

系所組別： 熱帶植物科學研究所

考試科目： 生物化學

考試日期： 0226 · 節次： 2

Choose the best answer (60分, 每題2分)

- Aside from maintaining the integrity of its hereditary material, the most important general metabolic concern of a cell is:
 - keeping its glucose levels high.
 - maintaining a constant supply and concentration of ATP.
 - preserving its ability to carry out oxidative phosphorylation.
 - protecting its enzymes from rapid degradation.
 - running all its major metabolic pathways at maximum efficiency.
- A function of the glyoxylate cycle, in conjunction with the citric acid cycle, is to accomplish the:
 - complete oxidation of acetyl-CoA to CO_2 plus reduced coenzymes.
 - net conversion of lipid to carbohydrate.
 - net synthesis of four-carbon dicarboxylic acids from acetyl-CoA.
 - net synthesis of long-chain fatty acids from citric acid cycle intermediates.
 - Both B and C are correct.
- The conversion of 1 mol of pyruvate to 3 mol of CO_2 via pyruvate dehydrogenase and the citric acid cycle also yields _____ mol of NADH, _____ mol of FADH_2 , and _____ mol of ATP (or GTP).
 - 2; 2; 2.
 - 3; 1; 1.
 - 3; 2; 0.
 - 4; 1; 1.
 - 4; 2; 1.
- The conversion of palmitoyl-CoA (16:0) to myristoyl-CoA (14:0) and 1 mol of acetyl-CoA by the β -oxidation pathway results in the net formation of:
 - 1 FADH_2 and 1 NADH.
 - 1 FADH_2 and 1 NADPH.
 - 1 FADH_2 , 1 NADH, and 1 ATP.
 - 2 FADH_2 and 2 NADH.
 - 2 FADH_2 , 2 NADH, and 1 ATP.
- If an aerobic organism (for example, the bacterium *E. coli*) were fed each of the following four compounds as a source of energy, the energy yield per mole from these molecules would be in the order:
 - alanine > glucose > palmitate (16:0).
 - glucose > alanine > palmitate.
 - glucose > palmitate > alanine.
 - palmitate > alanine > glucose.
 - palmitate > glucose > alanine.
- In amino acid catabolism, the first reaction for many amino acids is a(n):
 - decarboxylation requiring thiamine pyrophosphate (TPP).
 - hydroxylation requiring NADPH and O_2 .
 - oxidative deamination requiring NAD^+ .
 - reduction requiring pyridoxal phosphate (PLP).
 - transamination requiring pyridoxal phosphate (PLP).
- Serine or cysteine may enter the citric acid cycle as acetyl-CoA after conversion to:
 - oxaloacetate.
 - propionate.
 - pyruvate.
 - succinate.
 - succinyl-CoA.
- Which one of the following statements about photophosphorylation is *false*?
 - It can be uncoupled from electron flow by agents that dissipate the proton gradient.
 - The difference in pH between the luminal and stromal side of the thylakoid membrane is 3 pH units.
 - The luminal side of the thylakoid membrane has a higher pH than the stromal side.
 - The number of ATPs formed per oxygen molecule is about three.
 - The reaction centers, electron carriers, and ATP-forming enzymes are located in the thylakoid membrane.
- The relative concentrations of ATP and ADP control the cellular rates of:
 - glycolysis.
 - oxidative phosphorylation.
 - pyruvate oxidation.
 - the citric acid cycle.
 - all of the above.
- In the carbon assimilation ("dark") reactions of photosynthesis, the biosynthesis of 1 mol of hexose from 6 mol of carbon dioxide requires:
 - 12 mol of NADPH and 12 mol of ATP.
 - 12 mol of NADPH and 18 mol of ATP.
 - 18 mol of NADPH and 12 mol of ATP.
 - 18 mol of NADPH and 18 mol of ATP.
 - no NADPH and 12 mol of ATP.
- The precursors for sucrose biosynthesis are:
 - glucose and fructose.
 - UDP-glucose and fructose 6-phosphate.
 - UDP-fructose and glucose 6-phosphate.
 - UDP-glucose and fructose.
 - UDP-glucose and UDP-fructose.
- Which of these compounds is *not* synthesized by a pathway that includes isoprene precursors?
 - Natural rubber
 - Plastoquinone
 - Vitamin A
 - Vitamin B_{12}
 - Vitamin K
- Which of the following statements about the fixation of atmospheric nitrogen (N_2) into NH_3 by living cells is *false*?
 - It involves the transfer of 8 electrons per mol of N_2 .

