

國立高雄大學九十七學年度研究所碩士班招生考試試題

系所：

科目：專業英文

生物科技研究所碩士班甲組

是否使用計算機：否

考試時間：100 分鐘

生物科技研究所碩士班乙組

本科原始成績：100 分

一、解釋名詞（請寫出每個專有名詞最適切的中文翻譯及解釋，每題 4 分）

1. agribiotechnology
2. genetically modified organisms (GMOs)
3. natural selection
4. Human Genome Project
5. acquired immunodeficiency syndrome (AIDS)
6. electron microscope
7. gene cloning
8. plant hormone
9. ecosystems
10. bioinformatics

二、是非題（請以○或×進行作答，每題 2 分）

1. Compounds containing carbon are said to be inorganic, and the branch of chemistry that specializes in the study of carbon compounds is called inorganic chemistry.
2. Flower, the reproductive shoots of the angiosperm sporophyte, are typically composed of four whorls of highly modified leaves called floral organs, which are separated by very short internodes.
3. The mammalian digestive system consists of the alimentary canal and various accessory glands that secrete digestive juices into the canal through ducts.
4. An organism's development is determined by the genome of the zygote and also by differences that arise between early embryonic cells.
5. Behavior, which includes muscular as well as nonmuscular activity, is everything that an animal does and how it does it. For example, learning is not generally considered a behavioral process.
6. Of the 100,000 known species of fungi, about 30% make their living as parasites, mostly on or in animals.
7. A genomic library is the collection of recombinant vector clones produced by cloning DNA fragments derived from an entire genome.
8. Normal human somatic cells have 48 chromosomes made up of two sets-one set of 24 chromosomes derived from each parent.
9. Carbon, oxygen, hydrogen, and nitrogen make up approximately 96% of living matter.
10. In discovery science, scientists describe some aspect of the world and use inductive reasoning to draw general conclusions.

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三、選擇題（請以大寫 ABCDE 作答，每題 2 分）

1. Which of the following statements best distinguishes hypotheses from theories in science?
 - A. Theories are hypotheses that have been proved.
 - B. Hypotheses are guesses; theories are correct answers.
 - C. Hypotheses usually are relatively narrow in scope; theories have broad explanatory power.
 - D. Hypotheses and theories are essentially the same thing.
 - E. Theories are proved true in all cases; hypotheses are usually falsified by tests.
2. Which of the following tools of recombinant DNA technology is *incorrectly* paired with its use?
 - A. restriction enzyme-production of RFLPs
 - B. DNA ligase-enzyme that cuts DNA, creating the sticky ends of restriction fragments
 - C. DNA polymerase-used in a polymerase chain reaction to amplify sections of DNA
 - D. Reverse transcriptase-production of cDNA from mRNA
 - E. Electrophoresis-separation of DNA fragments
3. Compare to a smaller cell, a larger cell of the same shape has
 - A. less surface area.
 - B. less surface area per unit of volume.
 - C. the same surface-to-volume ratio.
 - D. a smaller average distance between its mitochondria and the external source of oxygen.
 - E. A smaller cytoplasm-to-nucleus ratio.
4. Which of the following is an example of a hydrophobic material?
 - A. paper
 - B. table salt
 - C. wax
 - D. sugar
 - E. pasta
5. Which of the following is *not* a protein?
 - A. hemoglobin
 - B. cholesterol

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- C. an antibody
- D. an enzyme
- E. insulin

6. Which structure is incorrectly paired its tissue system?

- A. root hair-dermal tissue
- B. palisade parenchyma-ground tissue
- C. guard cell-dermal tissue
- D. companion cell-ground tissue
- E. tracheid-vascular tissue

7. A fruit is a (an)

- A. mature ovary.
- B. mature ovule.
- C. seed plus its integuments.
- D. fused carpel.
- E. Enlarged embryo sac.

8. Which of the following areas of study focuses on the exchange of energy, organisms, and materials between ecosystems?

- A. population ecology
- B. organismal ecology
- C. landscape ecology
- D. ecosystem ecology
- E. community ecology

9. The smallest biological unit that can evolve over time is

- A. a cell.
- B. an individual organism.
- C. a population.
- D. a species.
- E. an ecosystem.

