

國立高雄大學九十六學年度研究所碩士班招生考試試題

科目：專業英文  
考試時間：100 分鐘

系所：生物科技研究所甲組  
          生物科技研究所乙組    是否使用計算機：否  
本科原始成績：100 分

I、請依題意寫出其所代表之生物科技專有名詞英文全名(以中文作答者不計分)：每題 2 分

1. Nucleotide sequences copied from DNA that serve as genetic code for synthesizing a protein and is then bound and “read” by ribosomes to produce proteins.
2. A genetically identical copy of a cell or whole organism; also describes the process of making copies of a gene, cell, or organism.
3. Laboratory technique for separating protein molecules by gel electrophoresis and transferring (blotting) proteins onto a filter paper blot that is usually probed with antibodies to study protein structure and function.
4. Enzyme that fills in gaps of DNA nucleotides at the ends of chromosomes that remain after DNA polymerase has copied DNA.
5. Immature (undifferentiated) cells that are capable of forming all mature cell types in animals and that can be derived from embryos at several days of age or from adult tissues.
6. Small, circular, self-replicating double-stranded DNA molecules found primarily in bacterial cells. They often contain genes coding for antibiotic resistance proteins and are routinely used for DNA cloning experiments.
7. Interdisciplinary science that involves developing and applying information technology (computer hardware and software) for analyzing biological data such as DNA and protein sequences; also includes the use of computers for the analysis of molecular structures and creating databases for storing and sharing biological data.
8. A single type of antibody that is directed against a specific epitope (antigenic determinant) and is produced by a hybridoma cell line, which is formed by the fusion of a lymphocyte with a myeloma cell.
9. A technique for detecting specific molecules in a mixed sample. An antibody (primary) is bound to the target molecule; another antibody (secondary), which binds to the primary antibody, is added later. The secondary antibody has attached to it an enzyme that can convert a colorless substrate into a colored product. If the target molecule is not present in the sample, washing steps will remove both antibodies, and no colored product will be produced.
10. The occurrence of variations in the lengths of certain DNA fragments that are produced after cleavage with type II restriction endonuclease. The differences in DNA lengths are due to the presence or absence of a specific restriction endonuclease recognition site(s) and are detected by DNA hybridization with DNA probes after separation by gel electrophoresis.
11. A technique for amplifying a specific segment of DNA by using a thermstable DNA polymerase, deoxyribonucleotides, and primer sequences in multiple cycles of denaturation, renaturation, and DNA polymerization.

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12. Gene unit common in bacteria; typically consists of a series of genes, located on adjacent regions of a chromosome, that are regulated in a coordinated fashion.
13. The segment of a Ti plasmid that is transferred and integrated into chromosomal sites in the nuclei of plant cells.
14. A spherical particle of lipid molecules in which the hydrophobic portions of the molecule are facing inward; a lipid vesicle with an aqueous interior that can carry nucleic acids, drugs, or other therapeutic agents.
15. A collection of complementary DNA clones that were generated in vitro from the mRNA sequences of a single tissue or cell population.
16. A mass of undifferentiated plant tissue from tissue cuttings or from individual plant cells, grown in culture on defined medium.
17. Containers for growing cultures of microorganisms or mammalian cells in a batch process. Fermenting vessels allow scientists to carefully control and monitor growth conditions such as temperature, pH, nutrient concentration, and cell density.
18. Laboratory technique involving the use of yeast to join together different proteins (creating a hybrid protein) as a way to study protein function.
19. Substances produced by microorganisms that inhibit the growth of other microorganisms and are commonly used to treat bacterial infections in humans, pets, and farm animals.
20. A harmless variant or derivative of a pathogen that stimulates a host's immune system to mount defenses against the pathogen.

II、閱讀測驗(請從選項中選出一個最適合的答案，標明題號並依序作答，每題 2 分)

Environmental pollution with metals and xenobiotics is a global problem, and the development of phytoremediation technologies for the plant-based clean-up of contaminated soils is therefore of significant interest. Phytoremediation technologies are currently available for only a small subset of pollution problems, such as arsenic. Arsenic removal employs naturally selected hyperaccumulator ferns, which accumulate very high concentrations of arsenic specifically in aboveground tissues. Elegant two-gene transgenic approaches have been designed for the development of mercury or arsenic phytoremediation technologies. In a plant that naturally hyperaccumulates zinc in leaves, approximately ten key metal homeostasis genes are expressed at very high levels. This outlines the extent of change in gene activities needed in the engineering of transgenic plants for soil clean-up. Further analysis and discovery of genes for phytoremediation will benefit from the recent development of segregating populations for a genetic analysis of naturally selected metal hyperaccumulation in plants, and from comprehensive ionomics data – multi-element concentration profiles from a large number of Arabidopsis mutants.

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1. What is phytoremediation?
  - (A) the environmental pollution with metals and xenobiotics
  - (B) the contaminated soils
  - (C) a plant that naturally hyperaccumulates zinc in leaves
  - (D) a large number of Arabidopsis mutants
  - (E) the clean-up of contaminated soils through plant-based methods
2. What is the best suitable topic of this passage?
  - (A) The environmental pollution
  - (B) Phytoremediation technologies do not work for pollution problems
  - (C) It is necessary to use the engineering of transgenic plants for soil clean-up
  - (D) Phytoremediation: novel approaches to cleaning up polluted soils
  - (E) Ten key metal homeostasis genes are expressed at very high levels in a plant
3. According to the passage, what event outlines the extent of change in gene activities needed in the engineering of transgenic plants for soil clean-up?
  - (A) Arsenic removal employs naturally selected hyperaccumulator ferns
  - (B) Global environmental pollution problems
  - (C) Approximately ten key metal homeostasis genes are expressed at very high levels in a plant that naturally hyperaccumulates zinc in leaves.
  - (D) Elegant two-gene transgenic plant approaches
  - (E) Further analysis and discovery of genes from soil bacteria
4. What are metal homeostasis genes?
  - (A) genes turn on in a zinc-hyperaccumulated plant
  - (B) genes regulate the balance of metal concentration in plant
  - (C) genes turn off in a zinc-hyperaccumulated plant
  - (D) genes turn on in a metal concentration increased plant
  - (E) genes turn on to decrease the metal concentration in plant
5. What is ionomics?
  - (A) the field to study of how genes regulate all the ions in a cell
  - (B) the field to study phytoremediation
  - (C) a large number of Arabidopsis mutants
  - (D) a genetic analysis of naturally selected metal hyperaccumulation in plants
  - (E) a comprehensive ionic database

