系所組別： 生命科學系學士班

考試科目： 普通生物學

考試日期：0710，節次：3

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請勿在本試題紙上作答，否則不予計分

一、選擇題：(60 分，每題 1.5 分)

1. What gives rise to the cohesiveness of water molecules?

A. hydrophobic interactions

B. nonpolar covalent bonds

C. ionic bonds

D. hydrogen bonds

E. both A and C

2. Lactose, a sugar in milk, is composed of one glucose molecule joined by a glycosidic linkage to one galactose molecule. How is lactose classified?

A. as a pentose

B. as a hexose

C. as a monosaccharide

D. as a disaccharide

E. as a polysaccharide

3. The presence of cholesterol in the plasma membranes of some animals

A. enables the membrane to stay fluid more easily when cell temperature drops.

B. enables the animal to remove hydrogen atoms from saturated phospholipids.

C. enables the animal to add hydrogen atoms to unsaturated phospholipids.

D. makes the membrane less flexible, allowing it to sustain greater pressure from within the cell.

E. makes the animal more susceptible to circulatory disorders.

4. The molecule that functions as the reducing agent (electron donor) in a redox or oxidation-reduction reaction

A. gains electrons and gains energy.

B. loses electrons and loses energy.

C. gains electrons and loses energy.

D. loses electrons and gains energy.

E. neither gains nor loses electrons, but gains or loses energy.

5.Where does glycolysis takes place?

A. mitochondrial matrix

B. mitochondrial outer membrane

C. mitochondrial inner membrane

(背面仍有題目,請繼續作答)

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D. mitochondrial intermembrane space
E. cytosol

6. In any ecosystem, terrestrial or aquatic, what group(s) is (are) always necessary?
A. autotrophs and heterotrophs
B. producers and primary consumers
C. photosynthesizers
D. autotrophs
E. green plants

7. A plant has a unique photosynthetic pigment. The leaves of this plant appear to be reddish yellow. What wavelengths of visible light are being absorbed by this pigment?
A. red and yellow
B. blue and violet
C. green and yellow
D. blue, green, and red
E. green, blue, and yellow

8. Which of the following is a **correct** association?
A. kinase activity and the addition of a tyrosine
B. phosphodiesterase activity and the removal of phosphate groups
C. GTPase activity and hydrolysis of GTP to GDP
D. phosphorylase activity and the catabolism of glucose
E. adenylyl cyclase activity and the conversion of cAMP to AMP

9. If mammalian cells receive a go-ahead signal at the G_1 checkpoint, they will
A. move directly into telophase.
B. complete the cycle and divide.
C. exit the cycle and switch to a nondividing state.
D. show a drop in MPF concentration.
E. complete cytokinesis and form new cell walls.

10. Asexual reproduction and sexual reproduction differ in all but which of the following ways?
A. Individuals reproducing asexually transmit 100% of their genes to their progeny, whereas individuals reproducing sexually transmit only 50%.

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B. Asexual reproduction produces offspring that are genetically identical to the parents, whereas sexual reproduction gives rise to genetically distinct offspring.
C. Asexual reproduction involves a single parent, whereas sexual reproduction involves two.
D. Asexual reproduction requires only mitosis, whereas sexual reproduction always involves meiosis.
E. Asexual reproduction is utilized only by fungi and protists, whereas sexual reproduction is utilized only by plants and animals.

11. A gene's location along a chromosome is known as which of the following?
A. Allele
B. Sequence
C. Locus
D. Variant
E. Trait

12. A karyotype results from which of the following?
A. A natural cellular arrangement of chromosomes in the nucleus
B. An inherited ability of chromosomes to arrange themselves
C. The ordering of human chromosome images
D. The cutting and pasting of parts of chromosomes to form the standard array
E. The separation of homologous chromosomes at metaphase I of meiosis

13. 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

14. When Thomas Hunt Morgan crossed his red-eyed F_1 generation flies to each other, the F_2 generation included both red- and white-eyed flies. Remarkably, all the white-eyed flies were male. What was the explanation for this result?
A. The gene involved is on the X chromosome.
B. The gene involved is on the Y chromosome.
C. The gene involved is on an autosome.

(背面仍有題目,請繼續作答)

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D. Other male-specific factors influence eye color in flies.
E. Other female-specific factors influence eye color in flies.

15. SRY is best described in which of the following ways?
A. A gene region present on the Y chromosome that triggers male development
B. A gene present on the X chromosome that triggers female development
C. An autosomal gene that is required for the expression of genes on the Y chromosome
D. An autosomal gene that is required for the expression of genes on the X chromosome
E. Required for development, and males or females lacking the gene do not survive past early childhood

16. Which of the following statements best describes the termination of transcription in prokaryotes?
A. RNA polymerase transcribes through the polyadenylation signal, causing proteins to associate with the transcript and cut it free from the polymerase.
B. RNA polymerase transcribes through the terminator sequence, causing the polymerase to fall off the DNA and release the transcript.
C. RNA polymerase transcribes through an intron, and the snRNPs cause the polymerase to let go of the transcript.
D. Once transcription has initiated, RNA polymerase transcribes until it reaches the end of the chromosome.
E. RNA polymerase transcribes through a stop codon, causing the polymerase to stop advancing through the gene and release the mRNA.