10. An element is to a (an) _____ as an organ is to a (an) _____.

- A. atom; organism

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B. compound; organism

C. molecule; cell

D. atom; cell

E. compound; organelle

四、英翻中（請將下列句子翻譯成為中文，每題 5 分）

1. In April 1953, James Watson and Francis Crick shook the scientific world with an elegant double-helical model for the structure of deoxyribonucleic acid, or DNA. Over the past 50 years, their model has evolved from a novel proposition to an icon of modern biology.
2. In most nuclear transplantation studies thus far, only a small percentage of cloned embryos develop normally to birth. And like Dolly, many cloned animals exhibit various defects.
3. Questions about the earliest stages in the origin of life on Earth may never be fully answered because, as far as we know, there is no record of these ancient events. Many later events, however, are well documented in the fossil record. Careful study of fossils opens a window into the lives of organisms that existed long ago and provides information about the evolution of life over billions of years.
4. A variety of life cycles have evolved among the multicellular algae. The most complex life cycles include an alternation of generations, the alternation of multicellular haploid and diploid.

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I. Single-choice questions (2 points each, except question 36, 5 points)

1. Which one of the following statements about the elongation phase of protein synthesis is **true**?
(A) At least five high-energy phosphoryl groups are expended for each peptide bond formed. (B) During elongation, incoming aminoacylated tRNAs are first bound in the P site.
(C) Elongation factor EF-Tu facilitates translocation. (D) Peptidyl transferase catalyzes the attack of the carboxyl group of the incoming amino acid on an ester linkage in the nascent polypeptide. (E) Peptidyl transferase is a ribozyme.
2. Which of the following reaction **is not** involved in the post-transcript modification?
(A) Phosphorylation. (B) 5' cap modification. (C) RNA splicing. (D) RNA editing.
(E) Methylation
3. Which of the following statements about aromatic amino acids is **correct**?
(A) All are strongly hydrophilic. (B). Histidine's ring structure results in its being categorized as aromatic or basic, depending on pH. (C) On a molar basis, tryptophan absorbs more ultraviolet light than tyrosine. (D) The major contribution to the characteristic absorption of light at 280 nm by proteins is the phenylalanine R group. (E) The presence of a ring structure in its R group determines whether or not an amino acid is aromatic.
4. The chirality of an amino acid results from the fact that its carbon: (A) has no net charge. (B) is a carboxylic acid. (C) is bonded to four different chemical groups. (D) is in the L absolute configuration in naturally occurring proteins. (E) is symmetric.
5. A convenient cloning vector with which to introduce foreign DNA into *E. coli* is a(n):
(A) *E. coli* chromosome. (B) messenger RNA. (C) plasmid. (D) yeast "ARS" sequence.
(E) yeast transposable element.
6. Which of the following statements about the specific cleavage of polypeptide between reagent and cleavage site is correct?
(A) Hydroxylamine → asparagine-glycine bonds. (B) Chymotrypsine → carboxyl side of tyrosine.
(C) Trypsin → carboxyl side of lysine and arginine. (D) CNBr → carboxyl side of methionine.
(E) All of above.
7. Histones are _____ that are usually associated with _____.
(A) acidic proteins; DNA. (B) acidic proteins; RNA. (C) basic proteins; DNA.
(D) basic proteins; RNA. (E) coenzymes derived from histidine; enzymes.

