國立高雄大學九十九學年度轉學招生考試試題(轉二年級)

科目：普通生物學
考試時間：80 分鐘

系所：
生命科學系

是否使用計算機：否

本科原始成績：100 分

一、選擇題（70%,每題 2%,請選最適當者）

1. Which taxon is essentially equivalent to the "embryophytes"?
A) Viridiplantae
B) Plantae
C) Pterophyta
D) Bryophyta
E) Charophycea

2. In plants, which of the following are produced by meiosis?
A) haploid sporophyte
B) haploid gametes
C) diploid gametes
D) haploid spores
E) diploid spores

3. Which protists are in the same eukaryotic "supergroup" as land plants?
A) green algae
B) dinoflagellates
C) red algae
D) brown algae
E) A and C are both correct

4. In a comparison of birds with mammals, having four appendages is
A) a shared ancestral character.
B) a shared derived character.
C) a character useful for distinguishing birds from mammals.
D) an example of analogy rather than homology.
E) a character useful for sorting bird species.

5. 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.

6. What is true of the fossil record of mammalian origins?
A) It is a good example of punctuated equilibrium.
B) It shows that mammals and birds evolved from the same kind of dinosaur.
C) It includes transitional forms with progressively specialized teeth.
D) It indicates that mammals and dinosaurs did not overlap in geologic time.
E) It includes a series that shows the gradual change of scales into fur.

7. In their laboratory simulations of the early Earth, Miller and Urey observed the abiotic synthesis of
A) amino acids.
B) complex organic polymers.
C) DNA.
D) liposomes.
E) genetic systems.

8. The origin of a new plant species by hybridization, coupled with accidents during nuclear division, is an example of
A) allopatric speciation.
B) sympatric speciation.
C) autopolyploidy.
D) habitat selection.
E) sexual selection

9. Which of the following is not an observation or inference on which natural selection is based?
A) There is heritable variation among individuals.
B) Poorly adapted individuals never produce offspring.
C) Species produce more offspring than the environment can support.
D) Individuals whose characteristics are best suited to the environment generally leave more offspring than those whose characteristics are less suited.
E) Only a fraction of the offspring produced by an individual may survive.

10. What is the source of the extra chromosome 21 in an individual with Down syndrome?
A) Nondisjunction in the mother only

B) Nondisjunction in the father only
C) Duplication of the chromosome
D) Nondisjunction or translocation in either parent
E) It is impossible to detect with current technology

11. How many unique gametes could be produced through independent assortment by an individual with the genotype AaBbCCDdEE?
A) 4
B) 8
C) 16
D) 32
E) 64

12. Most molecular biologists think that viruses originated from fragments of cellular nucleic acid. Which of the following observations supports this theory?
A) Viruses contain either DNA or RNA.
B) Viruses are enclosed in protein capsids rather than plasma membranes.
C) Viruses can reproduce only inside host cells.
D) Viruses can infect both prokaryotic and eukaryotic cells.
E) Viral genomes are usually more similar to the genome of the host cell than to the genomes of viruses that infect other cell types.

13. During DNA replication,
A) all methylation of the DNA is lost at the first round of replication.
B) DNA polymerase is blocked by methyl groups, and methylated regions of the genome are therefore left uncopied.
C) methylation of the DNA is maintained because methylation enzymes act at DNA sites where one strand is already methylated and thus correctly methylates daughter strands after replication.
D) methylation of the DNA is maintained because DNA polymerase directly incorporates methylated nucleotides into the new strand opposite any methylated nucleotides in the template.
E) methylated DNA is copied in the cytoplasm, and unmethylated DNA in the nucleus.

14. The lactose operon is likely to be transcribed when
A) there is more glucose in the cell than lactose.
B) the cyclic AMP levels are low.

C) there is glucose but no lactose in the cell.
D) the cyclic AMP and lactose levels are both high within the cell.
E) the cAMP level is high and the lactose level is low.

