

國立高雄大學九十八學年度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、乙組 是否使用計算機：否
本科原始成績：100 分

依題意寫出其生物科技專有名詞之英文“全名”(以中文回答者不予計分) 每題 3 分
(依序標明題號)

1. The stage of mitosis and meiosis in which sister chromatids of homologous chromosome are separated by spindle fiber.
2. Programmed cell death
3. A chromosome-mapping unit. (in honor of geneticist T.H. Morgan who won the Nobel Prize)
4. Constrictions in eukaryotic chromosomes on which the kinetochore lies. Also, the DNA sequence within the constriction that is responsible for appropriate function.
5. Cylindrical organelles, found in eukaryotes (except in higher plants), that reside in the centrosome. Also called basal bodies when they organize flagella or cilia.
6. The organelle that carries out photosynthesis and starch grain formation.
7. A process in which homologous chromosomes exchange parts by a breakage-and-reunion process. (usually producing X-shape chiasmata structure)
8. Family of proteins involved in cell cycle control. This protein can combine with CDK and become active complex.
9. The division of the cytoplasm of a cell (after nuclear division) into two daughter cells.
10. In a gene that has intervening sequences (introns), a region that is actually exported from the nucleus to be expressed or become part of a tRNA or rRNA.
11. The genes that an organism possesses. Its observable attribution is referred as phenotype.
12. Segments of newly replicated DNA produced during discontinuous DNA replication. (in honor of this scientist who first discovered it)
13. Hollow cylinders made of the protein tubulin (there are two subunits) that make up the spindle fiber.

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14. The sequences of three RNA or DNA nucleotides that specify either an amino acid or termination of translation.
15. An allele that expresses itself even when heterozygous. Also, the trait controlled by the allele. (opposite to recessive)
16. Biological or chemical work done in the test tube (or, "in glass") rather than in living systems.

單選題，每題 2 分（請依序標明題號）

Questions 17-20

Always read the meter dials from the right to the left. This procedure is much easier, especially if any of the dial hands are near the zero mark. If the meter has two dials, and one is smaller than the other, it is not imperative to read the smaller dial since it only registers a small amount. Read the dial at the right first. As the dial turns clockwise, always record the figure the pointer has just passed. Read the next dial to the left and record the figure it has just passed. Continue recording the figures on the dials from right to left. When finished, mark off the number of units recorded. Dials on water and gas meters usually indicate the amount each dial records.

17. These instructions show you how to ?

- (A). read a meter (B). turn the dials of a meter
(C). install a gas meter (D). repair a water meter

18. Always read the meter dials-

- (A). from left to right (B). from right to left
(C). from the large dial to the small dial (D). from the small to the large dial

19. As you read the first dial, record the figures

- (A) on the smaller dial (B) the pointer is approaching
(C) the pointer has just passed (D) at the top

20. When you have finished reading the meter, mark off-

- (A) the number of units recorded (B) the figures on the small dial
(C) the total figures (D) all the zero marks

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Questions 21-26.

Many great inventions are greeted with ridicule and disbelief. The invention of the airplane was no exception. Although many people who heard about the first powered flight on December 17, 1903, were excited and impressed, others reacted with peals of laughter. The idea of flying an aircraft was repulsive to some people. Such people called Wilbur and Orville Wright, the inventors of the first flying machine, impulsive fools. Negative reactions, however, did not stop the Wrights. Impelled by their desire to succeed, they continued their experiments in aviation. Orville and Wilbur Wright had always had a compelling interest in aeronautics and mechanics. As young boys they earned money by making and selling kites and mechanical toys. Later, they designed a newspaper-folding machine, built a printing press, and operated a bicycle-repair shop. In 1896, when they read about the death of Otto Lilienthal, the brother's interest in flight grew into a compulsion.

Lilienthal, a pioneer in hang-gliding, had controlled his gliders by shifting his body in the desired direction. This idea was repellent to the Wright brothers, however, and they searched for more efficient methods to control the balance of airborne vehicles. In 1900 and 1901, the Wrights tested numerous gliders and developed control techniques. The brothers' inability to obtain enough lift power for the gliders almost led them to abandon their efforts.

After further study, the Wright brothers concluded that the published tables of air pressure on curved surfaces must be wrong. They set up a wind tunnel and began a series of experiments with model wings. Because of their efforts, the old tables were repealed in time and replaced by the first reliable figures for air pressure on curved surfaces. This work, in turn, made it possible for them to design a machine that would fly. In 1903 the Wrights built their first airplane, which cost less than one thousand dollars. They even designed and built their own source of propulsion- a lightweight gasoline engine. When they started the engine on December 17, the airplane pulsed wildly before taking off. The plane managed to stay aloft for twelve seconds, however, and it flew one hundred twenty feet.

By 1905 the Wrights had perfected the first airplane that could turn, circle, and remain airborne for half an hour at a time. Others had flown in balloons or in hang gliders, but the Wright brothers were the first to build a full-size machine that could fly under its own power. As the contributors of one of the most outstanding engineering achievements in history, the Wright brothers are accurately called the fathers of aviation.

