

編號: 12 系所: 生命科學系學士班

科目: 普通生物學

本試題是否可以使用計算機:  可使用,  不可使用 (請命題老師勾選)**I. Multiple Choice (80%)**

1. Most eukaryotic regulation of gene expression occurs at the level of \_\_\_\_\_.  
A. transcription.  
B. splicing and processing.  
C. transport of mRNA from the nucleus.  
D. mRNA degradation.
2. In birds, sex is determined by a ZW chromosome scheme. Males are ZZ and females are ZW. A lethal recessive allele that causes death of the embryo is sometimes present on the Z chromosome in pigeons. What would be the sex ratio in the offspring of a cross between a male that is heterozygous for the lethal allele and a normal female?  
A. 2:1 male to female.  
B. 4:3 male to female.  
C. 1:1 male to female.  
D. 1:2 male to female.
3. Regarding eukaryotic and prokaryotic genetic regulation, what process seems to be the most similar between the two.  
A. transcriptional regulation.  
B. RNA splicing regulation.  
C. intron/exon shuffling.  
D. 5'-capping regulation.
4. RNA polymerase and DNA polymerase differ in that  
A. RNA polymerase is much more accurate than DNA polymerase.  
B. RNA polymerase uses RNA as a template, and DNA polymerase uses a DNA template.  
C. RNA polymerase does not need to separate the two strands of DNA in order to synthesize an RNA copy, whereas DNA polymerase must unwind the double helix before it can replicate the DNA.  
D. RNA polymerase can initiate RNA synthesis, but DNA polymerase requires a primer to initiate DNA synthesis.
5. Which of the following is (are) true about RNA?  
A. It has functional groups that allow it to act as a catalyst (ribozyme).  
B. SRP RNA is an essential component of spliceosomes.  
C. snoRNA aids in processing pre-rRNA transcripts in the nucleolus.  
D. Only A and C are true.
6. The characteristics displayed by primary and secondary immune responses are different. This phenomenon is not related with  
A. immune memory.  
B. immune specificity.  
C. immune deficiency.  
D. clonal selection theory.
7. Regulation of gene expression by microRNAs may be mediated by

(背面仍有題目,請繼續作答)

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- A. RNA interference.
  - B. RNA splicing.
  - C. alternative RNA splicing.
  - D. RNA polyadenylation.
8. Which of the following descriptions is right about the function of virus-derived reverse transcriptase (RTase) which is usually used in genetic engineering?
- A. RTase has only one function., eg., making ssDNA from mRNA template.
  - B. RTase can not make dsDNA from ssDNA template.
  - C. RTase can also digest the RNA from the DNA-RNA hybrid.
  - D. RTase can also make mRNA from RNA genome.
9. Living systems
- A. violate the first law of thermodynamics
  - B. violate the second law of thermodynamics
  - C. decrease their entropy while increasing the entropy of the universe
  - D. all of the above
10. Animals that use their body surface for gas exchange must
- A. be aquatic
  - B. have high ratio of body surface area to volume
  - C. have low ratio of body surface area to volume
  - D. have a special kind of hemoglobin
11. A cell that remains entirely flexible in its developmental possibilities is said to be
- A. totipotent.
  - B. differentiated.
  - C. determined.
  - D. genomically equivalent.
12. The swim bladder of bony fishes
- A. developed into lungs in saltwater fishes.
  - B. was probably modified from simple lungs of freshwater fishes.
  - C. first appeared in sharks.
  - D. provides buoyancy, but at a high energy cost.
13. Which of the following is a problem faced by animals as they increase in size?
- A. the tendency for larger bodies to be more variable in metabolic rate
  - B. decreasing surface-to-volume ratio
  - C. reproducing in aqueous environments
  - D. A and B only
14. \_\_\_\_\_ is/are responsible for increased speed of impulse conduction along an axon.
- A. Nodes of Ranvier
  - B. A graded potential
  - C. IPSPs
  - D. EPSPs

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15. Once an action potential is triggered, the first major chemical change is
- a reversal of the membrane polarity, with the interior of the cell becoming positive.
  - a reversal of the membrane polarity, with the interior of the cell becoming negative.
  - an increase in the negative charges inside the neuron.
  - a sudden rush of potassium into the neuron.
16. Which of the following increases the strength of a neurotransmitter's signal?
- more neurotransmitters binding to the receiving neuron.
  - the synapse located closer to the base of the receiving neuron's axon
  - the synapse located farther away from the base of the receiving neuron's axon
  - more neurotransmitters binding closer to the base of the receiving neuron's axon
17. Of the followings, which is NOT Darwin's theory?
- differential survival and reproduction between generations.
  - inheritance of acquired characteristics.
  - struggle for existence.
  - Common descent with modification.
18. Which evolutionary force is the ultimate source of genetic diversity?
- gene flow.
  - genetic drift.
  - natural selection.
  - mutation.
19. Which evolutionary process will result in paralogous genes?
- genetic drift.
  - point mutation.
  - gene duplication.
  - inbreeding.
20. Animals that are small in size and produce many young in one breeding season in general
- can reproduce for many years.
  - exhibit intensive parental care.
  - live at a density below carry capacity.
  - face a higher rate of juvenile mortality.
21. The diversity and complexity of bird songs may be associated with I. where a bird is distributed, II. how old a bird is, III its reproductive success, IV physiological and genetic conditions
- all of them
  - none of them
  - only II, III
  - only I, III
22. When equilibrium is reached on an island, \_\_\_\_\_.
- the number of organisms does not change
  - ecological disturbance is minimized