15. When does translation begin in prokaryotic cells?
A) after a transcription initiation complex has been formed
B) as soon as transcription has begun
C) after the 5' caps are converted to mRNA
D) once the pre-mRNA has been converted to mRNA
E) as soon as the DNA introns are removed from the template

16. What determines the nucleotide sequence of the newly synthesized strand during DNA replication?
A) the particular DNA polymerase catalyzing the reaction
B) the relative amounts of the four nucleoside triphosphates in the cell
C) the nucleotide sequence of the template strand
D) the primase used in the reaction
E) the arrangement of histones in the sugar phosphate backbone

17. A researcher lyses a cell that contains nucleic acid molecules and capsomeres of tobacco mosaic virus (TMV). The cell contents are left in a covered test tube overnight. The next day this mixture is sprayed on tobacco plants. Which of the following would be expected to occur?
A) The plants would develop some but not all of the symptoms of the TMV infection.
B) The plants would develop symptoms typically produced by viroids.
C) The plants would develop the typical symptoms of TMV infection.
D) The plants would not show any disease symptoms.
E) The plants would become infected, but the sap from these plants would be unable to infect other plants.

18. Which of the following is an example of post-transcriptional control of gene expression?
A) the addition of methyl groups to cytosine bases of DNA
B) the binding of transcription factors to a promoter
C) the removal of introns and splicing together of exons
D) gene amplification during a stage in development
E) the folding of DNA to form heterochromatin

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19. A plant has a unique photosynthetic pigment. The leaves of this plant appear to be reddish yellow. What wavelengths of visible light are being absorbed by this pigment?
A) red and yellow
B) blue and violet
C) green and yellow
D) blue, green, and red
E) green, blue, and yellow

20. Which statement describes the functioning of photosystem II?
A) Light energy excites electrons in the electron transport chain in a photosynthetic unit.
B) The excitation is passed along to a molecule of P700 chlorophyll in the photosynthetic unit.
C) The P680 chlorophyll donates a pair of protons to NADPH, which is thus converted to $NADP^+$.
D) The electron vacancies in P680 are filled by electrons derived from water.
E) The splitting of water yields molecular carbon dioxide as a by-product.

21. In which animal does blood flow from the pulmocutaneous circulation to the heart before circulating through the rest of the body?
A) annelid
B) mollusk
C) fish
D) frog
E) insect

22. What is the process called by which materials are returned to the blood from the nephron fluid?
A) filtration
B) ultrafiltration
C) selective reabsorption
D) secretion
E) active transport

23. Which of the following statements about endocrine glands is incorrect?
A) The parathyroids regulate metabolic rate.
B) The thyroid participates in blood calcium regulation.
C) The pituitary participates in the regulation of the gonads.

D) The adrenal medulla produces "fight-or-flight" responses.
E) The pancreas helps to regulate blood sugar concentration.

24. What is the process called that involves the movement of cells into new relative positions in an embryo and results in the establishment of three germ tissue layers?
A) determination
B) cleavage
C) fertilization
D) induction
E) gastrulation

25. After an action potential, the resting potential is restored by
A) the opening of sodium activation gates.
B) the opening of voltage-sensitive potassium channels and the closing of sodium activation gates.
C) an increase in the membrane's permeability to potassium and chloride ions.
D) the delay in the action of the sodium-potassium pump.
E) the refractory period in which the membrane is hyperpolarized.

26. The postsynaptic membrane of a nerve may be stimulated by certain neurotransmitters to permit the influx of negative chloride ions into the cell. This process will result in
A) membrane depolarization.
B) an action potential.
C) the production of an IPSP.
D) the production of an EPSP.
E) the membrane becoming more positive.

27. Which of the following is incorrectly paired?
A) hair cell-mechanoreceptor
B) muscle spindle-mechanoreceptor
C) gustatory receptor-chemoreceptor
D) electromagnetic energy-photoreceptors
E) motor neuron-thermoreceptor

28. Muscle cells are stimulated by neurotransmitters released from the synaptic terminal of
A) T tubules.

B) motor neuron axons.
C) sensory neuron axons.
D) motor neuron dendrites.
E) sensory neuron dendrites.