21. The idea of flying an aircraft was ___to some people.
- (A). boring
 - (B). distasteful
 - (C). needless
 - (D). answer not available

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22. People thought that the Wright brothers had _____.
(A). acted without thinking
(B). been negatively influenced
(C). been too cautious
(D). acted in a negative way
23. The Wright's interest in flight grew into a _____.
(A). financial empire
(B). foolish thought
(C). need to act
(D). answer not in article
24. Lilenthal's idea about controlling airborne vehicles was ___ the Wrights.
(A). opposed by
(B). opposite to the ideas of
(C). disliked by
(D). accepted by
25. The old tables were ___ and replaced by the first reliable figures for air pressure on curved surfaces.
(A). not used
(B). canceled
(C). multiplied
(D). discarded
26. The Wrights designed and built their own source of _____.
(A). force for moving forward
(B). force to going backward
(C). turning
(D). none of the above

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Questions 27 – 32: Marie Curie was one of the most accomplished scientists in history. Together with her husband, Pierre, she discovered radium, an element widely used for treating cancer, and studied uranium and other radioactive substances. Pierre and Marie's amicable collaboration later helped to unlock the secrets of the atom.

Marie was born in 1867 in Warsaw, Poland, where her father was a professor of physics. At the early age, she displayed a brilliant mind and a blithe personality. Her great exuberance for learning prompted her to continue with her studies after high school. She became disgruntled, however, when she learned that the university in Warsaw was closed to women. Determined to receive a higher education, she defiantly left Poland and in 1891 entered the Sorbonne, a French university, where she earned her master's degree and doctorate in physics.

Marie was fortunate to have studied at the Sorbonne with some of the greatest scientists of her day, one of whom was Pierre Curie. Marie and Pierre were married in 1895 and spent many productive years working together in the physics laboratory. A short time after they discovered radium, Pierre was killed by a horse-drawn wagon in 1906. Marie was stunned by this horrible misfortune and endured heartbreaking anguish. Despondently she recalled their close relationship and the joy that they had shared in scientific research. The fact that she had two young daughters to raise by herself greatly increased her distress.

Curie's feeling of desolation finally began to fade when she was asked to succeed her husband as a physics professor at the Sorbonne. She was the first woman to be given a professorship at the world-famous university. In 1911 she received the Nobel Prize in chemistry for isolating radium. Although Marie Curie eventually suffered a fatal illness from her long exposure to radium, she never became disillusioned about her work. Regardless of the consequences, she had dedicated herself to science and to revealing the mysteries of the physical world.

27. The Curies' ____ collaboration helped to unlock the secrets of the atom.
(A). friendly (B) competitive (C). chemistry (D) industrious
28. Marie had a bright mind and a __personality.
(A). strong (B). lighthearted (C). humorous (D). strange
29. When she learned that she could not attend the university in Warsaw, she felt ____.
(A). hopeless (B). annoyed (C). worried (D). none of the above
30. Marie ____ by leaving Poland and traveling to France to enter the Sorbonne.
(A). challenged authority (B). showed intelligence (C). behaved (D). none of above
31. Her ____ began to fade when she returned to the Sorbonne to succeed her husband.
(A). misfortune (B). anger (C). wretchedness (D). disappointment
32. Even though she became fatally ill from working with radium, Marie Curie was never ____.
(A). troubled (B). worried (C). disappointed (D). disturbed

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Questions 33-37.

One of the most intriguing stories of the Russian Revolution concerns the identity of Anastasia, the youngest daughter of Czar Nicholas II. During his reign over Russia, the Czar had planned to revoke many of the harsh laws established by previous czars. Some workers and peasants, however, clamored for more rapid social reform. In 1918 a group of these people, known as Bolsheviks, overthrew the government. On July 17 or 18, they murdered the Czar and what was thought to be his entire family.

Although witnesses vouched that all the members of the Czar's family had been executed, there were rumors suggesting that Anastasia had survived. Over the years, a number of women claimed to be Grand Duchess Anastasia. Perhaps the best known claimant was Anastasia Tschaikovsky, who was also known as Anna Anderson.

In 1920, eighteen months after the Czar's execution, this terrified young woman was rescued from drowning in a Berlin river. She spent two years in a hospital, where she attempted to reclaim her health and shattered mind. The doctors and nurses thought that she resembled Anastasia and questioned her about her background. She disclaimed any connection with the Czar's family. Eight years later, though, she claimed that she was Anastasia. She said that she had been rescued by two Russian soldiers after the Czar and the rest of her family had been killed. Two brothers named Tschaikovsky had carried her into Romania. She had married one of the brothers, who had taken her to Berlin and left her there, penniless and without a vocation. Unable to invoke the aid of her mother's family in Germany, she had tried to drown herself.

During the next few years, scores of the Czar's relatives, ex-servants, and acquaintances interviewed her. Many of these people said that her looks and mannerisms were evocative of the Anastasia that they had known. Her grandmother and other relatives denied that she was the real Anastasia, however.

Tired of being accused of fraud, Anastasia immigrated to the United States in 1928 and took the name Anna Anderson. She still wished to prove that she was Anastasia, though, and returned to Germany in 1933 to bring suit against her mother's family. There she declaimed to the court, asserting that she was indeed Anastasia and deserved her inheritance.

