一、單選題：(請注意答案卷有一定的格式，選擇『正確項』的正確答案，填寫在答案卷『所指定的位置』中，只有在指定位置中的答案才予以計分，若位置錯誤或未填，則不得分。)

1. The extracellular matrix is thought to participate in regulation of animal cell behavior by communicating via (A) DNA codes (B) plasmodesmata (C) integrins (D) the nucleus (E) lipoproteins in the membrane

2. Which of the following help to hold the DNA strands apart while they are being replicated?
(A) single-stranded binding proteins (B) helicase (C) DNA polymerase (D) exonuclease (E) ligase

3. During aerobic respiration, which of the following directly donates electrons to the electron transport chain at the lowest energy level? (A) ATP (B) NADH (C) NAD⁺ (D) FADH₂ (E) ADP + Pi

4. Which of the following is NOT a function of the Krebs cycle? (A) production of NADH (B) production of FADH₂ (C) splitting the carbon skeletons of glucose (D) release of carbon dioxide (E) production of ATP

5. Plasma proteins in humans have many functions. Which of the following is NOT one of them?
(A) maintenance of blood osmotic pressure (B) transport of water-insoluble lipids (C) blood clotting (D) immune responses (E) oxygen transport

6. The major inhibitory neurotransmitter of the brain is (A) norepinephrine (B) acetylcholine (C) dopamine (D) cholinesterase (E) GABA

7. If a human interphase nucleus contained three Barr bodies, it can be assumed that the person (A) is a female (B) has 4 X chromosomes (C) has Turner syndrome (D) is a male (E) has Down syndrome

8. During muscle contraction, the ion that leaks out of the sarcoplasmic reticulum and induces myofibrils to contract is: (A) Ca²⁺ (B) Na⁺ (C) K⁺ (D) Mg²⁺ (E) Fe³⁺

9. Which extraembryonic membrane of a chick embryo is a receptacle for uric acid wastes? (A) allantois (B) chorion (C) yolk sac (D) amnion (E) trophoblast

10. The movement of potassium into or out of an animal cell requires (A) glucose for binding and releasing ions (B) low cellular concentrations of sodium (C) an energy source such as ATP or a proton gradient (D) plant hormones embedded in the cell membrane (E) high cellular concentrations of potassium.

11. Once transcribed, eukaryotic mRNA typically undergoes substantial alteration that includes (A) fusion into circular forms known as plasmids (B) fusion with other newly transcribed mRNA (C) excision of introns (D) linkage to histone molecules (E) union with ribosomes.

12. The thermostat of vertebrates is located in the (A) pituitary gland (B) medulla oblongata (C) hypothalamus (D) subcutaneous layer of the skin (E) heart

13. Transcription of the structural genes in an inducible operon (A) starts when the pathway's product is present (B) does not produce enzymes (C) occurs all the time (D) stops when the pathway's product is present (E) starts when the pathway's substrate is present

14. Prions are infectious particles that are unique in that they are believed to lack (A) proteins (B) mitochondria (C) a membrane (D) RNA (E) any nucleic acid

15. The process of cellular differentiation is a direct result of (A) differences in cellular genomes (B) morphogenesis (C) cell division (D) differential gene expression (E) induction
16. The principal problem with inserting an unmodified mammalian gene into the bacterial chromosome, and then getting that gene expressed, is that (A) bacteria translate polycistrionic messages only (B) bacteria cannot remove eukaryotic introns (C) prokaryotes use a different genetic code from that of eukaryotes (D) bacterial DNA is not found in a membrane-enclosed nucleus and is therefore incompatible with mammalian DNA (E) bacterial RNA polymerase cannot make RNA complementary to mammalian DNA

17. Two potential devices that eukaryotic cells use to regulate transcription are DNA ____________ and histone ____________. (A) methylation; amplification (B) amplification; acetylation (C) acetylation; methylation (D) amplification; methylation (E) methylation; acetylation

18. Secretin (A) stimulates the gastric glands (B) stimulates the release of alkaline products by the pancreas (C) decreases the stomach’s churning activity (D) is released by the salivary glands (E) stimulates the release of digestive enzymes