29. Which of the following are important biotic factors that can affect the structure and organization of biological communities?
A) precipitation, wind
B) nutrient availability, soil pH
C) predation, competition
D) temperature, water
E) light intensity, seasonality

30. Which of these ecosystems accounts for the largest amount of Earth's net primary productivity?
A) tundra
B) savanna
C) salt marsh
D) open ocean
E) tropical rain forest

31. How is habitat fragmentation related to extinction?
A) Less carbon dioxide is absorbed by plants.
B) More soil is subject to erosion.
C) Populations of organisms in fragments are smaller and, thus, more susceptible to extinction.
D) Animals are forced out of habitat fragments.
E) Fragments generate silt that negatively affects drainages.

32. Buffers are substances that help resist shifts in pH by
A) releasing H^+ in acidic solutions.
B) donating H^+ to a solution when they have been depleted.
C) releasing OH^- in basic solutions.
D) accepting H^+ when the are in excess.
E) both B and D

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33. Which of the following adheres to the extracellular surface of animal cell plasma membranes?
A) fibers of the extracellular matrix
B) fibers of the cytoskeleton
C) the phospholipid bilayer
D) cholesterol
E) carrier proteins

34. Reactants capable of interacting to form products in a chemical reaction must first overcome a thermodynamic barrier known as the reaction's
A) entropy.
B) activation energy.
C) endothermic level
D) heat content.
E) free-energy content.

35. 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

二、解釋（12%,每題 3%,）
1. Torpor
2. Spermatogenesis
3. Operant conditioning
4. Chaperonin

三、問答題（18%,每題 9%）
1. List and briefly define the three stages of cell signaling.
2. Distinguish between active and passive immunity and describe examples of each.

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單選題 50 題　每一題 2 分

1. What is the purpose of a salt bridge in an electrochemical cell?

A) The salt bridge allows ions to move in order to replenish the reactants and remove products.

B) The salt bridge completes the circuit by allowing electrons to flow back to where they started.

C) The salt bridge allows solvent to flow between the compartments replenishing the solution.

D) The salt bridge allows ions to move from one cell to the other to keep them electrically neutral.

2. Based on the following cell diagram $Pt\left|Fe^{2+},Fe^{3+}\right\|Cu^{2+}\left|Cu\right.$, what reaction occurs at the anode?

A) $Fe^{2+} \rightarrow Fe^{3+}$　B) $Fe^{3+} \rightarrow Fe^{2+}$　C) $Cu \rightarrow Cu^{2+}$　D) $Cu^{2+} \rightarrow Cu$

3. When a sparingly soluble salt such as $CaCO_3$ dissolves in water, what chemical equilibrium occurs?

A) The compound in aqueous solution is in equilibrium with the dissociated atoms.

B) The solid compound is in equilibrium with the dissociated atoms in solution.

C) The solid compound is in equilibrium with its conjugate acid and conjugate base.

D) The solid compound is in equilibrium with the dissociated anion and cation.

4. $Cu(CrO_4)$ has a $K_{sp} = 3.6 \times 10^{-6}$. How many grams of $Cu(CrO_4)$ will dissolve in 100 ml of water?

A) 6.5×10^{-4}　B) 0.034　C) 0.68　D) 14.　(Cr: 52, Cu: 63.5)

5. If the half-life of a first-order reaction is 4 hours, how long will it take for the reactant to decrease to 1/8 of its initial value?

A) 8 hours　B) 12 hours　C) 16 hours　D) 32 hours

6. What is the cathode half-reaction in the equation

$2Mn^{2+}(aq) + 5Sn^{4+}(aq) + 8H_2O \rightarrow 2MnO_4^-(aq) + 5Sn^{2+}(aq) + 16H^+(aq)$?

