國立高雄大學 113 學年度研究所碩士班招生考試試題

科目：普通生物學　　系所：生命科學系　　是否使用計算機：否

考試時間：100 分鐘　　本科原始成績：100 分

單選題 (每題 2分，70%)

1) Which of the following processes is part of the whole-genome shotgun approach to sequencing?

A) fragmenting genomic DNA at random sites

B) mapping the chromosomal location of cloned DNA fragments

C) using DNA primers with randomly generated sequences to begin sequencing reactions throughout the genome

D) focusing the efforts to sequence the genomes of new species by using DNA primers known to be conserved between other species

2) Extraction of lipids from a tissue sample requires organic solvent because _____.

A) organic solvents are easily accessible

B) lipids are hydrophobic, and they can only be solubilized in organic solvent

C) organic solvents keep the temperature low and manageable

D) organic solvents are cheaper

3) Which of the following accurately describes meristematic plant cells?

A) All tissues throughout the plant contain meristematic cells.

B) Meristematic cells are undifferentiated cells that produce new cells.

C) Meristematic cells increase the surface area of dermal tissue by developing root hairs.

D) Parenchyma, ground meristem, and procambium are three subdivisions of meristematic cells.

4) Which of the following is the correct order of floral organs from the outside to the inside of a complete flower?

A) petals → sepals → stamens → carpels

B) sepals → stamens → petals → carpels

C) spores → gametes → zygote → embryo

D) sepals → petals → stamens → carpels

5) Which of the following best explains the inability of bacteria to correctly express the protein products of plasmid containing an unmodified mammalian gene?

A) prokaryotes use a different genetic code from that of eukaryotes

B) bacteria translate only mRNAs that have multiple messages

C) bacteria cannot remove eukaryotic introns

D) bacterial RNA polymerase cannot make RNA complementary to mammalian DNA

6) Rosalind Franklin's X-ray crystallography data suggested DNA is double stranded and has a uniform diameter. These observations can be used to rule out base pairing between two of the same nucleotide because _____.
A) the antiparallel orientation of strands would result in one of the pair being upside down
B) identical nucleotides would not have the appropriate number of hydrogen bonding sites to pair
C) an A-A pair is wider than a C-C pair
D) thymine dimers are removed by excision repair

7) A particular triplet of bases in the template strand of DNA is 5′-AGT-3′. What would be the corresponding codon for the mRNA that is transcribed?
A) 3′-UCA-5′
B) 3′-ACU-5′
C) 5′-AGT-3′
D) 5′-UCA-3′

8) If plant cells are grown on media containing radioactively labeled thymine for one generation, radioactively labeled macromolecules will be detected in which of the following organelles?
A) only in the nucleus
B) only in the nucleus and mitochondria
C) only in the nucleus and chloroplasts
D) in the nucleus, mitochondria, and chloroplasts

9) Which of the following cellular processes includes all of the others?
A) osmosis
B) facilitated diffusion
C) passive transport
D) transport of an ion down its electrochemical gradient

10) Which of the following generations in the conifer life cycle most directly produces the integument of a pine seed?
A) male gametophyte
B) female gametophyte
C) male sporophyte
D) female sporophyte

11) Depletion of which of the following molecules from the mitochondria will most directly inhibit the citric acid cycle?

A) NAD^+

B) NADH

C) CO_2

D) ATP

12) Apple on tree ripens ripe apple produces ethylene ethylene signals neighboring apples to ripen neighbor apples produce more ethylene more apples ripen. The above process is an example of which of the following?

A) positive feedback regulation

B) negative feedback regulation

C) chemical cycling

D) emergent properties

13) Why did all of the F_1 offspring of Mendel's purple and white flowered pea cross always look like one of the two parental varieties?

A) No genes interacted to produce a new unique phenotype.

B) Each allele affected phenotypic expression.

C) The traits blended together during fertilization.

D) One allele was dominant.

14) The chloroplasts of land plants are thought to have been derived according to which evolutionary sequence?

A) cyanobacteria → green algae → land plants

B) cyanobacteria → green algae → fungi → land plants

C) red algae → brown algae → green algae → land plants

D) cyanobacteria → red algae → green algae → land plants

15) In early chordates, the primitive pharyngeal slits carried out which of the following functions?

A) the digestive system's opening

B) suspension-feeding devices

C) components of the jaw

D) sites of respiration

16) Which of the following are produced by lateral meristems?
A) dermal and ground tissues
B) buds and branches
C) pith and cortex
D) wood and cork

17) Certain receptor tyrosine kinases (RTKs) that promote excessive cell division are found at high levels in various cancer cells. HER2 is an RTK that is present at excessively high levels in some breast cancer cells. Herceptin is a protein that binds to HER2 and inhibits cell division. Herceptin may be an effective treatment for breast cancer treatment under which of the following conditions?
A) If injection of HER2 in the patient's cancer cells inhibits cell division.
B) If the patient's cancer cells have excessive levels of HER2.
C) If the patient lacks functional HER2 proteins.
D) If the patient has excessive levels of other RTKs in cancer cells.

