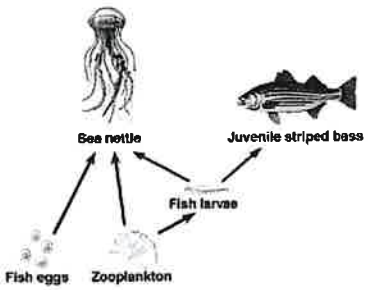
| 科目名稱 | 普通生物學 | 類組代碼 | A04.B04.C07.C08.D06 |
|---|---|---|---|
| | | 科目碼 | A0401 |

※本項考試依簡章規定所有考科均「不可」使用計算機。 本科試題共計 9 頁

## I. Questions (20%)

1. Please explain why the thin diameter of xylem cells can contribute to water allocation from roots to leaves? (5%)

2. Look at the following figure, which shows a partial the Chesapeake Bay food web. If sea nettles disappeared, what will be happening? (5%)




3. Please describe the characteristics of the model organism. (5%)

4. What are the two main functions of the nucleolus? (5%)

## II. Single choice (80%)

1. What is the correct sequence for the following structures in transmitting an electrical current of a typical motor neuron?
   1. cell body; 2. axon; 3. axon hillock; 4. dendrites; 5. synaptic terminals
   **(A)** 4, 1, 3, 2, 5 **(B)** 5, 4, 1, 3, 2 **(C)** 4, 3, 1, 2, 5
   **(D)** 5, 4, 1, 2, 3 **(E)** 4, 1, 2, 3, 5

2. Which is the **correct** description regarding fertilization in plants?
   **(A)** Fertilization involves multicellular organisms.
   **(B)** Fertilization is initiated once pollens are on the stigma.
   **(C)** Fertilization requires one fusion of cells.
   **(D)** Fertilization does not require specific recognition of mother cells.
   **(E)** Fertilization results in a change in ploidy.

3. A cell secretes a signal molecule that affects neighboring cells. What is the type of signaling?

(A) Hormonal signaling. (B) Paracrine signaling.
(C) Synaptic signaling. (D) Autocrine signaling.
(E) Endocrine signaling.

4. What is the mechanism by which testosterone functions inside a cell?
(A) It acts as a signal receptor that activates tyrosine kinases.
(B) It binds with a receptor protein that enters the nucleus and activates the expression of specific genes.
(C) It cooperates with a membrane receptor to response to drug treatment.
(D) It acts as a steroid signal receptor that activates ion channel proteins in the plasma membrane.
(E) It coordinates a phosphorylation cascade that reduces spermatogenesis.

5. Please identify which of the following structures is **not** haploid?
(A) sporangium (B) archegonia (C) pollens
(D) fungal hyphae (E) ovule

6. What is the correct order of plant evolution?
(A) secondary cell wall → independent gametophytes → formation of protected embryo → double fertilization
(B) secondary cell wall → multicellular gametophytes → double fertilization → formation of the protected embryo
(C) independent gametophytes → secondary cell wall → formation of protected embryo →double fertilization
(D) multicellular gametophytes→ secondary cell wall → double fertilization → formation of a protected embryo
(E) multicellular gametophytes→ formation of protected embryo→ secondary cell wall → double fertilization

7. Spermatogenesis and oogenesis are different in that
(A) Spermatogenesis produces four sperm and oogenesis produces one egg.
(B) Spermatogenesis produces four sperm and oogenesis produces two eggs.
(C) Spermatogenesis produces four cells and oogenesis produces one haploid cell.
(D) Oogenesis begins at the onset of puberty.



背面有題，請繼續作答。

**(E)** Spermatogenesis begins in the embryonic stage of development.

**8.** There is a mutated flower that only contains sepals and petals. According to ABC model for floral development, which type of identity genes is mutated?
**(A)** only B **(B)** only C **(C)** A and B **(D)** B and C **(E)** A and C

**9.** The major difference between a typical $C_4$ plant and a $C_3$ plant, is that
**(A)** The $C_3$ plant has a smaller opening of stomata, so that less $CO_2$ can enter the plant.
**(B)** The $C_4$ plant only uses PEP carboxylase to catalyze all carbon fixation.
**(C)** Rubisco in $C_4$ plant has a high binding affinity to $CO_2$ than that in the $C_3$ plant.
**(D)** The carbon fixation rate in $C_4$ plants is always higher than $C_3$ under various growth temperatures.
**(E)** The $C_4$ plant only carries out the Calvin cycle only in the chloroplasts of bundle-sheath cells.