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8. The proofreading function of DNA polymerase involves all of the following **except**:
- (A) a 3' → 5' exonuclease. (B) base pairing. (C) detection of mismatched base pairs.
(D) phosphodiester bond hydrolysis. (E) reversal of the polymerization reaction.
9. In homologous recombination in *E. coli*, the protein that moves along a double-stranded DNA, unwinding the strands ahead of it and degrading them, is:
- (A) chi. (B) DNA ligase. (C) RecA protein. (D) RecBCD enzyme. (E) RuvC protein (resolvase).
10. The reverse transcriptase of an animal RNA virus catalyzes:
- (A) degradation of the RNA strand in a DNA-RNA hybrid. (B) insertion of the viral genome into a chromosome of the host (animal) cell. (C) RNA formation in the 3' → 5' direction.
(D) RNA synthesis, but not DNA synthesis. (E) synthesis of an antisense RNA transcript.
11. The enzymatic machinery to fix atmospheric N₂ into NH₄⁺ is:
- (A) a means of producing ATP when excess N₂ is available. (B) composed of two key proteins, each containing iron. (C) relatively stable when exposed to O₂. (D) specific to plant cells.
(E) unaffected by the supply of electrons.
12. One amino acid directly involved in the purine biosynthetic pathway is:
- (A) alanine. (B) aspartate. (C) glutamate. (D) leucine. (E) tryptophan.
13. Which of the following **is not true** of the reaction catalyzed by ribonucleotide reductase?
- (A) Glutathione is part of the path of electron transfer. (B) It acts on nucleoside diphosphates.
(C) Its mechanism involves formation of a free radical. (D) There is a separate enzyme for each nucleotide (ADP, CDP, GDP, UDP). (E) Thioredoxin acts as an essential electron carrier.
14. Consider the lac operon of *E. coli*. When there is neither glucose nor lactose in the growth medium: (A) CRP protein binds to the lac operator. (B) CRP protein displaces the Lac repressor from the lac promoter. (C) repressor is bound to the lac operator. (D) RNA polymerase binds lac promoter and transcribes the lac operon. (E) the operon is fully induced.
15. RecA protein provides the functional link between DNA damage and the SOS response by displacing the LexA protein from its operator sites on the SOS genes. RecA does so by:
- (A) associating with polymerase holoenzyme to help it remove LexA from operator.
(B) bending LexA operator DNA to force dissociation of LexA repressor. (C) binding to LexA protein to weaken directly its affinity for operator sites. (D) causing self-cleavage of LexA, thus inactivating its binding to operator. (E) competitively binding to LexA operators and serving as an activator.

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16. What is the net reaction of the transketolase and transaldolase steps?
(A) $3C_5 \rightleftharpoons 2C_6 + C_3$. (B) $2C_5 \rightleftharpoons C_6 + C_4$. (C) $3C_5 \rightleftharpoons C_6 + 3C_3$.
(D) $2C_5 \rightleftharpoons 2C_4 + C_2$. (E) All of the above.
17. This is a readily transportable and mobilizable sugar in plants.
(A) 3-phosphoglycerate. (B) glucose. (C) fructose. (D) sucrose. (E) All of the above.
18. All are true statements about photorespiration **except**: (A) ribulose 1,5-bisphosphate is lost from the Calvin cycle. (B) O_2 is consumed and CO_2 is released. (C) it involves chloroplast, peroxisome, and mitochondria. (D) all carbons leaving chloroplast are lost. (E) ATP is expended.
19. Why is glycogen branching important?
(A) Branching significantly alters the melting point. (B) Branching increases the solubility of glycogen. (C) Branching increases glycogen synthesis and degradation by increasing the potential sites of action. (D) A and C. (E) B and C
20. Which of following statements about the physiological roles of fatty acids **is not true**?
(A) Fatty acids are fuel molecules. They are stored as triacylglycerols. (B) Since triacylglycerols store much higher energy than glycogen, they are the primary source of energy during acute exercise, such as 100-meter sprint. (C) Fatty acids are building blocks of phospholipids and glycolipids. (D) Many proteins are modified by the covalent attachment of fatty acids. (E) Fatty acid derivatives serve as hormones and intracellular messengers.
21. Which of the following compounds **is not** the inhibitor of gluconeogenesis?
1. acetyl CoA; 2. ADP ; 3. AMP; 4. citrate; 5. fructose 2,6-bisphosphatase.
(A) 1 and 4. (B) 1, 4, and 5. (C) only 4. (D) only 5. (E) 3 and 5.
22. The biological significances of substrate cycle have:
1. amplify metabolic signals; 2. promote energy production; 3. generate heat;
4. diminish gluconeogenesis; 5. reduce oxygen consumption.
(A) only 1;. (B) 1, 3, and 5. (C) 1 and 3. (D) 2 and 4. (E) only 3.
23. In which step of the citric acid cycle is $FADH_2$ formed?
(A) the conversion of succinate to malate. (B) the conversion of succinate to oxaloacetate.
(C) the conversion of succinate to fumarate. (D) the conversion of malate to oxaloacetate.
(E) the conversion of succinate CoA to succinate.