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Infected birds have been the primary source of influenza A (H5N1) infections in humans in Asia. Studies of isolates of avian influenza A (H5N1) from patients in 1997 revealed that virulence factors included the highly cleavable hemagglutinin that can be activated by multiple cellular proteases. Transmission between humans is very limited at present, but continued monitoring is required to identify any increase in viral adaptation to human hosts. Avian influenza A (H5N1) in humans differs in multiple ways from influenza due to human viruses, including the routes of transmission, clinical severity, pathogenesis, and perhaps, response to treatment. Case detection is confounded by the nonspecificity of initial manifestations of illness, so that detailed contact and travel histories and knowledge of viral activity in poultry are essential. Commercial rapid antigen tests are insensitive, and confirmatory diagnosis requires sophisticated laboratory support. Unlike human influenza, avian influenza A (H5N1) may have higher viral titers in the throat than in the nose, and hence, analysis of throat swabs or lower respiratory samples may offer more sensitive means of diagnosis. Recent human isolates are fully resistant to M2 inhibitors, and increased doses of oral oseltamivir may be warranted for the treatment of severe illness. Despite recent progress, knowledge of the epidemiology, natural history, and management of influenza A (H5N1) disease in humans is incomplete. There is an urgent need for more coordination in clinical and epidemiologic research among institutions in countries with cases of influenza A (H5N1) and internationally.

6. What is the major source of H5N1 infections in humans in Asia?
  - (A) avian
  - (B) swine
  - (C) bovine
  - (D) equine
  - (E) canine
7. What does the “H” and “N” represent in H5N1, respectively?
  - (A) human, nature
  - (B) hemagglutinin, neuraminidase
  - (C) hemoglobin, neutralization
  - (D) hemoglobin, nature
  - (E) human, neuraminidase
8. According to the passage, which of following statements is true?
  - (A) Commercial diagnostic tests for H5N1 antigen are rapid, sensitive, and specific.
  - (B) Hemagglutinin is inactivated after multiple cellular proteases digestion.
  - (C) So far, influenza A (H5N1) virus transmission between humans is very limited.

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(D) Analysis samples from nose may offer more sensitive means for influenza A (H5N1) virus diagnosis.

(E) Knowledge of the epidemiology, natural history, and management of influenza A (H5N1) disease in humans is well studied.

9. What is "oseltamivir"?

- (A) a kind of virus
- (B) antigen of influenza A (H5N1) virus
- (C) virulence factors of influenza A (H5N1) virus
- (D) drug for the treatment of influenza A infection
- (E) a protease to cleave hemagglutinin

10. According to the passage, why the detailed contact and travel histories of patient and knowledge of viral activity in poultry are essential?

- (A) Avian influenza A (H5N1) in humans differs in multiple ways from influenza due to human viruses, including the routes of transmission, clinical severity, pathogenesis, and perhaps, response to treatment.
- (B) They may offer more sensitive means of virus diagnosis.
- (C) It is useful to coordinate the researchers in clinical and epidemiologic research among institutions in countries with cases of influenza A (H5N1) and internationally.
- (D) It is useful to develop new drug to treat the infected patient.
- (E) The initial manifestations of illness are nonspecific and causing case detection is confounded.

Vaccines have saved countless lives. But there are still diseases that cause large numbers of cases and deaths, such as dengue and malaria, for which vaccines have been sought for decades but always seem to be five years in the future. Other important diseases like Ebola and Lassa fevers are crying out for vaccines, which are under development but still predicted to take years before they will be generally available. Apart from transfusion with immune serum from survivors, specific treatments were actually available for many diseases before the era of antibiotics and modern vaccines. Among the most effective was serum therapy with antitoxins and toxoids produced in horses against diphtheria, tetanus, and other diseases. The use of horse serum survives today in the treatment of human botulism; the US Centers for Disease Control and Prevention holds an emergency supply of trivalent horse antitoxin, released to treat the rare human cases that occur annually. Human convalescent serum has been used to treat Lassa fever patients in West Africa; the results are controversial but the therapy merits further testing. To date, not enough Ebola fever patients have so far been treated with the extremely rare convalescent serum (there aren't many

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survivors) to draw any conclusions about the efficacy of passive immunization in that disease.

But there are diseases for which we know passive immunization works. Why hasn't the serum of millions of dengue convalescents been pooled and the dengue immunoglobulin extracted, just as rabies immunoglobulin is produced from the serum of vaccinees? Why hasn't the same been done with serum from malaria immune people? It's not because of the known limitations of horse serum. In some people it produced serum sickness, so the therapy could not be used on everyone. Virus infections each produce a specific immune response, and a subsequent infection by a virus of the same group produces not only a specific response to itself, but also a boost in immunity to the first. Therefore, because of these cross-reactions, a horse serially immunized against only two or three different viruses could produce a serum effective to treat a whole range of hemorrhagic fevers. So, all the pieces are in place to produce a broad-spectrum arenavirus antiserum, which could save many lives while specific vaccines are being developed and certified. This path of proven technology to produce horse antisera could lead to licensed passive immunization products faster than the new generation of bioengineered vaccines, and offer valuable protection in the interim.

