

國立中山大學 106 學年度碩士暨碩士專班招生考試試題

科目名稱：生理學【海資系碩士班甲組選考】

題號：452006

※本科目依簡章規定「不可以」使用計算機(選擇題)

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單選擇(每題5分，答錯不倒扣)

1. ATP is a renewable resource that can be regenerated by the addition of a phosphate group to ADP. Which is **NOT CORRECT**?
 - (A) A working muscle cell recycles its entire pool of ATP once each minute. More than 10 million ATP molecules are consumed and regenerated per minute per cell.
 - (B) The free energy to phosphorylate ADP comes from exergonic (catabolic) reactions in the cell.
 - (C) Catabolic (exergonic) pathways, especially cellular respiration, provide the energy for the endergonic regeneration of ATP.
 - (D) Regeneration of ATP is an endergonic process, requiring an investment of energy: $\text{ADP} + \text{P}_i \rightarrow \text{ATP} + \text{H}_2\text{O}$ where $\Delta G = +7.3 \text{ kcal/mol}$, under standard conditions.
 - (E) Plants can use light energy to generate ATP via photosynthesis.

2. Catabolic metabolic pathways release energy stored in complex organic molecules.
 - (A) Fermentation, leads to the partial degradation of sugars with the use of partial oxygen. aerobic respiration, consumes oxygen as a reactant to complete the breakdown of a variety of organic molecules.
 - (B) Reactions that result in the transfer of one or more electrons (e^-) from one reactant to another are oxidation-reduction reactions, or redox reactions. Electron transfer from NADH to oxygen is an exergonic reaction with a free-energy change of -106 kcal/mol
 - (C) Catabolic pathways transfer the electrons stored in food molecules, releasing
 - (D) energy that is used to synthesize ATP. $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{energy}$ (ATP + heat)
 - (E) The catabolism of glucose is exergonic, with $\Delta G = -686 \text{ kcal}$ per mole of glucose.
 - (F) Fructose generates more energy than glucose

3. An enzyme is a macromolecule that acts as a catalyst, a chemical agent that speeds up the rate of a reaction without being consumed by the reaction. Binding by inhibitors prevents enzymes from catalyzing reactions. Certain chemicals selectively inhibit the action of specific enzymes. Which is **NOT CORRECT**?

背面有題

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- (A) Some reversible inhibitors resemble the substrate and compete for binding to the active site. Competitive inhibition can be overcome by increasing the concentration of the substrate.
- (B) If inhibitors attach to the enzyme by covalent bonds, inhibition may be irreversible. It is irreversible inhibition. If inhibitors bind by weak bonds, inhibition may be reversible.
- (C) Noncompetitive inhibitors that impede enzymatic reactions are also binding to the active site of the enzyme.
- (D) Many antibiotics are inhibitors of specific enzymes in bacteria. Penicillin blocks the active site of an enzyme that many bacteria use to make their cell walls.
- (E) Toxins and poisons are often irreversible enzyme inhibitors. For example, Sarin, the nerve gas that was released by terrorists in the Tokyo subway in 1995, binds covalently to the R group on the amino acid serine.
4. The mitotic phase alternates with interphase in the cell cycle. Which is **CORRECT**?
- (A) Chromosomes are duplicated during the G₁-S phase.
- (B) The mitotic (M) phase of the cell cycle, which includes mitosis and cytokinesis, alternates with the much shorter interphase. Interphase accounts for about 30% of the cell cycle.
- (C) A typical human cell might divide once every 12 hours. Of this time, the M phase would last less than an hour and the S phase might take 10–12 hours, or half the cycle.
- (D) Interphase has three subphases: the G₁ phase (“first gap”), the S phase (“synthesis”), and the G₂ phase (“second gap”). The daughter cells may then repeat the cycle. During all three subphases, a cell that will eventually divide grows by producing proteins and cytoplasmic organelles such as mitochondria and endoplasmic reticulum.
- (E) The rest of the time would be divided between the G₁ and G₂ phases. The G₂ phase varies most in length from cell to cell.
5. Cancer cells have escaped from cell cycle controls. Cancer cells divide excessively and invade other tissues because they are free of the body’s control mechanisms. Which is **NOT CORRECT**?

