第壹部份：(40 分)

1. How does epinephrine stimulate glycogen breakdown and inhibit glycogen synthesis? (5 %)
2. The oxygen (O_2) is not involved in the reactions of the citric acid cycle, but the citric acid cycle does fail when the oxygen is absent. Why? (5 %)
3. What are the major products of pentose phosphate pathway? (4 %)
4. How does a proton gradient drive the synthesis of ATP? (4 %)
5. What is the committed reaction of fatty acid biosynthesis? (2 %)
6. What are the two additional enzymes required in β-oxidation of unsaturated fatty acids? (4 %)
7. What is the enzyme of committed reaction in fatty acid biosynthesis? (2 %)
8. What is the precursor of cholesterol biosynthesis? (2%)
9. What is the enzyme of committed reaction in cholesterol biosynthesis? (2 %)
10. What are the precursors of Sphingolipid biosynthesis? (4 %)
11. What are the precursors for aromatic amino acid biosynthesis via the shikimate pathway? (4 %)
12. What is the major product of purine oxidation in human? (2 %)

第貳部份：(40 分) **(2 points each)**

1. Entropy change, ΔS, is:
   a. the sum of heat absorbed and work
   b. not a thermodynamic state function
   c. a measure of disorder in a system
   d. determined by pressure change at a constant temperature
   e. equal to the heat transferred at constant pressure and volume

2. Glutamic acid has pK_as at 2.2, 4.3 and 9.7. Calculate the isoelectric point for glutamic acid.
   a. 3.25
   b. 4.3
   c. 5.4
   d. 7.0
   e. 8.6

3. RNA is _____ stable to alkaline hydrolysis than DNA because RNA's vicinal _____ group makes the 3'-phosphodiester bond susceptible to _____ cleavage.
   a. less; 3'-OH; nucleophilic
   b. less; 2'-OH; nucleophilic
   c. more; 2'-OH; electrophilic
   d. more; 2'-OH; nucleophilic
   e. more; 3'-OH; electrophilic

4. Protein isolation and purification include all of the techniques **EXCEPT:**
   a. gas-liquid chromatography
   b. ion exchange chromatography
   c. electrophoresis
   d. solubility ("salting in" and "salting out")
   e. affinity chromatography

5. Determine the amino acid sequence of the following oligopeptide from the experimental data below.
The amino acid composition is found to be [ala, lys, phe, met, cys, plus some decomposition products]
The peptide has a molecular weight around 700 Da and absorbs at 280 nm
Treatment with carboxypeptidase results in tryptophan and a peptide
CNBr treatment yields a tetrapeptide and a dipeptide
Trypsin digestion produces an amino acid and a pentapeptide with met on the amino end
Chymotrypsin digestion yields a dipeptide and a tetrapeptide
   a. trp-lys-met-cys-met-ala
   b. lys-met-cys-phe-ala-trp
   c. trp-ala-phe-cys-met-lys
   d. lys-ala-cys-phe-met-trp
   e. lys-met-cys-ala-phe-trp

6. Alpha helices are stabilized primarily by:
   a. hydrogen bonds between the main chain peptide bond component atoms
   b. electrostatic interactions between R-groups
   c. hydrophobic interactions between the α-carbons of the main chain
   d. hydrogen bonding between the R-groups
   e. hydrophobic interactions between R-groups and the solvent water

7. When the peptide (AEFFLAMEP) forms an α-helix, which amino acid residue would be closest to being in the same position on the same face of the helix as is the initial alanine residue?
   a. F(3)
   b. A(6)
   c. E(8)
   d. P(9)
   e. L(5)

8. Silk fibers consist of _____ proteins consisting of alternating _____ and _____ or _____ residues.
   a. fibroin; glycine; proline; leucine
   b. α-keratin; alanine; glycine; serine
   c. fibroin; glycine; alanine; threonine
   d. β-keratin; cysteine; alanine; proline
   e. fibroin; glycine; alanine; serine

9. All of the following are characteristics of hemoglobin's binding of oxygen **EXCEPT:**
   a. CO_2promotes dissociation of $O_2$from hemoglobin by lowering the pH
   b. Protons promote binding of oxygen by Hb
   c. 2,3-*Bis*phosphoglycerate (BPG) promotes release of O_2 by Hb
   d. CO_2can bind with Hb's free amino groups and stabilize deoxy-Hb
   e. BPG and $O_2$are mutually exclusive allosteric effectors of Hb

10. All of the following statements about cyclic sugars are true EXCEPT:
   a. The α-anomer has the -OH of the anomeric carbon positioned on the opposite side of the sugar ring from the $-CH_2OH$
   b. The five and six membered rings are more frequently observed due to stability
   c. In a chair conformation, the predominant form has the bulkiest substituents occupying axial positions
   d. The carbonyl carbon becomes a chiral center
   e. They can be formed by the intramolecular reactions to hemiacetals or hemiketals