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24. The moving units of ATP synthase are 1. a, 2. β , 3.c, 4. γ , 5. ϵ
(A) 1 and 2. (B) 2, 4, and 5. (C) 3, 4, and 5. (D) 4 and 5. (E) only 2.
25. Which of the following enzymes becomes active when bound to Ca^{2+} and diacylglycerol.
(A) protein kinase A. (B) protein kinase C. (C) phospholipase A_1 . (D) phospholipase A_2 .
(E) phospholipase C.
26. Which of the following proteins **is not** involved in epidermal growth factor (EGF) signaling?
(A) IRS-1. (B) Grb-2. (C) Sos. (D) Ras. (E) Raf.
27. In the cell, the hydrolysis of an ATP molecule in a coupled reaction changes the equilibrium ratio of products to reactants by a factor of (A) 10^1 . (B) 10^5 . (C) 10^6 . (D) 10^8 . (E) 10^{10} .
28. The disaccharide repeating unit of hyaluronate is (A) glucuronic acid and acetylglucosamine.
(B) glucuronic acid and acetylglucosamine sulfate. (C) glucuronic acid and acetylgalactosamine sulfate. (D) glucuronic sulfate and glucosamine sulfate.
(E) glucuronic acid and acetylgalactosamine.
29. An integral membrane protein can be extracted with: (A) a buffer of alkaline or acid pH.
(B) a chelating agent that removes divalent cations. (C) a solution containing detergent.
(D) a solution of high ionic strength; (E) hot water.
30. Which of following statement about the dynamic biological membrane is **incorrect**?
(A) Lateral diffusion of lipids is much more rapid than transverse diffusion (flip-flop).
(B) The transverse diffusion of lipids can be catalyzed by flippase. (C) Membrane proteins are virtually immobile. (D) The flip-flop of protein has not been observed.
(E) Lipids can occasionally jump.
31. Which of the following is **correct** concerning the sarcoplasmic reticulum Ca^{2+} ATPase? (A) It is an example of an ABC transporter. (B) It transports Ca^{2+} from the sarcoplasmic reticulum into the cytoplasm. (C) This P-type ATPase maintains a calcium ion concentration of approximately $0.1 \mu\text{M}$ in the cytosol and 1.5mM in the sarcoplasmic reticulum. (D) One Ca^{2+} is transported for each ATP hydrolyzed. (E) None of the above.
32. Trehalose is (A) α -D-Glucopyranosyl- (1 \rightarrow 1) - α -D-Glucopyranose.
(B) α -D-Glucopyranosyl- (1 \rightarrow 1) - β -D-fructofuranose. (C) α -D-Glucopyranosyl- (1 \rightarrow 2) - β -D-fructofuranose. (D) α -D-Glucopyranosyl- (1 \rightarrow 4) - α -D-Glucopyranose.
(E) β -D-Galactopyranosyl- (1 \rightarrow 4) - α -D-Glucopyranose.

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33. The biochemical property of lectins that is the basis for most of their biological effects is their ability to bind to: (A) amphipathic molecules. (B) hydrophobic molecules. (C) specific lipids. (D) specific oligosaccharides. (E) specific peptides.
34. Inhibitors against this viral enzyme have potential as anti-influenza agents is: (A) selectin. (B) calnexin. (C) SNARE. (D) N-glycosidase F. (E) neuraminidase.
35. Which of the following statements about cancer cells growth is **incorrect**? (A) Tumors with a high glucose uptake by GLU1 and GLU3. (B) Cancer cells grow under a hypoxia condition. (C) Hypoxia-inducible transcription factor decreases the expression of most glycolytic enzymes. (D) Hypoxia-inducible transcription factor simultaneously increases the expression vascular endothelial factors that stimulate the growth of new blood vessels. (E) None of the above.
36. Which of the following statements about phosphofructokinase 2 is **not true**? **(5 points)** (A) It is a bifunctional enzyme containing a kinase domain and a phosphatase domain in a single 55-kd polypeptide chain. (B) The activities of kinase and phosphatase are reciprocally controlled by phosphorylation of a single serine residue. (C) When glucose is scarce, glucagon stimulates protein kinase C leading to phosphatase activity is activated and gluconeogenesis is stimulated. (D) When blood-glucose levels are high, the activity of kinase is activated and accelerate glycolysis. (E) Insulin also stimulates phosphofructokinase 2 that makes and degrade fructose 2,6-bisphosphate.