11. Which of the following diseases caused by bacteria?

- (A) diphtheria and tetanus
- (B) dengue and Ebola fever
- (C) malaria and dengue fever
- (D) malaria and tetanus
- (E) diphtheria and malaria

12. According to the passage, which of following statements is NOT true?

- (A) There are effective vaccines against malaria and dengue fever for human use already
- (B) Serum therapy is a kind of passive immunization.
- (C) Vaccines have rescued countless lives. But there are still many diseases that cause large numbers of cases and deaths without vaccines.
- (D) The Ebola fever patients have so far rare been treated with convalescent serum because the virus infection is high mortality.
- (E) The horse antisera could lead to licensed passive immunization products and offer valuable protection before the new generation of bioengineered vaccines produced.

13. What is convalescent serum?

- (A) serum produced from horse
- (B) serum from patients recently recovered from a disease
- (C) usually used for the induction of active immunity
- (D) serum produced after vaccine immunization
- (E) a kind of virus vaccine

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14. The serum use for the treatment of human botulism today produced from

- (A) bovine
- (B) equine
- (C) canine
- (D) swine
- (E) feline

15. What is "serum sickness"?

- (A) serum from a sick animal and transmits the disease to others
- (B) serum contains virus and causes human infection
- (C) symptoms are similar to allergic reaction typically develops after exposure to antiserum
- (D) the phenomena of serum lack of suitable storage
- (E) serum used in cell culture which causes the cell death

Personalized management of cancer means the prescription of specific therapeutics that is best suited for an individual patient and the type of tumor. Molecular diagnostics influences cancer management in several ways that aid personalization. These technologies are enabling the classification of cancer, using molecular profiles, as a basis for more effective personalized therapies. Using microarrays, classification of a cancer based on the gene expression profile is important for personalizing cancer therapy. Molecular imaging, such as by positron emission tomography, enables determination of tumor response to drug action at the molecular level. The combination of diagnostics with therapeutics -- an important feature of personalized cancer therapy -- is facilitated by the use of monoclonal antibodies and nanobiotechnology. Development of drug resistance -- an important problem in cancer management -- varies according to the anticancer agent, type of tumor and individual patient. There are no universal strategies to overcome drug resistance in cancer. Various efforts to deal with this problem should be tailored to each patient. A better understanding of cancer biology will facilitate rational drug discovery for cancer, by linking the various pathways involved to targeted therapies. Oncoproteomics will play an important role in the development of personalized cancer therapy. Use of pharmacogenomic technologies in early clinical trials is enabling rapid assessment of the efficacy of anticancer agents, and reducing the time of drug development. Application of pharmacogenetics will reduce the adverse effect of anticancer drugs. Cell/gene therapies, cancer vaccines and RNA interference will facilitate the development of personalized cancer therapy.

16. According to the passage, what method can be used to measure the tumor response to drug action at the molecular level?

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- (A) molecular diagnostics
  - (B) microarray
  - (C) positron emission tomography
  - (D) monoclonal antibody
  - (E) RNA interference
17. What is the important feature of personalized cancer therapy?
- (A) the classification of cancer
  - (B) cancer vaccines
  - (C) nanobiotechnology
  - (D) diagnostics combine with therapeutics
  - (E) cell/gene therapies
18. Which of following event/method will impede the development of personalized cancer therapy?
- (A) cancer vaccines
  - (B) RNA interference
  - (C) microarrays
  - (D) drug resistance
  - (E) pharmacogenomic technologies
19. Which of following statements is NOT true?
- (A) Oncoproteomics is the term used to describe the application of proteomic technologies in oncology and parallels the related field of oncogenomics
  - (B) There are no universal strategies to conquer drug resistance in cancer.
  - (C) A better knowledge of cancer biology combine with diagnostic and therapeutic methods will speed rational drug research and development for personalized treatment of cancer.
  - (D) Pharmacogenomic technologies can assess the efficacy of anticancer agents rapidly, shorten the time of drug development, and reduce the adverse effect of anticancer drugs.
  - (E) Cancer vaccine can be used as cancer classification based on the gene expression profile
20. The author mentioned that various efforts to deal with the cancer therapy problem should be tailored to each patient. What does the “tailored” mean?
- (A) work hard
  - (B) treatment with new anticancer drug
  - (C) reduce the course of treatment
  - (D) treatment with cell/gene therapies
  - (E) depend on individual patient’s situation

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III、重點摘錄(閱讀完下文後，請以條列方式摘錄文章中 4 項重點，用中文作答，專有名詞可以直接用英文表示，每項 5 分，英文作答者不計分。)

RNA silencing is a general phenomenon in eukaryotic organisms and plays important roles in diverse biological processes including developmental regulation, antiviral defense and chromatin remodeling. The key features of RNA silencing include the production of ~21–25 nt small RNAs by Dicer and the formation of Argonaute (AGO)-containing RNA-induced silencing complexes (RISCs) that directly carry out gene silencing at the transcriptional or post-transcriptional level. In plants, the RNA interference (RNAi) machinery responds to a variety of triggers including viral infection, transgenes, repeated elements and transposons. All of these triggers lead to silencing outcomes ranging from mRNA degradation to translational repression to chromatin remodeling. Thus, plants offer us a potentially unique opportunity to understand the full range of RNAi effector mechanisms.

In plants, there are three RNA silencing pathways. The first comprises post-transcriptional gene silencing (PTGS) mediated by ~21 nt small interfering RNAs (siRNAs) that are processed from double-stranded RNAs (dsRNAs). The source of dsRNAs includes replication intermediates of plant RNA viruses, transgenic inverted repeats, and products of RNA-dependent RNA polymerases (RdRps). The second pathway involves a class of endogenous small RNAs, microRNAs (miRNAs). MiRNAs are generated by Dicer-like 1 (DCL1) from miRNA precursors that are transcribed from miRNA genes. MiRNAs down-regulate gene expression through base-pairing to target mRNAs, leading to either the degradation of mRNAs or the inhibition of translation or both. The third pathway is transcriptional gene silencing (TGS) that is associated with siRNA-directed chromatin modifications including DNA and histone methylation.