18) Students in a biology lab isolated cells in various phases of the cell cycle. A population of cells that have 1 1/2 times the DNA of G_1 phase cells was most likely isolated from which of the following parts of the cell cycle?
A) between the G_1 and S phases
B) in the G_2 phase
C) in the M phase
D) in the S phase

19) Which of the following statements best defines proteomics?
A) The field working to link each gene to a particular protein.
B) The study of the properties of sets of proteins.
C) The characterization of the functional possibilities of a single protein.
D) The study of how amino acids are ordered in a protein.

20) In eukaryotes which of the following is the first step in translation?
A) base pairing of activated methionine-tRNA to AUG of the messenger RNA
B) binding of the larger ribosomal subunit to smaller ribosomal subunits
C) the ribosome reaches a stop codon
D) the small subunit of the ribosome recognizes and attaches to the 5′ cap of mRNA

21) The cells in the cell line grown in low-glucose conditions showed the effects of which of the following processes?
A) gene flow and genetic drift
B) natural selection and mutation
C) natural selection and gene flow
D) conjugation and transformation

22) A student examined a leaf and observed that it was dark green, thin, had stoma on the lower surface only, and had a total surface area of more than two square meters. In which environment was the leaf most likely growing?
A) a large, still pond
B) a tropical rain forest
C) an oasis within a grassland
D) the floor of a deciduous forest

23) In cats, an X-linked locus is responsible for fur color. There are two known alleles at this locus. One results in black fur color; the other results in orange fur color. A heterozygote animal has patches of orange and black fur (tortoiseshell). Which of the following explains the patches of color in female heterozygote cats?
A) Incomplete dominance of the black fur color allele
B) Fur color is codominant at the organism level
C) Imprinting at the fur color locus
D) Random X inactivation affects fur color

24) Humans and chimpanzees show approximately 98% sequence similarity yet exhibit significant phenotypic differences. Changes to which of the following genome characteristics contributes most to the differences between humans and chimpanzees?
A) structural genes
B) the number of repeated sequences
C) regulatory sequences
D) genome size

25) Which of the following statements is the reason that most cells cannot harness heat to perform work?
A) heat is not a form of energy
B) temperature is usually uniform throughout a cell
C) heat can never be used to do work
D) heat must remain constant during work

26) What evidence do paleobotanists look for that indicates the movement of plants from water to land?
A) waxy cuticle to decrease evaporation from leaves
B) loss of structures that produce spores
C) sporopollenin to inhibit evaporation from leaves
D) remnants of chloroplasts from photosynthesizing cells

27) Elements found in the first two columns of the periodic table contain outer electron shells that are _____; these elements tend to form _____ in solution.
A) almost empty; cations
B) almost empty; anions
C) almost full; cations
D) almost full; anions

28) Which of the following statements best describes *evolution*?
A) Populations change genetically from one generation to the next.
B) The match between individuals and their environment decreases over time.
C) Natural selection favors the most abundant trait.
D) Individuals change in response to changes in the environment.

29) Growth and development of plant parts involves which of the following processes?
I) cell division to produce new cells
II) enlargement and elongation of cells
III) specialization of cells into tissues
A) only I
B) only II
C) only III
D) I, II, and III

30) Viruses can carry out which of the following processes?
A) They can manufacture their own ATP, proteins, and nucleic acids.
B) They can use the host cell machinery to make copies of viral genomes and viral proteins.
C) They can use the host cell as a source of energy allowing viral machinery to replicate the virus.
D) They can replicate while within a host cell as well as when they are between host cells.

31) Cyanide binds with at least one protein complex involved in producing ATP. If a cell is exposed to cyanide, most of the bound cyanide is likely to be localized within which of the following organelles?
A) mitochondria
B) peroxisomes
C) lysosomes
D) smooth endoplasmic reticulum

32) In a human karyotype, chromosomes are arranged in 23 pairs. If one of the autosomal pairs is examined, which of the following characteristics will the two chromosomes of the pair have in common?
A) length and DNA sequence
B) alleles and centromere position
C) loci and staining pattern
D) X-like shape and alignment on the metaphase plate

33) Which of the following statements best describes unity within a species?
A) Members of a given species can be distinguished by similarity in body shape and other structural features.
B) Members of a given species have the potential to interbreed in nature and produce viable, fertile offspring.
C) A species is described in terms of its interaction with living and non-living environment.
D) The DNA sequence lacks similarities among individuals.

34) Which process is most directly driven by light energy?
A) creation of a pH gradient by pumping protons across the thylakoid membrane
B) reduction of $NADP^+$ molecules
C) transfer of energy from pigment molecule to pigment molecule
D) ATP synthesis

35) Which of the following is a common feature shared by rhizobial bacteria, actinomycete bacteria, and cyanobacteria?

A) They increase water uptake in plants.

B) They kill parasites in the soil.

C) Each exists only in extreme environments.

D) Each fixes atmospheric nitrogen.

簡答題 – 解釋名詞 (每題 5分，30%)

1. Operon
2. Promoter
3. Transcription factor
4. microRNAs
5. Polymerase chain reaction
6. DNA microarrays