11. Neither α-amylase or β-amylase can cleave the _____ bonds of amylopectin and _____ glucosidase is required to completely hydrolyze starch.
   a. α (1→6)-; α (1→6)-
   b. β (1→6)-; β (1→6)-
   c. α (1→4)-; α (1→4)-
   d. β (1→4)-; β (1→4)-
   e. none are true

12. All are correct statements comparing an intact 4 kb plasmid and a 4 kb fragment of *E. coli* chromosomal DNA. The plasmid has a 50% G+C content and the chromosomal DNA has a 55% G+C content **EXCEPT**:
   a. The T_m of the plasmid would be less than the T_m of the chromosomal DNA
   b. The $c_o t_{1/2}$ value (time required to renature 50% of the DNA molecules) of the plasmid would be more than that of the chromosomal DNA
   c. The plasmid DNA and chromosomal DNA would both show approximately a 30-40% increase in their absorption at 260 nm upon heating to 90∘C
   d. The plasmid DNA would contain more negative supercoiling than the chromosomal DNA fragments
   e. All are true

13. An RNA-dependent DNA polymerase that carries the RNA template with it to synthesize repeats at the 3'-ends of chromosomes is called:
   a. DNA ligase
   b. telomerase
   c. DNA polymerase γ (gamma)
   d. topoisomerase
   e. DNA polymerase β (beta)

14. The correct sequence for homologous recombination steps is:
   A. ligation
   B. branch migration and strand exchange
   C. nicking
   D. EW or NS cleavage, resolution and re-ligation
   E. strand invasion
   a. B, C, E, A, D
   b. C, B, E, D, A
   c. D, C, B, A, E
   d. C, E, A, B, D
   e. C, A, B, E, D

15. Nitrous acid causes the oxidative deamination of cytosine producing uracil. What point mutation is the logical result?
   a. C-G to A-T, only
   b. C-G to T-A, only
   c. C-G to G-C, only
   d. C-G to A-T, only AND C-G to T-A, only
   e. C-G to A-T, only AND C-G to T-A, only AND C-G to G-C, only

16. Within the _____ are two consensus sequence elements, the _____ near -10 and a sequence of TATAAT, and the _____ containing the consensus TTGACA.
   a. termination sequence; rho subunit; sigma sub
   b. termination sequence; Pribnow box; sigma subunit unit
   c. promoter sequence; rho subunit; Pribnow box
   d. promoter sequence; Pribnow box; -35 region
   e. promoter sequence; rho subunit; -35 region

17. In prokaryotes, gene expression is often responsive to small molecules where increasing synthesis of enzymes for metabolism of a certain substrate is termed _____ and the substrate is called _____. Likewise metabolic products that decrease synthesis of enzymes for their production are called _____ and carry out _____.
   a. autoregulation; regulatory; co-repressors; initiation
   b. co-induction; induction; co-repressors; initiation
   c. induction; co-inducer; co-repressors; repression
   d. induction; co-inducer; repressor; co-repression
   e. all are true

18. When the cellular level of tryptophan decreases in *E. coli*:
   a. tryptophan-bound Trp repressor associates with *trp* operator
   b. trp aporepressor has lowered affinity for *trp* promoter allowing RNA. polymerase binding and transcription of the *trp* operon
   c. tryptophan binds *trp* inducer to promote positive control of *trp* promoter
   d. *trp* repressor has a greater affinity for *trp* operator
   e. none of these choices

19. Heat shock element (HSE) is a(n) _____ found in the _____ region of genes whose transcription is activated in response to _____.
   a. silencer; enhancer; cold
   b. response element; promoter; elevated temperature
   c. promoter; enhancer; elevated temperature
   d. enhancer; response element; elevated temperature
   e. silencer; promoter; cold

20. The order of events in the initiation of protein synthesis is:
   A. GTP hydrolysis triggered by the 50 S subunit joining the 30 S subunit releasing IF-1, IF-2 and IF-3
   B. IF-2 delivers the initiator f-Met-tRNA$_i^{fMet}$ in a GTP-dependent process
   C. A-site of the 70 S initiation complex is ready to accept an incoming aminoacyl-tRNA
   D. IF-3 and IF-1 bind 30 S subunit E. mRNA binds to form the 30 S initiation complex
   a. C, A, E, B, D
   b. E, D, A, B, C
   c. B, D, C, E, A
   d. D, B, E, A, C
   e. D, E, A, B, C

第參部份：(20 分)

1. Which one of the followings is not used in "DNA sequencing" (A). dNTP (B). DNA polymerase (C). primer (D). ddNTP (E). DNA ligase. (1 分)

2. Which one of the followings is not true to describe the "nucleic acid" (A). RNA is DNA transcription product (B). RNA is stable in weak acidic solution (C). the 2' ribose moiety of RNA is –OH group (D). RNA is less stable than DNA (E). RNA comes with double strand. (1 分)