(題目結束，以下空白)

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**I. Single-choice questions (2 points each)**

- 1. What did Watson and Crick suggest to be significant about the base pairing found in the helix?**  
(A) It allowed the DNA to twist in a helix; (B) The DNA could be circular;  
(C) It was a mechanism for copying; (D) All of the above; (E) None of the above.
- 2. What are the primary chemical components present in a phosphate buffer at pH 7.4?**  
(A)  $\text{H}_3\text{PO}_4$  and  $\text{PO}_4^{-3}$ ; (B)  $\text{H}_2\text{PO}_4^-$  and  $\text{PO}_4^{-3}$ ; (C)  $\text{HPO}_4^{-2}$  and  $\text{PO}_4^{-3}$ ; (D)  $\text{H}_2\text{PO}_4^-$  and  $\text{HPO}_4^{-2}$ ; (E)  $\text{H}_3\text{PO}_4$  and  $\text{HPO}_4^{-2}$ .
- 3. Which amino acids contain reactive aliphatic hydroxyl groups?**  
(A) serine and methionine; (B) serine and threonine; (C) methionine and threonine; (D) cysteine and methionine; (E) cysteine and threonine.
- 4. Which of the following amino acid residues would most likely be buried in the interior of a water soluble, globular protein?**  
(A) Asp; (B) Ser; (C) Phe; (D) Lys; (E) Gln.
- 5. Two-dimensional electrophoresis is a combination of what two techniques?**  
(A) isoelectric focusing and affinity chromatography; (B) ion-exchange chromatography and SDS-PAGE; (C) affinity chromatography and SDS-PAGE; (D) isoelectric focusing and SDS-PAGE; (E) isoelectric focusing and ion-exchange chromatography.
- 6. Reagents necessary for sequencing by chain termination include**  
(A) template DNA, deoxyribonucleoside triphosphates (dNTPs), primer, dideoxy nucleotide analogs, DNA polymerase, and radioactive probe; (B) template DNA, deoxyribonucleoside triphosphates (dNTPs), primer, dideoxy nucleotide analogs, and DNA polymerase; (C) template DNA, deoxyribonucleoside triphosphates (dNTPs), primer, dideoxy nucleotide analogs, RNA polymerase; (D) All of the above; (E) None of the above.
- 7. What conclusion can be drawn concerning an inhibitor if the  $V_{\text{max}}$  is the same in the presence and absence of the inhibitor?**  
(A) The inhibitor binds to the substrate; (B) The inhibitor has a structure that is not very similar to the substrate; (C) The inhibitor reacts with a critical residue of the enzyme; (D) The inhibitor binds to the same active site as the substrate; (E) The  $K_M$  is smaller in the presence of inhibitor.
- 8. When the  $k_{\text{cat}} / K_M$  ratio is at its upper limit, it is referred to as**  
(A) Circe limits; (B) Michaelis rate; (C) kinetic perfection; (D) All of the above; (E) None of the above.
- 9. The half-life of a cytosolic protein is primarily determined by the**  
(A) length of the protein chain; (B) amino terminal residue; (C) sequence at the carboxyl terminus; (D) all of the above; (E) none of the above.

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10. What do trypsin, subtilisin, and wheat carboxypeptidase II have in common?  
(A) All contain asp in the active site; (B) All bind hydrophobic amino acids; (C) All are synthesized in the pancreas; (D) All contain a catalytic triad at the active site; (E) All contain a hydrophilic substrate-binding pocket.
11. The eukaryotic system for ubiquitination appears to have evolved from what prokaryotic precursor?  
(A) a system for protein degradation and turnover; (B) a system for protein phosphorylation; (C) a system for coenzyme biosynthesis; (D) All of the above; (E) None of the above.
12. This amino acid, in high levels, is correlated with the damage of cells lining the blood vessels.  
(A) serine; (B) cysteine; (C) S-adenosylmethionine; (D) citrulline; (E) homocysteine.
13. Tetrahydrofolate is generated from dihydrofolate by dihydrofolate reductase and uses the reductant  
(A) FADH<sub>2</sub>; (B) NADH; (C) NADPH; (D) riboflavin; (E) none of the above.
14. A channel that opens in response to binding a particular molecule is called a \_\_\_\_\_ channel.  
(A) passive diffusion; (B) symport; (C) ligand-gated; (D) All of the above; (E) None of the above.
15. This energy source powers most ATP synthesis.  
(A) electrochemical potential of ion gradients; (B) electrochemical potential of stored glycogen; (C) high-energy intermediates; (D) All of the above; (E) None of the above.
16. How many moles of H<sub>2</sub>O are formed when 1 mole of palmitoyl-CoA is completely oxidized to carbon dioxide? (A) 8; (B) 16; (C) 23; (D) 32; (E) 46.
17. Which of the following vitamins play crucial roles in the metabolism of propionic acid (propionate) ?  
1. B<sub>1</sub>; 2. B<sub>2</sub>; 3. B<sub>6</sub>; 4. B<sub>12</sub>; 5. biotin.  
(A) 1, 2, and 5; (B) 1, 4, and 5; (C) 3, 4, and 5; (D) 1 and 4; (E) 4 and 5.
18. Which of the following statements about the light reactions in photosynthetic plants is false?  
(A) Membrane-bound ATPase couples ATP synthesis to electron transfer; (B) No CO<sub>2</sub> is fixed in the light reactions; (C) The ultimate electron acceptor is O<sub>2</sub>; (D) The ultimate source of electrons for the process is H<sub>2</sub>O; (E) There are two distinct photosystems, linked together by an electron transfer chain.
19. In liver cells, which enzyme serve as the glucose sensor when blood-glucose level rise? (A) Glycogen phosphorylase a; (B) Glycogen phosphorylase b; (C) Glycogen phosphorylase kinase; (D) Glycogen synthase; (E) None of the above.
20. Which of the following regulators does not act as inhibitor of acetyl CoA carboxylase?  
(A) citrate; (B) epinephrine; (C) glucagons; (D) AMP; (E) palmitoyl CoA.

