

- Ribosomes are made up of
  - RNA and proteins
  - DNA and proteins
  - RNA and DNA
  - proteins and carbohydrates
- The following cellular component is characteristic of bacteria:
  - Nucleus
  - Ribosomes
  - Chloroplasts
  - Mitochondria
  - More than one of these is characteristic of bacteria.
- Which organelle does not have a double membrane?
  - Nucleus
  - Lysosome
  - Rough Endoplasmic Reticulum
  - Chloroplast
  - Mitochondrion
- Which of the following compounds is most likely to form a micelle?
  - Acetic acid.
  - Glucose.
  - Glycerol.
  - Sodium palmitate.
  - Sodium phosphate.
- A buffer solution at pH 10 has a ratio of  $[HA]/[A^-]$  of 0.1. What is the pKa of the acid?
  - 1
  - 5
  - 8
  - 9
- The pOH a solution of 0.04 M HCl is:
  - 1.4
  - 10
  - 12.6
  - 13.6
  - The pOH cannot be determined

Exhibit 1A contains information on the pK's of some common buffers.

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Buffer	pK1	pK2	pK3
Acetate	4.75		
Ammonia	9.25		
Carbonic acid	6.37	10.20	
Citric acid	3.09	4.75	5.41
Formic Acid	3.75		
Phosphoric acid	2.14	7.20	12.4
Pyruvic acid	2.50		
Tris8.3			

7. Refer to the table in exhibit 1A. A carbonate buffer would work well at this pH:
- A) 4.0
  - B) 6.0
  - C) 8.0
  - D) 10.0
  - E) 6.0 and 10.0
8. In common unsaturated fatty acids, the first double bond in the chain is usually in this position:
- A) Between carbons #3 and #4.
  - B) Between carbons #7 and #8.
  - C) Between carbons #9 and #10.
  - D) Between carbons #12 and #13.
  - E) Between carbons #17 and #18.
9. A 20-carbon fatty acid is designated an “omega-three” ( $w_3$ ) fatty acid. What does  $w_3$  means?
- A) It has a double bond between carbons #3 and #4.
  - B) It has a double bond between carbons #17 and #18.
  - C) It has three double bonds.
  - D) It has three carboxyl groups.
10. Transport of a compound across a cell membrane (down a concentration gradient) was measured at several concentrations. The presence or absence of ATP had no effect on the transport of this compound. Which best describes the mechanism of transport?

concentration difference, $\mu\text{M}$	Transport Rate, $\mu\text{mol}/\text{min}$
2.5	30
5	60
10	100
25	175

50

200

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- A) facilitated diffusion
  - B) passive diffusion
  - C) primary active transport
  - D) secondary active transport
  - E) proton pumping
11. The direction of synthesis of DNA is
- A) from the 5' end to the 3' end on both strands
  - B) from the 3' end to the 5' end on both strands
  - C) from the 5' end to the 3' end on one strand and from the 3' end to the 5' end on the other strand
  - D) none of the above
12. The many subunits of DNA Polymerase III are needed to do all the following, except:
- A) Polymerization.
  - B) Ligating the final products.
  - C) Proofreading.
  - D) Clamping on to the template.
  - E) All of these.
13. The primer for in vivo DNA replication is:
- A) The 3' hydroxyl of the preceding Okazaki fragment.
  - B) A short piece of RNA.
  - C) A nick made in the DNA template.
  - D) A primer is not always required for DNA replication.
  - E) All of these are true.
14. 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.
15. Which of the following correctly describes a difference between RNA & DNA polymerases?
- A) RNA polymerases usually do not need a template, while DNA polymerases do.
  - B) DNA polymerases usually require a primer (i.e., they can only continue a strand, not start one), while most RNA polymerases do not.