A) $Mn^{2+}(aq) + 4H_2O + 5e^- \rightarrow MnO_4^-(aq) + 8H^+(aq)$　B) $Sn^{4+}(aq) + 2e^- \rightarrow Sn^{2+}(aq)$

C) $Sn^{4+}(aq) \rightarrow Sn^{2+}(aq) + 2e^-(aq)$　D) $Mn^{2+}(aq) + 4H_2O \rightarrow MnO_4^-(aq) + 8H^+(aq) + 5e^-$

7. What is the ground state electron configuration for the element vanadium?

A) $1s^2 2s^2 2p^6 3s^2 3p^4 4s^2 3d^5$　B) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^4$　C) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$　D) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^3$

8. The different types of electromagnetic radiation vary in their

A) speed and frequency.　B) speed and amplitude.　C) speed and wavelength.　D) frequency and wavelength.

背面尚有試題

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9. What is the frequency of the 528 nm green light emitted from an argon ion laser?
A) 1.58×10^{11} B) 1.58×10^{2} C) 5.68×10^{14} D) 5.68×10^{5}

10. Which of the following sets of quantum numbers is NOT allowed?
A) n = 3; l = 2, m_l = +2 B) n = 5; l = 2, m_l = +1 C) n = 2; l = 2, m_l = 0 D) n = 4; l = 2, m_l = -1

11. When a metal complex ion forms in solution, what are the metal ion and ligands acting as?
A) The metal ion acts as a Lewis base, and the ligand acts as a Lewis acid.
B) The metal ion is a Lewis acid, and the ligand is its conjugate base.
C) The ligand is a Lewis base, and the metal ion is its conjugate acid.
D) The metal ion acts as a Lewis acid, and the ligand acts as a Lewis base.

12. Most metal oxides and hydroxides are classified as
A) acidic oxides. B) amphoteric oxides. C) basic oxides. D) highly insoluble.

13. How does a closed system differ from an open system?
A) Energy is conserved in a closed system.
B) A closed system cannot exchange matter with the surroundings.
C) A closed system cannot exchange heat with the surroundings.
D) A closed system does not do any work on the surroundings.

14. Which of the following is NOT true about a state function?
A) The change in a state function depends on the initial and final states.
B) A state function does not depend on the history of the system.
C) The change in a state function depends on the pathway used.
D) The state function only depends on the present state.

15. What types of forces are responsible for the phenomenon of incomplete dissociation?
A) Hydrogen bonding B) Dipole-dipole attractions C) Electrostatic attractions D) Polar covalent bonds

16. What kinds of compounds have increased solubility because of incomplete dissociation?
A) Ionic compounds
B) Molecular compounds
C) Highly charged ionic compounds
D) Covalent network solids

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17. How does the formation of ion pairs affect the solubility of an ionic compound?
A) Ion pairing decreases the solubility of a compound.
B) Ion pairing does not change the solubility of a compound.
C) Ion pairing increases the solubility of a compound.
D) Ion pairing can increase or decrease the solubility.

18. What will occur if 10 ml of 0.500 M sodium acetate solution is added to 90 ml of 0.100 M silver nitrate solution (K_{sp} for silver acetate is 2.0×10^{-3})?
A) The solution will become acidic. B) The solution will remain clear.
C) A precipitate will form. D) Two immiscible liquid layers will form.

19. If a saturated solution of the salt AB has a small amount of another soluble salt of B added, what is expected to occur?
A) The soluble salt will also precipitate from solution.
B) The soluble salt will dissolve and nothing will precipitate
C) The soluble salt will dissolve, and some of the AB will precipitate.
D) Both the soluble salt and AB will precipitate from the solution.

20. What is a catalyst?
A) A catalyst is a molecule that decreases the rate of undesired reactions.
B) A catalyst increases the rate of a reaction but is not changed during the reaction.
C) A catalyst increases the rate of a reaction and is consumed during the reaction.
D) A catalyst helps to direct the course of a reaction but does not increase the rate.