In 1957, the court decided that it could neither confirm nor deny Anastasia's identity. Although we will probably never know whether this woman was the Grand Duchess Anastasia, her search to establish her identity has been the subject of numerous books, plays, and movies.

33. Some Russian peasants and workers___for social reform.
- A. longed
 - B. cried out
 - C. begged
 - D. thought much

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34. Witnesses ___ that all members of the Czar's family had been executed.
A. gave assurance
B. thought
C. hoped
D. answer not stated
35. Tschaikovsky ___ any connection with the Czar's family.
A. denied
B. stopped
C. noted
D. justified
E. answer not stated
36. She was unable to ___ the aid of her relative.
A. locate
B. speak about
C. call upon
D. know
37. In court she ___ maintaining that she was Anastasia and deserved her inheritance.
A. finally appeared
B. spoke forcefully
C. testified
D. gave evidence
E. answer not stated

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單選題，每題 2 分（請依序標明題號）

Questions 38-42 Charles A. Lindbergh is remembered as the first person to make a nonstop solo flight across the Atlantic, in 1927. This feat, when Lindbergh was only twenty-five years old, assured him a lifetime of fame and public attention.

Charles Augustus Lindbergh was more interested in flying airplanes than he was in studying. He dropped out of the University of Wisconsin after two years to earn a living performing daredevil airplane stunts at country fairs. Two years later, he joined the United States Army so that he could go to the Army Air Service flight-training school. After completing his training, he was hired to fly mail between St. Louis and Chicago.

Then came the historic flight across the Atlantic. In 1919, a New York City hotel owner offered a prize of \$25,000 to the first pilot to fly nonstop from New York to Paris. Nine St. Louis business leaders helped pay for the plane Lindbergh designed especially for the flight. Lindbergh tested the plane by flying it from San Diego to New York, with an overnight stop in St. Louis. The flight took only 20 hours and 21 minutes, a transcontinental record.

Nine days later, on May 20, 1927, Lindbergh took off from Long Island, New York, at 7:52 A. M. He landed at Paris on May 21 at 10:21 P. M. He had flown more than 3,600 miles in less than thirty four hours. His flight made news around the world. He was given awards and parades everywhere he went. He was presented with the U. S. Congressional Medal of Honor and the first Distinguished Flying Cross. For a long time, Lindbergh toured the world as a U. S. goodwill ambassador. He met his future wife, Anne Morrow, in Mexico, where her father was the United States ambassador.

During the 1930s, Charles and Anne Lindbergh worked for various airline companies, charting new commercial air routes. In 1931, for a major airline, they charted a new route from the east coast of the United States to the Orient. The shortest, most efficient route was a great curve across Canada, over Alaska, and down to China and Japan. Most pilots familiar with the Arctic did not believe that such a route was possible. The Lindberghs took on the task of proving that it was. They arranged for fuel and supplies to be set out along the route. On July 29, they took off from Long Island in a specially equipped small seaplane. They flew by day and each night landed on a lake or a river and camped. Near Nome, Alaska, they had their first serious emergency. Out of daylight and nearly out of fuel, they were forced down in a small ocean inlet. In the next morning's light, they discovered they had landed on barely three feet of water. On September 19, after two more emergency landings and numerous close calls, they landed in China with the maps for a safe airline passenger route.

Even while actively engaged as a pioneering flier, Lindbergh was also working as an engineer. In 1935, he and Dr. Alexis Carrel were given a patent for an artificial heart. During World War I in the 1940s, Lindbergh served as a civilian technical advisor in aviation. Although he was a civilian, he flew over fifty combat missions in the Pacific. In the 1950s, Lindbergh helped design the famous 747 jet airliner. In the late 1960s, he spoke widely on conservation issues. He died August 1974, having lived through aviation history from the time of the first powered flight to the first steps on the moon and having influenced a big part of that history himself.

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38. What did Lindbergh do before he crossed the Atlantic?
(A). He charted a route to China.
(B). He graduated from flight-training school.
(C). He married Anne Morrow.
(D). He acted as a technical advisor during World War II.
(E). He was responsible for the fuel supply for planes.
39. What happened immediately after Lindbergh crossed the Atlantic?
(A). He flew the mail between St. Louis and Chicago.
(B). He left college.
(C). He attended the Army flight-training school.
(D). He was given the Congressional Medal of Honor.
(E). He married Anne Morrow.
40. When did Charles meet Anne Morrow?
(A). before he took off from Long Island
(B). after he worked for an airline
(C). before he was forced down in an ocean inlet
(D). after he received the first Distinguished Flying Cross
(E). when visiting his parents
41. When did the Lindberghs map an air route to China?
(A). before they worked for an airline
(B). before Charles worked with Dr. Carrel
(C). after World War II
(D). while designing the 747
(E). when he was thirty
42. What event happened "last"?
(A). Lindbergh patented an artificial heart.
(B). The Lindberghs mapped a route to the Orient.
(C). Lindbergh helped design the 747 airline.
(D). Lindbergh flew fifty combat missions.
(E). Charles finally was given an honorary degree from college.

