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SESSION 14: PHYSICS - CONSOLIDATION

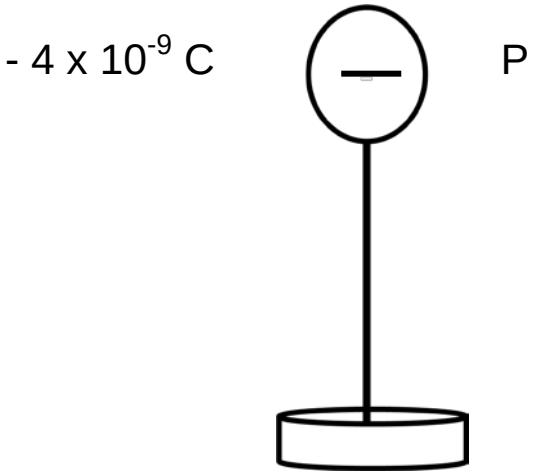
Key Concepts

- Electrostatics
- Capacitors
- Circuits
- N-P Junction
- Faraday's Law
- Momentum
- Newton's Laws

X-ample Questions

Question 1

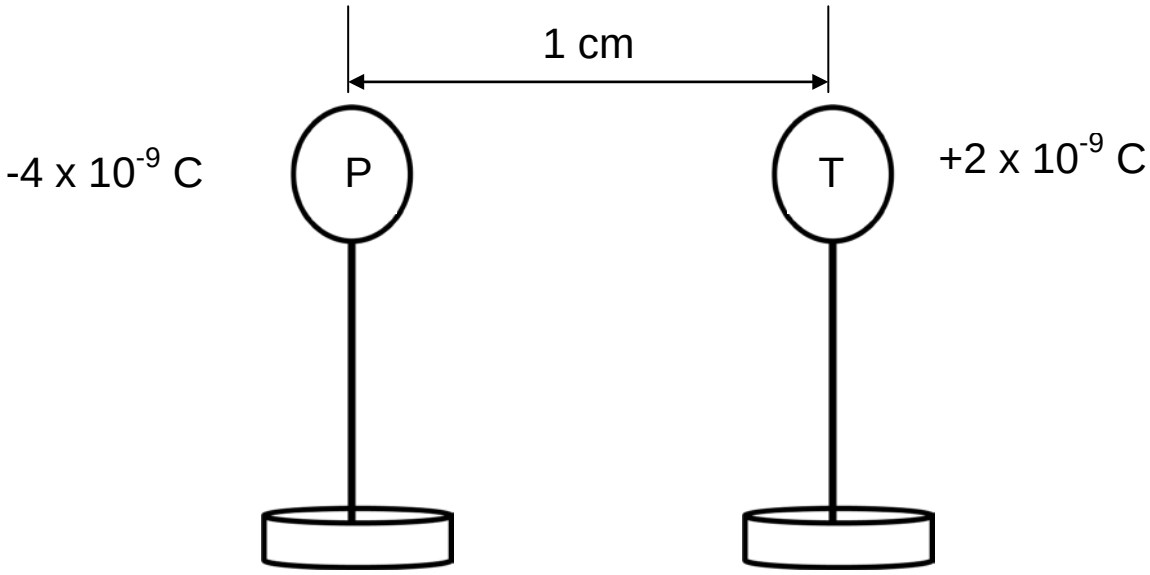
The diagram below shows a small metal sphere P on an insulated stand. The sphere carries a charge of - 4 x 10^{-9} C, as shown in the diagram.



1.1 Draw the field pattern around sphere P. Assume that no other charges affect this pattern. (2)

2.2 Calculate the number of electrons in excess on sphere P. (2)

A second metal sphere T, carrying a charge of + 2 x 10^{-9} C, is placed 1 cm from sphere P, as is shown in the diagram below.



1.3 Calculate the magnitude of the electrostatic force that sphere P exerts on sphere T. (4)

The spheres are now brought into contact with each other and returned to their original positions.

1.4 Calculate the new charge on the spheres. (2)

Question 2

A capacitor is an electrical component which can store electric energy. Capacitors are used in many devices and electric circuits such as radios, camera flashes, computer keyboards, energy back-ups in computers and laptops in case of power failure, time delay circuits such as alarm systems, etc.