(21~23) Rydberg equation $\frac{1}{\lambda} = R\left[\frac{1}{n_a^2} - \frac{1}{n_b^2}\right]$ **R = 1.0974 × 10^{7}m^{-1}**

21. What is the wavelength of light emitted when an electron in a hydrogen atom changes from the n = 5 state to the n = 2 state?
A) 230 nm B) 304 nm C) 1914 nm D) 434 nm

22. The Paschen series of lines in the atomic spectrum of hydrogen end in the orbit n = 3. What is the wavelength of the second line in the Paschen series?
A) 656 nm B) 1281 nm C) 1875 nm D) 103 nm

23. The Lyman series of lines in the atomic spectrum of hydrogen end in the lowest energy orbit. What is the wavelength of the fourth line in the Lyman series?

A) 121 nm B) 114 nm C) 95 nm D) 364 nm

24. How much work in joules is done on the system when a 1.15 atm external pressure causes a piston to decrease in volume from 6.55 liters to 3.16 liters?

A) -3.90 J B) -394 J C) -761 J D) -367 J E) 3.90 J F) 394 J G) 761 J H) 367 J

25. What is the energy change of the system if a chemical reaction transfers 32,146 J of heat to the surroundings while it causes the expansion of a 1.465 liter vessel to 3.687 liters against a pressure of 3.64 atmospheres?

A) 33.0 kJ B) 31.3 kJ C) 40.2 kJ D) 24.1 kJ E) -33.0 kJ F) -31.3 kJ G) -40.2 kJ H) -24.1 kJ

26. What is the definition of entropy?

A) A thermodynamic property of all substances proportional to their degree of disorder.

B) A thermodynamic property of substances proportional to the degree of order.

C) A thermodynamic property of a substance proportional to its internal energy.

D) A thermodynamic property of a substance proportional to spontaneity.

27. Which of the following processes results in a decrease in the entropy of the system?

A) Melting of ice B) Sublimation of CO_2 C) Condensation of steam D) Dissolving of NaCl in water

28. What is the Gibbs free energy equation?

A) $\Delta G = \Delta H + T\Delta S$ B) $\Delta G = \Delta H - T\Delta S$ C) $\Delta G = \Delta H - P\Delta V$ D) $\Delta G = \Delta S + T\Delta H$

29. When a system is at equilibrium, which of the following is NOT true?

A) The composition of the system is not changing.

B) The forward reaction is occurring at a faster rate than the reverse.

C) Reactants are being converted to products and product converted back to reactants.

D) The forward and reverse chemical reactions are in balance.

30. Consider the reaction $CO(g) + H_2O(g) \leftrightarrow CO_2(g) + H_2(g)$.

Which of the following initial compositions will NOT achieve equilibrium?

A) 1.0 mol of CO_2 and 0.50 mol H_2 B) 0.25 mol CO and 0.75 mol H_2O

C) 0.85 mol CO and 0.25 mol H_2 D) 0.25 mol H_2, 0.35 mol CO_2, and 0.25 mol CO

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31. How is it possible to tell if equilibrium has been achieved?
A) The rate of the forward reaction has decreased to zero.
B) All of the reactants are converted to products.
C) The composition of the system does not change.
D) The concentration of one of the reactants becomes zero.

$C(s) + CO_2(g) \leftrightarrow 2CO(g)$ $\triangle H° = +172.5$ kJ/mol for questions 32 ~ 34

32. What would be the effect of increasing the temperature on the preceding reaction?
A) The reaction would proceed to the product side.
B) The reaction would proceed to the reactant side.
C) The position of the equilibrium would not change.
D) Additional information is needed to answer this question.

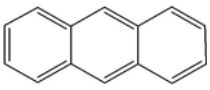
33. What would be the effect on the preceding reaction of decreasing the volume to one-half its original value?
A) The reaction would proceed to the product side.
B) The reaction would proceed to the reactant side.
C) The position of the equilibrium would not change.
D) Additional information is needed to answer the question.

34. What would be the effect on the preceding reaction of adding 2.0 mol of CO?
A) The reaction would shift to the product side.
B) The composition of the system at equilibrium will not change.
C) The reaction will shift to the reactant side.
D) Additional information is needed to answer the question.