II. Answer the problems

1. Please describe why the activity of aminoacyl-tRNA synthetase is so fidelity. (10 points)
2. Protein X has been found specifically target into mitochondria. Please design an experiment to identify the signal that lead it into mitochondria and identify the X' docking protein which located in the membrane of mitochondria. (15 points)

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I、單選題(每題 2 分，答題時請註明題號依序寫在答案卷上，以大寫字母 ABCDE 回答)

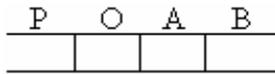
- The phosphodiester bonds that link adjacent nucleotides in both RNA and DNA:
 - are uncharged at neutral pH.
 - link A with T and G with C.
 - form between the planar rings of adjacent bases.
 - are susceptible to alkaline hydrolysis.
 - link the 3' hydroxyl of one nucleotide to the 5' hydroxyl of the next.
- Some restriction enzymes produce sticky (cohesive) ends. This means that they:
 - digest both DNA strands at the same base pair.
 - cut in regions of high GC content, leaving ends that can form more hydrogen bonds than ends of high AT content.
 - make ends that can anneal to cohesive ends generated by any other restriction enzyme.
 - stick tightly to the ends of the DNA they have cut.
 - make a staggered double-strand cut, leaving ends with a few nucleotides of single-stranded DNA protruding.
- In DNA sequencing by the Sanger dideoxy method:
 - radioactive dideoxy ATP is included in each of four reaction mixtures before enzymatic synthesis of complementary strands.
 - specific enzymes are used to cut the newly synthesized DNA into small pieces, which are then separated by electrophoresis.
 - the dideoxynucleotides must be present at high levels to obtain long stretches of DNA sequence.
 - the role of the dideoxy CTP is to occasionally terminate enzymatic synthesis of DNA where Gs occur in the template strands.
 - the template DNA strand is radioactive.
- Which of the following statements about the genomes or proteomes is **False**?
 - Current estimates indicate that humans have about 25,000 genes.
 - The genome of *Mycoplasma genitalium* is the known smallest genome of the self-replication organisms.
 - DNA microarray, 2D-gel electrophoresis, MALDI-TOF, and protein chip are powerful tools for genomics or proteomics analysis.
 - The *E. coli* is the first bacterium which genome was sequenced completely.
 - Functional genomics focuses on the dynamic aspects such as gene transcription, translation, and protein-protein interactions.

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5. The diagram below represents a hypothetical operon in *E. coli*. It consists of two structural genes (A and B), which code for the enzymes A-ase and B-ase, respectively, and also includes P (promoter) and O (operator) regions as shown.



When a certain compound (X) is added to the growth medium of *E. coli*, the separate enzymes A-ase and B-ase are both synthesized at a 50-fold higher rate than in the absence of X. (X has a molecular weight of about 200.) Which of the following statements is **True** of such an operon ?

- A) All operon (P, O, A, and B) will be transcribed into an mRNA that will then be translated into four different proteins.
- B) The repressor for this operon binds just to the right of A.
- C) Adding X to the growth medium causes a repressor protein to be released from the O region.
- D) Synthesis of the mRNA from this operon is not changed by the addition of compound X.
- E) Two mRNA molecules are made from this operon, one from gene A the other from gene B.
6. A transcription unit that is 1800 nucleotides long may use 1,200 nucleotides to make a protein consisting of 400 amino acids. This is best explained by the fact that
- A) there is redundancy and ambiguity in the genetic code.
- B) many nucleotides are needed to code for each amino acid.
- C) many noncoding nucleotides are present.
- D) nucleotides break off and are lost during the transcription process.
- E) there are termination exons near the beginning of mRNA.
7. Which of the following statements about the core enzyme of *E. coli* RNA polymerase is **False**?
- A) In the absence of the σ subunit, core polymerase has little specificity for where initiation begins.
- B) The core enzyme has no polymerizing activity until the σ subunit is bound.
- C) It is required for the synthesis of mRNA, rRNA, and tRNA in *E. coli*.
- D) It can start new chains de novo or elongate old ones.
- E) The RNA product is complementary to the DNA template.
8. If proteins were composed of only 12 different kinds of amino acids, what would be the smallest possible codon size in a genetic system with four different nucleotides?
- A) 1
- B) 2
- C) 3
- D) 4
- E) 12