19. Proton pumps of bacteria probably functioned first for (A) oxidation of food (B) pH regulation (C) photosynthesis (D) ATP synthesis (E) reduction of O₂

20. A 1:2:1 phenotypic ratio in the F₂ generation of a monohybrid cross is a sign of (A) pleiotropy (B) multiple alleles (C) polygenic inheritance (D) incomplete dominance (E) epistasis

21. The meshwork that forms the fabric of a blood clot mostly consists of which protein? (A) fibrinogen (B) fibrin (C) thrombin (D) prothrombin (E) collagen

22. Multicellular animals lacking true tissues are called the (A) protozoa (B) parazoa (C) hydrozoa (D) metazoa (E) eumetazoa.

23. Which of the following could be a preventive approach to reduce schistosomiasis? (A) reduce the freshwater snail population (B) carefully wash all raw fruits and vegetables (C) ensure that all meat is properly cooked (D) reduce the mosquito population (E) purify all drinking water

24. Aspirin and ibuprofen affect the production of (A) interleukins (B) hormones (C) histamine (D) prostaglandins (E) neurotransmitters

25. Osteocytes and chondrocytes are housed in small cavities called (A) lacunae (B) matrices (C) intercellular spaces (D) narrow cavities (E) Haversian systems

26. The female gametangium of pine is called (A) antheridium (B) archegonium (C) embryo sac (D) ovary (E) sporangium

27. The plant hormone related to the “orange agent” in Vietnam War is (A) auxin (B) abscisic acid (C) cytokinin (D) ethylene (E) gibberellin

28. The plant hormone first discovered in Taiwan is (A) auxin (B) abscisic acid (C) cytokinin (D) ethylene (E) gibberellin

29. The structure just outside the plasma membrane of a plant cell with secondary cell wall is (A) cytoplasm (B) middle lamella (C) primary cell wall (D) secondary cell wall (E) vacuole

30. Which length is close to the limit of the light microscope resolution power? (A) 200 μm (B) 2 μm (C) 200 nm (D) 20 nm (E) 2 nm

31. Which statement about moss is NOT correct? (A) gametophyte is dominant (B) male gamete needs water to fertilize egg (C) protonema is diploid (D) young sporophyte performs photosynthesis (E) sporophyte is diploid

32. Mushroom is a member of (A) Ascomycota (B) Basidiomycota (C) Chytridiomycota
33. Which of the following algal groups is with two additional membranes outside the usual chloroplast envelope? (A) brown algae (B) dinoflagellates (C) euglenoids (D) green algae (E) red algae

34. Seed is a mature (A) embryo (B) endosperm (C) nucellus (D) ovary (E) ovule

35. Mycorrhizae are associations of (A) animal skins and fungi (B) cyanobacteria and fungi (C) green algae and fungi (D) hosts and parasites (E) plant roots and fungi

36. Shared derived character states are (A) paralogous (B) paraphyletic (C) parsimonious (D) pleomorphic (E) synapomorphic

37. Which is the highest level among categories listed? (A) class (B) division (C) genus (D) order (E) subphylum

38. Which of the followings is definitely a geographical variation? (A) clade (B) cline (C) clone (D) paedomorphosis (E) polymorphism

39. Which is the first barrier in reproductive process? (A) gametic isolation (B) habitat isolation (C) mechanical isolation (D) reduced hybrid fertility (E) temporal isolation

40. Which of the following species concepts is most useful in fossil study? (A) biological species concept (B) cohesion species concept (C) ecological species concept (D) morphological species concept (E) recognition species concept

41. Which of the followings is most dominant in arctic biomes? (A) chaparral (B) coniferous forest (C) desert (D) savanna (E) tundra

42. Critical period is the most important criterion to distinguish ________ and other learning? (A) associative learning (B) classical conditioning (C) habituation (D) imprinting (E) operant conditioning

43. When one male mating with one female, it is called (A) androgyneous (B) dioecious (C) monogamous (D) polygamous (E) promiscuous

44. The distribution of rice in the cultivated field is (A) clumped (B) dispersive (C) random (D) uniform (E) varied

45. Which of the followings is NOT related to K-selected populations? (A) extensive parental care (B) long lifespan (C) long maturation time (D) low death rate (E) small size of offspring or eggs

