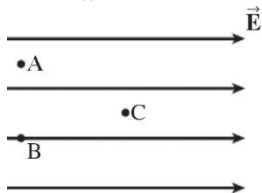Name _____ Date _____ Period _____

1) A region of space contains a uniform electric field, directed toward the right, as shown in the figure. Which statement about this situation is correct?

A) The potential at all three locations is the same.
B) The potentials at points A and B are equal, and the potential at point C is higher than the potential at point A.
C) The potential at points A and B are equal, and the potential at point C is lower than the potential at point A.
D) The potential at point A is the highest, the potential at point B is the second highest, and the potential at point C is the lowest.

2) Which statements must be true about the surface of a charged conductor in which no charge is moving? (There could be more than one correct choice.)
A) The electric field is zero at the surface.
B) The electric potential of the surface is zero.
C) The electric field is constant at the surface.
D) The electric potential is constant over the surface.
E) The electric field is perpendicular to the surface.

3) If the result of your calculations for a quantity has SI units of $C^2 \cdot s^2/(kg \cdot m^2)$, that quantity could be
A) an electric potential difference.
B) a dielectric constant.
C) an electric field strength.
D) a capacitance.
E) an electric potential energy.

4) If the electric field between the plates of a given air-filled capacitor is weakened by removing charge from the plates, the capacitance of that capacitor
A) increases.
B) decreases.
C) does not change.
D) It cannot be determined from the information given.

5) Two ideal parallel-plate capacitors are identical in every respect except that one has twice the plate area of the other. If the smaller capacitor has capacitance C, the larger one has capacitance
A) $C/2$.   B) C.   C) $2C$.   D) $4C$.

6) An ideal parallel-plate capacitor has a capacitance of C. If the area of the plates is doubled and the distance between the plates is halved, what is the new capacitance?
A) $C/4$ B) $C/2$ C) $2C$ D) $4C$

7) A battery charges a parallel-plate capacitor fully and then is removed. The plates are then slowly pulled apart. What happens to the potential difference between the plates as they are being separated?
A) It increases.
B) It decreases.
C) It remains constant.
D) It cannot be determined from the information given.

8) The plates of a parallel-plate capacitor are maintained with constant potential by a battery as they are pulled apart. During this process, the amount of charge on the plates
A) must increase.
B) must decrease.
C) must remain constant.
D) could either increase or decrease. There is no way to tell from the information given.

9) When a certain capacitor carries charges of ±10 μC on its plates, the potential difference cross the plates is 25 V. Which of the following statements about this capacitor are true? (There could be more than one correct choice.)
A) If we double the charges on the plates to ±20 μC, the capacitance of the capacitor will also double.
B) If we double the charges on the plates to ±20 μC, the potential difference across the plates will also double.
C) If we double the charges on the plates to ±20 μC, the capacitance of the capacitor will not change.
D) If we double the charges on the plates to ±20 μC, the potential difference across the plates will decrease by a factor of two.

10) An ideal parallel-plate capacitor having circular plates of diameter D that are a distance d apart stores energy U when it is connected across a fixed potential difference. If you want to triple the amount of energy stored in this capacitor by changing only the size of its plates, the diameter should be changed to

A) 9D.   B) 3D.   C) $D\sqrt{3}$ D) $\dfrac{D}{\sqrt{3}}$ E) $\dfrac{D}{3}$

11) Which of the following will increase the capacitance of a parallel-plate capacitor? (There could be more than one correct choice.)
A) a decrease in the plate area and an increase in the plate separation
B) a decrease in the potential difference between the plates
C) an increase in the potential difference between the plates
D) an increase in the plate area and a decrease in the plate separation
E) an increase in the charge on the plates

12) An ideal parallel-plate capacitor consists of two parallel plates of area A separated by a distance d. This capacitor is connected across a battery that maintains a constant potential difference between the plates. If the separation between the plates is now doubled, the magnitude of the charge on the plates will
A) double.   D) be cut in fourth.
B) quadruple.   E) not change.
C) be cut in half.

