

Capacitance

TOPIC QUESTIONS

Level	A Level
Subject	Physics
Exam Board	AQA
Paper Type	Multiple Choice

Time Allowed : 30min



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1. The voltage across a capacitor falls from 10 V to 5 V in 48 ms as it discharges through a resistor. What is the time constant of the circuit?

- A 24 ms
- B 33 ms
- C 69 ms
- D 96 ms

2. An initially uncharged capacitor of capacitance $20 \mu\text{F}$ is charged by a constant current of $80 \mu\text{A}$. Which line, A to D, in the table gives the potential difference across, and the energy stored in, the capacitor after 50 s?

	potential difference / V	energy stored / J
A	4.0×10^{-3}	2.0×10^{-3}
B	4.0×10^{-3}	4.0×10^{-1}
C	2.0×10^2	2.0×10^{-3}
D	2.0×10^2	4.0×10^{-1}

3. Which one of the following statements about a parallel plate capacitor is incorrect?
- A The capacitance of the capacitor is the amount of charge stored by the capacitor when the pd across the plates is 1V.
 - B A uniform electric field exists between the plates of the capacitor.
 - C The charge stored on the capacitor is inversely proportional to the pd across the plates.
 - D The energy stored when the capacitor is fully charged is proportional to the square of the pd across the plates.

4. A 1000 μF capacitor and a 10 μF capacitor are charged so that they store the same energy. The pd across the 1000 μF capacitor is V_1 and the pd across the other capacitor is V_2 .

What is the value of the ratio $\left(\frac{V_1}{V_2}\right)^2$?

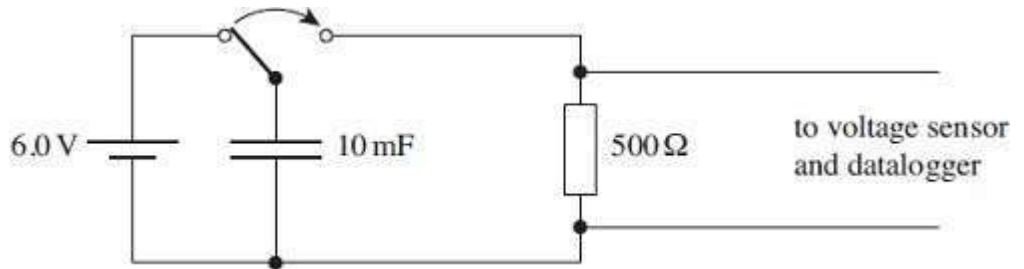
A $\frac{1}{1000}$

B $\frac{1}{100}$

C $\frac{1}{10}$

D 10

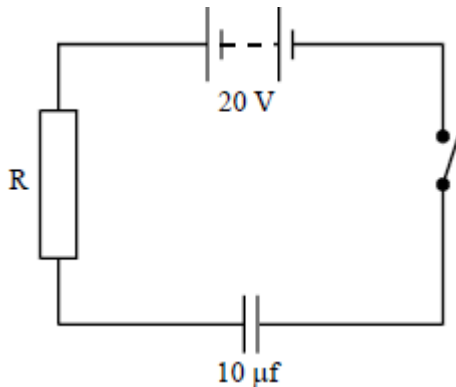
5. A voltage sensor and a datalogger are used to record the discharge of a 10 mF capacitor in series with a 500 Ω resistor from an initial pd of 6.0 V. The datalogger is capable of recording 1000 readings in 10 s. Which line, A to D, in the table gives the pd and the number of readings made after a time equal to the timeconstant of the discharge circuit?



	potential difference/V	number of readings
A	2.2	50
B	3.8	50
C	3.8	500
D	2.2	500

6. A 1 μF capacitor is charged using a constant current of 10 μA for 20 s. What is the energy finally stored by the capacitor?
- A 2×10^{-3} J
- B 2×10^{-2} J
- C 4×10^{-2} J
- D 4×10^{-1} J

7.



A capacitor of capacitance $10 \mu\text{F}$ is fully charged through a resistor R to a p.d. of 20 V using the circuit shown. Which one of the following statements is **incorrect**?

- A The p.d. across the capacitor is 20 V .
- B The p.d. across the resistor is 0 V .
- C The energy stored by the capacitor is 2 mJ .
- A The total energy taken from the battery during the charging process is 2 mJ .

8. A capacitor of capacitance C stores an amount of energy E when the p.d. across it is V . Which line, A to D, gives the correct stored energy and p.d. when the charge is increased by 50%?

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	energy	p.d.
A	$1.5E$	$1.5V$
B	$2.25E$	$1.5V$
C	$1.5E$	$2.25V$
D	$2.25E$	$2.25V$

9. In experiments to pass a very high current through a gas, a bank of capacitors of total capacitance $50 \mu\text{F}$ is charged to 30 kV . If the bank of capacitors could be discharged completely in 5.0 ms what would be the mean power delivered?

- A 9.0 MW
- B 4.5 MW
- C 110 kW
- D 22 kW



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10. Which of the following does **not** give a value in seconds?

A capacitance \times
resistance

B $\frac{1}{\text{frequency}}$

C half-life

D $\frac{\text{power}}{\text{work}}$

11. A $10 \mu\text{F}$ capacitor stores 4.5 mJ of energy. It then discharges through a 25Ω resistor.

What is the maximum current during the discharge of the capacitor?

A 1.2 A

B 18 A

C 30 A

D 36 A

12. A $1.0 \mu\text{F}$ capacitor is charged for 20 s using a constant current of $10 \mu\text{A}$.

What is the charge collected by the sphere each second?