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9. Which of the following statements about the synthesis of rRNA and tRNA in *E. coli* is **True**?
- A) Both rRNA and some tRNAs are part of the same primary transcript.
 - B) The tRNA sequences all lie at the 3' end of the rRNA transcripts
 - C) Primary tRNA transcripts undergo methylation, but rRNA sequences are not methylated.
 - D) Each rRNA sequence (16S, 23S, 5S) is transcribed into a separate primary transcript.
 - E) There is a single copy of the rRNA genes.
10. Which one of the following statements about the elongation phase of protein synthesis is **True**?
- A) Peptidyl transferase is a ribozyme.
 - B) At least five high-energy phosphoryl groups are expended for each peptide bond formed.
 - C) Peptidyl transferase catalyzes the attack of the carboxyl group of the incoming amino acid on an ester linkage in the nascent polypeptide.
 - D) Elongation factor EF-Tu facilitates translocation.
 - E) During elongation, incoming aminoacylated tRNAs are first bound in the P site.
11. In contrast to bacteria, eukaryotic chromosomes need multiple DNA replication origins because:
- A) their replication rate is much slower, and it would take too long with only a single origin per chromosome.
 - B) eukaryotic chromosomes cannot usually replicate bidirectionally.
 - C) eukaryotic genomes are not usually circular, like the bacterial chromosome is.
 - D) the processivity of the eukaryotic DNA polymerase is much less than the bacterial enzyme.
 - E) they have a variety of DNA polymerases for different purposes, and need a corresponding variety of replication origins.
12. *E. coli* DNA polymerase III :
- A) is efficient at nick translation.
 - B) is the principal DNA polymerase in chromosomal DNA replication.
 - C) contains a 5' → 3' proofreading activity to improve the fidelity of replication.
 - D) synthesizes only the leading strand; DNA polymerase I synthesizes the lagging strand.
 - E) can initiate replication without a primer.
13. A certain bacterial mRNA is known to represent only one gene and to contain about 800 nucleotides. If you assume that the average amino acid residue contributes 110 to the peptide molecular weight, the largest polypeptide that this mRNA could code for would have a molecular weight of about:
- A) 800.
 - B) 5,000.
 - C) 30,000.
 - D) 80,000.

國立高雄大學九十七學年度研究所碩士班招生考試試題

科目：分子生物學
考試時間：100 分鐘

系所：

生物科技研究所碩士班甲組
本科原始成績：100 分

是否使用計算機：是

E) An upper limit cannot be determined from the data given.

14. In a mammalian cell, DNA repair systems:

- A) are generally absent, except in egg and sperm cells.
- B) can repair deletions, but not mismatches.
- C) are extraordinarily efficient energetically.
- D) normally repair more than 99% of the DNA lesions that occur.
- E) can repair most types of lesions except those caused by UV light.

15. Which of the following is **True** for both prokaryotic and eukaryotic gene expression?

- A) After transcription, a 3' poly(A) tail and a 5' cap are added to mRNA.
- B) Translation of mRNA can begin before transcription is complete.
- C) mRNA is synthesized in the 3' → 5' direction.
- D) The mRNA transcript is the exact complement of the gene from which it was copied.
- E) RNA polymerase may recognize a promoter region and begin transcription.

