

A-Level Physics

Name: _____ Score: _____

1. Capacitance is the charge stored per unit:

- ☐ time
- ☐ current
- ☐ potential difference
- ☐ resistance

2. The energy stored in a capacitor is:

- ☐ $\frac{1}{2}CV$
- ☐ $\frac{1}{2}CV^2$
- ☐ CV^2
- ☐ $\frac{1}{2}QV^2$

3. During discharge through a resistor, the charge on a capacitor:

- ☐ decays exponentially
- ☐ rises steadily
- ☐ stays constant
- ☐ falls in a straight line

4. A capacitor holds 0.012 C at 4.0 V. What is its capacitance, in mF?

_____ mF

5. A 2.0 μF capacitor is charged to 1000 V. How much energy does it store?

_____ J

6. Why is a capacitor's discharge exponential?

- ☐ the capacitance falls with time
- ☐ the resistance increases as the capacitor empties
- ☐ the rate of loss of charge is proportional to the charge remaining
- ☐ the current is constant

7. A charged capacitor holds +Q on one plate and -Q on the other, so the capacitor as a whole is neutral.

- ☐ True
- ☐ False

8. Why is there a factor of $\frac{1}{2}$ in the stored-energy formula?

- ☐ half the charge leaks away
- ☐ the average p.d. during charging is only $V/2$
- ☐ the capacitor is only half full
- ☐ energy is always halved

9. A capacitor of $500\ \mu\text{F}$ discharges through a $2000\ \Omega$ resistor. What is the time constant?

_____ s

10. Doubling the charge on a capacitor doubles the voltage, so its capacitance stays the same.

- ☐ True ☐ False

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1. potential difference
 $C = \frac{Q}{V}$ – charge per volt, in farads.

2. $\frac{1}{2}CV^2$

Equivalent forms: $W = \frac{1}{2}QV = \frac{1}{2}CV^2 = \frac{Q^2}{2C}$.

3. decays exponentially

The bigger the charge, the bigger the current – giving an exponential decay.

4. 3 mF
 $C = \frac{Q}{V} = \frac{0.012}{4.0} = 0.0030 \text{ F} = 3.0 \text{ mF}.$
5. 1 J
 $W = \frac{1}{2}CV^2 = \frac{1}{2} \times 2.0 \times 10^{-6} \times (1000)^2 = 1.0 \text{ J}.$
6. the rate of loss of charge is proportional to the charge remaining

$Q/C = -R \, dQ/dt$ says exactly that. Every quantity with this property, radioactive decay included, gives the same curve.

7. True

Electrons move from one plate to the other through the battery, so the charges are always equal and opposite. The stored charge Q means the charge on one plate.

8. the average p.d. during charging is only $V/2$

The p.d. rises from 0 to V as it charges, so the average is $V/2$ – hence the triangle area $\frac{1}{2}QV$.

9. 1 s
 $\tau = RC = 2000 \times 500 \times 10^{-6} = 1.0 \text{ s}.$
10. True

$C = \frac{Q}{V}$ is fixed by the capacitor's size and dielectric – Q and V rise together.