2.1 What is the primary function of a capacitor in an electric circuit? (1)

Two parallel plates are arranged to form a capacitor. The area of each plate is 0, 02 m. The plates are separated by a 0, 004 m air gap.

2.2 Calculate the capacitance of the capacitor. (4)

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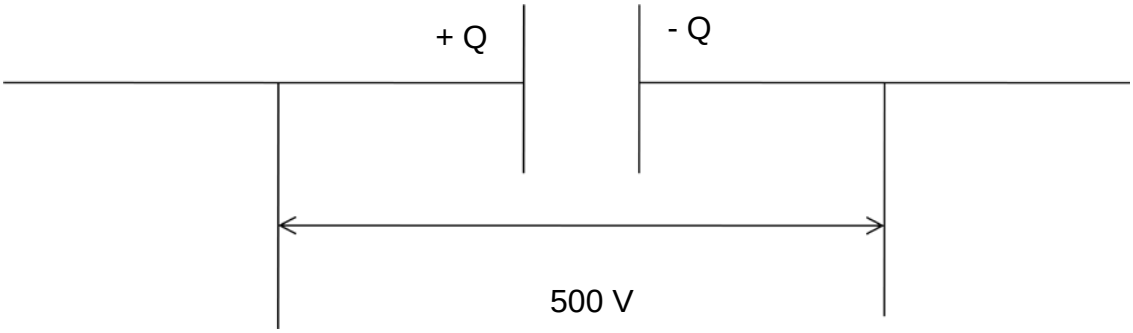
The capacitor is connected across a 500 V source as shown below:



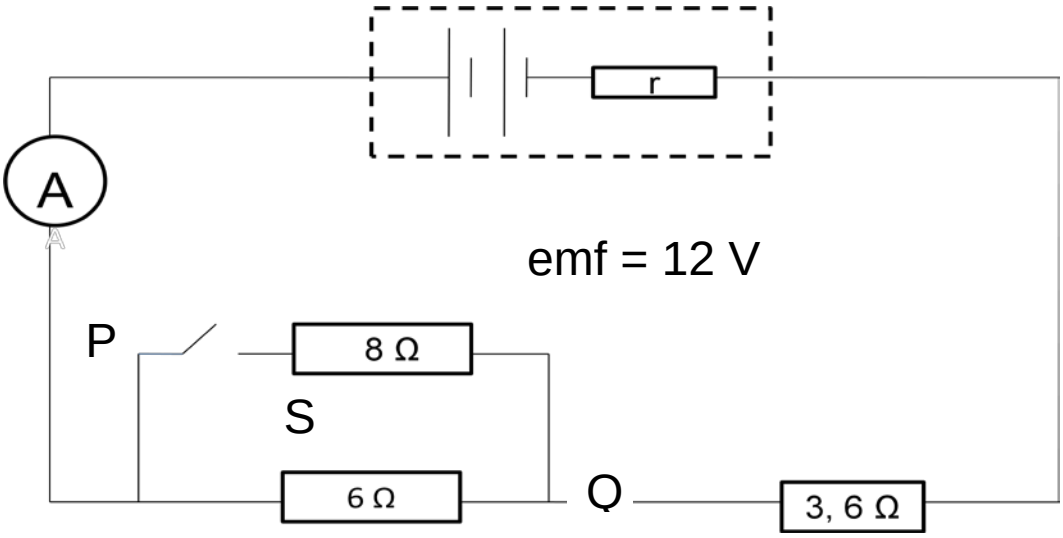
2.3 Calculate the charge on each plate. (3)

2.4 State two practical ways in which the charge stored on the plates of the capacitor can be increased. (2)

2.5 What is the name given to the insulating material, which fills the space between the plates of a capacitor? (1)

Question 3

The circuit diagram below represents a combination of resistors in parallel and series. The battery has an emf of 12 V and an unknown internal resistance *r*.



With switch S open, ammeter A, gives a reading of 1, 2 A.

3.1 Calculate the total resistance of the circuit. (3)

3.2 Calculate the internal resistance of the battery. (4)

Switch S is now CLOSED.