**10.** Motor proteins require which of the following structures or molecules to function in the movement of chromosomes toward the poles of the mitotic spindle?
**(A)** intact centromeres **(B)** ATP as an energy source **(C)** kinetochores
**(D)** a microtubule-organizing center **(E)** taxol

**11.** Which of the following amino acids are most frequently phosphorylated by protein kinases in the cytoplasm during signal transduction?
**(A)** tyrosine **(B)** glycine and histidine **(C)** serine and threonine
**(D)** glycine and glutamic acid **(E)** methionine and cysteine

**12.** Which of these characteristics contributed the most to vertebrate success in relatively dry environments?
**(A)** the ability to maintain a constant body temperature
**(B)** the shelled, amniotic egg **(C)** two pairs of appendages
**(D)** four-chambered heart **(E)** greater speed of locomotion

**13.** Resting potential is mostly dependent on which two of the following ion

channels?

1. Na+/K+ pumps; 2. voltage-gated Na+ and K+ channels;
3. ligand-gated Na+ and K+ channels; 4. voltage-gated Ca2+ channels
5. Na+ and K+ leak channels

**(A)** 1 and 2 **(B)** 1 and 3 **(C)** 1 and 5 **(D)** 2 and 3 **(E)** 4 and 5

**14.** Which of the following descriptions is true for the taste receptors?

**(A)** There are four major types of taste receptors.
**(B)** Different types of taste receptors are confined and located in a specialized region of the tongue.
**(C)** One taste bud contains at least one sensory receptor cell.
**(D)** Taste buds consist of sensory cells that function as mechanoreceptors.
**(E)** There are two main types of taste receptors.

**15.** The mature leaves of tomato plants that I grew in my backyard turn dark purple. What kind of mineral nutrients you should fertilize the plant in order to recover the green color?

**(A)** iron **(B)** nitrogen **(C)** phosphate **(D)** potassium **(E)** calcium

**16.** The slow block to polyspermy during fertilization are dependent on

**(A)** the entrance of potassium ions into the egg
**(B)** the departure of sodium ions from the egg
**(C)** the entrance of calcium ions into the egg
**(D)** the departure of hydrogen ions from the egg
**(E)** the entrance of chloride ions into the egg

**17.** Crossing over of chromosomes normally takes place during which of the following processes?

**(A)** meiosis II **(B)** meiosis I **(C)** metaphase **(D)** mitosis **(E)** prometaphase

**18.** Cellular respiration

**(A)** occurs only in animal cells because plants carry on photosynthesis
**(B)** is the reverse process of photosynthesis
**(C)** occurs at the same rate throughout all cells of the body
**(D)** is the mechanism that living organisms use to convert glucose into

背面有題，請繼續作答。

energy

**(E)** is the only cellular mechanism that yields ATP

**19.** Which statement regarding plant auxin is correct?

**(A)** It is synthesized in active growing cells and transported up or down to promote cell growth.

**(B)** The antagonistic interactions between cytokinin and auxin shape the morphology of shoots.

**(C)** Accumulation of auxin in axillary buds will promote lateral shoot development.

**(D)** When the sunlight shines on the stem with an angle, auxin will accumulate in the lighting side of the stem to promote cell elongation.

