

19. Capacitance

Starter Quiz · 课前小测

A-Level Physics

Name: _____ Score: _____

1. Capacitance is the charge stored per unit:

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

2. The energy stored in a capacitor is:

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

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

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

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

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

☐ half the charge leaks away

☐ the capacitor is only half full

☐ energy is always halved

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

- ☐ True ☐ False

10. The energy stored equals the _____ under the V–Q graph.

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**

$Q/C = -R \text{ d}Q/\text{d}t$ 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. **True**

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

10. **area**

The triangle under the line has area $\frac{1}{2}QV$ — the stored energy.