46. Which of the followings is a density-dependent factor restricting population growth? (A) competition (B) food supply (C) predator (D) toxic waste accumulation (E) typhoon

47. Species richness is _______ in a particular place. (A) species cover percentage (B) the number of species (C) the number of species individuals (D) where the species most dominant (E) none of the above

48. When the interaction between two species is beneficial to one species but neutral to another species, it is called (A) commensalism (B) competition (C) mutualism (D) parasitism (E) predation

49. When two or more toxic species resemble each other in color, it is called (A) Batesian mimicry (B) coevolution (C) cryptic coloration (D) Mullerian mimicry (E) resource partitioning

50. In an idealized pyramid of net productivity, how much percentage of the energy in each trophic level is converted into new biomass in the trophic level above it? (A) 1% (B) 10% (C) 25% (D) 50% (E) 99%
二、問答題：（請依先後次序回答於答案卷上，50%）

1. From the viewpoint of scientific methodology, why “evolution” is regarded as a scientific discipline but “creationism” is not? (7 points)

2. Draw an angiosperm (flowering plant) embryo sac, and label its components. (10 points)

3. What is an “ecological succession”? Please describe its process, and differentiate between primary succession and secondary succession? (8 points)

4. Explain the following biological terms: (A) Genomic imprinting (B) Epigenesis (C) Koch’s postulates (D) Limbic system (E) Segment polarity genes (15 points)

5. Describe as the best as you can about the 2002 Noble Prize winners in biomedical sciences and their research themes from the level of molecule to the level of organism. (10 points)
1. Describe the role in the living cell of each of the following: (1) DNA, 
   (2) phospholipids, and (3) enzymes. (10 %)

2. Draw a Lineweaver-Burk plot showing the relationship between initial 
   velocity and substrate concentration for an enzyme in the absence and 
   presence of (1) a competitive inhibitor and (2) a noncompetitive 
   inhibitor. (5 %)

3. Explain the biochemical basis for the following treatments: (9 %) 
   (1) Allopurinol is used to treat gout. 
   (2) Methotrexate is used as a cancer chemotherapeutic agent. 
   (3) Mevalonate is used to treat hypercholesterolemia.

4. Describe two major regulation mechanisms for protein activity. (8 %)

5. Describe two methods of protein purification. (8 %)

6. Describe how glucose is completely oxidized into CO₂ and H₂O in 
   vivo. (10 %)

7. Compare the following pairs: (50 %) 
   (1) Anaerobic respiration and fermentation 
   (2) ΔG and ΔG°
   (3) Enzyme and ribozyme 
   (4) Globular protein and fibrous protein 
   (5) Hexokinase and glucokinase 
   (6) Amylose and cellulose 
   (7) Peripheral membrane protein and integral membrane protein 
   (8) Intron and exon 
   (9) Genomics and proteomics 
   (10) Insulin and glucagon
1. Regarding messenger RNA molecules, which of the following statements is NOT correct?
   A. They are transcribed by RNA polymerase II of eukaryotic cells.
   B. They are a class of unstable RNAs that associate transiently with ribosomes.
   C. They carry genetic information from the genes to the ribosomes, which synthesize polypeptides.
   D. They are very short-lived in prokaryotic cells.
   E. Upon initiation of translation, they bind to the first charged amino acid and the large subunit of ribosomes.

2. A zinc finger is an example of
   A. a helix-turn-helix motif.     B. a homeo domain.     C. a copper fist.
   D. a DNA-binding protein.       E. none of the choices.

3. In elongation step of translation, peptide bonds is formed by a peptidyl transferase. Which of the following molecules contains the catalytic center of peptidyl transferase and appears to have peptidyl transferase activity?
   A. 28S rRNA     B. 16S rRNA     C. ribosomal proteins L2
   D. GTPase-activator protein (GAP)       E. EF-Tu

4. The phosphodiester bond of DNA links
   A. base to base, 3'→5'.     B. base to sugar, 3'→5'.
   C. sugar to sugar, 3'→5'.     D. sugar to sugar, 3'→3'.
   E. sugar to sugar, 5'→3'.