(背面仍有題目, 請繼續作答)

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- B) It occurs in certain microorganisms, but not in humans.
C) It requires a source of electrons, normally ferredoxin.
D) It requires one ATP per mol of N_2 fixed.
E) It requires two key protein components, each containing iron.
14. The ABC excinuclease is essential in:
A) base-excision repair. B) methyl-directed repair. C) mismatch repair.
D) nucleotide-excision repair. E) SOS repair.
15. Which one of the following statements about mRNA stability is true?
A) Degradation always proceeds in the 5' to 3' direction.
B) Degradation of mRNA by polynucleotide phosphorylase yields 5'-nucleoside monophosphates.
C) In general, bacterial mRNAs have longer half-lives than do eukaryotic mRNAs.
D) Rates of mRNA degradation are always at least ten-fold slower than rates of mRNA synthesis.
E) Secondary structure in mRNA (hairpins, for example) slows the rate of degradation.
16. Determining the precise spacing of atoms within a large protein is possible only through the use of:
A) electron microscopy. B) light microscopy. C) molecular model building. D) Ramachandran plots.
E) x-ray diffraction.
17. Which statement of protein structure is correct?
A) only D form amino acid are constituents of proteins
B) Cysteine and methionine are important to form disulfide link to stabilize the proteins
C) Phenylalanine, Tyrosine, and Lysine all contain aromatic side chain
D) Arginine and Leucine both contain basic side chain
E) the pKa for Glutamate is around 7
18. If the pH value inside of a cell is 4 and 7 outside of the cell. Then, the concentration of H^+ inside the cell is how much higher than that outside the cell?
A) -3 B) 3 C) 8 D) 1000 E) 0.001
19. The hydrolysis of pyrophosphate to orthophosphate is important in synthesis of DNA and is catalyzed by pyrophosphatase. For this enzyme, a unit of activity is defined as that hydrolyzed 10 μ moles of pyrophosphate in 20 minutes at 37°C. The purified enzyme has a V_{max} of 2400 units per milligram. How many moles of substrate are hydrolyzed at 37 °C per second per milligram of enzyme when the substrate concentration is much greater than K_M ?
A) 2400 B) 20 C) 400 D) 1200
20. The major component of cell membrane is the phospholipids bilayer. Therefore, the fluidity of cell membrane could be generally increased by:
A) a decrease in temperature.
B) an increase in fatty acyl chain length.
C) an increase in the number of double bonds in fatty acids.
D) an increase in the percentage of phosphatidyl ethanolamine
E) the binding of water to the fatty acyl side chains.
21. Which factor is **NOT** the determinant in the active transport activity on the cell membrane?
A) pH gradient B) membrane potential C) ATPase activity D) concentration gradient
22. Phosphorylated sugars are key intermediates in energy generation and biosynthesis. What is **NOT** the function of this process:
A) serves to make sugars anionic for interaction with enzymes
B) creates reactive intermediate for the formation of glycosidic linkages.
C) transfer the phosphate group to ADP to synthesize of ATP
D) promote the sugars to cross the lipid bilayer membranes
E) Store the energy from ATP

