

※ 注意：請於試卷內之「選擇題作答區」依序作答。

一、選擇題 (每題2分，共50分)

1. Loosely packed regions of DNA associated with histones are called _____.
 - a. euchromatin
 - b. heterochromatin
 - c. chromosomes
 - d. nucleosomes
 - e. 30-nm chromatin fibers

2. At the conclusion of S phase, a diploid cell with 40 chromosomes will have _____ chromosomes and _____ sister chromatids.
 - a. 20; 40
 - b. 20; 20
 - c. 40; 40
 - d. 40; 80
 - e. 80; 80

3. Once human nerve cells become mature, they normally exit the cell cycle and remain in _____.
 - a. G₀
 - b. G₁
 - c. G₂
 - d. S phase
 - e. prophase

4. Karyotype analyses are performed on cells in _____ of mitosis.
 - a. prophase
 - b. prometaphase
 - c. metaphase
 - d. anaphase
 - e. telophase

5. Replication of a bacterial chromosome begins at a specific region called the _____.
 - a. *ter*

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b. replication fork

c. *beg*

d. *ori*

e. *rep*

6. Homologous chromosomes ____.

a. are found in somatic cells and gametes

b. align along the equatorial plane during metaphase II

c. are replicated during interkinesis

d. contain a maternal and paternal chromosome

e. are preserved in each daughter cell produced by meiosis

7. Synapsis refers to the ____.

a. crossing-over between homologous chromosomes

b. alignment of homologous chromosomes along the equatorial plane

c. alignment of sister chromatids along the equatorial plane

d. pairing of homologous chromosomes during prophase I

e. pairing of sister chromatids during prophase II

8. Nondisjunction during meiosis I results in ____.

a. the generation of an extra daughter cell

b. a change in the status of a daughter cell from diploid to haploid

c. a change in the status of a daughter cell from haploid to diploid

d. one pole of the cell receiving neither member of a homologous pair of chromosomes

e. a gamete that cannot fuse with another gamete

9. In a frog in which the diploid number of chromosomes per cell is 24, what is the total number of chromatids present during prophase I?

a. 4

b. 6

c. 12

d. 24

e. 48

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10. Crossing-over ____.
- only takes place towards the middle of chromatids
 - can only occur once for each non-sister chromatid
 - can only occur once for each homologous chromosome pair
 - only takes place between sister chromatids
 - can occur at multiple sites in each set of paired chromosomes
11. An F_1 individual resulting from a cross between a homozygous dominant parent and a homozygous recessive parent is always ____.
- heterozygous or homozygous dominant
 - heterozygous or homozygous recessive
 - homozygous dominant
 - homozygous recessive
 - heterozygous
12. Events X and Y are independent of each other. If the probability of event X occurring is 1 in 4, and the probability of event Y occurring is 1 in 5, the probability of *both* events occurring is ____.
- $(1/4)^2 + (1/5)^2 = (1/16) + (1/25) = (25/400) + (16/400) = 41/400$
 - $(1/4) + (1/5) = (5/20) + (4/20) = 9/20$
 - $(1/4)^2(1/5)^2 = (1/16)(1/25) = 1/400$
 - $(1/4)(1/5) = 1/20$
 - $(1/4 + 1/5)^2 = (5/20 + 4/20)^2 = (9/20)^2 = 81/400$
13. Your father is heterozygous for the recessive disorder phenylketonuria (PKU). You know your mother has two "good" alleles. You have a ____ chance of having the disorder.
- 0%
 - 100%
 - 25%
 - 50%
 - 75%
14. A man and woman are each heterozygous for the autosomal recessive gene for albinism. They already have two non-albino children and want to have two more. What is the

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probability that their next two children will be phenotypically identical to each other with regard to skin color (i.e., either both albino or neither albino)?

- a. 1/16
- b. 3/16
- c. 4/16
- d. 9/16
- e. 10/16

15. You have type A blood (genotype $I^A i$). Who can you donate blood to in an emergency?

- a. type O only
- b. type AB only
- c. type A only
- d. types A and B, not O
- e. types A and AB

16. What happens when living *R* strain *Streptococcus pneumoniae* bacteria are mixed with heat-killed *S* strain *Streptococcus pneumoniae* bacteria?

