

True / False (1/2 point each; 10 points total)

1. With respect to a pure lipid membrane,
___ water crosses more efficiently than glucose.
___ ions cross more efficiently than glucose.
2. The flow of water across a biological membrane is:
___ regulated by the opening and closing of water channels.
___ correlates with ion flow.
3. Phosphorylation enhances:
___ the polarity of the modified side chain.
___ ionic interactions with glutamate and aspartate side chains.
4. SCF-type E3 ligases:
___ bind phosphorylated substrates.
___ are covalently modified with ubiquitin.
5. Facilitated transport:
___ is typically highly specific with respect to cargo.
___ can involve the transport of molecules up their concentration gradients.
6. Porins:
___ have a larger pore size than water channels.
___ are found on the inner membrane of Gram-negative bacteria.
7. Type I bacterial secretion:
___ is mechanistically similar to ER translocation.
___ involves the action of an ABC transporter.
8. Regarding protein-protein interaction domains:
___ PH domains bind phosphoserine residues.
___ SH2 domains bind phosphotyrosine residues.
9. Regarding the use of radiolabeled azido-ATP to probe enzyme function:
___ kinase substrates can be labeled using $^{32}\text{P}(\gamma)\text{-ATP}$.
___ ATPases can be labeled using $^{32}\text{P}(\gamma)\text{-ATP}$.
10. Requirements for the application of FRET include:
___ fluorophores that emit at different wavelengths.
___ physical interaction between the fluorophores.

Multiple Choice (2 points each; 20 points total)

11. Based on the analogies presented in class, where proteins are represented by plants and lipids by water, a biological membrane is most like a:
- A) a dense forest with a few pools of water
 - B) a grassland with the occasional lake and river
 - C) a swamp with waterways, bogs and small forested islands
 - D) a sea dotted with the occasional forested island
12. All of the following are key characteristics of plasma membranes, except for:
- A) they are composed of lipids, proteins and carbohydrates
 - B) they have similar ratios of lipids, proteins and carbohydrates from organism to organism
 - C) the leaflets of the bilayer are asymmetric in composition
 - D) they are generally permeable to ions
13. Which of the following amino acids would you expect to find, more likely than the others, in a transmembrane segment?
- A) glutamate
 - B) leucine
 - C) lysine
 - D) serine
14. All of the following are hallmarks of eukaryotic secretory signal sequences, except for:
- A) they have a tripartite composition
 - B) they interact with RNA
 - C) they are proteolytically cleaved at two or more sites
 - D) they target proteins to an ABC-type transporter on the ER
15. P-type transporters are phosphorylated on which of the following residues during their catalytic cycle?
- A) aspartate
 - B) cysteine
 - C) serine
 - D) tyrosine
16. Which of the following proteolytic mechanisms does not require a water nucleophile during the hydrolytic cycle?
- A) aspartate
 - B) cysteine
 - C) metallo
 - D) serine

17. As a group, ABC transporters exhibit which one of the following characteristics:

- A) they can transport a variety of substrates
- B) they function only in the import of molecules
- C) they are smaller than the average 30 kDa protein
- D) they can be composed of four identical subunits

18. All of the following can occur during the transport of ions via channels, except for:

- A) desolvation
- B) transport of cargo down a concentration gradient
- C) weak interactions with carbonyl atoms of helices that line the channel
- D) generation of electrochemical gradients

19. The following are features of GPCR systems, except for:

- A) they are used for transducing extracellular signals to the inside of the cell
- B) they require a peptide ligand
- C) they require a receptor that has multiple membrane spans
- D) they are coupled to trimeric G-proteins

20. All of the following contain a fatty acid component, except for:

- A) sphingolipids
- B) prostoglandins
- C) GPI proteins
- D) isoprenylated proteins

Short Answer - These can be answered using one or two keywords, diagrams, and/or a short sentence (2-5 points each; 36 points total)

21. Draw the stick figure chemical structure of a 16:1(Δ^5) fatty acid. (4 points)