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23. There is reciprocal regulation of glycolytic and gluconeogenic reactions interconverting fructose-6-phosphate and fructose-1,6-bisphosphate. Which one of the following statements about this regulation is **NOT** correct?
- Fructose-2,6-bisphosphate activates phosphofructokinase-1.
 - Fructose-2,6-bisphosphate inhibits fructose-1,6-bisphosphatase.
 - The fructose-1,6-bisphosphatase reaction is exergonic.
 - The phosphofructokinase-1 reaction is endergonic.
 - This regulation allows control of the direction of net metabolite flow through the pathway.
24. The combustion of glucose to CO_2 and water is a major source of energy in aerobic organisms. $\text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$. If $\Delta H = -3000 \text{ kJ/mol}$ and $\Delta S = +100 \text{ J/mol}$, then, at 37°C , what is the value of ΔG ?
- -3031 kJ/mol
 - -67001 kJ/mol
 - -30001 kJ/mol
 - -29001 kJ/mol
 - -31001 kJ/mol
25. What is not the important feature for water in biological reaction?
- An excellent solvent for ion molecules
 - High specific heat to stable the temperature
 - Hydrogen bonds are the electrostatic attractions between water molecules
 - Contain strong cohesion and adhesion between molecules
 - It is non-polar molecule
26. In an equilibrium biochemical reaction of $\text{A} + \text{B} \leftrightarrow \text{C} + \text{D}$, $dG = -10 \text{ kJ/mole}$ What will the final content in the reaction?
- $\text{A} + \text{B} > \text{C} + \text{D}$
 - $\text{C} + \text{D} > \text{A} + \text{B}$
 - only contain C and D
 - only contain A and B
27. The easiest way to analyze protein molecular weight and subunits is SDS-Gel electrophoresis. which description is correct?
- the protein analyzed still contain secondary structure
 - can use reducing agent, like β -mercaptoethanol to break the S-S bond
 - the positive charge of carried by SDS bound to the protein enable them to migrate on the gel
 - SDS is consisting of a 12-carbon tail attached to a phosphate group, giving the material the amphiphilic properties
 - it can be used to analyze different subunits of the same molecular weights
28. The signal sequences that direct proteins to the nucleus are:
- always at the amino terminus of the targeted protein.
 - glycosyl moieties containing mannose 6-phosphate residues.
 - will be cleaved in the cytoplasm when entering into the nucleus.
 - the same as those that direct certain proteins to lysosomes.
 - highly conserved between different organisms
29. Which about carbohydrates is correct statement?
- Glucose is a ketose
 - Hexoses can exist in boat and chair conformations. Usually the boat form is more stable.
 - O-glycosides are formed by elimination of a hydroxyl group from sugar
 - Sucrose is formed from a dimer of glucose
 - Starch is a polysaccharides made from $\beta(1 \rightarrow 4)$ linkage of glucose
30. Within signal transduction in the cell, which statement is NOT correct?
- The signals were activate and function in very short period
 - The transduction of signals are passed through kinases and phosphorylation reactions
 - cAMP is an important second messenger in the action of many hormones.
 - The perception of environmental signals is mainly located in the nucleus.
 - Calcium-bound form of calmodulin stimulates any enzyme and transporters.

Applying what you known (40分, 每題10分)

- CAM plants, such as *Phalaenopsis* and pineapple, are native to hot and dry environments. Briefly describe the biochemical events that allow CAM plants to minimize water loss by closing their stroma during daylight hours.

(背面仍有題目, 請繼續作答)

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2. Isoprenoids, also known as terpenoids, are the largest family of natural compounds, consisting of >40,000 different molecules. The isoprenoid biosynthetic pathway generates both primary and secondary metabolites that are of great importance to plant growth and survival.

I. What are the two pathways leading to the formation of the C5 units isopentenyl diphosphate (IDP) and its allylic isomer dimethylallyl diphosphate (DMADP), the basic terpenoid biosynthesis building blocks? (4)

II. What are the cellular compartments of these two pathways located? (3)

III. What are the acyclic precursors for the monoterpene, sesquiterpene and the diterpene, respectively? (3)

3. The non-covalent bonds are important for interaction of biomolecule interaction. Please describe what these are and their importance. Please provide the examples.

4. Please write balanced chemical equations, including ATP, NADH...etc. for each of the following:

I. fermentation of one glucose residue from 1 mole of starch into ethanol (3)

II. aerobic glycolysis of 1 mole of maltose (3)

III. anaerobic glycolysis of 1 mole of sucrose, cleaved initially by sucrose phosphorylase (4)