17. What is a ribozyme?
A. an enzyme that uses RNA as a substrate
B. an RNA with enzymatic activity
C. an enzyme that catalyzes the association between the large and small ribosomal subunits
D. an enzyme that synthesizes RNA as part of the transcription process
E. an enzyme that synthesizes RNA primers during DNA replication

18. Which of the following statements describes the lysogenic cycle of lambda (λ) phage?
A. After infection, the viral genes immediately turn the host cell into a lambda-producing factory, and the host cell then lyses.
B. Most of the prophage genes are activated by the product of a particular prophage gene.
C. The phage genome replicates along with the host genome.
D. Certain environmental triggers can cause the phage to exit the host genome, switching from the lytic to

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the lysogenic.

E. The phage DNA is incorporated by crossing over into any nonspecific site on the host cell's DNA.

19. Which of the events described below agrees with the idea of catastrophism?

A. The gradual uplift of the Himalayas by the collision of the Australian crustal plate with the Eurasian crustal plate

B. The formation of the Grand Canyon by the Colorado River over millions of years

C. The gradual deposition of sediments many kilometers thick on the floors of seas and oceans

D. The sudden demise of the dinosaurs, and various other groups, by the impact of a large extraterrestrial body with Earth

E. The development of the Galapagos Islands from underwater seamounts over millions of years

20. Natural selection is based on all of the following ***except***

A. genetic variation exists within populations.

B. the best-adapted individuals tend to leave the most offspring.

C. individuals who survive longer tend to leave more offspring than those who die young.

D. populations tend to produce more individuals than the environment can support.

E. individuals adapt to their environments and, thereby, evolve.

21. In a hypothetical population's gene pool, an autosomal gene, which had previously been fixed, undergoes a mutation that introduces a new allele, one inherited according to incomplete dominance. Natural selection then causes stabilizing selection at this locus. Consequently, what should happen over the course of many generations?

A. The proportions of both types of homozygote should decrease.

B. The proportion of the population that is heterozygous at this locus should remain constant.

C. The population's average heterozygosity should increase.

D. Both (A)and (B)

E. Both (A)and (C)

22. In a Hardy-Weinberg population with two alleles, *A* and *a,* that are in equilibrium, the frequency of allele *a* is 0.2. What is the frequency of individuals with *Aa* genotype?

A. 0.20

B. 0.32

C. 0.42

D. 0.80

E. Genotype frequency cannot be determined from the information provided.

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23. In a hypothetical situation, a certain species of flea feeds only on pronghorn antelopes. In rangelands of the western United States, pronghorns and cattle often associate with one another. If some of these fleas develop a strong preference, instead, for cattle blood and mate only with fleas that, likewise, prefer cattle blood, then over time which of these should occur, if the host mammal can be considered as the fleas' habitat?

1. reproductive isolation
2. sympatric speciation
3. habitat isolation
4. prezygotic barriers

A. 1 only
B. 2 and 3
C. 1, 2, and 3
D. 2, 3, and 4
E. 1 through 4

24. Which of the following has not yet been synthesized in laboratory experiments studying the origin of life?

A. liposomes
B. liposomes with selectively permeable membranes
C. oligopeptides and other oligomers
D. protobionts that use DNA to program protein synthesis
E. amino acids

25. How many half-lives should have elapsed if 6.25% of the parent isotope remains in a fossil at the time of analysis?

A. one
B. two
C. three
D. four
E. five

26. A phylogenetic tree that is "rooted" is one

A. that extends back to the origin of life on Earth.

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B. at whose base is located the common ancestor of all taxa depicted on that tree.
C. that illustrates the rampant gene swapping that occurred early in life's history.
D. that indicates our uncertainty about the evolutionary relationships of the taxa depicted on the tree.
E. with very few branch points.

27. If, someday, an archaean cell is discovered whose SSU-rRNA sequence is more similar to that of humans than the sequence of mouse SSU-rRNA is to that of humans, the best explanation for this apparent discrepancy would be
A. homology.
B. homoplasy.
C. common ancestry.
D. retro-evolution by humans.
E. co-evolution of humans and that archaean.

28. The predatory bacterium, *Bdellovibrio bacteriophorus*, drills into a prey bacterium and, once inside, digests it. In an attack upon a gram-negative bacterium that has a slimy cell covering which can inhibit phagocytosis, what is the correct sequence of structures penetrated by *B. bacteriophorus* on its way to the prey's cytoplasm?
1. membrane composed mostly of lipopolysaccharide
2. membrane composed mostly of phospholipids
3. peptidoglycan
4. capsule
A. 2 → 4 → 3 →1
B. 1 → 3 → 4 → 2
C. 1 → 4 → 3 → 2
D. 4 → 1 → 3 → 2
E. 4 → 3 → 1 → 2

29. Which kind of plant tissue should lack phragmoplasts?
A. bryophyte tissues
B. diploid tissues of charophytes
C. spore-producing tissues of all land plants
D. tissues performing nuclear division without intervening cytokineses
E. the meristematic tissues of fern gametophytes

(背面仍有題目,請繼續作答)

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30. In animal cells and in the meristem cells of land plants, the nuclear envelope disintegrates during mitosis. This disintegration does not occur in the cells of most protists and fungi. According to our current knowledge of plant evolution, which group of organisms should feature mitosis most similar to that of land plants?