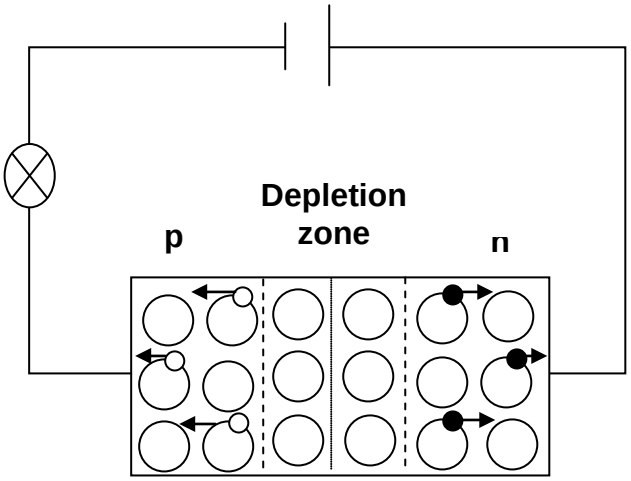
3.4 How will EACH of the following be affected? Write only increase, decrease or remains the same.

3.4.1 The total resistance of the circuit. (1)

3.4.2 The reading on the ammeter. (1)

Question 4

Study the following diagram that is used in an investigation:



4.1. Name the component that is connected with the bulb across the cell in the diagram above. (1)

4.2 Define the term "dopant." (2)

4.3 Name two dopants and state clearly how each is used to change the properties of the main element that the component is made up of. (4)

4.4 Predict the effect of connecting the component the opposite way. (1)

4.5 Give a reason for your answer. (2)

Question 5

Michael Faraday was a self educated English physicist and chemist who discovered that when the magnetic field through a loop is changing, a current is induced in the loop. This discovery led to the development of the electricity supply industry.

While making study notes, Daniela finds the following question in her textbook.

5.1 A loop of a coil has an area of 0,2 m^2. The magnetic field at right angles to the coil (magnetic field normal to the coil) has a magnitude of 0,15 T. Calculate the magnetic flux. (3)

She learnt that a change in magnetic flux (field linkage) is needed to induce an emf in the coil and decided to do the investigation. However, the only coil available has 15 turns and the magnet that she found, is very weak.

5.2 Explain how the following factors will affect the emf induced in the coil in Daniela's investigation:

a. Changing the turns of the coil to 15 (2)

b. Using a weak magnet (2)

5.3 Suggest one way of increasing the induced emf by using the available apparatus. (1)

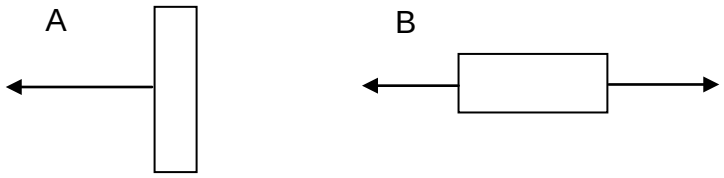
Question 6

A trolley A (10 kg) moves East at a speed of 5 $m.s^{-1}$ when it collides against a second stationary trolley B (6 kg). The trolleys separate after the collision and trolley B now has a velocity of 1 $m.s^{-1}$ East.

6.1 Calculate the velocity of trolley A after the collision. (5)
6.2 Calculate the change in momentum of trolley B. (4)
6.3 What is the impulse on trolley B? (2)
6.4 The trolleys were in contact for 0,1 s. Calculate the force of trolley A on trolley B during the collision. (4)

Question 7

In diagram A, a person pulls on the string connected to the wall. The force is applied 25 N.
In diagram B, two people pull in opposite directions on a spring balance. Each person exerts a force of 25 N in the direction of the arrows shown.



4.1 Name the force pairs in each diagram (3)
4.2 What is the force exerted on the wall in diagram A? (1)
4.3 What will the reading be on the spring balance in diagram B? (1)

Question 8

An object is stationary on an inclined rough plane. Draw a diagram to show the forces acting

8.1 parallel along the surface of the slope (plane). (3)
8.2 vertically. (2)
8.3 at right angles to the slope. (3)
8.4 Give examples of contact and non contact forces in this example. (4)
8.5 Give the Newton's third Law pairs in this example. (2)