1. First, charge $+q$ is brought to point $A$ at a distance $r$ from $+Q$. Next, $+q$ is removed and $+2q$ is brought to $B$ at a distance $2r$ from $+Q$. Which is bigger: the potential due to $+Q$ at $A$ or the potential due to $+Q$ at $B$?

* A. $A$
* B. $B$
* C. both the same

2. First, charge $+q$ is brought to point $A$ at a distance $r$ from $+Q$. Next, $+q$ is removed and $-q$ is brought to the same point. For which charge is the potential energy larger?

* A. $+q$
* B. $-q$
C. both the same

3. An electron is located in an electric field where the potential is 1 V. If instead two electrons are located at this spot, the potential they experience is:

A. 0.25 V

B. 0.5 V

* C. 1 V

D. 2 V

E. 4 V

4. A solid spherical conductor is charged. The potential of the conductor is:

A. largest at its center

B. largest on the surface

C. largest somewhere between the center and the surface

* D. constant throughout the sphere

5. Two isolated spherical conductors each carry net charge +Q. If radius b>a, which sphere has the higher potential?
6. Can two equipotential surfaces intersect?
   A. Yes
   * B. No

7. The electric field at some point in space is zero. The potential at that point:
   A. must be zero
   B. must be nonzero
   * C. could have any value

8. If the potential is constant throughout a region of space, the electric field in that region:
A. must be zero
B. must be nonzero
C. could have any value

9.
What must be the value of $Q_1$ to make the potential at $P$ zero?

A. $+Q_0$
B. $-2Q_0$
C. $+2Q_0$
D. $+Q_0 \sin(p/3)$

10.
If a metal slab is inserted between the plates of an isolated, charged parallel-plate capacitor (without touching either plate), the potential difference across the capacitor
A. increases
B. decreases
C. remains the same
11. Two identical parallel-plate capacitors have a metal slab inserted. In case A, the slab is not connected to either plate. In case B, it is connected to the upper plate. Which has higher capacitance?

A. A

* B. B

C. both the same

12. The plates of an isolated, charged parallel-plate capacitor are pulled apart, so as to increase the plate separation.

What happens to the electrostatic energy stored in the capacitor?

* A. It increases.

B. It decreases.

C. It remains unchanged.

13. An isolated, charged parallel-plate capacitor contains a dielectric. This dielectric is carefully removed without disturbing the plates.

What happens to the electrostatic energy stored in the capacitor?
14.
An empty parallel-plate capacitor is connected to a battery. A dielectric is carefully inserted between the plates without disturbing them.

What happens to the electrostatic energy stored in the capacitor?

* A. It increases.
B. It decreases.
C. It remains unchanged.

15.
The electric field between the plates of the indicated capacitor is:

\( s = \frac{Q}{A} \) where \( A \) is the area of one side of either plate

\[ +Q \quad -Q \]

A. \( s/2e0 \) to the right
B. \( s/2e0 \) to the left
C. s/e0 to the right

D. s/e0 to the left

16.
If the distance between the two plates is halved, the potential difference across this isolated capacitor:

A. doubles

B. remains the same

C. halves

D. is quartered

17.
Each of the capacitors is 30 mF and initially uncharged. After closing the switch, how much charge flows through the ammeter?
A. 30 mC
* B. 90 mC
C. 10 mC
D. 15 mC

18.
What is the ratio of the energy stored in the 2 mF capacitor to that stored in the 4 mF capacitor?

A. 4
B. 2
C. 1
* D. 0.5
19. What is the ratio of the energy stored in the 2 mF capacitor to that stored in the 4 mF capacitor?

A. 4

* B. 2

C. 1

D. 0.5

20. A nonzero value for $Q_1$ can be chosen such that at point P:

A. $E = 0$ and $V = 0$

B. $E = 0$ but $V$ must be nonzero

* C. $V = 0$ but $E$ must be nonzero
21. The work you must do to slowly move a -3 mC charge from 0.5 to 3 m is:

A. +45 mJ

* B. +30 mJ

C. -45 mJ

D. -30 mJ

22. Capacitance depends upon:

A. the charge on and voltage between the plates

* B. the geometry of and dielectric between the plates

C. both A and B