--END--

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I . Single-choice questions (30 points)

- The structure of lactose is:
(A) α -D-glucopyranosyl-(1 \rightarrow 2)- β -D-fructofuranose;
(B) α -D-glucopyranosyl-(1 \rightarrow 4)- β -D-galactopyranose;
(C) β -D-galactopyranosyl-(1 \rightarrow 4)- α -D-glucopyranose;
(D) β -D-glucopyranosyl-(1 \rightarrow 4)- α -D-glucopyranose;
(E) β -D-glucopyranosyl-(1 \rightarrow 2)- α -D-galactopyranose.
- Which of the following compounds is the major product of amylose being exhaustively methylated by methyl iodide and then hydrolyzed in aqueous acid?
(A) 2,3,4,6-tetra-O-methyl-D-glucose; (B) 1,2,4-tri-O-methyl-D-glucose;
(C) 2,3,4-tri-O-methyl-D-glucose; (D) 2,3,6-tri-O-methyl-D-glucose;
(E) 2,3-di-O-methyl-D-glucose.
- What is the systemic name of arachidonate ?
(A) cis- Δ^9 - Hexadecenoate; (B) cis- Δ^9 - Octadecenoate;
(C) cis, cis- $\Delta^{9,12}$ - Octadecadienoate; (D) all cis- $\Delta^{9,12,15}$ - Octadecatrienoate;
(E) all cis- $\Delta^{5,8,11,14}$ - Eicosatetraenoate.
- Proteins are key membrane components that can help draw appropriate membranes together to initiate the fusion process:
(A) selectin; (B) chaperon; (C) SNARE; (D) lectin; (E) fetuin.
- Which of the following is not correct concerning the mechanism about cholera toxin produced by the gram-negative bacterium *Vibrio cholerae*?
(A) The subunit A of cholera toxin catalyzes the covalent modification of $G_{\alpha s}$ protein. (B) This modification stabilizes the $G_{\alpha s}$ -GTP form, causing it to be persistent in an active conformation.
(C) This active G protein, in turn, continuously activates protein kinase A. (D) Protein kinase A opens a Cl^- channel and enhances Na^+ - H^+ exchanger via phosphorylation. (E) The net result is an excessive loss of $NaCl$ and the loss of large amounts of water into the intestine.
- Which of the following compounds serves as a methyl carrier? (A) coenzyme A;
(B) lipoyl-CoA; (C) biotin; (D) tetrahydrofolate; (E) S-adenosylmethionine.
- In muscle, phosphofructokinase is inhibited by: (1) fructose 1,6-bisphosphate;
(2) fructose-2,6-bisphosphate; (3) lowering pH; (4) high energy charge; (5) alanine
(A) only 1; (B) only 2; (C) 2,3, and 4; (D) 4 and 5; (E) 3 and 4.

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8. The conversion of 1 mol of fructose 1,6-bisphosphate to 2 mol of pyruvate by the glycolytic pathway results in a net formation of:
(A) 1 mol of NAD^+ and 2 mol of ATP; (B) 1 mol of NADH and 1 mol of ATP;
(C) 2 mol of NAD^+ and 4 mol of ATP; (D) 2 mol of NADH and 2 mol of ATP;
(E) 2 mol of NADH and 4 mol of ATP.
9. Phosphoenolpyruvate carboxykinase catalysis:
(A) phosphoenolpyruvate \rightarrow oxaloacetate;
(B) oxaloacetate \rightarrow phosphoenolpyruvate;
(C) pyruvate \rightarrow phosphoenolpyruvate;
(D) phosphoenolpyruvate \rightarrow pyruvate;
(E) pyruvate \rightarrow oxaloacetate.
10. Which of the following statements about the citric acid cycle are **not true**?
(1) The function of the citric acid cycle is the harvesting of high-energy electrons from carbon fuels.
(2) This cycle does not include oxygen as a reactant.
(3) This cycle can proceed under anaerobic and aerobic conditions.
(4) The determining rate of the citric acid cycle is the step of α -ketoglutarate formation.
(5) The two moles of CO_2 produced in the first turn of the citric acid cycle have their origin in the carboxyl and methylene carbons of oxaloacetate.
(A) 1 and 2; (B) 3 and 4; (C) 2 and 4; (D) 3 and 5; (E) 1 and 5.
11. How many photons are required when the production of one molecule of oxygen from two moles of water?
(A) two; (B) four; (C) six; (D) eight; (E) ten.
12. Which of the following statements about rubisco is **not true**? (A) Rubisco located on the stromal surface of the thylakoid membranes of chloroplasts. (B) Rubisco activity requires a CO_2 molecule other than the substrate. This CO_2 molecule adds to the lysine 210 residue and to form a carbamate intermediate. (C) This carbamate is most likely to be formed at high pH, which occurs during light induced proton pumping from the stroma into the thylakoid. (D) The carbamate binds the calcium ion which playing a key role in binding ribulose 1,5-bisphosphate. (E) The formation of the carbamate is facilitated by the rubisco activase.
13. The activated form of orthophosphate is
(A) ATP; (B) ADP; (C) AMP; (D) pyrophosphate; (E) None of the above.

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14. What kind of vitamin involves in the glycogen phosphorylation reaction?

(A) vitamin A; (B) vitamin B₁; (C) vitamin B₂; (D) vitamin B₆; (E) vitamin B₁₂.