II、請寫出題意所代表的分子生物學專有名詞英文全名(每題 2 分，寫出全名但字彙拼錯者，該題以得 1 分計算；以中文作答不計分，請謹慎作答。)

1. Transferring DNA fragments separated by gel electrophoresis to a suitable support medium such as nitrocellulose, in preparation for hybridization to a labeled probe.
2. Control of gene expression by specific mRNA degradation caused by insertion of a double-stranded RNA into a cell.
3. The enzyme that links a tRNA to its cognate amino acid.
4. The branched DNA structure formed by the first strand exchange during recombination.
5. A transcript carrying the information that, during translation, specifies the amino acid
6. Small DNA fragment, 1000-2000 bases long, created by discontinuous synthesis of the lagging strand.
7. A 300-nt RNA that resembles a tRNA and can rescue a stalled ribosome on a non-stop mRNA.
8. A high-capacity cloning vector consisting of yeast left and right telomeres and a centromere. It can replicate in yeast cells.
9. A set of three contiguous nucleotides in a tRNA molecule that are complementary to a set of three contiguous nucleotides in an mRNA.
10. An enzyme that recognizes a specific duplex DNA sequence and cleaves phosphodiester bonds on both strands at or near the recognition site.

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11. A segment of a gene that is transcribed but is then excised from the primary transcript during processing to a functional RNA molecule.
12. A technique to change one or more specific nucleotides in a cloned gene in order to create an altered form of a protein with a specific amino acid change(s).
13. A single nucleotide difference between two or more individuals at a particular genetic locus.
14. A laboratory technique which is used to amplify and simultaneously quantify a targeted DNA molecule. It enables both detection and quantification (as absolute number of copies or relative amount when normalized to DNA input or additional normalizing genes) of a specific sequence in a DNA sample.
15. A sequence to which a ribosome can bind and begin translating in the middle of a transcript, without having to scan from 5' end.

III. 問答題

1. If you want to label the 3' end of DNA with large fragment DNA polymerase I by end-filling method, what kind of the isotope, $[\alpha\text{-}^{32}\text{P}]\text{dNTP}$, $[\beta\text{-}^{32}\text{P}]\text{dNTP}$ or $[\gamma\text{-}^{32}\text{P}]\text{dNTP}$, should be used for the labeling, why? When you want to label an isotope on the 5' end of DNA fragment with polynucleotide kinase, what kind of the isotope, $[\alpha\text{-}^{32}\text{P}]\text{ATP}$, $[\beta\text{-}^{32}\text{P}]\text{ATP}$ or $[\gamma\text{-}^{32}\text{P}]\text{ATP}$, should be used for the labeling, why? (5 分)
2. Describe the activities of following enzymes that are used for recombinant DNA technology: (1) alkaline phosphatase (2) *E. coli* exonuclease III (3) Klenow fragment (4) RNase H (5) S1 nuclease. (5 分)
3. Identify the following consensus sequences (what process or system they are used in and their basic function...you don't need to list names of factors that bind unless you want to). (10 分)
 - (1) AAUAAA
 - (2) TATAAA
 - (3) AGGAGGNNNNNNNAUG (Note: N represents any base)
 - (4) GUaagt.....(N).....UACUAAC.....(N).....cAG (capital letters are absolutely conserved, small letters are frequently but not absolutely conserved)
 - (5) Tyr Ser Pro Thr Ser Pro Ser
4. A double-stranded DNA with (91.5 kb). Please answer following questions: (10 分)
 - (a) How many full double-helical turns does this DNA contain?
 - (b) How long is the DNA in microns (1 micron = 10^4 \AA)?

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- (c) What is the molecular mass of this DNA?
(d) How many genes of average size (encoding proteins of about 22,000 molecular weight) can this DNA contain?
(e) How many phosphorus atoms does the DNA contain?
(Hint: The spacing between base pairs is about $3.4 \times 10^{-4} \mu\text{m}$ ($=3.4\text{\AA}$). One double-helical turn encompasses 10.5 bp. One base pair has a molecular mass of about 660 daltons. The average molecular mass of an amino acid is about 110 daltons.)

5. Please answer following questions base on a portion of a bacterial gene sequence showed below. The template strand is on the bottom. (10 分)

5?GTATCGTATGCATGCATCGTGAC-3

3?CATAGCATACGTACGTAGCACTG-5

- (a) Assuming that transcription starts with the first T in the template strand, and continue to the end, what would be the sequence of the mRNA derived from this fragment?
(b) Find the initiation codon in this mRNA. (indicate with underline)
(c) Would there be an effect on translation of changing the first G in the template strand to a C? If so, what effect?
(d) Would there be an effect on translation of changing the second T in the template strand to a G? If so, what effect?
(e) Would there be an effect on translation of changing the last T in the template strand to a C? If so, what effect?