5. Which of the following molecules assists proper folding of completed proteins or heat-mediated partially unfolded proteins?
   A. Activator.     B. Attenuator.     C. Topoisomerase.
   D. Photolyase.     E. Molecular chaperones.

6. The E. coli enzyme DNA glycosylase is involved in
   D. Gene conversion.     E. Postreplicative repair.

7. Regarding mechanism of pre-mRNA splicing, which of the following statements is NOT correct?
   A. Introns of pre-mRNA have conserved sequences at splice junctions.
   B. snRNPs bind critical sites on the pre-mRNA.
   C. The snRNAs are transcribed by RNA polymerase II.
   D. The snRNAs associate with accessory proteins.
   E. The snRNPs recognize critical sites for splicing by base pairing.
8. Higher order of chromosome structure result from the interaction of
histones and DNA.
A. True. B. False.

9. Genome projects of several organisms are complete. For studying functional
genomics, it is important to probe the pattern of gene expression in a given
cell type. One of the techniques involved in functional genomics is
A. DNA fingerprinting assay. B. DNase footprinting assay.
E. DNA microarrays and microchips.

10. Essential components involved in the transcription process in prokaryotes are
A. rRNA, tRNA, mRNA, RNA polymerase, dNTPs, Mg$^{++}$.
B. rRNA, RNA polymerase, dNTPs, Mg$^{++}$.
C. Primary transcript, DNA polymerase, NTPs, Mg$^{++}$.
D. dsDNA, RNA polymerase, NTPs, Mg$^{++}$.
E. ssDNA, DNA polymerase, NTPs, Mg$^{++}$.

11. The main means of induction and repression of operons and individual genes
in prokaryotes include the use of
A. repressor. B. promoter. C. activator.
D. silencer. E. all of the choices.

12. An unusual property of inosine, a modified base can be found in tRNA, is
that it can base pair with A, C, G, or U.
A. True. B. False.

13. Unlike tRNAs or rRNAs, there are a much larger range of different mRNAs
in a cell. All cellular proteins are derived from mRNAs.
A. True. B. False.

14. Eukaryotic mRNA differs from prokaryotic mRNA in that eukaryotic mRNA
lacks a modified base at the 5' end.
A. True. B. False.

15. In general, all of the following are true of DNA methylation in eukaryotes
EXCEPT it
A. can be measured using isochizomers.
B. is greater in dominant genes.
C. is greater in active genes.
D. can be unrelated to gene transcription.
E. can be prevented by the use of certain drugs.

II. 配合題：下列16-25題之名詞請自A-J選出最適當之定義。（20%）
16. _____ alternative splicing 21. _____ retrotransposon
17. _____ clone
18. _____ domain
19. _____ homology
20. _____ reading frame
22. _____ trans-acting
23. _____ transition
24. _____ transfection
25. _____ transversion

A. Type of eukaryotic mobile DNA element whose movement in the genome is mediated by an RNA intermediate and involves a reverse transcription process.
B. A mutation in which one purine is replaced with the other purine, or a pyrimidine is replaced by the other pyrimidine.
C. A population of identical cells or DNA molecules descended from a single progenitor.
D. Experimental introduction of foreign DNA into eukaryotic cells in culture, usually followed by expression of genes in the introduced DNA.
E. A mutation event such as G→T or G→C.
F. Property of a regulatory gene that allows it to act even when on a different segment of DNA from the gene being regulated, implies that the gene encodes a regulatory protein.
G. The production of different proteins from the same RNA transcript by splicing it in different ways.
H. Region of a protein with a distinct tertiary structure and characteristic activity.
I. The phase in which nucleotides are read in sets of three to encode a protein.
J. Similarity in the sequence of a protein or nucleic acid or in the structure of an organ that reflects a common evolutionary origin.