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21. Which of the following statements about ketone bodies is incorrect? (A) Ketone bodies are formed from acetyl CoA when fat breakdown predominates; (B) The major site of production of acetoacetate and 3-hydroxybutyrate is liver; (C) During starvation and diabetes, the brain adapts to the utilization of acetoacetate as major fuel; (D) Liver can also utilize ketone bodies as a fuel; (E) Acetoacetate also has a regulatory role to adjust the rate of lipolysis in adipose tissue.
22. Mitochondria are also involved in the cell's response to oxidative stress. Which of the following steps in the path of oxygen reduction in mitochondria have the potential to produce highly reactive free radicals? (1) from complex I to QH<sub>2</sub>; (2) from QH<sub>2</sub> to complex III; (3) from complex III to complex IV; (4) in complex III; (5) in complex IV.  
(A) all above have; (B) 1, 2, and 3; (C) 1, 2, and 4; (D) 1, 2, and 5; (E) 2, 3, and 5.
23. Which of the following enzymes is not directly involved to remove reactive oxygen species?  
(A) superoxide dismutase; (B) catalase; (C) peroxidase; (D) glucose 6-phosphate dehydrogenase; (E) malate dehydrogenase.
24. Which of the following proteins does not involve terminating or diminishing the signal transduction? (A) Ca<sup>2+</sup>-ATPase; (B) b-arrestin; (C) GTPase; (D) GTPase activating proteins; (E) serotonin.
25. If you have just eaten a meal rich in fatty acids (triacylglycerol) but low carbohydrates (glucose), which of the following mechanism is not correct  
(A) Pyruvate carboxylase is stimulated by the high levels of acetyl-CoA;  
(B) Phosphoenolpyruvate carboxylase is also stimulated by the high levels of acetyl-CoA;  
(C) The concentrations of citrate will increase; (D) Glycolysis is inhibited; (E) Pyruvate dehydrogenase is also inhibited.
26. Although photosynthetic phosphorylation (PP) and oxidative phosphorylation (OP) appear to be generally similar processes, there are still some differences between both processes. Which of the following statements is not true? (A) Photons and carbon fuels oxidation are the source of high-energy electrons of PP and OP, respectively; (B) ATP synthesis is driven by a proton gradient across the thylakoid membrane in PP and mitochondria membrane in OP, respectively; (C) The proton-motive force is appreciably contributed by charge gradient in PP and chemical gradient in OP, respectively; (D) The localization of CF<sub>1</sub> of ATP synthase is at stroma, but F<sub>1</sub> at mitochondria matrix; (E) Both processes contain cytochromes and flavins in their electron carrier chains.
27. Which of the following phospholipids exposure on the outer surface marks a cell for destruction by programmed cell death?  
(A) phosphatidylethanolamine; (B) phosphatidylcholine; (C) sphingomyelin;  
(D) phosphatidylserine; (E) phosphatidylinositol.

國立高雄大學九十六學年度研究所碩士班招生考試試題

科目：生物化學

系所：生物科技研究所甲組

是否使用計算機：是

考試時間：100 分鐘

生物科技研究所乙組

本科原始成績：100 分

28. Which one of the following statements directly results in the activation of glycogen synthase?  
(A) Binding of glucose 6-phosphate; (B) Dephosphorylation of multiple residues by phosphoprotein phosphatase-1 (PP1); (C) Phosphorylation of specific residues by casein kinase II (CKII); (D) Phosphorylation of specific residues by glycogen synthase kinase-3 (GSK-3); (E) The presence of epinephrine.
29. Which of the following enzyme deficiency cause many adults are intolerant of milk?  
(A) hexokinase; (B) galactokinase; (C) galactose 1-phosphate uridyl transferase; (D) lactase; (E) aldose reductase.
30. How many moles of ATP yield when pyruvate is completely oxidized to  $\text{CO}_2$  by a mammalian cell homogenate? Assume that glycolysis, the citric acid cycle, and oxidative phosphorylation are full active. (A) 12.5; (B) 13.0; (C) 14.5; (D) 15.0; (E) 16.5.

II. Answer the problems (10 points each)

1. Please describe why the fatty acid can used as fuel?
2. What is the Bohr effect? Please describe the biological function of it.
3. Explain the effect of insulin and glucagon on the bifunctional protein phosphofructokinase-2/fructose 2,6-bisphosphatase (PFK-2/FBPase-2) become phosphorylated or dephosphorylated, and what are the consequences of its phosphorylation states to the glycolytic and gluconeogenic pathways?
4. Please describe the mechanism of potassium channel, including its structure and energetic standpoint of ion selectivity.

國立高雄大學九十六學年度研究所碩士班招生考試試題

科目：分子生物學  
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系所： 生物科技研究所甲組  
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一. 單選題(50% , 每題 2 分 , 共 25 題)

1. Which of the following is not part of a nucleotide?
  - a). An alpha carbon, to which the side group is attached
  - b). A 5-carbon sugar
  - c). A phosphate group
  - d). A nitrogenous base
  
2. If DNA isolated from an organism has an adenine content of 25%, what is the % G+C?
  - a). 25%
  - b). 50%
  - c). 75%
  - d). Answer cannot be determined from this information
  
3. How is CAP regulated?
  - a). Inactivated by lactose
  - b). Inactivated by cAMP
  - c). Activated by cAMP
  - d). Inactivated by glucose
  
4. Which of the following techniques would *not* give you information about the abundance of a protein you're studying?
  - a). Western blotting
  - b). GFP tagging
  - c). Northern blotting
  - d). Immunoprecipitation
  
5. DNaseI footprinting experiments:
  - a). require a DNA probe labeled at one end of one strand
  - b). reveal the sequence to which a protein binds
  - c). give quantitative information about the affinity of a protein for the DNA
  - d). all of the above
  
