Conceptual Questions

16-1. Two charged objects are separated by a distance $d$. The first charge is larger in magnitude than the second charge.

A) The first charge exerts a larger force on the second charge.
B) The second charge exerts a larger force on the first charge.
C) The charges exert forces on each other that are equal in magnitude and opposite in direction.
D) The charges exert forces on each other equal in magnitude and pointing in the same direction.
More Conceptual Questions

16-2. Two charges separated by a distance $d$ exert mutual attractive forces of $F$ on each other. If these charges are separated by a distance of $d/2$, what are the new mutual forces?

A) $F/4$  B) $F/2$  C) $2F$  D) $4F$

16-3. Two charged objects attract each other with a certain force. If the charges on both objects are doubled with no change in separation, the force between them

A) quadruples.  B) doubles.  C) halves.
   D) increases, but we can't say by how much without knowing the distance between them.
Conceptual Question

16-4. At three times the distance from a point charge, the strength of the electric field is

A) nine times its original value.
B) three times its original value.
C) one-third its original value.
D) one-ninth its original value.
When two point charges each $-Q$ are separated by a given distance, the magnitude of the force acting on each charge is $F_0$. Now replace one charge by $-2Q$ without changing the separation distance.

Possible Answers for the following questions:

- F_0
- B) 2 F_0
- C) 4 F_0
- D) $\frac{1}{2} F_0$

16-5: Now, what is the magnitude of the force on the unchanged charge $-Q$?

16-6: Also, what is the force on the new charge, $-2Q$?
Concept Question

17-1: A proton is released from the positively charged plate and an electron is released from the negatively charged plate. When they reach the opposite plate which one will have the larger Kinetic Energy?

- The proton
- The electron
- They have the same K.E.
- Neither one gains any K.E.

17-2: Which had the larger acceleration? Why?
17-3. A small charged ball is accelerated from rest to a speed \( v \) by a 300 V potential difference. If the potential difference is changed to 1200 V, what will the new speed of the ball be?

A) \( v \)
B) \( 2v \)
C) \( 4v \)
D) \( 16v \)
Concept Question

17-4: The electric potential at point A is

C) positive
D) negative
E) zero

17-5: what about $V$ at pt B?
17-6. Charges are located at the corners of a square as shown below. Which best describes the electric potential \( V \) and electric field \( E \) at the center?

D) \( V = 0, \ E = 0 \)  
E) \( V \neq 0, \ E = 0 \)  
C) \( V = 0, \ E \neq 0 \)  
D) \( V \neq 0, \ E \neq 0 \)
Questions re \( C \): parallel plate Capacitor

How does the capacitance \( C \) change if the following changes are made? (By what factor in each case?)

B) stays the same \quad B) \text{ increases} \quad C) \text{ decreases}

17-7: The plate area is doubled to \( 2A_0 \)?

17-8: The separation distance is reduced to one third \( d_0 \)?

17-9: The volume is filled with a material having \( K = 5 \)?

17-10: The charge on each plate is doubled to \( 2Q_0 \)?
17-11: A parallel plate capacitor is charged to a voltage of $V_0$ and the field inside is $E_0$. If the separation distance $d$ is doubled without changing $Q$, the new potential difference between the plates will be

A) $V_0$  
B) $2V_0$  
C) $V_0/2$  
D) $4V_0$

17-12: What is the new E-field inside the capacitor?

$E = A) \ E_0 \quad B) \ 2\ E_0 \quad C) \ E_0/2 \quad D) \ 4\ E_0$

17-13: By what factor does the stored energy change?

A) stays the same  
B) $\times 2$  
C) $\times \frac{1}{2}$  
D) $\times 4$

17-14: How much work was required to change $d$?

17-15: What would happen to $Q$ if $V$ remained the same?
Q18-1: If a wire carries a current of 250 mA, how much charge flows past a given point in 10 seconds?

A) 250 C  
B) 0.25 C  
C) 2.5 C  
D) 25 C
Concept Question

Q18-2: Two wires are made of the same material and have the same length. Wire A has four time the resistance of wire B \((R_A = 4 R_B)\). How are their diameters related?

- \(d_A = 4 \ d_B\)
- \(d_A = 2 \ d_B\)
- \(d_A = d_B / 2\)
- \(d_A = d_B / 4\)

Q18-3: How could you get identical resistances using these two different wire sizes?
Q18-4: The heating elements of two electrical space heaters have different resistances. Which one will produce more heat when the same voltage is applied across the elements.

A) the one with the larger resistance  
B) the one with the smaller resistance  
C) neither, they will produce the same amount heat
Q19-1: What happens to the voltage across resistor $R_1$ when the switch is closed?

A) It decreases
B) It increases
C) It stays the same

Q19-2: What happens to the current flowing through $R_3$?
Q19-3: There is a 200 pF capacitor in a circuit and you wish to make it 300 pF by adding a second capacitor to it. You should
   A) add a 100 pF capacitor in series.
   B) add a 100 pF capacitor in parallel.
   C) add a 400 pF capacitor in series.
   D) None of these options will work.

Q19-4: What value of C results for the wrong Answers for Q19-3?
Q 20-1: A positively charged particle enters a region of constant magnetic field with velocity as shown in Fig 1. What is the direction of the magnetic force?

A) to right
B) to left
C) into page
D) out of page
E) there is no force

Q 20-2: Same question for Fig 2
Q 20-3: Two long parallel wires carry currents as shown, what direction is the resulting magnetic field at point A?

A) into the page  
B) out of the page  
C) to the right  
D) to the left  
E) zero

Q 20-4: The force that Wire 1 experiences due to the current in Wire 2 is in what direction?  
(same answers as above)
Check your Answers

Ch 16: 1) C  2) D  3) A  4) D  5) B  6) B
Ch 17: 1) C  2) B  3) B  4) C  5) A  6) C  7) B  8) B  9) C  10) A  11) B  12) A  13) B  14) $\frac{1}{2} Q V_0$  15) Q to $\frac{1}{2} Q$
Ch 18: 1) C  2) C  3) $L_B = 4L_A$ for $R_A$; 4 strands of A for $R_B$  4) B
Ch 19: 1) B  2) A  3) B  4) $R(A) = 67 \ \Omega$; $R(C) = 133 \ \Omega$
Ch 20: 1) C  2) E  3) A  4) D