※注意：作答時，請於答案卷上標明作答之大題及其題號。

I. Correlate the following names or terms in (A) with those in (B) (8%)

A.

a. Lipase; **b.** Trypsin; **c.** HMG-CoA synthetase; **d.**; ATPase

e. PEP Carboxylase; **f.** α-Amylase; **g.** Phospholipase A_2; **h.** Enolase

i. Malate dehydrogenase; **j.** *cis-trans* Isomerase ; **k.** Pyruvate kinase ;

l. Pyruvate dehyrogenase; **m.** Cytochrome a; **n.** Pyruvate carboxylase;

o. Diacylglycerol kinase ; **p.** Ribozyme; **q.** Aldolase **r.** Citrate synthase; **s.** Isomerase;

t. Fumarate hydratase **u.** Isocitrate lyase; **v.**Thiolase; **w.** Hemoglobin;

x. Glycosyltransferase; **y.** Chlorophyll a; **z.** Phosphatase

B.

1. **The enzyme** in TCA cycle which catalyzes the C—C bond formation.

2. **The enzyme** which is directly associated with anaplerotic reaction for TCA cycle.

3. The **key enzyme** in the conversion of fatty acids to carbohydrates in plant or microorganism via glyoxylate cycle, but absent in mammalian cells.

4. **The enzyme** which is used to fix CO_2 in C4 plants that are more adaptable in the arid region.

5. **The enzyme** which cleaves a C—C bond in glycolysis.

6. The **key enzyme** which is the primary control site for cholesterol biosynthesis and can be inhibited by compactin and lovastatin.

7. **An enzyme** which is abundant in snake venoms.

8. **An enzyme** which is involved in glycolysis and one of control points for regulation and can be inhibited by ATP.

II. Correlate the following names or terms in (A) with those in (B) (12%)

A.

a. UDP-glucose; **b.** Fluorocitrate; **c.** Glycerol; **d.**; Sucrose

e. Aspirin; **f.** cyclic AMP; **g.** Vitamin B6 (Pyridoxal derivatives); **h.** FMN

i. Choline; **j.** Sialic Acid ; **k.** Inositol ; **l.** Vitamin K

m. Coenzyme Q; **n.** Ribose; **o.** Nicotinamide; **p.** Glucose; **q.** Mannose

r. Pectin; **s.** AMP; **t.** Fumarate **u.** Fructose-2,6-*bis*phosphate; **v.** Citrate;

w. Adenine; **x.** Penicillin; **y.** Ascorbic acid; **z.** Tyrosine

B.

9. **A compound** which is an important allosteric activator of phosphofructokinase, the key enzyme of glycolysis.

10. **An inhibitor** of aconitase (in TCA cycle).

11. **A compound** in TCA cycle, which contains a C=C double bond in trans form.

12. Acetyl CoA is the basic unit to synthesize fatty acid and mainly produced in mitochondria. However, the site for fatty acid synthesis is in cytosol. **Which of the compounds in A** is produced in mitochondria and can cross mitochondria membranes, then converted to acetyl CoA in cytosol for fatty acid synthesis?

13. **A compound** which is an important factor in the blood-clotting process.

14. **A compound** which is involved in glycogen synthesis.

15. **A monosaccharide** which is the outermost residue (or non-reducing end) of complex carbohydrates, which are attached to ceramides to form gangliosides.

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16. **A compound** which can be used as an analgesic, antipyretic and anti-inflammatory drug due to its inhibition on the conversion of arachidonic acid to prostaglandin H_2.

17. **A compound** which is an allosteric inhibitor of phosphorylase a.

18. Glycogen mobilization is controlled hormonally by a metabolic cascade. **Which compound in A** is the first activator to ignite the cascade that involves successive phosphorylations of various enzymes.

19. **which sugar** is not a reducing sugar?

20. **A coenzyme** is covalently linked to enzymes via a Schiff base (imine) formed between its aldehyde group and the ε-amino group of Lys in enzymes that are involved in amino acid metabolism.

III. Correlate the following names or terms in (A) with those in (B) (10%)

A.

a. Leukotrienes; **b.** Valine; **c.** Tryptophan; **d.**; Coenzyme Q

e. Starch; **f.** Vitamin D_3; **g.** Thromboxane A_2; **h.** Glycogen

i. Biotin; **j.** Palmitic acid ; **k.** 2,4-Dinitrophenol ; **l.** Proline

m. Serine a; **n.** Fucose; **o.** Lipoic acid ; **p.** Asparagine; **q.** Chitin

r. NADH; **s.** ATP; **t.** Fumarate; **u.** $FADH_2$; **v.** Acetoacetate;

w. NADPH; **x.** GTP; **y.** Vitamin E; **z.** Avidin

B.

21. **A polysaccharide** which is a polymer formed by β-(1→4) glycosidic linkages.

22. **A protein** which is found in egg white and can strongly bind to biotin.

23. The only **amino acid** without a free amino-terminal group.

24. An **uncoupler** which inhibits the phosphorylation of ADP by destroying the pH gradient between intermembrane space and matrix of mitochondria, but oxygen can still be reduced to H_2O.

25. **A cofactor** which is involved in the conversion of pyruvate into acetyl CoA.

26. A **coenzyme** which is covalently linked to acetyl-CoA carboxylase and involved in the synthesis of fatty acid by converting acetyl-CoA to malonyl-CoA.

27. In red blood cell, **Which compound** is generated in the pentose phosphate pathway to maintain the sulfhydryl groups of hemoglobin and other proteins in their reduced forms, and keep the Fe(II) of hemoglobin in its reduced form?

