70 beats/minute, a stroke volume of 70 mL/beat (milliliters per beat), and a respiratory rate of 25 breaths/minute will have a cardiac output of _____.
(A) 2,800 mL/minute (B) 1,750 mL/minute (C) 4,900 mL/minute (D) 1,000 mL/minute

21) Processing of filtrate in the proximal and distal tubules _____.
(A) achieves the conversion of toxic ammonia to less toxic urea
(B) reabsorbs urea to maintain osmotic balance
(C) regulates the speed of blood flow through the nephrons
(D) maintains homeostasis of pH in body fluids

22) Terrestrial organisms lose water through evaporation. In what ecosystem might an entomologist find a good study organism to examine the prevention of water loss?
(A) prairie (B) chaparral (C) wet rain forest (D) desert

23) At the time of fertilization, the maturation of the human oogonium has resulted in _____.
(A) four secondary oocytes (B) two primary oocytes
(C) one secondary oocyte (D) four zygotes

24) The outer-to-inner sequence of tissue layers in a post-gastrulation vertebrate embryo is _____.
(A) ectoderm → endoderm → mesoderm (B) mesoderm → endoderm → ectoderm
(C) ectoderm → mesoderm → endoderm (D) endoderm → ectoderm → mesoderm

25) Vaccination increases the number of _____.
(A) major histocompatability (MHC) molecules that can present an antigen
(B) epitopes that the immune system can recognize
(C) lymphocytes with receptors that can bind to the pathogen
(D) macrophages specific for a pathogen

26) Short-term and long-term memory are related but have important differences. Short-term memory _____.
(A) is essential for acquiring new long-term memories but not for maintaining them
(B) involves temporary links formed in the cerebral cortex while long-term memory involves permanent connections within the hippocampus
(C) and long-term memory store information in the cerebellum but use different neurotransmitters
(D) is essential for acquiring and retaining long-term memories

27) What component of amino acid structure varies among different amino acids?
(A) the presence of a central C atom
(B) the components of the R-group
(C) the glycerol molecule that forms the backbone of the amino acid
(D) the long carbon-hydrogen tails of the molecule

28) What is the function of the nuclear pore complex found in eukaryotes?
(A) It selectively transports molecules out of the nucleus, but prevents all inbound molecules from entering the nucleus.
(B) It regulates the movement of proteins and RNAs into and out of the nucleus.
(C) It synthesizes the proteins required to copy DNA and make mRNA.
(D) It assembles ribosomes from raw materials that are synthesized in the nucleus.

29) Which observation suggested to Sutherland the involvement of a second messenger in epinephrine's effect on liver cells?
(A) Glycogen breakdown was observed only when epinephrine was administered to intact cells.
(B) Epinephrine was known to have different effects on different types of cells.
(C) Receptor studies indicated that epinephrine was a ligand.
(D) Glycogen breakdown was observed when epinephrine and glycogen phosphorylase were combined.

30) Which of the following triggers the cell's passage past the G2 checkpoint into mitosis?
(A) Cdk (B) cyclin (C) MPF (D) PDGF

31) Somatic cells of roundworms have four individual chromosomes per cell. How many chromosomes would you expect to find in an ovum from a roundworm?
(A) eight (B) a diploid number (C) four (D) two

32) One of two major forms of a human condition called neurofibromatosis (NF 1) is inherited as a dominant gene, although it may range from mildly to very severely expressed. Which of the following is the best explanation for why a young, affected child is the first in her family to be diagnosed?
(A) One of the parents has a mild expression of the gene.
(B) The condition skipped a generation in the family.
(C) The child has one more chromosome than either of the parents.
(D) The mother carries the gene but does not express it.

33) Many songbirds breed in North America in the spring and summer and then migrate to Central and South America in the fall. They spend the winter in these warmer areas, where they feed and prepare for the spring migration north and another breeding season. Two hypothetical species of sparrow, A and B, overwinter together in mixed flocks in Costa Rica. In spring, species A goes to the east coast of North America, and species B goes to the west coast. What can you say about the isolating mechanisms of these two species?
(A) Reinforcement must be occurring when they winter together.
(B) They must have strong prezygotic isolating mechanisms to spend winter in such close proximity.
(C) Their winter habitat has no bearing on their degree of reproductive isolation.
(D) They must have strong postzygotic isolating mechanisms to spend winter in such close proximity.