III. 項目（第 26-29 題）:
26. An operon usually contains a series of clustered genes which are transcribed into a single mRNA. The genes in a given operon often encode for several enzymes active in a single metabolic pathway. How can these metabolic related enzymes be produced under one operon and one single mRNA molecule? (5%)
27. (A) What is an enhancer? (B) What are the similarities and differences between an enhancer and a promoter? (C) Describe the features of enhancers. (10%)
28. (10%) Contrast and compare prokaryotic and eukaryotic gene expression with respect to:
   A. degree of coupling of transcription and translation
   B. number of gene products on a primary transcript
   C. number of proteins arising from the translation of a primary transcript
   D. organization of genes in operons
   E. presence of introns and alternative splicing
29. Define RNA interference and discuss its role in the cell and its application to the research of molecular cell biology. (10%)
1. In recording cell membrane potential, scientists found that cells are typically inside negative. Explain how this condition arises. (10%)

2. Compare action potentials recorded from skeletal muscle and cardiac muscles. Indicate the major differences and explain the causes of the difference. (15%)

3. Hypothalamus has been considered the master of neuroendocrine systems. Please list all the functions you know about hypothalamus. (15%)

4. The following arterial blood gas data was obtained from a male patient: PaCO₂ = 50 mmHg, PaO₂ = 87 mmHg, pH=7.37, [HCO₃⁻] = 27.5 mmol/L.
   (a). Describe the acid-base status of this patient. (5%)
   (b). Distinguish between the respiratory and metabolic components of acid-base balance. (5%)
   (c). What are some of the causes of acid-base disturbances. (5%)

5. Explain how kidney can regulate systemic blood pressure. (15%)

6. Explain the cardiovascular changes (including cardiac output and arterial blood pressure) associated with exercise in mammals. (15%)

7. The diagram below is an oxygen-hemoglobin dissociation curve. (15%)
   (a). What direction would this curve be shifted by increases in hydrogen ions, CO₂, body temperature and blood DPG (2,3 diphosphoglycerate)?
   (b). What would the curve change when small amount of carbon monoxide has been administered.
問答題:

1. Describe in detail how the immune system fights against the extracellular and intracellular bacterial infections? (20%)
2. From the immunological point of view, please explain why the infection of SARS virus resulted in such a dreadful disease among certain human population. (10%)
3. What is allelic exclusion? Why is it important in the immune response? (10%)
4. Describe the mechanisms for the induction of autoimmunity. (10%)
5. Describe what are the co-stimulatory signal and how it operates in activation of T cell. (10%)
6. Describe how the influenza viral antigen presented during influenza viral infection? (10%)

解釋名詞: 30%，每題 3 分
1. MHC restriction 6. Complete Freund’s adjuvant
2. Affinity maturation 7. MALT
3. IL-1 8. Delayed type hypersensitivity
4. C1q 9. Ig class switching
5. T-cell epitope 10. Positive selection
Multiple Choice (2 points each)

1. Why are blue filters used on the light source of light microscopes?
   a. to make clear cells appear blue
   b. decrease resolution
   c. they decrease reflection
   d. they cause the specimen to fluoresce
   e. they allow only shorter wavelengths of light to pass through

2. What dye in the Gram stain do Gram positive bacteria retain?
   a. safranin  b. iodine  c. crystal violet  d. methylene blue  e. malachite green

3. The technique of heat-fixing a specimen is:
   a. used to prepare a hanging drop
   b. a procedure used in electron microscopy but not in light microscopy
   c. only used in simple-stain techniques
   d. used to make wet mounts
   e. a procedure that causes the microbial cells to adhere to the slide

4. A microbiologist uses a stain on specimen that when viewed on a microscope shows clear cells against a stained background. Which of the following pertains to this stain:
   a. it had to involve a basic dye
   b. it is designed to stain cell walls rich in lipids
   c. the microbiologist probably overdecolorized the cells
   d. it is called a negative stain
   e. the specimen was improperly heat-fixed

5. Lipopolysaccharide:
   a. is found in all bacterial cell walls
   b. can induce fever and dilation of blood vessels in infected patients
   c. is extremely thick in gram positive bacteria
   d. is found in the periplasmic space
   e. is found in cells that will appear purple after the gram stain

6. Which one of the following allows bacterial cell motility?
   a. plasmid  b. cilia  c. flagella  d. pill  e. capsule

7. Which term is used to describe flagella that are found all over the surface of the bacterial cell:
   a. amphotrichous  b. peritrichous  c. lophotrichous  d. monotrichous  e. Zetrichous