13) An capacitor consists of two large parallel plates of area A separated by a very small distance d. This capacitor is connected to a battery and charged until its plates carry charges +Q and -Q, and then disconnected from the battery. If the separation between the plates is now doubled, the potential difference between the plates will
A) double.
B) quadruple.
C) be cut in half.
D) be cut in fourth.
E) not change.

14) The plates of a parallel-plate capacitor are maintained with constant voltage by a battery as they are pulled apart. What happens to the strength of the electric field between the plates during this process?
A) It increases.   C) It remains constant.
B) It decreases.   D) It cannot be determined from the information given.

15) A parallel-plate capacitor is connected to a battery and becomes fully charged. The capacitor is then disconnected, and the separation between the plates is increased in such a way that no charge leaks off. As the plates are being separated, the energy stored in this capacitor
A) increases.   B) decreases.   C) does not change.   D) become zero.

16) Doubling the capacitance of a capacitor that is holding a constant charge causes the energy stored in that capacitor to
A) quadruple.   B) double.   C) decrease to one-half.   D) decrease to one-fourth.

17) Doubling the potential across a given capacitor causes the energy stored in that capacitor to
A) quadruple.   B) double.   C) reduce to one-half.   D) reduce to one-fourth.

18) An ideal parallel-plate capacitor consists of two parallel plates of area A separated by a distance d. This capacitor is connected to a battery that maintains a constant potential difference across the plates. If the separation between the plates is now doubled, the amount of electrical energy stored on the capacitor will
A) double.   B) quadruple.   C) be cut in half.   D) be cut in fourth.   E) not change.

19) An ideal parallel-plate capacitor consists of two parallel plates of area A separated by a distance d. This capacitor is connected to a battery and charged until its plates carry charges $+Q$ and $-Q$, and the battery is then disconnected. If the separation between the plates is now doubled, the electrical energy stored in the capacitor will
A) double.
B) quadruple.
C) be cut in half.
D) be cut in fourth.
E) not change.

20) When a dielectric material is introduced between the plates of a parallel-plate capacitor and completely fills the space, the capacitance increases by a factor of 4. What is the dielectric constant of the material that was introduced?
A) 0.4
B) 1/4
C) 2
D) 4
E) None of the other choices is correct.

21) A parallel-plate capacitor consists of a set of two parallel plates of area A separated by a distance d. This capacitor is connected to a battery that maintains a constant potential difference across the plates. A slab of a dielectric material is inserted in the region between the plates and completely fills it. What changes would you observe as the dielectric is inserted? (There could be more than one correct choice.)
A) Only the charge on the plates of the capacitor would change.
B) Only the capacitance would change.
C) Both the charge on the plates of the capacitor and its capacitance would change.
D) The potential difference across the plates would increase.
E) Nothing would change.

22) Which of the following changes will *increase* the capacitance of a parallel-plate capacitor? (There could be more than one correct choice.)
A) increase the charge on the plates
B) decrease the potential between the plates
C) increase the potential between the plates
D) introduce a dielectric material between the plates
E) decrease the separation between the plates

23) A dielectric material such as paper is inserted between the plates of a capacitor as the capacitor holds a fixed charge on its plates. What happens to the electric field between the plates as the dielectric is inserted?
A) There is no change in the field.
B) The field becomes stronger.
C) The field becomes weaker.
D) The field reduces to zero.

24) At a distance d from a point charge Q, the energy density in its electric field is u. If we double the charge, what is the energy density at the same point?
A) $16u$ B) $8u$ C) $4u$ D) $2u$ E) $u\sqrt{2}$

25) At a distance d from a point charge Q, the energy density in its electric field is u. If we now go to a distance $d/2$ from the charge, what is the energy density at the new location?
A) $16u$ B) $8u$ C) $4u$ D) $2u$ E) $u\sqrt{2}$