A $5.0 \times 10^{-3} \text{ J}$

B $1.0 \times 10^{-2} \text{ J}$

C $2.0 \times 10^{-2} \text{ J}$

D $4.0 \times 10^{-2} \text{ J}$

13. A $1.0 \mu\text{F}$ capacitor initially stores $15 \mu\text{C}$ of charge. It then discharges through a 25Ω resistor.

What is the maximum current during the discharge of the capacitor?

A 0.60 mA

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B 1.2 mA

C 0.60 A

D 1.2 A



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14. The initial potential difference across a capacitor is V_0 . The capacitor discharges through a circuit of time constant T . The base of natural logarithms is e .

What is the potential difference across the capacitor after time T ?

A $\frac{V_0}{e}$

B $\frac{V_0}{e}$

C $V_0 e$

D $V_0 \ln 2$

15. An air-filled parallel-plate capacitor is charged from a source of emf. The electric field has a strength E between the plates. The capacitor is disconnected from the source of emf and the separation between the isolated plates is doubled.

What is the final electric field between the plates?

A $2E$

B E

C $\frac{E}{2}$

D $\frac{E}{4}$

16. A capacitor of capacitance C stores an amount of energy E when the pd across it is V . Which line, A to D, in the table gives the correct stored energy and pd when the charge is increased by 50%?

	energy	pd
A	$1.5 E$	$1.5 V$
B	$1.5 E$	$2.25 V$
C	$2.25 E$	$1.5 V$
D	$2.25 E$	$2.25 V$

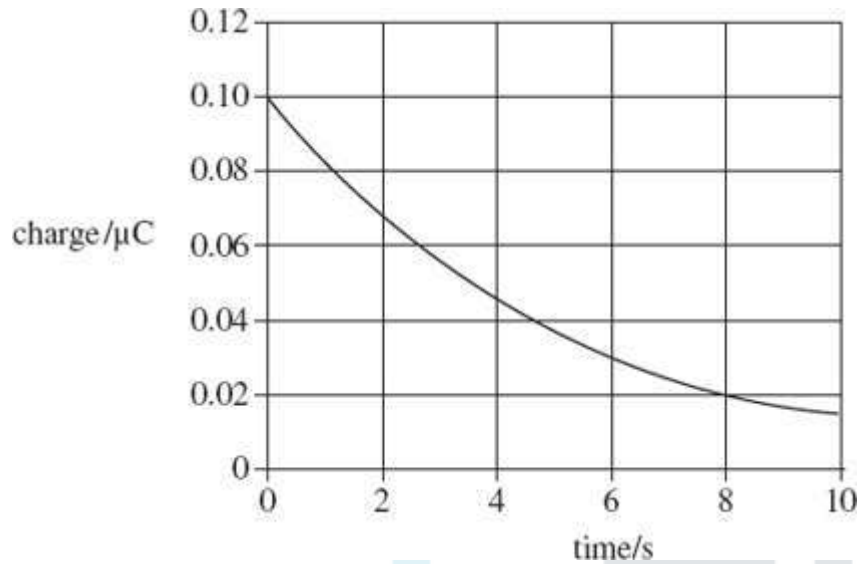
17. A capacitor of capacitance C discharges through a resistor of resistance R .

Which one of the following statements is not true?

- A The time constant will decrease if C is increased.
- B The time constant will increase if R is increased.
- C After charging to the same voltage, the initial discharge current will increase if R is decreased.
- D After charging to the same voltage, the initial discharge current will be unaffected if C is increased.



18. The graph shows how the charge on a capacitor varies with time as it is discharged through a resistor.



What is the time constant for the circuit?

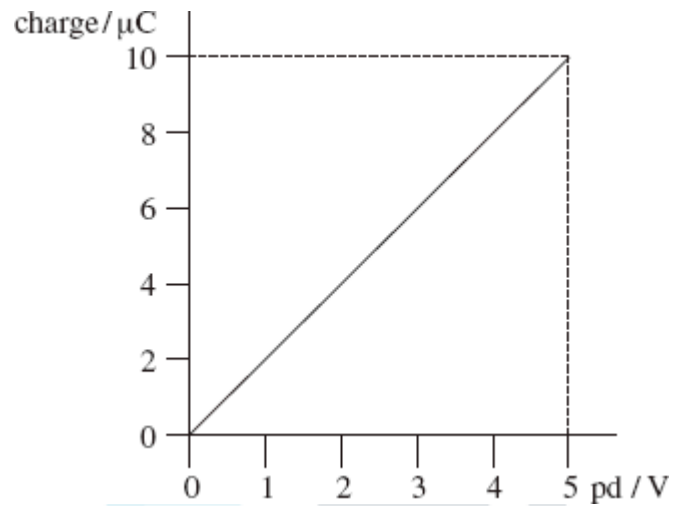
A 3.0 s

B 4.0 s

C 5.0 s

D 8.0 s

19. The graph shows how the charge stored by a capacitor varies with the pd applied across it.



Which line, A to D, in the table gives the capacitance and the energy stored when the potential difference is 5.0 V?

	capacitance/ μF	energy stored/ μJ
A	2.0	25
B	2.0	50
C	10.0	25
D	10.0	50

20. A 10 mF capacitor is charged to 10 V and then discharged completely through a small motor. During the process, the motor lifts a weight of mass 0.10 kg. If 10% of the energy stored in the capacitor is used to lift the weight, through what approximate height will the weight be lifted?
- A 0.05 m
 - B 0.10 m
 - C 0.50 m
 - D 1.00 m



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