15. The NADPH source of fatty acid synthesis is provided by (A) only pentose phosphate pathway; (B) only malate-aspartate shuttle; (C) only malate-pyruvate shuttle; (D) pentose phosphate pathway and malate-pyruvate shuttle; (E) pentose phosphate pathway and malate-aspartate shuttle.

II. Simply explain the following terms (20 points)

1. Noncompetitive inhibition
2. Chromatin immunoprecipitation
3. microRNA
4. Enzymatic cascade
5. Michaelis constant

III. Please answer the following questions (50 points)

1. HMG-CoA reductase is an important control site in cholesterol biosynthesis; please describe how to regulate its activity? (15 points)
2. An elicitor protein X that secreted by a bacterial pathogen induces host cell apoptosis. Please design an experiment to identify the host cell protein that may interact with elicitor X and proof its function. (15 points)
3. Please describe the processes about acetylcholine is transported from presynaptic terminal to postsynaptic terminal. (10 points)
4. What is the stoichiometry of the synthesis of ribose 5-phosphate from glucose 6-phosphate without the concomitant generation of NADPH? Please list the possible reactions. (10 points)

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是否使用計算機：是

I、是非題(每題 1 分)

1. Some genes located on the same chromosome do not show perfect linkage because they are interrupted by other genes.
2. The noncoding strand of a gene is the same as the antisense strand.
3. The G-less cassette assay is conducted using a promoter fused to a short DNA sequence and can be used to measure the transcription activity in a cell.
4. Roeder and Rutter showed that there are four polymerases operating in the eukaryotic cell.
5. Binding of the CAP-cAMP to the *lac* activator-binding site recruits RNA polymerase.
6. Capped mRNAs are degraded much more slowly than non-capped mRNAs, due to the fact that the 5' to 5' link of the cap blocks the action of RNases that degrade mRNA from the 5' end of an RNA molecule.
7. All mature tRNAs contain the trinucleotide CCA at their 3'-end. These three bases are coded for by the tRNA gene. Instead, these nucleotides are not added during processing of the pre-tRNA transcript.
8. The charging reaction of tRNA is catalyzed by a set of enzymes called aminoacyl-tRNA synthetases. Only 20 aminoacyl-tRNA synthetases exist, one for each amino acid, and they are very specific. The specificity of the aminoacyl tRNA synthetases is determined by the structure of the tRNA and the recognition of tRNAs by aminoacyl-tRNA synthetase has been dubbed the "second genetic code".
9. Because bacteria have circular chromosomes, termination of replication occurs when the two replication forks meet each other on the opposite end of the parental chromosome. However, eukaryotes initiate DNA replication at multiple points in the chromosome, so replication forks meet and terminate at many points in the chromosome.
10. The transcriptome is the set of total RNA molecules which is roughly fixed for a given cell line. Transcriptome reflects the genes that are being actively expressed at any given time, with the exception of mRNA degradation phenomena such as transcriptional attenuation.

II、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)

1. The C-value paradox can be explained by
 - (A) the number of cytosine and guanine in DNA.
 - (B) the number of mutations in each gene.
 - (C) the amount of noncoding DNA in an organism.
 - (D) the number of extra genes in the genome.
 - (E) hyperchromic shift.

國立高雄大學九十八學年度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：生物科技研究所甲組
本科原始成績：100 分

是否使用計算機：是

2. Which of the following would result in a block of transcription of RNA?
 - (A) dATP
 - (B) dCTP
 - (C) dGTP
 - (D) TTP
 - (E) none of the choices are correct.
3. A disadvantage of using a prokaryotic expression system for eukaryotic proteins is that the proteins are
 - (A) highly phosphorylated after translation.
 - (B) improperly folded.
 - (C) highly soluble.
 - (D) heavily glycosylated.
 - (E) over expressed.
4. Which of the following isotopes would be the most appropriate for the end-labeling of a DNA strand with a radioactive phosphate?
 - (A) α - ^{32}P
 - (B) ^{35}S
 - (C) β - ^{32}P
 - (D) γ - ^{32}P
 - (E) ^{14}C
5. Which of the following techniques would be most useful in testing the ability of the core RNA polymerase to bind to the promoter?
 - (A) DNase footprinting
 - (B) S1 mapping
 - (C) immunoblotting
 - (D) gel filtration
 - (E) northern blotting
6. Which of the following techniques is most useful in determining if RNA polymerase has initiated transcription from the *lac* DNA template?
 - (A) Southern analysis
 - (B) DNA fingerprinting
 - (C) DNA sequencing
 - (D) RACE
 - (E) run-off transcription assay
7. Which of the following statements is true about the *cro* gene?