**(E)** In response to gravity, auxin will accumulate in the upper side of roots to promote cell elongation.

**20.** The end product of glycolysis is

**(A)** acetyl-CoA **(B)** citrate **(C)** pyruvate **(D)** oxaloacetate **(E)** oxygen

**21.** During the Krebs cycle,

**(A)** electrons and H+ are transferred to coenzymes NAD+ and FAD

**(B)** substrate-level phosphorylation occurs

**(C)** molecules of carbon dioxide are formed

**(D)** oxaloacetate is regenerated

**(E)** all of these

**22.** Which statement about how some plants benefit from the presence of soil microbes is correct?

**(A)** Through their mycorrhizal interactions with fungi, plant roots can acquire nutrients with less bioenergy.

**(B)** Most beneficial microbes can form a symbiosis with both monocot and dicot plants.

**(C)** Upon establishment of symbiosis, these microbes form special compartments randomly inside the root.

**(D)** By interactions with soil bacteria, some plant roots can fix nitrogen gas directly.

**(E)** Plant roots sometimes obtain organic molecules from these beneficial microbes.

**23.** Fermentation

**(A)** produces more ATP than is liberated in the hydrogen transfer series

**(B)** may occur in a muscle under anaerobic conditions

**(C)** breaks down glucose in reaction with oxygen

**(D)** is restricted to yeasts **(E)** none of these

**24.** Which of the following sequences is most likely as a restriction site?

**(A)** 5´-AATTCT-3´ **(B)** 5´-AATATT-3´ **(C)** 5´-AAAATT-3´

**(D)** 5´-ACTACT-3´ **(E)** 5´-TTCCTT-3´

**25.** Which defensive chemical is **incorrectly** paired with a function?

**(A)** antibodies—pathogen neutralization

**(B)** cytokines—immune cell stimulation **(C)** histamines—dilate capillaries

**(D)** perforins—lysis **(E)** lysozymes—cause fevers

**26.** Which part is **not required** for the feeling of hearing or equilibrium in humans?

**(A)** utricle **(B)** vestibular canal **(C)** ocelli **(D)** incus **(E)** hair cells

**27.** Based on the acid growth model of cell expansion in the plant, which statement is correct?

**(A)** Proton pumps on the plasma membrane are activated by de novo synthesis of gibberellins.

**(B)** Protons are pumped from cell wall space into the cytoplasm to acidify the cell.

**(C)** Expansins function to re-connect the linkage between cellulose microfibrils after cell expansion.

**(D)** The direction of elongation is perpendicular to the alignment of microfibrils.

**(E)** The losing reaction of microfibrils can also be observed in the secondary cell wall.

**28.** Cleavage of the newly fertilized mammal embryo begins in the
**(A)** ovary **(B)** uterus **(C)** vagina **(D)** oviduct **(E)** endometrium

**29.** Which animal has a closed circulatory system?
**(A)** snail **(B)** fish **(C)** spider **(D)** insect **(E)** none of above

**30.** Steroid hormones are synthesized from
**(A)** amino acids **(B)** cholesterol **(C)** nucleic acids **(D)** carbohydrates
**(E)** all of the above

**31.** What is the correct processes in order for one cycle of polymerase chain reaction (PCR)?
**(A)** denature DNA; add fresh enzyme; anneal primers; add dNTPs; extend primers
**(B)** anneal primers; denature DNA; extend primers
**(C)** extend primers; anneal primers; denature DNA
**(D)** denature DNA; anneal primers; extend primers
**(E)** add fresh enzyme; extend primers; add dNTPs; denature DNA

**32.** Fluid is filtered from the capillary into the interstitial fluid due to the _____, but fluid is reabsorbed back to the blood and exits a capillary due to the _____.
**(A)** hydrostatic pressure from sphincter muscle; cooler temperatures in the blood
**(B)** hydrostatic pressure from sphincter muscle; cooler temperatures in venous blood
**(C)** osmotic pressure from high levels of potassium in plasma but not extracellular fluid; osmotic pressure from reversed levels of potassium in extracellular fluid but not plasma
**(D)** blood pressure from the heart; osmotic pressure from proteins in the plasma
**(E)** osmotic pressure from salts; hydrostatic pressure from the veins

**33.** What is the impact of DNA microarrays on genomic studies?
**(A)** They can be used to eliminate the function of any gene in the genome.

**(B)** They can be used to introduce entire genomes into bacterial cells.
**(C)** They allow the expression of many or even all of the genes in the genome to be compared at once.
**(D)** They allow physical maps of the genome to be assembled in a very short time.
**(E)** All of the above.

**34.** Why are males more often affected by sex-linked traits than females?
**(A)** Testosterone alters the effects of mutations on the X chromosome.
**(B)** Males are hemizygous for the X chromosome.
**(C)** Estrogen often compensate for the effects of mutations on the X chromosome.
**(D)** X chromosomes in males generally have more mutations than X chromosomes in females.
**(E)** The *SRY* gene protects male to be affected by mutations on the X chromosome.

**35.** What is the correct statement regarding gene linkage?
**(A)** Linked genes are found on different chromosomes.
**(B)** The closer two genes are on a chromosome, the lower the probability that a crossover will occur between them.
**(C)** The observed frequency of recombination of two genes that are far apart from each other has a maximum value of 100%.
**(D)** All of the traits that Mendel studied—seed color, pod shape, flower color, and others—are due to genes linked on the same chromosome.
**(E)** None of the above.

**36.** Arousal and sleep are controlled by what part of the brain?
**(A)** hypothalamus **(B)** medulla oblongata **(C)** cerebrum
**(D)** amygdala **(E)** reticular formation.

**37.** Which of the following options **incorrectly** pairs an endocrine gland or hormone with an aspect of metabolism that it regulates?
**(A)** parathyroid hormone = raises the calcium level in the blood
**(B)** adrenal hormones = response to stress


背面有題，請繼續作答。

(C) insulin = regulates blood glucose levels
(D) prolactin = allergic reactions
(E) pineal = controls biological rhythms

**38.** The fluid in the circulatory system of a typical arthropod is the?
(A) intracellular fluid (B) hemolymph (C) blood plasma
(D) digestive juices (E) cytosol

**39.** Hormone pathways involved in maintaining homeostasis (such as the maintenance of blood glucose levels) are often characterized by which of the following?
(A) positive feedback (B) negative feedback (C) retrospective adjustment
(D) countercurrent exchange (E) endothermy and ectothermy

**40.** What is the common similarity between aerobic respiratory reactions in mitochondria and photosynthetic fixation in the chloroplast?
(A) Both use the electron transport chain to pump protons from the organelle's liquid compartment into intermembrane space.
(B) Both use ATPase pump to produce ATP in the intermembrane space.
(C) Both use water as the electron donor.
(D) Both proceed the electron transport from complex I to complex II.
(E) Both perform carbon metabolism only when the active electron transport occurs.