35. Acetic acid has a K_a of 1.75×10^{-5}. What is the value of K_b for the acetate ion?
A) 1.75×10^{-5} B) 2.39×10^{-5} C) 5.71×10^{-10} D) 1.75×10^{-19}

36. Which of the following is the strongest acid?
A) CH_3CO_2H B) $ClCH_2CO_2H$ C) CCl_2HCO_2H D) CCl_3CO_2H

37. What would be the most important solute-solvent interaction when anthracene is dissolved in benzene?
A) London dispersion forces B) Dipole-dipole attractions C) Hydrogen bonding D) Iondipole attractions



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38. Based on the reaction $NH_3(aq) + CH_3CO_2H(aq) \leftrightarrow NH_4^+(aq) + CH_3CO_2^-(aq)$, which of the following is a conjugate acid-base pair?

A) $NH_3/CH_3CO_2^-$ B) NH_3/NH_4^+ C) $CH_3CO_2H/NH4^+$ D) NH_3/CH_3CO_2H

39. The water molecule has a bent shape, and the O atom pulls electrons away from the H atoms, which

A) results in the formation of an ionic compound with two hydrogen ions and one oxide ion.

B) makes water a polar molecule with a partial negative charge on the oxygen.

C) results in a nonpolar molecule with no charges on any of the atoms.

D) results in partial negative charges on the hydrogen atoms and a partial positive charge on the oxygen atom.

40. When sodium chloride dissolves in water to form an aqueous solution, which of the following is NOT true?

A) The sodium ions are surrounded by water molecules with the hydrogen atoms directed inward.

B) Each of the cations and anions are surrounded by their own shell of water molecules.

C) The sodium ion and chloride ion are separated from each other by many water molecules.

D) The sodium and chloride ions are each hydrated by water molecules.

41. What is the molar concentration of a solution that is prepared by dissolving 4.79 g of $C_6H_5CO_2H$ in 100 ml of solution?

A) 5.84 M B) 0.392 M C) 0.0479 M D) 0.514 M

42. The lattice energy of an ionic compound is

A) the energy released when an ionic compound is formed from the elements.

B) equal to the enthalpy of formation of the ionic compounds.

C) the energy released when two gas phase ions combine to give an ion pair.

D) the energy released when gas phase ions combine to form a solid ionic compound.

43. Sodium crystallizes in a body-centered cubic unit cell. How many atoms are contained in the unit cell of Na?

A) 1 B) 2 C) 4 D) 9

44. What is the molecular geometry of the $SeCl_4$ molecule?

A) Trigonal bipyramidal B) Tetrahedral C) Square planar D) Seesaw shaped

45. The bonding in the O_2 molecule is best described as

A) nonpolar covalent. B) polar covalent. C) ionic. D) coordinate covalent.

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46. The ideal gas law adequately describes the behavior of real gases when
A) the temperature is low and the pressure is low.
B) the pressure is high and the temperature is low.
C) the pressure is high and the temperature is high.
D) the temperature is high and the pressure is low.

47. A sample of gas occupies a volume of 0.683 liters at 25°C. What volume would the gas occupy at 100°C?
A) 2.73 liters B) 0.546 liters C) 0.854 liters D) 0.171 liters

48. What is diffusion?
A) The motion of a gas through a barrier with a hole in it
B) The gradual mixing of gases due to the motion of the gas molecules
C) The motion of gas particles from one container to another
D) The tendency of some molecules to want to form clusters

49. What is an adhesive force?
A) The intermolecular interactions between molecules in a liquid
B) The forces that make droplets of water form on a surface
C) The attractive forces between the liquid and a substance
D) The forces that allow insects to walk easily on water

50. What is the definition of the normal boiling point of a liquid?
A) The vapor pressure of the liquid at a temperature of 25°C.
B) The temperature when the vapor pressure of a liquid is equal to the applied pressure.
C) The temperature at which the vapor pressure of the liquid is 1 mmHg.
D) The temperature at which the vapor pressure of the liquid is 1 atmosphere.