28. **A compound** which is one of the components of ketone bodies that are overproduced in diabetes and during starvation?

29. **A hormone or a compound** that regulates calcium uptake in the intestine and calcium levels in kidney and bone.

30. The only **amino acid** which cannot be determined on a regular amino acid analysis using 6 M HCl.

IV. Single-Choice Questions (15%)

31. (a) A (b) B (c) C (d) D form DNA is the principle form that occurs in nature.

32. In nucleoside, sugar is linked to (a) nitrogen (b) carbon (c) phosphate (d) oxygen.

33. The process by which the sequence of bases is passed from DNA to RNA is called (a) polymerase chain reaction (b) translation (c) transcription (d) replication

34. Supercoiling in eukaryotic DNA is from (a) primary (b) secondary (c) tertiary (d) quaternary structure of DNA, which resembles beads on a string.

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35. In replication, (a) DNA ligase (b) DNA polymerase I (c) DNA polymerase III (d) DNA gyrase is used for polymerization of leading strand and lagging strand.

36. DNA replication occurs at (a) G1 phase (b) G2 phase (c) S phase (d) M phase for eukaryotes.

37. (a) transcription factor (b) sigma factor (c) silencer (d) rho factor is used in prokaryotic transcription initiation.

38. (a) inosine (b) ddGTP (c) UTR (d) AZT, which is a nucleoside, has been used in human immunodeficiency disease (AIDS) therapy.

39. Which one is incorrect? (a) Retinoic acid is water insoluble and can penetrate into cell to activate or repress gene expression. (b) CREB is a transcription factor for TATA box binding. (c) Xeroderma pigmentosum is a disease caused by gene mutation caused by UV irradiation. (d) In general, introns exist in many eukaryotic genes.

40. (a) wobble hypothesis (b) reading frame (c) methionine (d) anticodon is used to illustrate the variation in codon usage.

41. (a) ATG (b) TTA (c) TGA (d) AAT is used as the termination codon in protein translation.

42. (a) tRNA (b) mRNA (c)rRNA (d) SnRNA is not used in prokaryote translation.

43. (a) Kozac sequence (b) Shine-Dalgarno sequence (c) enhancer (d) exon is recognized by ribosome in translation initiation for prokaryotes.

44. Which is not used in post-translational modification for insuiin synthesis? (a) disulfide linkage (b) protease cleavage (c) folding (d) nuclear localization.

45. (a) codon (b) chaperon (c) tumor suppressor (d) retrovirus acts as inhibitor to transcription of genes that would cause increased replication.

V. Multiple-Choice Questions (20%)

46. Which of the following substances belong to the class of antioxidants? (A) niacin (B) ascorbic acid (C) tocopherol (D) retinal (E) folic acid.

47. In glycoproteins, which amino acids in the protein part were attached by carbohydrate moieties? (A) proline (B) serine (C) tryptophan (D) glycine (E) asparagine.

48. Which of the following belong to the class of free radicals? (A) superoxide (B) singlet oxygen (C) triplet oxygen (D) hydrogen peroxide (E) folic acid.

49. Anemia can be caused by deficiency in (A) vitamin A (B) folic acid (C) cyanocobalamin (D) iron (E) amino acid.

50. Which of the following buffering substances are used in maintaining the homeostasis of physiological pH conditions? (A) phosphate buffer (B) hemoglobin solution in the blood (C) cellular amino acids and proteins (D) urea (E) none of the above.

51. Which of the following diseases are caused by retroviruses? (A) hepatitis A (B) AIDS (C) flu (D) lung cancer (E) ulcer.

52. Which of the following informations cannot be determined or deduced from the amino acid analyzer? (A) amino acid contents (B) amino acid sequence (C) isoelectric point (D) molecular weight (E) protein conformation

53. Which of the following amino acids function as "neurotransmitter" *in vivo*? (A) glycine (B) glutamic acid (C) leucine (D) phenylalanine (E) none of the above.

54. Which of the following compounds belong to catecholamines (A) epinephrine (B) norepinephrine (C) dopamine (D) mescaline (E) serotonin.

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55. "Ketone bodies" are formed when (A) oxaloacetate is converted to acetoacetyl-CoA (B) there is an excess of acetyl-CoA (C) there is not enough oxaloacetate to react with available acetyl-CoA (D) an organism consumes excessive amounts of carbohydrate compared to its lipid intake. (E) an organism consumes excessive amounts of fat compared to its carbohydrate.

VI. What is the "Central Dogma" proposed by Francis Crick in 1950's regarding informational macromolecules present in various cells and how is it modified today? (8%)

VII. What is "Polymerase Chain Reaction" (PCR) and how is it applied to diagnosis of diseases and forensic medicine? What is the name of enzyme used in the PCR reaction? (6%)

VIII. There is a new emerging field of "Proteomics" in contrast to the conventional Human "Genomics" study. What are the major differences between the two in terms of the methodology? (8%)

IX. What is the pH of the solution by mixing one part of 6 mM Na_2HPO_4 and two parts of 2 mM NaH_2PO_4 ? (Three pKa of H_3PO_4 are 2.14, 6.86 and 12.4, respectively. log 2=0.301 and log 3=0.477) (6%)

X. The techniques of *in vitro* site-specific mutagenesis provide a powerful method for chemical modification of proteins or enzymes at will to examine the structure-function relationship. How to apply this approach to study the role of serine at the active site of trypsin? In the conventional chemical modification method, how to determine whether tyrosine residue is involved in the catalysis of active site? What is the advantage or disadvantage of this method as compared to site-specific mutagenesis? (7%)