8. If a student accidentally inoculates a bacterial culture into a hypertonic solution instead of balanced nutrient broth, which of the following describes the inoculated culture:
   a. the solution has a lower solute concentration compared to the cells
   b. the solution has a higher water concentration compared to the cells
   c. water will leave the cells
   d. water will enter the cells
   e. the cells will burst

9. Which of the following movements require the cell to use ATP:
   a. facilitated diffusion  b. movement from an area of high to low concentration
   c. osmosis  d. diffusion  e. movement from an area of low to high concentration

10. A microbiologist detects a thick polysaccharide structure tightly bound to the external cell wall surface of a prokaryotic cell. Which pertains to the cell:
    a. can easily attach to a surface  b. motile  c. resistant to heat and harsh chemicals
    d. resistant to being phagocytized  e. photosynthetic

11. Where would you expect to find an exoenzyme participating in a chemical reaction:
    a. inside mitochondria  b. in the cytoplasm  c. inside the lysosome
    d. outside the cell membrane  e. inside the cell membrane
12. Which pathway begins with a reaction that produces citric acid:
   a. fermentation  b. glycolysis  c. photosynthesis  d. Kreb's cycle
e. electron transport chain

13. Laboratory analysis of an unknown microorganism shows that the organism has the following characteristics: 1. utilizes glucose to form lactic acid  2. grows in an anaerobic environment. This organism's utilization of glucose could be termed:
   a. photosynthesis  b. respiration  c. biosynthesis  d. facultative  e. fermentation

14. What is the name of the biochemical sequence that degrades glucose to pyruvate yielding ATP:
   a. Kreb's cycle  b. glycolysis  c. respiration  d. fermentation  e. photosynthesis

15. Before entering the Kreb's cycle what must first happen to pyruvate:
   a. addition of oxaloacetic acid  b. addition of citric acid
c. removal of carbon as CO₂ and addition of coenzyme A  d. transfer of electrons to oxygen
e. accept of electrons from NADH

16. A microorganism in a polluted lake that is oxidizing proteins and other organic compounds for carbon and electron sources while utilizing light energy would be termed a:
   a. chemoaotroph  b. chemoheterotroph  c. photoautotroph  d. photoheterotroph
e. cyanobacteria

17. In what phase of a bacterial growth curve do cell deaths equal new cells formed?
   a. log phase  b. lag phase  c. stationary phase  d. decline phase  e. generation phase

18. A bacterium that can grow with or without the presence of oxygen is called a(n):
   a. microaerophile  b. facultative anaerobe  c. obligate anaerobe  d. obligate aerobic
e. capnophile

19. A microbiology student noticed that a culture broth tube was very turbid at the surface but clear throughout the rest of the tube. What can this student correctly conclude:
   a. the broth is sterile  b. the organisms cannot tolerate oxygen  c. the organisms are aerobes
d. the organisms should be put in a candle jar  e. the organisms cannot produce superoxide dismutase and/or catalase

20. A medium which contains substances whose exact chemical composition is known is called a(n) medium:
   a. selective  b. complex  c. natural  d. differential  e. synthetic defined

21. If a food product is not prepared properly to kill microbes before canning, which type of microbe is most likely to grow in the canned food:
   a. microaerophile  b. capnophile  c. aerobe  d. anaerobe  e. acidophile

22. A pour plate is made with 1 ml of a 1/1000 dilution of milk. After incubation, 50 colonies are counted. How many bacteria/ml are in the milk:
   a. 5  b. 50  c. 500  d. 5,000  e. 50,000

23. What does ligase do during replication of DNA:
   a. makes copies of mRNA from DNA  b. removes damaged sections of DNA
c. joins together mRNA  d. joins together DNA segments
e. digests mRNA when it is no longer needed

24. What is the inducer for the lactose operon:
   a. tryptophan  b. the z gene  c. lac repressor  d. lactose  e. glucose

25. A bacterium that undergoes a mutation causing it to be nutritionally deficient is called a(n):
   a. progeny  b. wild types  c. prototrophs  d. auxotrophs  e. mutagen
26. Which of the following best describes a prophage:
   a. a phage about to enter lytic cycle within a bacterial cell
   b. a plasmid
   c. a phage that has inserted its genetic material into bacterial DNA
   d. a virus infecting yeast only
   e. a gene coding for the production of pili