(背面仍有題目, 請繼續作答)

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- C. the rate of species immigration will equal the rate of species extinction  
D. the food web will be highly stable
23. Bacteria are especially important in making \_\_\_\_\_ available to plants.  
A. water  
B. phosphorus  
C. carbon  
D. nitrogen
24. Which major threat to biodiversity has contributed to about 40% of the extinctions recorded since 1750, and is brought on by humans both deliberately and accidentally?  
A. introduced species  
B. bioremediation  
C. habitat destruction  
D. overexploitation
25. Infants can be poisoned by honey or nitrate that is harmless to adults. This is because:  
A. Their gastro-intestinal tract is more alkaline than that of adults, causing different microbial fauna to prevail.  
B. Their gastro-intestinal tract is more alkaline than that of adults, leading to greater stability of nitrate and the toxin from *Clostridium botulinum*.  
C. Their gastro-intestinal tract is aerobic.  
D. Sugar stimulates microbial growth in their gastro-intestinal tract.
26. The coliform test:  
A. Identifies water-borne pathogens.  
B. Is sufficient to prove that water is safe to drink.  
C. Reliably estimates the risk of pathogens in drinking water based on its content of coliform bacteria.  
D. Reliably estimates the risk of pathogens in meat products based on their content of coliform bacteria.
27. Which of the following structures is common to plant and animal cells?  
A. chloroplast  
B. wall made of cellulose  
C. tonoplast  
D. mitochondrion
28. The final electron acceptor of the electron transport chain that functions in oxidative phosphorylation is  
A. Oxygen.  
B. Water.  
C. NAD<sup>+</sup>  
D. Pyruvate.
29. Most CO<sub>2</sub> from catabolism is released during  
A. glycolysis.  
B. The citric acid cycle.  
C. Lactate fermentation.  
D. Electron transport.

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30. Consider this pathway: epinephrine → G-protein-linked receptor → G protein → adenylyl cyclase → cAMP. Identify the second messenger.
- cAMP
  - G protein
  - GTP
  - Adenylyl cyclase
31. In the thylakoid membranes, what is the main role of the antenna pigment molecules?
- transfer electrons to ferredoxin and then NADPH
  - split water and release oxygen to the reaction-center chlorophyll
  - harvest photons and transfer light energy to the reaction-center chlorophyll
  - concentrate photons within the stroma
32. Which of the following best explains why CAM plants are not tall?
- Since the stomata are closed in the leaves, the Casparian strip is closed in the endodermis of the root.
  - Transpiration occurs only at night, and this would cause a highly negative  $\psi$  in the roots of a tall plant during the day.
  - They would be unable to supply sufficient sucrose for active transport of minerals into the roots during the day or night.
  - They would be unable to move water and minerals to the top of the plant during the day.
33. In plants, which of the following could be an advantage of sexual reproduction as opposed to asexual reproduction?
- rapid population increase
  - mitosis
  - greater longevity
  - genetic variation
34. A pathogenic fungus invades a plant. What does the infected plant produce in response to the attack?
- phytoalexins
  - thickened cellulose microfibrils in the cell wall
  - phytochrome
  - antisense RNA
35. The cell type associated primarily with cell division and plant differentiation is the \_\_\_\_.
- xylem cell
  - meristematic cell
  - phloem cell
  - epidermal cell
36. The science of botany is divided into branches. Which of these branches deals with the naming and classifying of plants?
- Plant Taxonomy
  - Plant Pathology
  - Plant Morphology

(背面仍有題目, 請繼續作答)

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## D. Plant Genetics

37. Vessel elements
- conduct food materials that are in solution
  - are alive at maturity
  - may have end walls with holes called perforations
  - have thin areas in their cell walls called pits
38. Regarding the action of appetite-regulating hormones, which one is incorrect?
- Ghrelin triggers feelings of hunger as mealtimes approach.
  - Leptin suppresses appetite as its level increases
  - Insulin suppresses appetite by acting on the brain.
  - PYY acts as an appetite stimulant
39. In vertebrate animals, spermatogenesis and oogenesis differ, in that.
- Oogenesis has long "resting" periods, in contrast to spermatogenesis, which produces mature sperm from precursor cells in an uninterrupted sequence
  - Spermatogenesis begins before birth while oogenesis begins at the onset of sexual maturity
  - Oogenesis produces four haploid cells, while spermatogenesis produces only one functional spermatozoon.
  - During the meiotic division of spermatogenesis, cytokinesis is unequal
40. Arrange the following stages of fertilization and early development into a proper sequence
- Onset of new DNA synthesis
  - Cortical reaction
  - First cell division
  - Acrosomal reaction, plasma membrane depolarization
  - Fusion of egg and sperm nuclei complete
- V, I, IV, II, III
  - I, III, II, IV, V
  - V, III, I, II, IV
  - IV, II, V, I, III

## II. Answer the following questions (20%)

- What is genetically modified organisms (GMO)? (5%)
- List one example of GMO and indicate how it produces? (10%)
- What is the advantage of using stem cells for gene therapy? (5%)