6. Using a standard PCR reaction, you can:
  - a). invert a cloned piece of DNA in a plasmid vector
  - b). determine unknown DNA sequence
  - c). synthesize short oligonucleotide primers
  - d). amplify DNA between known sequences

國立高雄大學九十六學年度研究所碩士班招生考試試題

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7. When a typical restriction enzyme like BamHI cuts DNA, it leaves:
- a 5' PO<sub>4</sub> on the top strand and a 3' PO<sub>4</sub> on the bottom strand
  - a 3' PO<sub>4</sub> on the top strand and a 5' PO<sub>4</sub> on the bottom strand
  - 5' PO<sub>4</sub>'s on both strands
  - 3' PO<sub>4</sub>'s on both strands
8. Which of the following is NOT characteristic of prokaryotic genomes?
- Genes arranged in operons. .
  - Presence of introns.
  - May have histone-like proteins associated with the chromatin.
  - Presence of exons.
9. Which protein is observed exclusively in association with prokaryotic DNA replication?
- DNA Polymerase I.
  - Primase.
  - Helicase.
  - SSB proteins.
10. Eukaryotic nuclear mRNA splicing
- Occurs in the cytoplasm
  - Occurs while translation is taking place
  - On a polyacrylamide gel, the lariat form of the intron can migrate above the pre-mRNA that still contains the intron.
  - The introns found within pre-mRNA in the nucleus are self-splicing introns.
11. Group II introns
- A 2' OH at the branch point attacks the phosphodiester bond between exon 1 and the intron.
  - A 2' OH at the end of exon 1 attacks the phosphodiester that joins exon 2 to the intron.
  - A guanine containing ribonucleotide attacks the phosphodiester bond between exon 1 and exon 2.
  - Found in tetrahymena rRNA
12. RNase protection assays
- A good method to identify all of the different mRNAs expressed in two different tissues.
  - A radiolabeled RNA probe is allowed to base pair to mRNA. This is then digested with an single-strand specific endonuclease.
  - A radiolabeled RNA probe is allowed to base pair to mRNA. This is then run on a gel and the double stranded molecule migrates at a new position.
  - Can provide you with a cDNA fragment derived from a mRNA under study

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13. Which of the following experimental questions could be addressed by a Northern blot?

- a). Does protein X bind to protein Y?
- b). Is my favorite protein ubiquitinated?
- c). What level of mRNA is present for my favorite gene?
- d). Where is my favorite protein located in cells?

14. What is the relationship between a G protein and a GTPase switch protein?

- a). The alpha subunit of the GTPase switch protein is a G protein
- b). The alpha subunit of a G protein is a GTPase switch protein
- c). A GTPase switch protein triggers the alpha subunit of the G protein to exchange GDP for GTP
- d). A G protein triggers the alpha subunit of the GTPase switch protein to exchange GDP for GTP

15. Phosphorylation of eIF4E increases its binding affinity for:

- a). GTP
- b). mRNA cap
- c). aminoacyl tRNA
- d). A site

16. The function of eIF2 is to:

- a). Promote binding of 60S subunit to the 48S complex
- b). Binds to the 5' cap of the mRNA
- c). Bind the initiating aminoacyl tRNA to the 40S subunit
- d). Binds the 60S subunit to block premature 48S complex binding

17. Indicate which of the following statements are true.

- a). The stability of ferretin mRNA increases when iron is abundant.
- b). Ferretin protein levels increase when iron is abundant.
- c). There is a single IRE in the 3'UTR of ferretin mRNA..
- d). Translation of ferretin mRNA increases when IRE binding protein is bound to an IRE.

18. UV light treated bacteria would most likely have DNA damage in the form of

- a). Analog incorporation.
- b). Pyrimidine dimmer formation.
- c). Intercalation of the bases. .
- d). Deamination.

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19. A change in nucleotide sequence that results in addition or deletion of a single nucleotide and largely changes the amino acid sequence of the resulting peptide is known as a:

- a). Nonsense mutation.
- b). Silent mutation.
- c). Missense mutation.
- d). Frameshift mutation.

20. All of the following are true about DNA microarray technology except

- a). An electron microscope is used to gather data from the arrays.
- b). The technology is used to access transcription from multiple genes simultaneously.
- c). The technology works best for organisms whose genome is completely sequenced.
- d). The technology allows many different DNAs to be spotted on one chip.

21. In a homologous recombinant where would the crossover(s) occur?

- a). Anywhere.
- b). In both homologous regions.
- c). In the area that is between the TK genes and the homologous regions.
- d). In the first but not the second homologous region.

22. Which of the following do NOT need a primer in order to function?

- a). DNA Pol I
- b). DNA Pol II
- c). DNA Pol III
- d). RNA polymerase

23. The only methylated base in mammals is?

- a). 7-methyl guanine
- b). methyl adenine
- c). 5-methyl cytosine
- d). deoxythymidine

24. Repressor molecules bind to the:

- a). promoter
- b). enhancer
- c). operator
- d). alpha subunit

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25. The RNA primer is removed from the Okazaki fragment by:

- a). DNA Pol I
- b). DNA Pol II
- c). DNA Pol III
- d). Exonuclease

二. 解釋名詞(30%, 每題三分)

- 1. Directional cloning
- 2. Klenow fragment
- 3. Degeneracy in the genetic code
- 4. Chargaff rule
- 5. Shine-Dalgarno sequence
- 6. RNA editing.
- 7. Architectural transcription factor.
- 8. SR protein.
- 9. Sliding clamp
- 10. RecBCD protein

三. 問答題(20%)

- 1. Describe two classes of genes in which TATA-less promoters are found. (5%)
- 2. Present a model for activation and repression by the same protein, depending on the presence or absence of that protein's ligand. (7%)
- 3. Diagram the two mechanisms by which eukaryotic cells deal with premature termination codons. (8%)