34) Which of the following animals most likely uses the largest percentage of its energy budget for homeostatic regulation?
(A) a shark swimming in the open ocean (B) a snake in a tropical forest
(C) a bird living year round in a desert (D) a marine jelly (an invertebrate) living deep in the ocean

35) Insect hormones and their receptors _____.
(A) are a focus in pest control research (B) utilize cell-surface receptors only
(C) are active independently of environmental cues (D) act independently of each other

36) When a woman has her gallbladder removed, she should probably reduce her consumption of _____.
(A) proteins (B) carbohydrates (C) proteins and carbohydrates (D) fats

37) The only vertebrates in which blood flows directly from respiratory organs to body tissues without first returning to the heart are the _____.
(A) amphibians (B) mammals (C) fishes (D) reptiles

38) The osmoregulatory/excretory system of an earthworm is based on the operation of _____.
(A) Malpighian tubules (B) metanephridia (C) protonephridia (D) nephrons

39) Contact of a sea urchin egg with signal molecules on sperm causes the egg to undergo a brief _____.
(A) acrosomal reaction (B) mitosis (C) vitellogenesis (D) membrane depolarization

40) The complement system is _____.
(A) a set of proteins involved in innate but not acquired immunity
(B) a group of proteins that includes interferons and interleukins
(C) a set of proteins that act individually to attack and lyse microbes
(D) a group of antimicrobial proteins that act together in a cascade fashion

41) Saturated fatty acids _____.
(A) are usually produced by plants
(B) are usually liquid at room temperature
(C) are the principal molecules in lard and butter
(D) have double bonds between carbon atoms of the fatty acids

42) A cell with an extensive area of smooth endoplasmic reticulum is specialized to _____.
(A) actively export protein molecules (B) play a role in storage
(C) synthesize large quantities of lipids (D) import and export protein molecules

43) Caffeine is an inhibitor of phosphodiesterase. Therefore, the cells of a person who has recently consumed coffee would have increased levels of _____.
(A) phosphorylated proteins (B) cAMP (C) activated G proteins (D) adenylyl cyclase

44) MPF is a dimer consisting of _____.
(A) cyclin and tubulin (B) a growth factor and mitotic factor
(C) ATP synthetase and a protease (D) cyclin and a cyclin-dependent kinase

45) A given organism has 46 chromosomes in its karyotype. Therefore, we can conclude that it must _____.
(A) reproduce sexually (B) be human
(C) be an animal (D) have gametes with 23 chromosomes

46) Gray seed color in peas is dominant to white. Assume that Mendel conducted a series of experiments where plants with gray seeds were crossed among themselves, and the following progeny were produced: 302 gray and 98 white.(**i**) What is the most probable genotype of each parent? (**ii**) Based on your answer in (i) above, what genotypic and phenotypic ratios are expected in these progeny? (Assume the following symbols: *G* = gray and *g* = white.)
(A) (i) *GG* × *gg*; (ii) genotypic = 3:1, phenotypic = 1:2:1
(B) (i) *gg* × *Gg*; (ii) genotypic = 1:2, phenotypic = 3:1
(C) (i) *GG* × *Gg*; (ii) genotypic = 1:2:1, phenotypic = 2:1
(D) (i) *Gg* × *Gg*; (ii) genotypic = 1:2:1, phenotypic = 3:1

47) Positive feedback differs from negative feedback in that _____.
(A) positive feedback benefits the organism, whereas negative feedback is detrimental
(B) the effector's response increases some parameter (such as body temperature), whereas in negative feedback it can only decrease the parameter
(C) the positive feedback's effector responses are in the same direction as the initiating stimulus rather than opposite of it
(D) positive feedback systems have only effectors, whereas negative feedback systems have only receptors

48) The relationship between the insect hormones ecdysteroid and PTTH is an example of _____.
(A) homeostasis maintained by antagonistic hormones
(B) how peptide-derived hormones have more widespread effects than steroid hormones
(C) an interaction of the endocrine and nervous systems
(D) competitive inhibition of a hormone receptor

49) The active ingredient orlistat acts to decrease the amount of fat that is absorbed by attaching to enzymes that digest fat. Which of the following are potential targets of orlistat?
(A) pancreatic lipase (B) salivary amylase (C) secretin (D) pepsidase

50) Blood is pumped at high pressures in arteries from the heart to ensure that all parts of the body receive adequate blood flow. Capillary beds, however, would hemorrhage under direct arterial pressures. How does the design of the circulatory network contribute to reducing blood pressure to avoid this scenario?
(A) Capillary beds have the thickest walls of any blood vessel to resist these high pressures.
(B) Fluid loss from the arteries is high enough that pressure drops off significantly by the time blood reaches the capillaries.
(C) Blood flow through the capillaries is essentially frictionless, and this reduces the amount of pressure on their walls.
(D) The total cross-sectional diameter of the arterial circulation increases with progression from artery to arteriole to capillary, leading to a reduced blood pressure.