Critical Thinking Items

18.1 Electrical Charges, Conservation of Charge, and Transfer of Charge 15.

If you dive into a pool of seawater through which an equal amount of positively and negatively charged particles is moving, will you receive an electric shock?

a. Yes, because negatively charged particles are moving.
b. No, because positively charged particles are moving.
c. Yes, because positively and negatively charged particles are moving.
d. No, because equal amounts of positively and negatively charged particles are moving.

16.

True or false—The high-voltage wires that you see connected to tall metal-frame towers are held aloft by insulating connectors, and these wires are wrapped in an insulating material.

a. true
b. false

17.

By considering the molecules of an insulator, explain how an insulator can be overall neutral but carry a surface charge when polarized.

a. Inside the insulator, the oppositely charged ends of the molecules cancel each other.
b. Inside the insulator, the oppositely charged ends of the molecules do not cancel each other.
c. The electron distribution in all the molecules shifts in every possible direction, leaving an excess of positive charge on the opposite end of each molecule.
d. The electron distribution in all the molecules shifts in a given direction, leaving an excess of negative charge on the opposite end of each molecule.

18.2 Coulomb's law 18.

In terms of Coulomb's law, why are water molecules attracted by positive and negative charges?

a. Water molecules are neutral.
b. Water molecules have a third type of charge that is attracted by positive as well as negative charges.
c. Water molecules are polar.
d. Water molecule have either an excess of electrons or an excess of protons.

19.

A negative lightning strike occurs when a negatively charged cloud discharges its excess electrons to the positively charged ground. If you observe a cloud-to-cloud lightning strike, what can you say about the charge on the area of the cloud struck by lightning?

a. The area of the cloud that was struck by lightning had a positive charge.
b. The area of the cloud that was struck by lightning had a negative charge.
c. The area of the cloud that was struck by lightning is neutral.
d. The area of the cloud that was struck by lightning had a third type of charge.

18.3 Electric Field 20.

An arbitrary electric field passes through a box-shaped volume. There are no charges in the box. If 11 electric-field lines enter the box, how many electric-field lines must exit the box?

a. nine electric field lines
b. 10 electric field lines
c. 11 electric field lines
d. 12 electric field lines

21.

In a science-fiction movie, a villain emits a radial electric field to repulse the hero. Knowing that the hero is electrically neutral, is this possible? Explain your reasoning.

a. No, because an electrically neutral body cannot be repelled or attracted.
b. No, because an electrically neutral body can be attracted but not repelled.
c. Yes, because an electrically neutral body can be repelled or attracted.
d. Yes, because an electrically neutral body can be repelled.

18.4 Electric Potential 22.

What is the relationship between voltage and energy? More precisely, what is the relationship between potential difference and electric potential?

a. Voltage is the energy per unit mass at some point in space.
b. Voltage is the energy per unit length in space.
c. Voltage is the energy per unit charge at some point in space.
d. Voltage is the energy per unit area in space.

23.

Three parallel plates are stacked above each other, with a separation between each plate. If the potential difference between the first two plates is $\Delta \mathrm{V}_1$ and the potential between the second two plates is ΔV_2, what is the potential difference between the first and the third plates?

a. $\Delta V_3 = \Delta V_2 + \Delta V_1$

b. $\Delta V_3 = \Delta V_2 - \Delta V_1$
c. $\Delta V_3 = \Delta V_2 \ / \ \Delta V_1$
d. $\Delta V_3 = \Delta V_2 \times \Delta V_1$

18.5 Capacitors and Dielectrics 24.

When you insert a dielectric into a capacitor, the energy stored in the capacitor decreases. If you take the dielectric out, the energy increases again. Where does this energy go in the former case, and where does the energy come from in the latter case?

a. Energy is utilized to remove the dielectric and is released when the dielectric is introduced between the plates.
b. Energy is released when the dielectric is added and is utilized when the dielectric is introduced between the plates.
c. Energy is utilized to polarize the dielectric and is released when the dielectric is introduced between the plates.
d. Energy is released to polarize the dielectric and is utilized when dielectric is introduced between the plates.