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- (A) Cancer cells do not stop dividing when growth factors are depleted. This is because a cancer cell manufactures its own growth factors, has an abnormality in the signaling pathway, or has an abnormal cell cycle control system.
- (B) Cells in culture that acquire the ability to divide indefinitely are said to have undergone transformation, the process that causes them to behave like cancer cells. Normally, the immune system recognizes and destroys transformed cells.
- (C) If and when cancer cells stop dividing, they do so at random points, not at the normal checkpoints in the cell cycle. HeLa cells from a tumor removed from a woman (Henrietta Lacks) in 1951 are still reproducing in culture.
- (D) Cancer cells are abnormal in many ways. For example, cancer cells may have an unusual number of chromosomes, their metabolism may be disabled, and they may cease to function in any constructive way. Cancer cells may secrete signal molecules that cause blood vessels to grow toward the tumor.
- (E) Cells that evade destruction proliferate to form a tumor, a mass of abnormal cells. If the abnormal cells remain at the originating site, the lump is called a benign tumor. Most benign tumors immediately cause serious problems and can be fully removed by surgery.
6. Cancer cells often lose their attachment to nearby cells, are carried by the blood and lymph system to other tissues, and start more tumors in an event called metastasis. Which description is **NOT CORRECT**?
- (A) Treatments for metastasizing cancers include high-energy radiation and chemotherapy with toxic drugs. These treatments target actively dividing cells.
- (B) Chemotherapeutic drugs interfere with specific steps in the cell cycle.
- (C) The side effects of chemotherapy are due to the drug's effects on normal cells.
- (D) Nausea results from chemotherapy's effects on intestinal cells, hair loss results from its effects on hair follicle cells, and susceptibility to infection results from its effects on immune system cells.
- (E) Taxol prevents microtubule depolymerization, preventing cells from proceeding past anaphase.
7. Which of the statement about digestion system in animals is **CORRECT**?
- (A) Secretin modulates digestion by triggering acid release in the stomach
- (B) The bile salts function in fat digestion by dispersing big droplets of fats to small droplets
- (C) Stomach acid activates pepsinogen into pepsin.

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- (D) A fatty acid absorbed into an intestinal cell becomes part of a chylomicron
- (E) Glucagon, the pancreatic hormone, functions to stimulate the liver to release glucose.
8. For the transport in the animal, which statement is **CORRECT**?
- (A) An adaptive advantage of having a three-chambered heart, as found in amphibians, over the two-chambered heart of fish is that fully oxygenated blood is kept completely separate from relatively deoxygenated blood in the heart.
- (B) Concurrent flow is not as efficient in exchange as countercurrent flow because the latter provides more diffusion at the end of capillary flow than midway through the capillary
- (C) The fluid that moves around in the circulatory system of a typical arthropod is the hemolymph.
- (D) Birds organisms breathe through tracheae
- (E) When a girl goes running, her face begins to flush mainly due to systolic pressure
9. About the animal excretory system, which statement is **NOT CORRECT**?
- (A) Animals that can produce exceptionally concentrated urine should be expected to have nephrons with longer descending limbs of the loops of Henle and ascending limbs of the loops of Henle.
- (B) The worms have flame bulbs that eliminate nitrogenous wastes.
- (C) Osmoregulation is the processes by which animals control solute concentrations and balance water gain and loss.
- (D) When urea and KCl become more abundant in the kidney medulla's interstitial fluid as one progresses deeper into the medulla, it promotes better retention of water
- (E) Marine bony fishes have more and larger nephrons than freshwater fishes, and their nephrons also lack a proximal tubule.
10. Which of the following statement is **CORRECT**?
- (A) An infant suckling on the breast of a woman who has recently given birth sends a nerve impulse to the pituitary gland. The pituitary gland then secretes oxytocin, which stimulates the mammary glands in the breasts to release milk. This is the case for negative feedback.
- (B) The formation of the fertilization membrane and the slow block to polyspermy are dependent on the departure of sodium ions from the egg.

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- (C) In humans, oogenesis is completed after ovulation, but before the sperm enters the oocyte.
- (D) Males produce estradiol in high levels.
- (E) Spermatogenesis and oogenesis differ in that oogenesis produces one egg and spermatogenesis produces four sperm.

