Unit 22 · Capacitors

WORKSHEET

Full marks 37

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 37

1 Key words [4]

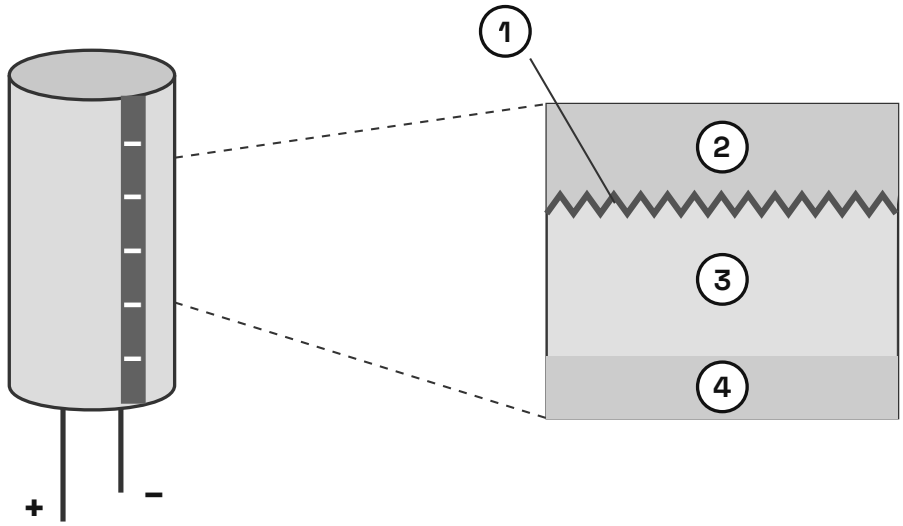
Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

capacitance	**capacitor**	**coulomb**	**dielectric**	**electrolytic**	**farads**	**permittivity**
		polarized	**resistance**	**strength**		

A component made of two conductors separated by an insulator, which stores charge for a while, is a _____. The charge stored per unit potential difference is its _____, measured in _____. The insulator between the plates is the _____; the number of times its permittivity is greater than a vacuum's is its relative _____. In an electric field, the molecules of an insulator are _____. The greatest field an insulator can take without breaking down is its dielectric _____. A capacitor whose dielectric is a thin layer of aluminium oxide is an _____ capacitor.

2 Label the diagram [2]

The diagram shows the layers inside an aluminium electrolytic capacitor. Write the labels that belong in place of 1 to 4. Each carries 0.5 mark.



1. _____ **2.** _____

3. _____ **4.** _____

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. 1 farad is the same as: [1]

a. 1 V/C
b. 1 C/V
c. 1 J/C
d. 1 C V

ii. The gap of a parallel-plate capacitor is halved and the area of its plates is also halved. Its capacitance: [1]

a. doubles
b. halves
c. stays the same
d. becomes four times as large

iii. Capacitors of 2 μF, 3 μF and 6 μF are joined in series. Their combined capacitance is: [1]

a. 11 μF
b. 1 μF
c. 6 μF
d. 0.5 μF

iv. A capacitor is connected to a battery and fully charged. While it stays connected, the gap is filled with a dielectric. The charge on its plates: [1]

a. falls
b. stays the same
c. rises
d. becomes zero

v. A 330 μF camera-flash capacitor is charged to 300 V. The energy stored is about: [1]

a. 0.10 J
b. 50 J
c. 15 J
d. 30 J

4 Very short answers [3]

Write very short answers to the following questions.

a. Define one farad. [1]

b. A fully charged capacitor has +20 μC on one plate. What is the total charge on the capacitor? [1]

c. Why must an electrolytic capacitor be connected the right way round? [1]

5 Short answers [6]

Write short answers to the following questions.

a. Why does the current from a cell to a capacitor last only a moment, while the current to a lamp goes on? [2]

b. Explain how a dielectric increases the capacitance of a charged, disconnected capacitor. **[2]**

c. Write two uses of capacitors. **[2]**

6 Long answer **[4]**

Write a long answer to the following question.

Show that the energy stored in a capacitor of capacitance C charged to a p.d. V is ½CV^2. Why is it not QV?

7 Numerical problems **[10]**

Solve the following problems. Show your working. Take $\varepsilon_0 = 8.85 \times 10^{-12}$ F/m.

a. Two square metal plates of area 0.040 m^2 are separated by a sheet of mica 0.50 mm thick, of relative permittivity 6.0. Find the capacitance, and the charge on each plate at 200 V. **[3]**

Answer:

b. A 2 μF and a 3 μF capacitor are joined in series, and this pair is joined in parallel with a 4 μF capacitor, across a 10 V supply. **[4]**

i. Find the combined capacitance.

ii. Find the charge on and the p.d. across the 2 μF capacitor.

Answer: _____

c. A defibrillator is to deliver 200 J from a 100 μF capacitor. To what p.d. must it be charged, and how much charge does it then hold? **[3]**

Answer: _____

8 Think **[3]**

Capacitances add in parallel but as reciprocals in series, the opposite of resistors. Explain this using what parallel and series do to a parallel-plate capacitor's area and gap.

9 Activity: A capacitor from your kitchen (Activity 22.1) (not marked)

Make the foil-and-newspaper capacitor of the unit and read it with a multimeter's capacitance setting, if your school has one.

Arrangement	Capacitance (nF)
one sheet of newspaper	
one sheet, a heavy book pressed on top	
five sheets of newspaper	
one sheet, the foils overlapping by half as much	

Which change made the biggest difference? Use $C = \varepsilon_r \varepsilon_0 A/d$ to explain each result.