- C) RNA polymerases usually synthesize introns, while DNA polymerases synthesize cistrons.
- D) RNA polymerases polymerize 5' → 3', while DNA polymerases polymerize 3' → 5'.
16. The promoter site is
- A) the start site for transcription in DNA
- B) the binding site for regulatory proteins that stimulate transcription
- C) the general region of DNA downstream from the start site
- D) the site on DNA at which RNA polymerase binds to initiate transcription
17. Cyclic AMP affects transcription by
- A) triggering the action of several protein factors
- B) phosphorylating a subunit of RNA polymerase
- C) phosphorylating a transcription factor
- D) inhibiting DNA looping
18. Which of the conditions would result in the greatest amount of transcription of the lac operon?
- |    | [glucose] | [lactose] |
|----|-----------|-----------|
| A) | high      | high      |
| B) | low       | low       |
| C) | high      | low       |
| D) | low       | high      |
19. Transcription in eukaryotes differs from RNA synthesis in prokaryotes
- A) by requiring a primer
- B) by simplifying the process with multifunctional enzymes
- C) in using more complex  $\sigma$  factors
- D) by having three RNA polymerases rather than one
20. The following are all structural motifs for proteins that bind to DNA
- A) Helix-turn-helix
- B)  $\beta$ -barrel
- C) Zinc finger
- D) Leucine zipper
- E) All of these.
21. Which of the following modifications is likely to happen to the mRNA in a eukaryotic cell?
- A) capping of the 5' end
- B) addition of a poly-A tail to the 3' end
- C) removal of intervening sequences (introns)
- D) All of the above occur in eukaryotic cells.

22. Which ends of eukaryotic mRNA are protected from degradation?
- A) 5' end only
  - B) 3' end only
  - C) Both ends
  - D) Neither end
  - E) The RNA is circular and has no ends.
23. Which ends of prokaryotic mRNA are protected from degradation?
- A) 5' end only
  - B) 3' end only
  - C) Both ends
  - D) Neither end
  - E) The RNA is circular and has no ends.
24. In humans, pyruvate can be converted to
- A) acetyl-CoA only
  - B) lactate only
  - C) ethanol only
  - D) acetyl-CoA and lactate
25. The step that commits the cell to metabolize glucose is catalyzed by
- A) hexokinase
  - B) phosphoglucomutase
  - C) aldolase
  - D) phosphofructokinase
26. How many different reactions involve substrate phosphorylation during glycolysis?
- A) 1
  - B) 2
  - C) 3
  - D) 4
  - E) 6
27. A unique feature of the glyoxylate cycle is that it allows the organisms that possess this pathway to
- A) produce fats from carbohydrates
  - B) produce carbohydrates from fats
  - C) convert acetyl-CoA to pyruvate
  - D) do all of the above
28. There is a cyclic reaction in which pyruvate becomes oxaloacetate. The oxaloacetate is converted to malate and then back to pyruvate. This cycle is important because:

- A) There is no net use or fixation of  $\text{CO}_2$  in this cycle.  
B) NADH is converted to NADPH in this cycle.  
C) There is no net oxidation or reduction in this cycle.  
D) NADPH is converted to NADH in this cycle.  
E) This is actually a wasteful pathway with no practical use.
29. Which of the following cannot cross the inner mitochondrial membrane?  
A) malate  
B) phosphoenolpyruvate  
C) succinyl-CoA  
D) oxaloacetate
30. The citric acid cycle is considered part of aerobic metabolism even though oxygen does not appear explicitly in any reaction because  
A) the NADH and  $\text{FADH}_2$  produced are reoxidized in the electron transport chain linked to oxygen  
B) the reoxidation of NADH and  $\text{FADH}_2$  leads to the production of considerable quantities of ATP  
C) it takes place in the mitochondrion  
D) it contains oxidation reactions
31. When mitochondria are actively carrying out aerobic respiration  
A) the pH of the matrix is greater than the pH of the intermembrane space.  
B) the pH of the matrix is less than the pH of the intermembrane space.  
C) the pH of the matrix is about the same as the pH of the intermembrane space.  
D) the pH of the matrix versus the intermembrane space has nothing to do with whether not aerobic respiration is occurring.
32. The final reduced species in the electron transport chain is  
A)  $\text{O}_2$   
B)  $\text{H}_2\text{O}$   
C) cytochrome c  
D) coenzyme Q
33. Which complex of the electron transport chain does NOT contain an iron-sulfur cluster?  
A) Complex I  
B) Complex II  
C) Complex III  
D) Complex IV
34. Oxidative phosphorylation is coupled to electron transport in  
A) Complexes I, II, and III

