

**Section 1: Multiple choices.** Please choose **the best answer** for each question. (2.5 points for each question)

- Which of the following statements is false?
  - Enzymes are regenerated in the course of the reactions they catalyze.
  - Enzymes decrease the activation energy of the reactions they catalyze.
  - All known enzymes are proteins.
  - All enzymes increase the rate of reactions they catalyze.
- The hydrogen bonding properties of the water molecule influence
  - its boiling point
  - its freezing point
  - its properties as a solvent
  - all of the above
- In general, organic molecules that contain abundant hydrogen bonding functional groups
  - dissolve in water
  - are dipoles
  - are hydrophobic
  - bind amino acids
- Ion Exchange Chromatography separates proteins by:
  - size
  - charge
  - ligand binding
  - protein affinity
- Catabolic reactions are generally \_\_\_\_\_, while anabolic reactions \_\_\_\_\_.
  - are exergonic; are endergonic
  - are chemical reductions; are chemical oxidations
  - increase enthalpy (or heat content); increase entropy
  - all of the above
- The structure of a protein depends on several different types of chemical bonds and group interactions. Which of the following are necessary to stabilize the secondary structure of a protein?
  - peptide bonds
  - hydrogen bonds between side groups of the amino acids residues
  - disulfide bonds
  - ionic bonds
- The part of the protein that extends through the center of the lipid bilayer is composed of amino acids that are:
  - hydrophobic
  - water soluble.
  - positively charged.
  - negatively charged.
- Water does not move across cell membranes by
  - simple diffusion across the lipid bilayer.
  - permeation through channel proteins.
  - transport via carrier proteins.
  - Water only moves across cell membranes by one of the above routes.
  - Water does not move across cell membranes by any of the above routes.

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9. Histones contain large amounts of which of the following amino acids?
- (a) histidine
  - (b) glutamic acid
  - (c) lysine
  - (d) leucine
  - (e) tryptophan
10. Replication of eukaryotic DNA
- (a) must occur faster than replication of prokaryotic DNA
  - (b) must be controlled to coordinate with the cell cycle
  - (c) takes place during mitosis
  - (d) takes place twice during each cell cycle
11. RNA synthesis begins at the base in the DNA sequence designated by the following number:
- (a) +1 (plus one)
  - (b) 0 (zero)
  - (c) - 1 (minus one)
  - (d) - 10 region (minus ten)
  - (e) You cannot tell from the information given.
12. Degeneracy allows all of the following efficiencies in the genetic code, **except**:
- (a) More than one amino acid can bind to a tRNA.
  - (b) Each tRNA can bind to more than one codon.
  - (c) Most codons can bind to more than one tRNA.
  - (d) Fewer tRNA molecules are needed.
  - (e) All of these are true.
13. The following steps are all involved in genetic recombination:
1. Screening for cells that contain the recombined gene.
  2. Cutting the vector with restriction enzyme.
  3. Mixing the gene of interest with the vector.
  4. Isolating the gene of interest from its original source.
  5. Ligating the gene of interest and the vector together.
- The following sequence of these five steps would be typical:
- (a) 1 → 2 → 3 → 4 → 5
  - (b) 2 → 3 → 5 → 1 → 4
  - (c) 5 → 4 → 3 → 2 → 1
  - (d) 4 → 2 → 3 → 5 → 1
  - (e) 2 → 3 → 5 → 4 → 1
14. A single clone of interest can be distinguished from others in a mixture of clones by
- (a) testing the clones for antibiotic resistance
  - (b) mobility of the clones in gel electrophoresis
  - (c) a specific probe, usually a labeled complementary DNA
  - (d) resistance to damage by ultraviolet light
15. Site directed mutagenesis using PCR is possible for all of the following reasons, **except**:
- (a) The primer does not need to match the template sequence exactly.
  - (b) Once a "mutated" template is made, it will be duplicated with the modified sequence.
  - (c) Synthesis of DNA during PCR does not have any proofreading mechanism.
  - (d) None of these answers is correct.
  - (e) All of these answers are correct.

