※ 考生請注意：本試題 □可 ☑不可 使用計算機

**Choose the best answer (60分, 每題3分)**

1. The pH of a sample of blood is 7.4, while gastric juice is pH 1.4. The blood sample has:
   A) 0.189 times the $[H^+]$ as the gastric juice. B) 5.29 times lower $[H^+]$ than the gastric juice.
   C) 6 times lower $[H^+]$ than the gastric juice. D) 6,000 times lower $[H^+]$ than the gastric juice.
   E) a million times lower $[H^+]$ than the gastric juice.
2. Amino acids are ampholytes because they can function as either a(n):
   A) acid or a base.
   B) neutral molecule or an ion.
   C) polar or a nonpolar molecule.
   D) standard or a nonstandard monomer in proteins.
   E) transparent or a light-absorbing compound.
3. 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.
4. Which of the following is *not* correct concerning cooperative binding of a ligand to a protein?
   A) It is usually a form of allosteric interaction.
   B) It is usually associated with proteins with multiple subunits.
   C) It rarely occurs in enzymes.
   D) It results in a nonlinear Hill Plot.
   E) It results in a sigmoidal binding curve.
5. In DNA sequencing by the Sanger (dideoxy) method:
   A) radioactive dideoxy ATP is included in each of four reaction mixtures before enzymatic synthesis of complementary strands.
   B) specific enzymes are used to cut the newly synthesized DNA into small pieces, which are then separated by electrophoresis.
   C) the dideoxynucleotides must be present at high levels to obtain long stretches of DNA sequence.
   D) the role of the dideoxy CTP is to occasionally terminate enzymatic synthesis of DNA where Gs occur in the template strands.
   E) the template DNA strand is radioactive.
6. The fluidity of the lipid side chains in the interior of a bilayer is 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.
7. 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?
   A) Fructose-2,6-bisphosphate activates phosphofructokinase-1.
   B) Fructose-2,6-bisphosphate inhibits fructose-1,6-bisphosphatase.
   C) The fructose-1,6-bisphosphatase reaction is exergonic.
   D) The phosphofructokinase-1 reaction is endergonic.
   E) This regulation allows control of the direction of net metabolite flow through the pathway.
8. Which compound is an intermediate of the β-oxidation of fatty acids?
   A) $CH_3—(CH_2)_{20}—CO—COOH$ B) $CH_3—CH_2—CO—CH_2—CO—OPO_3^{2-}$
   C) $CH_3—CH_2—CO—CH_2—OH$ D) $CH_3—CH_2—CO—CO—S—CoA$
   E) $CH_3—CO—CH_2—CO—S—CoA$
9. Uncoupling of mitochondrial oxidative phosphorylation:
   A) allows continued mitochondrial ATP formation, but halts $O_2$ consumption.
   B) halts all mitochondrial metabolism.
   C) halts mitochondrial ATP formation, but allows continued $O_2$ consumption.
   D) slows down the citric acid cycle.
   E) slows the conversion of glucose to pyruvate by glycolysis.

(背面仍有題目,請繼續作答)