27. Which method of gene transfer can transfer the greatest amount of genetic material:
   a. specialized transduction
   b. transformation
   c. generalized transduction
   d. bacteriophage
   e. conjugation

28. A unicellular heterotroph with a nucleus and cilia should be placed in which kingdom?
   a. Fungi
   b. Monera
   c. Protista
   d. Plantae
   e. Animalia

29. Which of the following is the BEST method to determine bacteriophage concentration in a sample:
   a. spectrophotometer
   b. plaque assay
   c. light microscopy
   d. animal inoculation
   e. biochemical tests

30. PriOus:
   a. are infectious particles not destroyed by DNase or RNase
   b. are infectious pieces of RNA
   c. are also called viroids
   d. are easily inactivated at 90°C
   e. is the name given to latent viruses

31. The protein outer coat of a virus particle is called:
   a. nucleocapsid
   b. capsomere
   c. genome
   d. capsid
   e. cell wall

32. Which of the following viruses is capable of reverse transcription of their nucleic acid followed by
    integration of this DNA as a provirus into the host chromosome:
   a. Herpes simplex
   b. papillomavirus
   c. HIV
   d. Hepatitis B virus
   e. rabies virus

33. What do all prophages and proviruses have in common:
   a. have reverse transcriptase
   b. integrate into host DNA
   c. are oncogenic
   d. are infectious proteins without nucleic acid
   e. infect only bacterial cells

34. Malaria, typhus, plague and Lyme disease are all diseases:
   a. caused by protozoans
   b. caused by insects
   c. transmitted by mosquitoes
   d. involving helminths
   e. in which the pathogens are transmitted by arthropods

35. Some protozoa form a thick-walled structure that provides protection against harsh conditions: This
    structure is called a/an:
   a. pellicle
   b. spore
   c. capsule
   d. plasmodium
   e. cyst

36. Before use, surgical instruments must be:
   a. disinfected
   b. pasteurized
   c. sanitized
   d. sterilized
   e. boiled

37. If the phenol coefficient of disinfectant A is 7.5, and the phenol coefficient of disinfectant B is 0.5,
    and the phenol coefficient of disinfectant C is 30.0, what conclusion can be made:
   a. disinfectant B is more effective than phenol
   b. disinfectant C is less effective than phenol
   c. disinfectant A is less effective than phenol
   d. of the three test agents, disinfectant C has the greatest effect compared to phenol
   e. agent C was exposed to the test microbes for a longer time than agents A & B

38. If a microbiology lab sets up a Kirby-Bauer assay, which of the following will pertain to this test:
   a. pathogen is added to serial dilutions of various antimicrobial
   b. after incubation, an agar plate with the pathogen will show various zones of inhibition
   c. reflecting the microbe's sensitivity or resistance to each drug
   d. the lab will be able to tell if a pathogen was killed or merely inhibited by each drug
   e. a patient's serum is tested for its bactericial action
39. Endotoxins differ from exotoxins in that only endotoxins:
   a. are proteins  b. are secreted during the log growth phase  c. are usually sensitive to heat
   d. have a specific site of action in animals  e. are found only in gram negative bacteria

40. Pili or fimbria enable bacteria to establish infections on mucosal surfaces because they:
   a. inhibit phagocytosis  b. dissolve mucin  c. attach bacteria to cell surfaces
   d. damage cytoplasmic membrane of blood cells  e. induce fever

41. An elderly patient in a nursing home comes down with influenza and then a week later develops a
    pneumonia caused by Streptococcus pneumoniae. The pneumonia that develops is considered a/a
    a. septicemia  b. mixed infection  c. secondary infection  d. subclinical infection
    e. focal infectio

42. Which type of disease is acquired by a larger percentage of the population at one time or a greater
    number than past history indicates:
    a. epidemic  b. sporadic  c. endemic  d. indigenous  e. zoonoses

43. A disease that occurs naturally in animals while a human serves as an accidental host is called:
    a. epidemic  b. endemic  c. zoonosis  d. pandemic  e. nosocomial

44. A pregnant, HIV positive woman transmits the virus to her fetus. This is an example of:
    a. horizontal transmission  b. vector transmission  c. droplet nuclei
    d. vertical transmission  e. a sexually transmitted disease