- a. The *S* strain bacteria come back to life.
- b. The *R* strain bacteria are killed, and the *S* strain bacteria remain dead.
- c. The *R* strain bacteria are transformed into *S* strain bacteria.
- d. The *S* strain bacteria are transformed into *R* strain bacteria.
- e. The *R* strain bacteria are killed, and the *S* strain bacteria come back to life.

17. How are purines distinguished from pyrimidines?

- a. Purines are derived from a pair of fused C-N rings, while pyrimidines are derived from a single C-N ring.
- b. Pyrimidines are derived from a pair of fused C-N rings, while purines are derived from a single C-N ring.
- c. Purines have a carbon-containing ring, while pyrimidines have a nitrogenous ring.
- d. Pyrimidines have a carbon-containing ring, while purines have a nitrogenous ring.
- e. Purines are found only in DNA, while pyrimidines are found only in RNA.

18. The polynucleotide chain of DNA has polarity: the 5' end has a bound _____, while the 3' end has a bound _____.

- a. deoxyribose sugar, ribose sugar

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- b. adenine, thymine
- c. cytosine, guanine
- d. hydroxyl group, phosphate group
- e. phosphate group, hydroxyl group

19. Topoisomerase functions by _____.

- a. creating cuts in the DNA to relieve over-twisting and strain ahead of the replication fork
- b. binding DNA polymerase to hold it tightly to the template DNA
- c. unwinding the DNA double helix to expose the template strands for replication
- d. binding the newly synthesized DNA to re-twist it into a double helix after replication
- e. reading the DNA template and synthesizing a complementary strand of DNA

20. A short RNA chain is synthesized as the first nucleotides in a new DNA strand by the enzyme _____ to provide a _____ for DNA elongation.

- a. topoisomerase; 3' hydroxyl group
- b. primase; 3' hydroxyl group
- c. primase; 5' hydroxyl group
- d. DNA polymerase; 5' phosphate group
- e. DNA polymerase; 3' hydroxyl group

21. During normal DNA replication, part of the sequence at the ends of linear chromosomes is not copied into the new DNA strands because _____.

- a. DNA ligase cannot join pieces at the end of a chromosome
- b. RNA primers at the beginning of a new strand cannot be replaced with DNA
- c. those ends are Okazaki fragments that are lost
- d. cells do not need the DNA at the ends of chromosomes
- e. the ends of chromosomes are made of protein, not DNA

22. In both prokaryotes and eukaryotes, the start codon (or initiator codon) is _____, which codes for the amino acid _____.

- a. UGA; proline
- b. UUU; phenylalanine

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- c. AAA; lysine
- d. ACG; threonine
- e. AUG; methionine

23. The _____, located _____ of the transcription start point, is the site at which RNA polymerase associates with DNA to begin transcription.

- a. promoter; upstream
- b. initiator; downstream
- c. initiator; upstream
- d. promoter; downstream
- e. intron; downstream

24. In an mRNA transcript, the 3' UTR refers to the region of the mRNA that is _____.

- a. upstream from the start codon
- b. upstream from the site for initiation of transcription
- c. downstream from the stop codon
- d. the coding region
- e. downstream from the site for termination of transcription

25. At the start of translation, the initiator tRNA pairs with the start codon at the _____ of the ribosome.

- a. A (aminoacyl) site
- b. promoter
- c. P (peptidyl) site
- d. ribosomal binding site
- e. E (exit) site

二、問答題 (每題10分，共50分) ※ 注意：請於試卷內之「非選擇題作答區」標明題號依序作答。

1. In many cancers, the cancerous cells have fully active telomerase enzymes. Explain how this might play a role in enabling cancer cells to keep rapidly dividing.
2. Where in a prokaryotic cell is DNA found? How is that DNA organized?

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3. Many scientists once believed that proteins were the most likely hereditary molecules. Describe briefly how DNA was found to be the molecule of heredity.
4. What are the three ways in which sexual reproduction enhances the degree of genetic variability among individuals?
5. How does a missense mutation differ from a silent mutation?

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