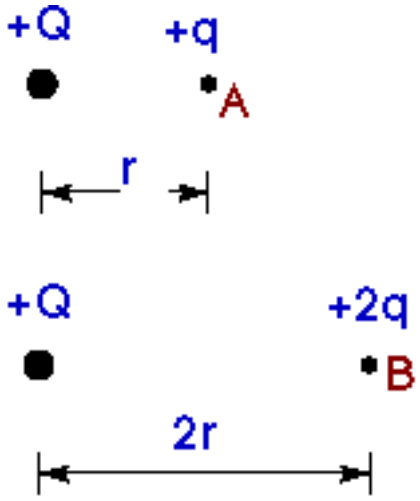
CPS lesson
Potential and Capacitance
ANSWER KEY

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?

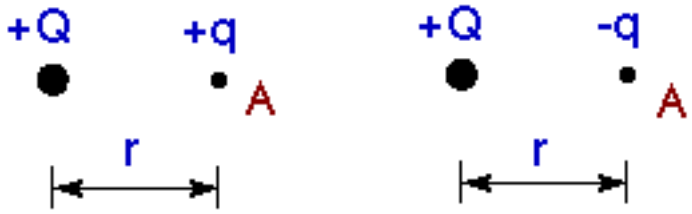


* A. A

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:

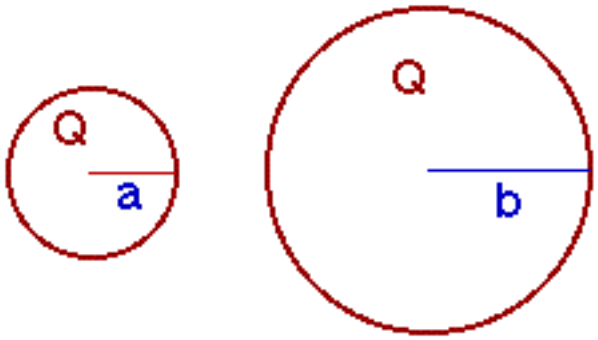
A. largest at its center

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?



* A. The smaller sphere.

B. The larger sphere.

C. Both the same.

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:

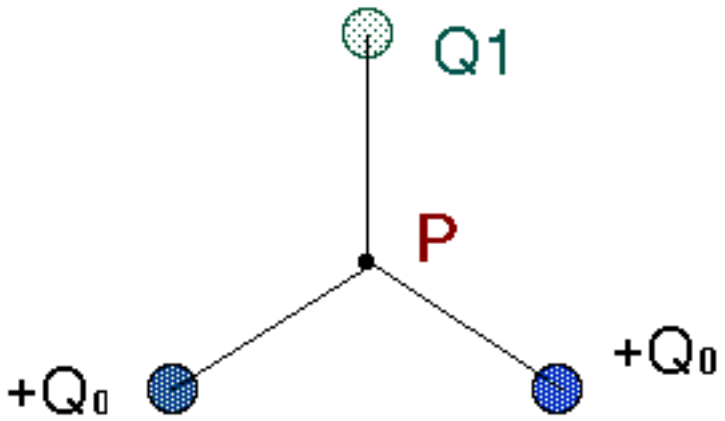
* A. must be zero

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. +Q0

* B. -2Q0

C. +2Q0

D. +Q0 sin(p/3)

10.

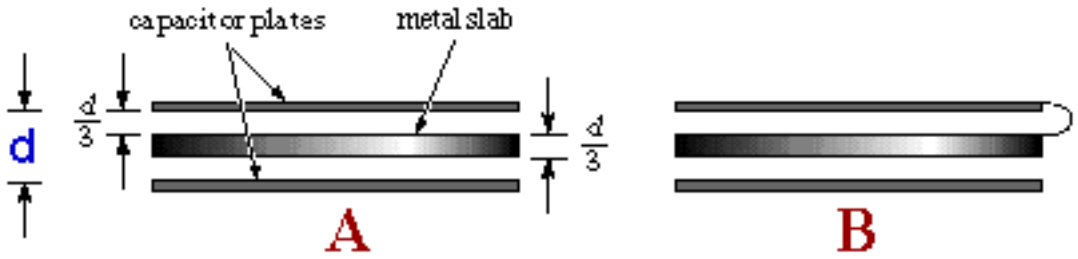
If a metal slab is inserted between the plates of an isolated, charged parallel-plate capacitor (without touching either plate), the potential difference across the capacitor

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?

* A. It increases.

B. It decreases.

C. It remains unchanged.

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.

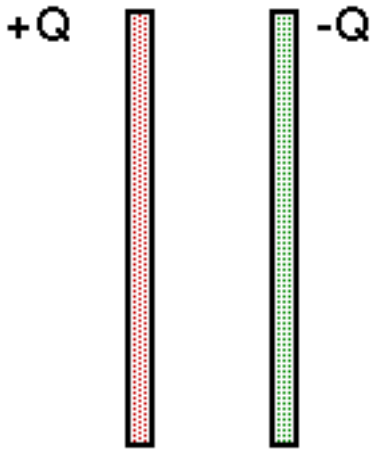
B. It decreases.