45. Lysozyme and the antibiotic penicillin have similar mechanisms of action in that they both cause
    damage to the bacterial:
    a. cell membrane  b. capsule  c. cell wall  d. DNA  e. ribosomes

46. Neonates acquiring immunoglobulins from mother's breast milk is an example of which type of
    immunity:
    a. natural active  b. artificial active  c. natural passive  d. artificial passive
    e. innate immunity

47. All of the following cause hemorrhagic fevers EXCEPT:

48. The process of forming nitrates from ammonia is called:
    a. photosynthesis  b. nitrogen fixation  c. denitrification  d. nitrification  e. sulfate reduction

49. Most numerous microorganisms in the soil:
    a. viruses  b. protozoans  c. algae  d. bacteria  e. fungi

50. When analyzing a water sample to see if it's potable, the presence of which of the following will
    help in the determination:
    a. nitrifying bacteria  b. anaerobes  c. algae  d. oxygen levels  e. coliforms
Questions: 100%

1. Describe the chemiosmotic synthesis of ATP in isolated chloroplast.
2. Describe the crassulacean acid metabolism.
3. Describe the chemiosmotic-polar diffusion model for polar transport of IAA in tissues.
4. Describe the action of phytochrome.
5. Describe the relationship between IAA and root gravitropism.
I. 解釋名詞，並舉例說明之：每一子題 5 分（共 40 分，40%）
   1. functional response
   2. haplodiploidy
   3. cohort life table
   4. character displacement
   5. Batesian mimicry
   6. intrasexual selection
   7. tolerance model
   8. per capita rate of increase

II. 問答題，每一子題 15 分（共 60 分，60%）

   9. What are the short-term and long-term effects of tropical deforestation?

   10. Describe the various types of wetlands and explain the ecological and economic value of wetlands in the world.

   11. Describe circadian rhythms and their relation to the biological clock of animals. What are the adaptive values of seasonal synchronization for a seasonal breeder?

   12. What are advantages and disadvantages of sexual and asexual reproduction? Discuss from the ecological and evolutionary points of views.
問答題

一、請就系統發生學（phylogeny）的探討上，形態與分子特徵二者之優缺點加以討論。 （15 分）

二、請敘述如何應用形態與分子證據去探討植物的雜交問題。 （20 分）

三、在植物分類上，松葉蘚（Psilotum）之分類地位為何，請討論之。 （15 分）

四、請列出台灣之原生植物五種（不同科）之中名、學名與科名，並作檢索表區分此五種植物。 （20 分）

五、染色體資料，有那些可應用於植物之系統分類上，請討論之。 （15 分）

六、一張具有科學研究價值的植物標本，最好具有那些資訊？又至少應包含哪些項目？請討論之。 （15 分）
1. Explain the following terms:
   Type I error, null hypothesis, statistical power, continuous probability distribution
   (10 pts)

2. There were 1500 SARS cases in Hong Kong, which has a population of
   approximate 6,000,000 in April 2003. What is the probability of a family of 5
   observing 3 or more cases in April? What is the probability of exactly 4 cases?
   (15%)

3. The final grades of students from two classes of biostatistics are shown below:
   Class 1  90, 80, 70, 70, 60, 60
   Class 2  100, 100, 90, 90, 80, 80, 70
   a. Calculate the sample variance for each class. Is there a significance difference in
      variances between classes?
   b. Is there a significant difference of mean grades between two classes?
      (30%)

4. The following are the body lengths and weights of 5 rats.

<table>
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<tr>
<th>1</th>
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<th>3</th>
<th>4</th>
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<tr>
<td>weight</td>
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<td>140</td>
<td>132</td>
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</table>

   Compute the correlation coefficient and test whether it is significantly different from
   zero. (25 pts)

5. The seeds of peas of F2 generation in Mendel's experiment were thought to follow
   a 9:3:3:1 ratio of round, yellow; round, green; wrinkled, yellow; wrinkled, green
   phenotypes. The observed frequencies are shown below:

   round, yellow  315  
   round, green   108  
   wrinkled, yellow 101  
   wrinkled, green  32  

   Test the hypothesis that the sample comes from a population having the proposed ratio.
   (20 pts)