3. Which one of the following methods is not true to describe "transgenic methodology" (A). electroporation (B). microinjection (C). transformation (D). transduction (E). addiction. (1 分)

4. Which one of the followings is not true to describe "eucaryotic DNA transcription" (A). three different type of RNA polymerase (B). transcription and translation are separate (C). posttranscriptional modification (D). transcription unit called as gene (E). to synthesis protein. (1 分)

5. Which one of the followings is not true to describe "DNA separation by gel electrophoresis" (A). the DNA can be visible under UV light by staining with ethidium bromide (B). separation based on the length of DNA (C). the gel can be acrylamide components (D). the current goes from negative to positive (E). DNA carry positive charge. (1 分)

6. Which one of the followings is not true to describe the "characteristics of nucleic acid" (A). can be single stranded RNA (B). can be antiparallel double stranded DNA (C). all linked by phosphodiester bond (D). all are in 5 → 3 orientation (E). DNA is more stable than RNA. (1 分)

7. Which one of the followings is not true to describe the "cDNA library" in eucaryotic species (A). RNase H is used in library construction (B). cDNA library is different in each organ (C). the cDNA library is use to screen gene expression (D). the cDNA library is first made by RNA polymerase from total RNA (E). each cDNA library probably represent only part of whole genome gene expression profile. (1 分)

8. Which one of the descriptions is not true in "in vivo DNA replication" (A). semiconservative (B). need SSB proteins to stabilize ssDNA (C). all synthesis strand follow the 5'→3'orientation (D). the replication initiation primers are DNA (E). producing Okazaki fragments in the lagging strand. (1 分)

9. Which one of the followings is not found in "Krebs cycle" (A). citrate (B). isocitrate (C). α-ketoglutarate (D). glutamine (E). oxaloacetate. (1 分)

10. Which one of the followings is not recognized as "in vivo DNA replication enzyme" (A). helicase (B). single strand binding protein. (C). ligase (D). reverse transcriptase (E). primase. (1 分)

11. Which one of the following biochemical characteristics is not found in "TCA cycle" (A). macromolecules exchange place (B). producing high energy molecules as NADH and FADH (C). producing CO_2 (D). producing ribose (E). producing precursors of purine and pyrimidine . (1 分)

12. Which one of the following descriptions is not true for "in vivo eucaryotic DNA transcription" (A). three different type of RNA polymerase (B). to synthesis single strand RNA (C). posttranscriptional modification (D). transcription and translation are coupled together (E). contains RNA splicing. (1 分)

13. Which one of the followings is not the major reasons to cause " DNA mutation" (A). DNA replication error (B). induced mutation (C). specific mispairing by mutagen (D). missense mutation (E). polymerase fidelity. (1 分)

14. Which one of the followings is not found in " in vivo DNA replication" (A). primase (B). DNA polymerase (C). helicase (D). endonuclease (E). topoisomerase. (1 分)

15. Which one of the followings is not true to describe the "gene is defined as a transcription unit" (A). made by RNA polymerase (B). initiated from initiation site, the +1 position. (C). the upstream DNA sequence of "+1 position" is called promoter (D). mRNA only, not for tRNA or rRNA (E). terminated at termination site recognized by ρ factor. (1 分)

16. Which one of the followings is not true to describe DNA sequencing strategy of "chromosome walking vs whole genome shot-gun sequencing" (A). both use the enzymatic dideoxy chain termination (B). both use nonisotopic detection (C). the readable DNA length in sequencing gel is the same (D). both use regular dNTP as major substrate + 4 color ddNTP as indicators (E). whole genome shot-gun sequencing need more primers than chromosome walking. (1 分)

17. Which one of the followings is not true to describe the "TCA cycle" (A). one of the most important anaplerotic reaction in cell (B). one of the important cycle to generate macromolecule precursors (C). also called citric acid cycle (D). the most important cycle to generate high energy molecules (E). α-ketoglutarate and citrate are important precursors for nucleic acid synthesis. (1 分)

18. Which one of the followings is not true to describe "acetyl -CoA" (A). glycolysis final product to enter TCA cycle (B). fatty acid β-oxidation product (C). precursor of malonyl-CoA for fatty acid synthesis (D). precursor of ketone body (E). precursor of malate. (1 分)

19. Which one of the followings is not true to describe the "prokaryotic genomic structure" (A). genomic DNA replication need RNA primer (B). prokaryotic genome replicate as θ type with two direction of replication (C). replication initiate at the OriC site only (D). prokaryotic transcription can be either monocistronic or polycistronic (E). an operon structure can transcribe only one gene. (1 分)

20. Which one of the followings is not true to describe "protein translation" (A). mRNA is the assembling line containing the genetic code (B). methione is the first amino acid to be synthesized (C). rRNA forms the manufactory (D). tRNAs carry the amino acids to ribosome (E). protein elongation from the carboxyl group to the amino group. (1 分)