

Scoring rationale: If you pick A, B, C, or D and you are correct, you get +4 points. If you provide a rationale that demonstrates you do not know why that answer is correct, I reserve the right to remove up to 2 points. If your pick is incorrect, and not explained, you get -2 points. If you realize that you do not know the answer ("no idea"), you get +1 point. If you pick "wrong" but make a reasonable case for your choice, you can receive up to +4 points.



1. What common feature of atoms and molecules leads to London Dispersion Forces (which give rise to van der Waals interactions)?

- ☒ A. moving electrons
- ☐ B. differences in electronegativity
- ☐ C. ability to make H-bonds
- ☐ D. molecular shapes
- ☐ no idea

2. If the electronegativities of H and O were equal (rather than quite different, as they are in the real world), what would happen to the boiling point of water?

- ☐ A. impossible to predict
- ☐ B. it would not change
- ☐ C. it would increase
- ☒ D. it would decrease
- ☐ no idea

3. The unique properties of water are largely determined by

- ☐ A. its ability to interact with other molecules through van der Waals interactions
- ☐ B. the random orientations of the H-bonds it makes
- ☒ C. its ability to take part in multiple H-bonds
- ☐ D. its small size
- ☐ no idea

4. This insect can walk on water, which is the most likely conclusion?

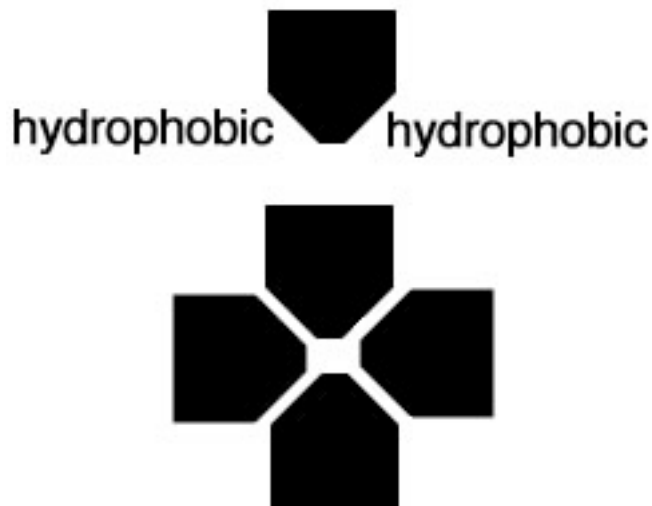
- ☐ A. each foot has water pumps associated with it
- ☐ B. the surface on the "soles" of its feet **can** form H-bonds with water
- ☒ C. the surface on the "soles" of its feet **cannot** form H-bonds with water
- ☐ D. the water under the soles of its feet is different from bulk water
- ☐ no idea



5. A water soluble molecule is formed by four identical subunits. You might well conclude that

- ☐ A. each subunit is uniformly hydrophilic
- ☐ B. each subunit is uniformly hydrophobic
- ☐ C. each subunit has one hydrophilic and one hydrophobic region
- ☒ D. each subunit has one hydrophilic and two hydrophobic regions ☐ no idea

You may want to draw a sketch to support your suggested answer



6. If we accept that all cells are homologous, then we would accept that their plasma membranes are

- ☐ A. depends upon the organism
- ☐ B. analogous
- ☒ C. homologous
- ☐ D. functionally unrelated ☐ no idea

7. You might well classify a molecule as a lipid if....

- ☐ A. it could aggregate
- ☒ B. it had distinct H-bonding and non-H-bonding regions
- ☐ C. It could make any H-bonds at all
- ☐ D. It could not make any H-bonds at all ☐ no idea

8. In a solution of water and sugar, which is true...

- ☐ A. only the water molecules are moving
- ☐ B. only the sugar molecules are moving
- ☐ C. only the diffusing molecules are moving, most molecules are not moving
- ☒ D. all molecules are moving ☐ no idea

9. Imagine you are looking at a cellular membrane; [O₂] is high outside of the cell, while [O₂] is low inside of the cell. We might conclude that the molecules of O₂ are

- ☒ A. moving into the cell (on average)
- ☐ B. only moving into the cell
- ☐ C. are moving faster outside of the cell
- ☐ D. have a lower energy when inside the cell ☐ no idea

10. Imagine a cell has a contractile vacuole. You place the cell in a osmotically neutral solution and poison its ATP synthesis system, what happens.

- ☒ A. nothing
- ☐ B. the cell shrinks (water moves out)
- ☐ C. the cell bursts (water moves in)
- ☐ D. the vacuole continues to pump. ☐ no idea

11. You are studying a cell; the concentration of Na⁺ is high on the outside and low on the inside. Glucose flows into the cell and its concentration is higher inside than outside. What type of membrane molecule could be responsible for this behavior.

- ☒ A. a symporter
- ☐ B. an antiporter
- ☐ C a glucose channel
- ☐ D. a glucose pump ☐ no idea

12. A membrane channel acts as a catalyst because a ...

- ☒ A. speeds a rate of a reaction but does not alter the equilibrium state.
- ☐ B. changes the force driving the reaction to completion
- ☐ C. uses energy from the environment to make unfavorable reactions occur
- ☐ D. uses membrane gradients to make reactions spontaneous ☐ no idea

13. Think about the steps in the origin of mitochondria and chloroplasts; what is the source of the outer membrane of both organelles?

- ☐ A. the original bacterial membrane
- ☐ B. it was generated de novo
- ☐ C. derived from the fusion of bacterial and eukaryotic cell membranes
- ☒ D. the original eukaryotic cell's plasma membrane ☐ no idea

14. You place a bacterium that normally lives in fresh water into a solution of high salt; what happens?

- ☒ A. Its membrane shrinks away from the cell wall
- ☐ B. Its membrane expands until it presses against its cell wall
- ☐ C. It will use the salt gradient to make ATP
- ☐ D. its membrane swells and the cell explodes ☐ no idea

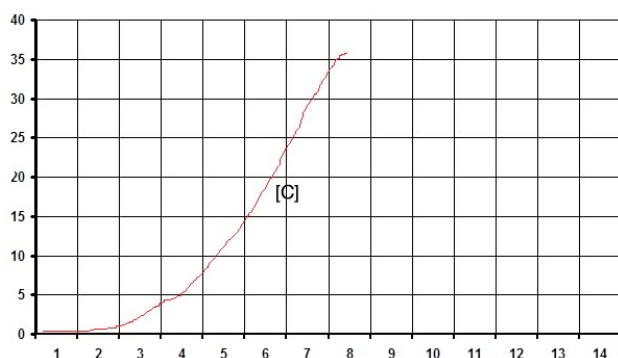
15. Consider the reactions: $A + B + C \rightleftharpoons E$ (reaction 1, unfavorable)
 (relax, read slowly, and take your time) $E + F \rightleftharpoons G$ (reaction 2, highly favorable)

If a large amount of G is added to the system, what happens to the level of C over time?

- ☐ A. decreases as long as more A and B are present
☒ B. increases as for as long as F is present
☐ C. is unchanged
☐ D. decreases ☐ no idea

in fact whether F is present or not is irrelevant)

Make a graph (please).



16. What must be true of a system of coupled reactions (more than one choice may be needed)?
- ☐ A. all forward reactions must be thermodynamically favorable
☒ B. there must be a way (paths) to go from reactants to products
☒ C. the reactions must share components
☐ D. there must be sufficient energy in the environment to break the bonds involved in the forward reactions
☐ E. catalysts must be present ☐ no idea

Score _____ adjusted percentage _____