國立高雄大學九十六學年度研究所碩士班招生考試試題

科目：普通化學

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是否使用計算機：否

考試時間：100 分鐘

本科原始成績：100 分

題目總共有四十題，均為單選題，每題 2.5 分

1. Normal body temperature is 37 °C. What is the equivalent temperature in kelvins?  
A) 310 K    B) 309 K    C) 309.5 K    D) 310.5 K
2. Which of the following pairs of elements should combine to give covalent compounds?  
A) Mg + O<sub>2</sub>    B) Cl<sub>2</sub> + F<sub>2</sub>    C) Cl<sub>2</sub> + Cr    D) S<sub>8</sub> + Na
3. What is wrong with the common names for the following compounds?  
A) tetraphosphorus trisulfide (P<sub>4</sub>S<sub>3</sub>)    B) silicon dioxide (SiO<sub>2</sub>)  
C) chlorine oxide (Cl<sub>2</sub>O)    D) copper (II) bromide (CuBr<sub>2</sub>)
4. Which pair of samples contains the same number of hydrogen atoms?  
A) 1 mole of NH<sub>3</sub> and 1 mole of N<sub>2</sub>H<sub>4</sub>    B) 2 moles of NH<sub>3</sub> and 1 mole of N<sub>2</sub>H<sub>4</sub>  
C) 2 moles of NH<sub>3</sub> and 3 moles of N<sub>2</sub>H<sub>4</sub>    D) 4 moles of NH<sub>3</sub> and 3 moles of N<sub>2</sub>H<sub>4</sub>
5. Which of the following graphs does not give a straight line for an ideal gas?  
A) n versus 1/P    B) V versus T    C) T versus P    D) P versus 1/V
6. Which of the following sets of n, l, m, and s quantum numbers can be used to describe an electron in a 2p orbital?  
A) 2, 0, 0, 1/2    B) 2, 1, 0, -1/2    C) 2, 2, 1, 1/2    D) 3, 2, 1, -1/2
7. Which of the following samples would have the largest volume at 25 °C and 75 mmHg?  
A) 100 g CO<sub>2</sub>    B) 100 g NO    C) 100 g CH<sub>4</sub>    D) 100 g SO<sub>2</sub>
8. Predict the electron configurations for zinc (Z = 30) from their positions in the periodic table.  
A) [Ar]4s<sup>1</sup>3d<sup>9</sup>    B) [Ar]4s<sup>1</sup>3d<sup>10</sup>    C) [Ar]4s<sup>2</sup>3d<sup>9</sup>    D) [Ar]4s<sup>2</sup>3d<sup>10</sup>
9. Which of the following transitions in the spectrum of the hydrogen atom results in the emission of light with the longest wavelength?  
A) n = 5 to n = 4    B) n = 3 to n = 2    C) n = 3 to n = 1    D) n = 2 to n = 3
10. Which of the following orbits cannot exist?  
A) 6s    B) 2d    C) 3p    D) 17f
11. Arrange the following atoms or ions in order of increasing radius. (a)Na (b) Na<sup>+</sup> (c) Cl (d) Cl<sup>-</sup>  
A) bacd    B) dcab    C) bcad    D) abcd
12. Which of the following ionization energies is the largest?  
A) 1<sup>st</sup> IE of Ba    B) 3<sup>rd</sup> IE of Al    C) 2<sup>nd</sup> IE of Al    D) 3<sup>rd</sup> IE of Mg
13. Which of the following series of elements is arranged in order of decreasing electronegativity?

國立高雄大學九十六學年度研究所碩士班招生考試試題

科目：普通化學

系所：生物科技研究所乙組

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- A) O, P, Al, Mg, K    B) C, Si, P, As, Se    C) Na, Li, B, N, F    D) Li, Be, B, C, N
14. Which of the following compounds should be the most ionic?  
A)  $\text{Ti}_2\text{O}_3$     B)  $\text{TiO}$     C)  $\text{Ti}_4\text{O}_7$     D)  $\text{TiO}_2$
15. Which of the following are exceptions to the Lewis octet rule?  
A)  $\text{CO}_2$     B)  $\text{SO}_3$     C)  $\text{SF}_4$     D)  $\text{PCl}_3$
16. Which of the following molecule is paramagnetic?  
A)  $\text{HF}$     B)  $\text{CO}$     C)  $\text{NO}^+$     D)  $\text{NO}$
17. Which of the following compounds is best described as T-shaped?  
A)  $\text{XeF}_3^+$     B)  $\text{NO}_3^-$     C)  $\text{ClO}_3^-$     D)  $\text{SF}_4$
18. Predict which of the following substances should have an enthalpy of formation equal to zero.  
A)  $\text{Br}_2(\text{g})$     B)  $\text{Hg}(\text{l})$     C)  $\text{H}(\text{g})$     D)  $\text{I}_2(\text{l})$
19. Which of the following reactions would you expect to be endothermic?  
A)  $2 \text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2 \text{H}_2\text{O}(\text{g})$     B)  $\text{H}_2\text{O}(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l})$   
C)  $\text{H}_2(\text{g}) \rightarrow 2 \text{H}(\text{g})$     D)  $\text{HCl}(\text{aq}) + \text{NaOH}(\text{aq}) \rightarrow \text{NaCl}(\text{aq}) + \text{H}_2\text{O}(\text{l})$
20. Which of the following would you expect to be best oxidizing agent?  
A)  $\text{Na}$     B)  $\text{H}_2$     C)  $\text{P}_4$     D)  $\text{O}_2$
21. Nitrogen has a reasonable oxidation number in all of the following compounds, and yet one of them is still impossible. Which one?  
A)  $\text{NF}_5$     B)  $\text{NO}$     C)  $\text{NO}_3^-$     D)  $\text{NO}_2^-$
22. Which of the following is not a Brønsted conjugate acid-base pair?  
A)  $\text{NH}_4^+/\text{NH}_3$     B)  $\text{H}_2\text{O}/\text{OH}^-$     C)  $\text{N}_3\text{O}^+/\text{OH}^-$     D)  $\text{CH}_4/\text{CH}_3^-$
23. Which of the following compounds can act as both a Brønsted acid and a Brønsted base?  
A)  $\text{Na}_2\text{CO}_3$     B)  $\text{H}_2\text{CO}_3$     C)  $\text{H}_2\text{O}$     D)  $\text{CO}_2$
24. Which of the following is the strongest acid?  
A)  $0.10 \text{ M H}_2\text{PO}_4^-$     B)  $0.10 \text{ M HPO}_4^{2-}$     C)  $0.10 \text{ M PO}_4^{3-}$     D)  $0.10 \text{ M H}_3\text{PO}_4$
25. In which of the following structures would a xenon atom form the largest number of induced dipole-induced dipole interactions?  
A) cubic closest-packed    B) simple cubic    C) body-centered cubic    D) simple closest-packed