11. Melatonin is

- (A) a methoxyindole
- (B) secreted by the pineal gland during the summer
- (C) autonomic nervous system during the winter
- (D) posterior pituitary gland during the day

12. The absorption of fats differs from that of carbohydrates in that _____.

- (A) fat absorption primarily occurs in the stomach, whereas carbohydrates are absorbed from the small intestine
- (B) carbohydrates need to be emulsified before they can be digested, whereas fats do not
- (C) fats, but not carbohydrates, are digested by bacteria before absorption
- (D) most absorbed fat first enters the lymphatic system, whereas carbohydrates directly enter the blood

13. In a well-fed human eating a Western diet, the richest source of stored chemical energy in the body is _____.

- (A) glucose in the blood
- (B) fat in adipose tissue
- (C) glucose in muscle cells
- (D) fat in muscle cells

14 Which of the following ions is most likely to cross the plasma membrane of a resting neuron?

- (A) Ca^{2+}
- (B) Na^+
- (C) Mg^{2+}
- (D) K^+

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15. Which statement about hyperpolarization of a neuron is true? When hyperpolarization occurs,
- (A) membrane potential is closer to E_{Na} than it is to E_K .
 - (B) Na^+ and/or Cl^- channels are open.
 - (C) membrane potential is more negative than during resting potential.
 - (D) if it occurs in a downstream neuron, EPSPs are more likely to be generated than are IPSPs.
 - (E) generation of action potentials is likely to occur
16. Which statement is **TRUE**?
- (A) Arousal and sleep are controlled by the part of the brain called the medulla oblongata
 - (B) Neurons are arranged according to the part of the body that receives the motor commands.
 - (C) In PET (positron-emission tomography) scanning of the brain, scientists and physicians inject radioactive glucose and detect activity in a specific brain region by changes in the local blood concentration.
 - (D) About the somatosensory and motor cortex, the cortical surface area devoted to each body part is proportional to the size of the part.
 - (E) The establishment of differences in cortical hemisphere function is called the “split-brain effect.”
17. The roles of glia in the vertebrate brain do **NOT** include:
- (A) Protecting the nervous system from invading microorganisms.
 - (B) Providing structural support for neurons.
 - (C) Receiving neurotransmitters.
 - (D) Modulating synaptic transmission.
 - (E) Generating neurons and additional glia.
18. Which is **CORRECT** for the relationship between photosynthesis and respiration in plants.
- (A) Plants respire only when they don't photosynthesize.
 - (B) Photosynthesis is the plant's form of cellular respiration.
 - (C) Respiration is not only needed for energy generation in the plants, but also provides compounds for the synthesis of other metabolites that is necessary for the plant life.

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- (D) Because photosynthesis supplements the plant the energy under light condition, the respiration will reduce when the plant is transferred from dark condition to light condition
- (E) Cellular respiration takes place only in plant roots, not throughout the plant.
19. Photosynthetic pigments in the thylakoid are light receptors. Which is **NOT CORRECT**?
- (A) Chlorophyll a, which participates directly in the light reactions and absorbs best in the red and violet-blue wavelengths and absorbs least in the green, participates directly in the light reactions, but accessory photosynthetic pigments absorb light and transfer energy to chlorophyll a.
- (B) An overall action spectrum for photosynthesis profiles the relative effectiveness of different wavelengths of radiation in driving the process. The action spectrum of photosynthesis was first demonstrated in 1883 in a clever experiment performed by Thomas Engelmann.
- (C) Accessory pigments include chlorophyll b, carotenoids, and anthocyanin.
- (D) Each light-harvesting complex consists of pigment molecules (which may include chlorophyll a, chlorophyll b, and carotenoids) bound to proteins, in which the light-harvesting complexes act as an antenna for the reaction-center complex.
- (E) The action spectrum of photosynthesis does not match exactly the absorption spectrum of any one photosynthetic pigment, including chlorophyll a.
20. The first product by the Calvin cycle is
- (A) Glucose
- (B) Sucrose
- (C) Glyceraldehyde-3-phosphate
- (D) Starch
- (E) Malic acid