- B) Complexes I, II, and IV  
C) Complexes I, III, and IV  
D) all four respiratory complexes
35. Which of the following amino acids contributes most to the absorption of UV by proteins at the wavelength of 280 nm?
- A) Threonine  
B) Phenylalanine  
C) Tryptophan  
D) Tyrosine
36. Which of the following amino acids would not be destroyed during 6N HCl hydrolysis?
- A) Serine  
B) Leucine  
C) Tryptophan  
D) Cysteine
37. Which of the following can not be used for molecular weight determination for proteins?
- A) SDS-PAGE  
B) Gel filtration  
C) Northern blotting  
D) Mass spectrometry
38. Which of the following reagents cleaves at the C-terminus of a methionine residue in a protein?
- A) Trypsin  
B) Chymotrypsin  
C) Cyanogen bromide  
D) Pepsin
39. Which of the following reagents is most commonly used for salting-out?
- A) NaCl  
B)  $(\text{NH}_4)_2\text{SO}_4$   
C) KCl  
D)  $\text{Na}_2\text{CO}_3$
40. Ni-NTA is a metal chelate affinity chromatography for purification of proteins with
- A) HA-tags  
B) Flag-tags  
C) His<sub>6</sub>-tags  
D) GST-tags

41. Which of the following protein quantification methods has the highest sensitivity?
- A) Biuret
  - B) Lowry
  - C) Bradford dye-binding
  - D) Absorbance at 280 nm
42. Which of the following is the most important improvement for isoelectric focusing (IEF) ?
- A) Carrier ampholytes
  - B) Immobilized pH gradients (IPG)
  - C) Novel chaotropes
  - D) Zwitterionic detergents
43. What is the electrophoretic method used as the second dimension in 2-DE, and what is the principle used for protein separation?
- A) IEF ; pI
  - B) IEF ; MW
  - C) SDS-PAGE ; pI
  - D) SDS-PAGE ; MW
44. A specific molecular structure within an antigen to which a specific antibody binds is as a(n):
- A) epitope
  - B) Fab region
  - C) Fc region
  - D) MHC site
45. Amino acid residues commonly found in the middle of  $\beta$ -turn are:
- A) Cys and Ser
  - B) Asp and Glu
  - C) Ala and Gly
  - D) Pro and Gly
46. Regions in proteins that show specific patterns of folding or function are called:
- A) peptides
  - B) sites
  - C) domains
  - D) subunits
47. Normally protein will not be denatured by:
- A) heating to 100°C

- B) urea
  - C) pH 10
  - D) Tris-HCl buffer
48. Which of the following can be used as powerful inhibitors for an enzyme-catalyzed reaction, thus being promising candidates for novel drug design?
- A) substrates
  - B) transition-state analogs
  - C) products
  - D) reaction intermediates
49. In the Lineweaver-Burk plot for an enzyme-catalyzed reaction, the presence of a competitive inhibitor will alter the
- A)  $V_{\max}$
  - B) intercept on the  $1/V$  axis
  - C) intercept on the  $1/[S]$  axis
  - D) curvature of the plot
50. A small molecule that decreases enzyme activity by binding to a site other than the active site is called a(n):
- A) competitive inhibitor
  - B) specific ligand
  - C) alternative inhibitor
  - D) allosteric inhibitor