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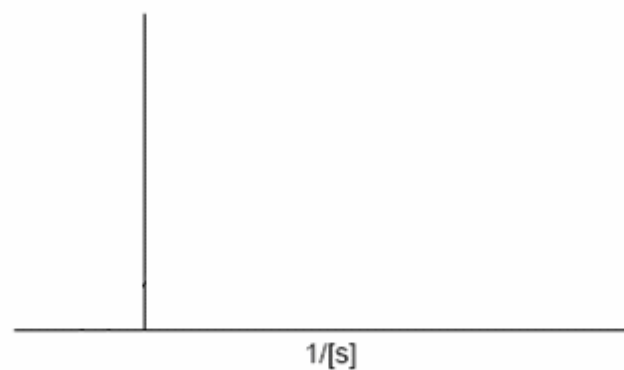
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16. An expression library contains genes corresponding to all of the following, **except**:
- (a) The mRNA made in a specific cell type.
  - (b) The genes for all the proteins found in an organism.
  - (c) The mRNA made in a specific tissue.
  - (d) The genes expressed during a particular developmental stage of the organism.
  - (e) An expression library could be any of these choices.
17. During reduction:
- (a) Electrons are lost.
  - (b) Electrons are gained.
  - (c) Electrons may either be lost or gained.
  - (d) Hydrogen is formed.
  - (e) None of these answers is correct.
18. SARS is caused by
- (a) an adenovirus.
  - (b) a retrovirus.
  - (c) a coronavirus.
  - (d) a rhinovirus.
19. Which statement was NOT correct about regulation of fructose 1,6-bisphosphatase 1 (FBPase-1) and phosphofructokinase-1 (PFK-1)?
- (a) AMP can induce PFK-1 activity.
  - (b) AMP can inhibit FBPase-1 activity.
  - (c) ADP can induce PFK-1 activity.
  - (d) ATP can induce PFK-1 activity.
  - (e) citrate can inhibit PFK-1 activity.
20. Which statement was NOT correct about reaction of the citric acid cycle?
- (a) acetyl-CoA to citrate required citrate synthase.
  - (b) citrate to isocitrate required aconitase.
  - (c) succinyl-CoA to succinate required succinate dehydrogenase.
  - (d) fumarate to malate required fumarase.
  - (e) malate to oxaloacetate required malate dehydrogenase.
21. When one mole palmitoyl-CoA through  $\beta$ -oxidation to form one mole myristoyl-CoA, which is correct?
- (a) required enol-CoA hydratase.
  - (b) generate 1 mole ATP.
  - (c) generate 2 mole  $\text{FADH}_2$
  - (d) formed 8 mole Acetyl-CoA.
  - (e) do not generate NADH.
22. Which reaction does **NOT** involved mitochondria?
- (a) Citric acid cycle.
  - (b) Free radicals generation.
  - (c) Electron transfer chain reaction.
  - (d) Pyruvate oxidation.
  - (e) Lipid synthesis.

23. Which was NOT correct about the protein components of the electron transfer chain?
- Complex I was called NADH dehydrogenase.
  - Complex II was called pyruvate dehydrogenase.
  - Complex III was called cytochrome  $bc_1$  complex.
  - Complex IV was called cytochrome oxidase.
  - ATP synthesis by ATP synthase.
24. Which of the following protein with half-lives less than 2 hours of degradation in protein turnover?
- Histones.
  - Pyruvate carboxylase.
  - Acetyl-CoA carboxylase.
  - Protein kinase C
  - Hemoglobin

**Section 2 : Short Answer**

1. The following question concerns enzyme kinetics.
- Draw a double reciprocal (Lineweaver-Burk) plot showing typical by performing assays on an enzyme over a range of substrate concentration. Don't forget to label the axes. (4 points)
  - Indicate with labeled arrows the points on the graph from which able to determine  $K_m$  and  $V_{max}$ . (2 points)
  - Use a dotted line to indicate the kind of line that you would get if enzyme assays in the presence of a competitive inhibitor. (4 points)



- Please describe the DNA Fingerprinting. (5 points)
- Please describe the Progenitors (pluripotent and multipotent cells). (5 points)
- What's happened about blood glucose when hepatocyte received the glucagon signal? Please describe the cascade mechanism in detail. (6 points)
- What is the "Ketone bodise" (2 points)? Which organ it was synthesis (2 points)? Described detail about the formation of ketone bodies from acetyl-CoA. (5 points)
- Please draw the detail about glucose-alanine cycle between muscle and liver. (5 points)