A. unicellular green algae
B. cyanobacteria
C. charophytes
D. red algae
E. multicellular green algae

31. Which of the following are relatively unspecialized cells that retain the ability to divide and perform most of the plant's metabolic functions of synthesis and storage?

A. parenchyma cells
B. collenchyma cells
C. clerenchyma cells
D. tracheids and vessel elements
E. sieve-tube elements

32. Plants growing in a partially dark environment will grow toward light in a response called phototropism. Choose the ***incorrect*** statement regarding phototropism.

A. It is caused by a chemical signal.
B. One chemical involved is auxin.
C. Auxin causes a growth increase on one side of the stem.
D. Auxin causes a decrease in growth on the side of the stem exposed to light.
E. Removing the apical meristem prevents phototropism.

33. If the digestive systems of animals are to provide the energy needed for ATP and biosynthesis, which of the following diets would be most suitable?

A. a high protein, low carbohydrate diet
B. a diet low in lipids and high in protein
C. a low-calorie diet with large intake of fluids, especially water
D. a diet that maximizes vitamins and minerals
E. a diet that matches the "food pyramid" for the species

34. How do people contract salmonella poisoning?

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A. The microbe can survive the acidic environment of the stomach and resist lysosomal degradation in macrophages.
B. The chemotactic messengers released by the salmonella bacterium do not attract sufficient neutrophils to entirely destroy the infection.
C. There is a delay in selection of the population of eosinophils that recognize and are responsible for fighting these bacterial infections.
D. The bacterium releases chemical messengers that make it resistant to phagocytosis.
E. The combination of foods eaten at the meal reduces the pH of the stomach sufficiently so that the bacterium was not destroyed.

35. The secretion of hormone A causes a change in the amount of protein X in an organism. If this mechanism works by positive feedback, which of the following statements represents that fact?
A. An increase in A produces an increase in X.
B. An increase in X produces a decrease in A.
C. A decrease in A produces an increase in X.
D. A and B are correct.
E. B and C are correct.

36. Which of the following statements best describes the difference in approach to studying the environment by early naturalists compared to present-day ecologists?
A. Early naturalists employed a descriptive approach; present-day ecologists generate hypotheses, design experiments, and draw conclusions from their observations.
B. Early naturalists manipulated the environment and observed changes in plant and animal populations, while modern ecology focuses on population dynamics.
C. Early naturalists systematically recorded what they observed in their environment; modern ecology is only concerned with man's impact on the environment.
D. Early naturalists were interested with man's interaction with the natural world; present-day ecologists seek to link ecology to developmental biology.
E. Early naturalists were interested in interactions between organisms and their environment; present day ecologists are interested in interactions between organisms.

37. Landscape ecology is best described as the study of
A. the flow of energy and materials between the biotic and abiotic components of an ecosystem.
B. how the structure and function of species enable them to meet the challenges of their environment.
C. what factors affect the structure and size of a population over time.

(背面仍有題目,請繼續作答)

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D. the interactions between the different species that inhabit and ecosystem.
E. the factors controlling the exchanges of energy, materials, and organisms among ecosystem patches.

38. During the spring, you are studying the mice that live in a field near your home. There are lots of mice in this field, but you realize that you rarely observe any reproductive females. This most likely indicates
A. that there is selective predation on female mice.
B. that female mice die before reproducing.
C. that this habitat is a good place for mice to reproduce.
D. that you are observing immigrant mice.
E. that the breeding season is over

39. As you study two closely related predatory insect species, the two-spot and the three-spot avenger beetles, you notice that each species seeks prey at dawn in areas without the other species. However, where their ranges overlap the two-spot avenger beetle hunts at night and the three-spot hunts in the morning. When you bring them into the laboratory, their offspring behave in the same manner. You have discovered an example of
A. mutualism.
B. character displacement.
C. Batesian mimicry.
D. facultative commensalism.
E. resource partitioning

40. According to the U.S. Endangered Species Act (ESA), the difference between an endangered species and a threatened one is that
A. an endangered species is closer to extinction.
B. a threatened species is closer to extinction.
C. threatened species are endangered species outside the U.S. borders.
D. endangered species are mainly tropical.
E. only endangered species are vertebrates.

二、簡答題 ：(40 分，每題分數將標示於該題文字敘述的最後部分)
1. Please define and describe: “ectoderm”, ”mesoderm” and “endoderm” (6 points)
2. Please describe what is the knee-jerk reflex? (4 points)

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3. Please define and describe what is the Renin-Angiotensin-Aldosterone System (RAAS) (10 points)
4. Please define and describe what is "microRNA"? (5 points)
5. Please define and describe what is "RNA splicing"? (5 points)
6. Please define and describe "Atherosclerosis". (5 points)
7. Please define and describe "Autophagy". (5 points)