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10. Which of these can be synthesized by plants but *not* by humans?
    A) Linoleate [18:2($\Delta^{9,12}$)]
    B) Palmitate (16:0)
    C) Phosphatidylcholine
    D) Pyruvate
    E) Stearate (18:0)
11. Which one of the following best describes the role of mitochondria in apoptosis?
    A) Escape of cytochrome *c* into the cytoplasm.
    B) Increased rate of fatty acid β-oxidation.
    C) Increase in permeability of outer membrane.
    D) Uncoupling of oxidative phosphorylation.
    E) Both A and C are correct.
12. In what order do the following five steps occur in the photochemical reaction centers?
    1) Excitation of the chlorophyll *a* molecule at the reaction center
    2) Replacement of the electron in the reaction center chlorophyll
    3) Light excitation of antenna chlorophyll molecule
    4) Passage of excited electron to electron-transfer chain
    5) Exit on transfer to neighboring chlorophyll
    A) 1-2-3-4-5
    B) 3-2-5-4-1
    C) 3-5-1-4-2
    D) 4-2-3-5-1
    E) 5-4-3-2-1
13. Cyclic electron flow in chloroplasts produces:
    A) ATP and $O_2$, but not NADPH.
    B) ATP, but not NADPH or $O_2$.
    C) NADPH, and ATP, but not $O_2$.
    D) NADPH, but not ATP or $O_2$.
    E) $O_2$, but not ATP or NADPH.
14. In "$C_4$" plants of tropical origin, the first intermediate into which $^{14}CO_2$ is fixed is:
    A) aspartate.
    B) phosphoenolpyruvate.
    C) oxaloacetate.
    D) malate.
    E) 3-phosphoglycerate.
15. The known mechanisms of activation of rubisco or of other enzymes of the Calvin cycle during illumination include all of the following *except:*
    A) increased stromal pH.
    B) light-driven entry of $Mg^{2+}$ into the stroma.
    C) phosphorylation by cAMP-dependent protein kinase.
    D) phosphorylation of phosphoenolpyruvate carboxylase.
    E) reduction of a disulfide bridge by thioredoxin.
16. A 30-carbon precursor of the steroid nucleus is:
    A) farnesyl pyrophosphate.
    B) geranyl pyrophosphate.
    C) isopentenyl pyrophosphate.
    D) lysolecithin.
    E) squalene.
17. Histones are _____ that are usually associated with _____.
    A) acidic proteins; DNA
    B) acidic proteins; RNA
    C) basic proteins; DNA
    D) basic proteins; RNA
    E) coenzymes derived from histidine; enzymes

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18. Processing of a primary mRNA transcript in a eukaryotic cell does *not* normally involve:
    A) attachment of a long poly(A) sequence at the 3′ end.
    B) conversion of normal bases to modified bases, such as inosine and pseudouridine.
    C) excision of intervening sequences (introns).
    D) joining of exons.
    E) methylation of one or more guanine nucleotides at the 5′ end.
19. Which of the following is true about the sorting pathway for proteins destined for incorporation into lysosomes or the plasma membrane of eukaryotic cells?
    A) Binding of SRP to the signal peptide and the ribosome temporarily accelerates protein synthesis.
    B) The newly synthesized polypeptides include a signal peptide at their carboxyl termini.
    C) The signal peptide is cleaved off inside the mitochondria by signal peptidase.
    D) The signal recognition particle (SRP) binds to the signal peptide soon after it appears outside the ribosome.
    E) The signal sequence is added to the polypeptide in a posttranslational modification reaction.
20. The signal sequences that direct proteins to the nucleus are:
    A) always at the amino terminus of the targeted protein.
    B) cleaved after the protein arrives in the nucleus.
    C) glycosyl moieties containing mannose 6-phosphate residues.
    D) not located at the ends of the peptide, but in its interior.
    E) the same as those that direct certain proteins to lysosomes.

**Applying what you known (40分, 每題10分)**

1. Show the structure of isopentenyl pyrophosphate and of dimethylallyl pyrophosphate. Connect with a dotted line the two carbon atoms that will be joined when these two molecules condense to form the 10-carbon intermediate in cholesterol biosynthesis.

2. The DNA of virtually every cell is underwound (i.e., negatively supercoiled) relative to B-form DNA. In bacteria, an enzyme called (a) _____ introduces negative supertwists into DNA using (b) _____ as a source of energy. This enzyme is classified as a type (c) _____, which affects the linking number in steps of (d) _____. The usual substrate for this enzyme within an *E. coli* cell is the bacterial chromosome. This enzyme would (e) _____ (decrease/increase/not change) this linking number when acting upon this DNA molecule in the presence of the above energy source.

3. Predict how an inhibitor of electron passage through pheophytin would affect electron through (a) photosystem II and (b) photosystem I. Explain your reasoning.

4. Sucrose synthesis occurs in the cytosol and starch synthesis in the chloroplast stroma, yet the two processes are intricately balanced. What factors shift the reactions in favor of (a) starch synthesis and (b) sucrose synthesis?