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- (A) It must be stimulated during lysogeny.
(B) Its product promotes repressor activity.
(C) *cro* repression is important to lysogeny.
(D) It is adjacent to the *cIII* gene.
(E) It must be stimulated during lysogeny and its product promotes repressor activity are correct.
8. Select the correct statement about enhancers
- (A) They are proteins that promote transcription of RNA.
(B) They stimulate the binding of repressor to DNA.
(C) They bind protein factors and stimulate transcription.
(D) They are nonpromoter protein elements.
(E) None of the choices is correct.
9. Predict the outcome of addition of DMS to the open complex formed when polymerase binds to a promoter.
- (A) Repressors will bind more tightly to the operator.
(B) Methylation may occur on some nucleotides.
(C) Polymerase will be displaced.
(D) Phosphodiester bonds in the operator region will be broken.
(E) All of the choices are correct.
10. The CCAAT boxes are bound by which of the following?
- (A) CTF
(B) DPE
(C) Sp1
(D) TBP
(E) TFB
11. Which of the following is considered a universal transcription factor?
- (A) TFIIA
(B) TFIIB
(C) TFIID
(D) TFIIF
(E) TFIIH
12. Which of the following can be found in DNA-binding domains?
- (A) zinc fingers
(B) glutamine-rich regions
(C) bZIP motifs
(D) bHLH motif

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- (E) all of the choices are correct.
13. Which of the following is the most common type of histone modification?
- (A) lysine ϵ -amino methylation
 - (B) acetylation
 - (C) lysine n-phosphorylation
 - (D) histidine n-phosphorylation
 - (E) serine o-phosphorylation
14. A messenger ribonucleic acid is 336 nucleotides long, including the initiator and termination codons. The number of amino acids in the protein translated from this mRNA is:
- (A) 999
 - (B) 333
 - (C) 112
 - (D) 110
 - (E) 111
15. A synthetic mRNA of repeating sequence 5'-CACACACACACACACAC... is used for a cell-free protein synthesizing system like the one used by Nirenberg. If we assume that protein synthesis can begin without the need for an initiator codon, what product or products would you expect to occur after protein synthesis?
- (A) one protein, consisting of a single amino acid
 - (B) three proteins, each consisting of a different, single amino acid
 - (C) two proteins, each with an alternating sequence of two different amino acids
 - (D) one protein, with an alternating sequence of three different amino acids
 - (E) one protein, with an alternating sequence of two different amino acids
16. What is the role of the DICER protein in microRNA processing?
- (A) Transcribe the miRNA from the genome
 - (B) Export the miRNA from the nucleus to the cytoplasm
 - (C) Match the guide strand with the mRNA target
 - (D) Cleave the loop sequences of the miRNA
 - (E) Promote the editing of a target mRNA
17. In order to identify the transcriptional profile of a single cell or individual tissue which of the following techniques is most appropriate?
- (A) Electromobility Shift Assays (EMSA)
 - (B) Chromatin Immunoprecipitation (ChIP)
 - (C) Two-dimensional electrophoresis
 - (D) DNA microarrays

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- (E) Bioinformatics
18. Why is DNA polymerase III a better enzyme than DNA polymerase I for replicating the *E. coli* chromosome?
- (A) DNA polymerase III doesn't require magnesium
 - (B) DNA polymerase III has a proofreading function
 - (C) DNA polymerase III is more processive
 - (D) DNA polymerase III doesn't require dNTP's
 - (E) DNA polymerase III uses a primer
19. What does puromycin resemble which enables puromycin to terminate peptide chain elongation?
- (A) amino acid
 - (B) aminoacyl-tRNA synthetase
 - (C) aminoacyl-tRNA
 - (D) aminopterin
 - (E) aminoglycosides
20. A student isolated and purified various molecules needed for DNA replication. When she added some DNA, replication occurred, but the DNA molecules formed were defective. Each consisted of a normal DNA strand paired with numerous segments of DNA a few hundred nucleotides long. What had she probably left out of the mixture?
- (A) Primers
 - (B) Ligase
 - (C) Okazaki fragments
 - (D) DNA polymerase
 - (E) Nucleotides
21. DNA is not completely stable; the spontaneous loss of amino groups from adenine, for example, results in hypoxanthine (H), an atypical base, opposite thymine. In other words, a H-T pair is formed. What combination of molecules could the cell use to repair such damage?
- (A) telomerase, primase, DNA polymerase
 - (B) nuclease, DNA polymerase, DNA ligase
 - (C) telomerase, helicase, single-strand binding protein
 - (D) DNA ligase, replication fork proteins, adenase
 - (E) nuclease, telomerase, primase
22. What is the role of the "primase" in DNA replication?
- (A) it synthesizes a short piece of RNA, which serves as starting point for replicating the DNA
 - (B) it makes pieces of DNA called Okasaki fragments
 - (C) it opens up the DNA to allow synthesis to begin

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- (D) it prevents the single strands of DNA from coming back together
(E) it synthesizes a short piece of DNA, which serves as starting point for replicating the DNA
23. Regarding mutation, which of the following is not correct?
(A) a point mutation will cause a shift in the reading frame
(B) many point mutations do not change the amino acid sequence of a protein
(C) breaking and rejoining chromosomes can cause mutations
(D) ultraviolet light can cause mutations
(E) deletion of a single nucleotide is more likely to disrupt a gene than changing a G to a T
24. The role of the Release Factor in translation is
(A) to bind the stop codon and terminate protein synthesis
(B) to release aminoacyl-tRNAs from the ribosome
(C) to promote the movement of the next codon into the ribosome
(D) to allow the ribosome to dissociate from the ER
(E) to allow mRNA to leave the nucleus
25. Humans have 23 types of chromosomes. Approximately how many genes are on the average human chromosome? (If you know the approximate total number of human genes you can figure this out.)
(A) 100
(B) 1,200
(C) 10,000
(D) 30,000
(E) 100,000
26. In animals a single gene often gives rise to several forms of a protein. The proteins can differ by having unique regions with different amino acid sequences. What is the mechanism that typically generates this protein diversity?
(A) the DNA has different regions missing in different types of cells
(B) RNA polymerase reads different regions of the gene
(C) during RNA splicing different exons are included in the final mRNA
(D) the open reading frame can be shifted during translation
(E) the ribosome reads different parts of the mRNA