(Hint: You do not need to know the genetic code to answer these questions; you just need to know the nature of initiation and termination codons.)

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應用化學系碩士班
 生物科技研究所碩士班乙組
 本科原始成績：100 分

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共二十題選擇題，答對每題五分。

(註：請於考試試卷第一頁依下列格式標示答案，否則不予計分。)

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

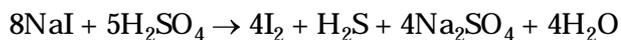
1. In balancing an equation, we change the _____ to make the number of atoms on each side of the equation balance.

- a) formulas of compounds in the reactants b) coefficients of compounds
 c) formulas of compounds in the products d) subscripts of compounds
 e) none of these

2. The limiting reagent in a reaction

- a) has the lowest coefficient in a balanced equation.
 b) is the reactant for which you have the fewest number of moles.
 c) has the lowest ratio of moles available/ coefficient in the balanced equation.
 d) has the lowest ratio of coefficient in the balanced equation/ moles available.
 e) none of these

3. In the following reaction, which species is oxidized?



- a) sodium b) iodine c) sulfur
 d) hydrogen e) oxygen

4. The following reaction occurs in aqueous acid solution: $\text{NO}_3^- + \text{I}^- \rightarrow \text{IO}_3^- + \text{NO}_2$. The oxidation state of iodine in IO_3^- is:

- a) 0 b) +3 c) -3 d) +5 e) -5

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10. Atoms with very similar electronegativity values are expected to form
- a) no bonds. b) covalent bonds. c) triple bonds.
d) ionic bonds. e) none of these
11. In which pair do both compounds exhibit predominantly ionic bonding?
- a) PCl_5 and HF b) Na_2SO_3 and BH_3 c) KI and O_3
d) NaF and H_2O e) RbCl and CaO
12. Which of the following has the smallest radius?
- a) Br^- b) S^{2-} c) Xe d) Ca^{2+} e) Kr
13. The hybridization of the central atom in XeF_5^+ is:
- a) sp b) sp^2 c) sp^3 d) dsp^3 e) d^2sp^3
14. On a relative basis, the weaker the intermolecular forces in a substance,
- a) the greater its heat of vaporization.
b) the more it deviates from ideal gas behavior.
c) the greater its vapor pressure at a particular temperature.
d) the higher its melting point.
e) none of these
15. A certain solid substance that is very hard, has a high melting point, and is nonconducting unless melted is most likely to be:
- a) I_2 b) NaCl c) CO_2 d) H_2O e) Cu
16. When a substance dissolves in water, heat energy is released if:
- a) the lattice energy is positive.
b) the hydration energy is positive.
c) the hydration energy is greater than the lattice energy.
d) the hydration energy is negative.
e) none of these (a-d)

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17. For which order reaction is the half life of the reaction proportional to $1/k$ (k is the rate constant)?

- a) zero order b) first order c) second order
d) all of these e) none of these

18. Which of the following statements concerning equilibrium is not true?

- a) A system that is disturbed from an equilibrium condition responds in a manner to restore equilibrium.
b) Equilibrium in molecular systems is dynamic, with two opposing processes balancing one another.
c) The value of the equilibrium constant for a given reaction mixture is the same regardless of the direction from which equilibrium is attained.
d) A system moves spontaneously toward a state of equilibrium.
e) The equilibrium constant is independent of temperature.

19. The hydrogen halides (HF, HCl, HBr, and HI) are all polar molecules. The strength of the acid each forms in water is based on which of the following?

- a) the polarity of the molecule
b) the size of the molecule
c) the strength of the bond
d) two of these
e) none of these

20. The second law of thermodynamics states that

- a) the entropy of a perfect crystal is zero at 0 K.
b) the entropy of the universe is constant.
c) the energy of the universe is increasing.
d) the entropy of the universe is increasing.
e) the energy of the universe is constant.