國立高雄大學九十六學年度研究所碩士班招生考試試題

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26. Tetrahedral holes and octahedral holes can be found in which of the following structures?

- A) simple cubic    B) cubic closest-packed    C) body-centered cubic    D) simple closest-packed

27. Which of the following compounds could dissolve in water to give a solution with a pH of about 5?

- A)  $\text{NH}_3$     B)  $\text{NaCl}$     C)  $\text{NH}_4\text{Cl}$     D)  $\text{KOH}$

28. A 0.10 m solution of  $\text{H}_2\text{SO}_4$  in water freezes at  $-0.371^\circ\text{C}$ . Which of the following statements agrees with this observation?

- A)  $\text{H}_2\text{SO}_4$  does not dissociate in water  
B)  $\text{H}_2\text{SO}_4$  dissociates in water to form  $(\text{H}_2\text{SO}_4)_2$  molecules  
C)  $\text{H}_2\text{SO}_4$  dissociates into water to form two  $\text{H}_3\text{O}^+$  ions and one  $\text{SO}_4^{2-}$  ion  
D)  $\text{H}_2\text{SO}_4$  dissociates into  $\text{H}_3\text{O}^+$  and  $\text{HSO}_4^-$  ions in water

29. Which of the following compounds would be the most soluble in a nonpolar solvent, such as  $\text{CCl}_4$ ?

- A)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$     B)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$   
C)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$     D)  $\text{CH}_3\text{OH}$

30. Which of the following is the correct equilibrium constant expression for the reaction  $\text{Cl}_{2(g)} + 3\text{F}_{2(g)} \rightleftharpoons 2\text{ClF}_{3(g)}$ ?

- A)  $K_c = \frac{2[\text{ClF}_3]}{[\text{Cl}_2] + 3[\text{F}_2]}$     B)  $K_c = \frac{[\text{ClF}_3]^2}{[\text{Cl}_2][\text{F}_2]^3}$     C)  $K_c = \frac{[\text{Cl}_2] + 3[\text{F}_2]}{2[\text{ClF}_3]}$     D)  $K_c = \frac{[\text{Cl}_2][\text{F}_2]^3}{[\text{ClF}_3]^2}$

31. Which structure would  $\text{BeO}$  be expected to most closely resemble?

- A)  $\text{NaCl}$     B)  $\text{CsCl}$     C)  $\text{ZnS}$     D)  $\text{CaF}_2$

32. Which of the following pairs of ions can't coexist in aqueous solution?

- A)  $\text{Na}^+$ ,  $\text{S}^{2-}$     B)  $\text{Hg}_2^{2+}$ ,  $\text{F}^-$     C)  $\text{Fe}^{2+}$ ,  $\text{Hg}^{2+}$     D)  $\text{Ag}^+$ ,  $\text{Hg}^{2+}$

33. Which of the following octahedral complexes can form cis / trans isomers?

- A)  $\text{Co}(\text{NH}_3)_4\text{Cl}_2^+$     B)  $\text{Co}(\text{NH}_3)_6^{3+}$     C)  $\text{Co}(\text{NH}_3)_5\text{Cl}^{2+}$     D)  $\text{Co}(\text{NH}_3)_5(\text{H}_2\text{O})^{3+}$

34. Which of the following transition metal ions are in an oxidation state in which the electron configuration of the metal is not formally  $d^0$ ?

- A)  $\text{Sc}^+$     B)  $\text{Fe}^{3+}$     C)  $\text{Ti}^{4+}$     D)  $\text{VO}_2^+$

國立高雄大學九十六學年度研究所碩士班招生考試試題

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35. Which isotope of carbon is most likely to decay by electron emission?  
A)  $^{12}\text{C}$  B)  $^{11}\text{C}$  C)  $^{14}\text{C}$  D)  $^{13}\text{C}$
36. Which of the following nuclide is most likely to be neutron-rich?  
A)  $^{31}\text{P}$  B)  $^{26}\text{Si}$  C)  $^{27}\text{Al}$  D)  $^{24}\text{Na}$
37. Which of the following is a product of the reaction between chlorine and ethylene?  
A)  $\text{ClCH}_2\text{CH}_2\text{Cl}$  B)  $\text{CH}_3\text{CH}_2\text{Cl}$  C)  $\text{CH}_3\text{CHCl}_2$  D)  $\text{Cl}_2\text{CHCHCl}_2$
38. Which of the following compounds has the largest octane number?  
A) n-butane B) n-pentane C) n-hexane D) n-octane
39. Which of the following molecule is optically active?  
A)  $\text{C}_2\text{H}_4$  B)  $\text{C}_6\text{H}_6$  C)  $\text{C}_4\text{H}_{10}\text{O}$  D)  $\text{C}_6\text{H}_4\text{Cl}_2$
40. If EtOH is used as the only source of carbon, which of the following can be synthesized by a Grignard reaction?  
A)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$  B)  $\text{CH}_3\text{CH}_2\text{CHO}$  C)  $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$  D)  $\text{CH}_3\text{CO}_2\text{CH}_2\text{CH}_3$