III、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，以中文作答不計分，請謹慎作答。)

1. A mechanism of transcription control that involves premature transcription termination.

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是否使用計算機：是

2. A region in a cloning vector that contains several restriction sites in tandem. Any of these can be used for inserting foreign DNA.
3. A reading frame that is uninterrupted by translation stop codons.
4. Inhibition of one activator by increasing the concentration of a second one. Presumably caused by competition for a scarce common factor.
5. The attachment of SUMO proteins to other proteins, such as activators.
6. A mechanism of replication in which one strand of a double-stranded circular DNA remains intact and serves as the template for elongation of the other strand at a nick.
7. The set of changes that occur in a protein after it is synthesized by attaching to it with other biochemical functional groups such as acetate, phosphate, various lipids and carbohydrates.
8. A DNA element that can move around to different positions within the genome of a single cell. In the process, it can cause mutation and change the amount of DNA in the genome.
9. An RNA-protein particle that translates mRNAs to produce proteins.
10. A unique stretch of DNA within a coding region of a gene that is useful for identifying full-length genes and serves as a landmark for mapping. It is a sequence tagged site (STS) generated by amplifying cellular mRNA by RT-PCR.

IV、問答題 (18 分)

1. Compare and contrast the classical and nonclassical class III promoters. Give an example of each. (8 分)
2. (A) You want to create a site-directed mutation in a gene you're working on, so you generate single-stranded circular DNA from a plasmid carrying the gene. You create an oligonucleotide carrying the desired mutation and phosphorylate it on the 5' end with a radioactive phosphate. You anneal the labeled oligo to the complementary single-stranded template and synthesize the second strand with *E. coli* DNA polymerase I, followed by ligation to close the circle. You run a little bit of the reaction on a gel and are disappointed that there doesn't seem to be any radioactivity in the double-stranded plasmid band. You decide to transform the reaction into *E. coli* cells anyway, but don't get any mutant clones. After thinking about it, you decide to try the reaction again with a different tube of *E. coli* DNA polymerase I that says "Klenow fragment". Now when you run the gel, the double-stranded plasmid band is radioactive. Why were the results different? (5 分)

(B) You transform the new batch of double-stranded DNA into *E. coli* cells, but upon analysis of the transformed cells you still can't find DNA molecules with the engineered mutation. A colleague in the lab suggests you alter your protocol and treat the double stranded DNA with dam

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methylase (methylates A in the sequence GATC) before transformation. You try it and now you obtain the engineered mutation in about half your clones. Why did treatment with the methylase increase the yield of mutants? (5 分)

國立高雄大學九十八學年度碩士班招生考試試題

科目：普通生物學
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系所：
生物科技研究所乙組
本科原始成績：100 分

是否使用計算機：是

一、選擇題(每題 2 分，共 44 分)

1. Given a population that contains genetic variation, what is the correct sequence of the following events, under the influence of natural selection?

1. Well-adapted individuals leave more offspring than do poorly adapted individuals.
 2. A change occurs in the environment.
 3. Genetic frequencies within the population change.
 4. Poorly adapted individuals have decreased survivorship.
- A) 2 → 4 → 1 → 3 B) 4 → 2 → 1 → 3 C) 4 → 1 → 2 → 3 D) 4 → 2 → 3 → 1
E) 2 → 4 → 3 → 1

2. Which group is *incorrectly* paired with its description?

- A) rhizarians—morphologically diverse group defined by DNA similarities
- B) diatoms—important producers in aquatic communities
- C) red algae—acquired plastids by secondary endosymbiosis
- D) apicomplexans—parasites with intricate life cycles
- E) diplomonads—protists with modified mitochondria

3. Photoautotrophs use

- A) light as an energy source and CO₂ as a carbon source.
- B) light as an energy source and methane as a carbon source.
- C) N₂ as an energy source and CO₂ as a carbon source.
- D) CO₂ as both an energy source and a carbon source.
- E) H₂S as an energy source and CO₂ as a carbon source.

4. The most important feature that permits a gene to act as a molecular clock is

- A) having a large number of base pairs.
- B) having a larger proportion of exonic DNA than of intronic DNA.
- C) having a reliable average rate of mutation.
- D) its recent origin by a gene-duplication event.
- E) its being acted upon by natural selection.

5. In their laboratory simulations of the early Earth, Miller and Urey observed the abiotic synthesis of

- A) amino acids. B) complex organic polymers. C) DNA. D) liposomes. E) genetic systems.