C. It remains unchanged.

15.

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

(s = Q/A where A is the area of one side of either plate)



A. s/2e0 to the right

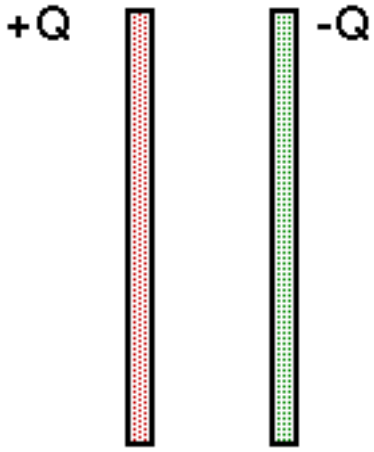
B. s/2e0 to the left

* 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

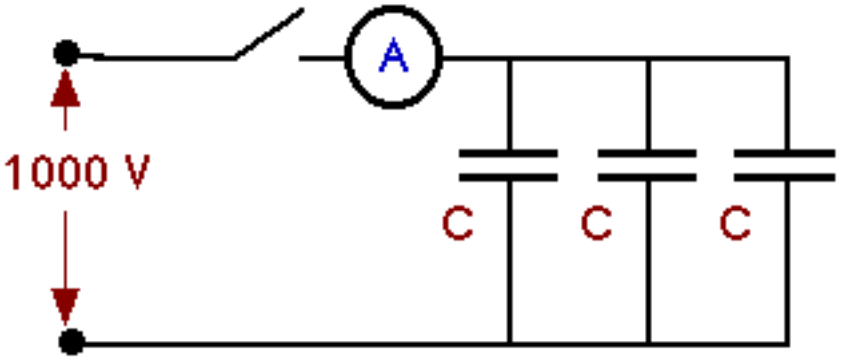
B. remains the same

* 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

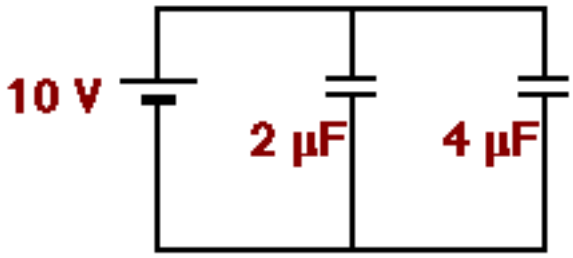
* B. 90 mC

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

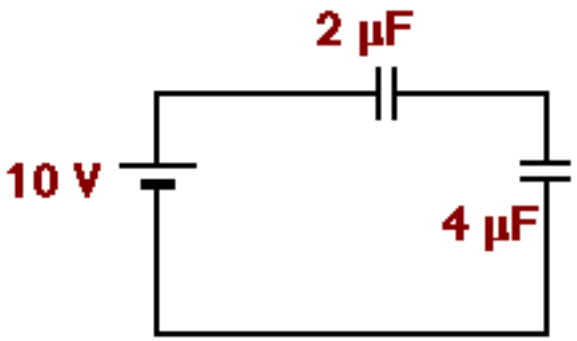
B. 2

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

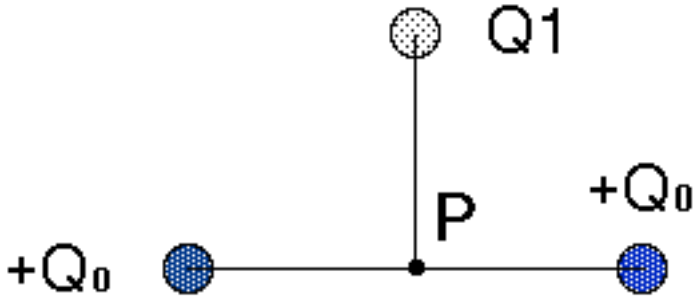
* B. 2

C. 1

D. 0.5

20.

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



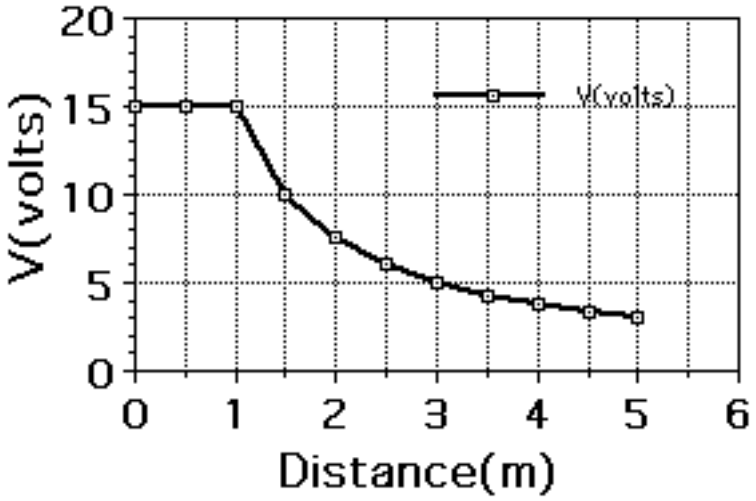
A. E = 0 and V = 0

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