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是否使用計算機：是

6. Which of the following is characteristic of the lytic cycle?
- A) Many bacterial cells containing viral DNA are produced.
 - B) Viral DNA is incorporated into the host genome.
 - C) The viral genome replicates without destroying the host.
 - D) A large number of phages is released at a time.
 - E) The virus-host relationship usually lasts for generations.
7. What would occur if the repressor of an inducible operon were mutated so it could not bind the operator?
- A) irreversible binding of the repressor to the promoter
 - B) reduced transcription of the operon's genes
 - C) buildup of a substrate for the pathway controlled by the operon
 - D) continuous transcription of the operon's genes
 - E) overproduction of catabolite activator protein (CAP)
8. How many unique gametes could be produced through independent assortment by an individual with the genotype *AaBbCCDdEE*?
- A) 4 B) 8 C) 16 D) 32 E) 64
9. What is the source of the extra chromosome 21 in an individual with Down syndrome?
- A) Nondisjunction in the mother only
 - B) Nondisjunction in the father only
 - C) Duplication of the chromosome
 - D) Nondisjunction or translocation in either parent
 - E) It is impossible to detect with current technology
10. What determines the nucleotide sequence of the newly synthesized strand during DNA replication?
- A) the particular DNA polymerase catalyzing the reaction
 - B) the relative amounts of the four nucleoside triphosphates in the cell
 - C) the nucleotide sequence of the template strand
 - D) the primase used in the reaction
 - E) the arrangement of histones in the sugar phosphate backbone
11. What is the most abundant type of RNA?

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A) mRNA B) tRNA C) rRNA D) pre-mRNA E) hnRNA

12. Which of the following components is present in a prokaryotic cell ?

A). chloroplasts. B). mitochondria. C). nuclear envelope. D). ribosomes. E). ER.

13. Lipid-soluble signal molecules, such as testosterone, cross the membranes of all cells but affect only target cells because

A). only target cells retain the appropriate DNA segments.

B). intracellular receptors are present only in target cells.

C). most cells lack the Y chromosome required.

D). only target cells possess the cytosolic enzymes that transduce the testosterone.

E). only in target cells is testosterone able to initiate the phosphorylation cascade leading to activated transcription factor.

14. Which of the following is not considered to be a tissue ?

A). cartilage. B). the mucous membrane lining the stomach. C). the brain. D). blood. E). cardiac muscle.

15. The symbiotic microbes that help nourish a ruminant live mainly in specialized regions of the

A). large intestine. B). liver. C). small intestine. D). pharynx. E). stomach.

16. Pulse is direct measure of

A). heart rate. B). stroke volume. C). cardiac output. D). blood pressure. E). breathing rate.

17. Which of the following is not part of the body's nonspecific defense system ?

A). natural killer (NK) cells. B). inflammation. C). phagocytosis by neutrophils. D). phagocytosis by macrophages. E). antibodies.

18. The majority of water and salt filtered into Bowman's capsule is reabsorbed by

A). the transport epithelia of the proximal tubule.

B). diffusion from the descending limb of the loop of Henle into the hyperosmotic interstitial fluid of the medulla.

C). active transport across the transport epithelium of the thick upper segment of the ascending limb of the loop of Henle.

D). selective secretion and diffusion across the distal tubule.

E). diffusion from the collecting duct into the increasing osmotic gradient of the renal medulla.

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19. A distinctive feature of the mechanism of action of thyroid hormones and steroid hormones is that
- A). these hormones are regulated by feedback loops.
 - B). target cells react more rapidly to these hormones than to local regulators.
 - C). these hormones bind with specific receptor proteins on target cell plasma membranes.
 - D). these hormones bind to receptors inside cells.
 - E). these hormones affect metabolism.
20. Which of the following characterizes parthenogenesis ?
- A). An individual may change its sex during its lifetime.
 - B). Specialized groups of cells may be released and grow into new individuals.
 - C). An organism is first a male and then a female.
 - D). An egg develops without being fertilized.
 - E). Both members of a mating pair have male and female reproductive organs.
21. Which of the following is common to both avian and mammalian development ? A). holoblastic cleavage. B). primitive streak. C). trophoblast. D). yolk plug. E). gray crescent.
22. Which of the following occurs when a stimulus depolarizes a neuron's membrane ?
- A). Na^+ diffuses out of the cell.
 - B). The action potential approaches zero.
 - C). The membrane potential changes from the resting potential to a voltage closer to the threshold potential.
 - D). The depolarization is all or none.
 - E). The inside of the cell becomes more negative in charge relative to the outside of the cell.

二、名詞解釋(每題 4 分，共 32 分)

1. biological species concept
2. semiconservative model
3. homologous chromosomes
4. RNA interference
5. epitope
6. countercurrent exchange
7. endomembrane system
8. action potential

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是否使用計算機：是

三、問答題(每題 6 分，共 24 分)

- 1.敘述真核染色體的染色質包裝 (chromatin packing) 過程。
- 2.何以天擇無法塑造出完美生物 (perfect organisms) ?
- 3.說明在細胞週期的過程中，細胞通過 G2 phase checkpoint 而進入有絲分裂階段的分子控制機制？
- 4.說明鈣離子及調節蛋白質調控肌肉收縮的機制。