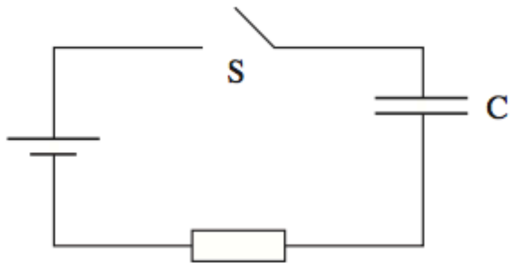
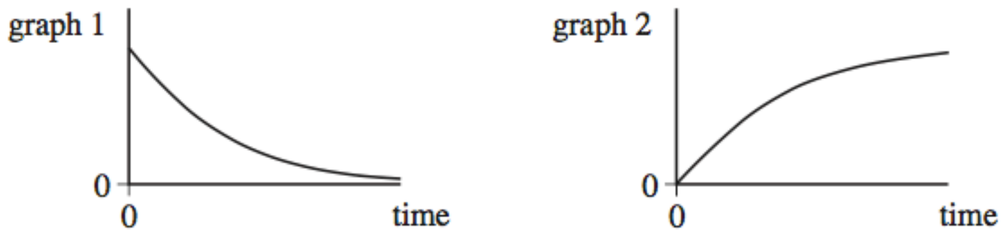
1)

In the circuit shown the capacitor C charges when switch S is closed.



Which line, **A** to **D**, in the table gives a correct pair of graphs showing how the charge on the capacitor and the current in the circuit change with time after S is closed?



	charge	**current**
A	graph 1	graph 1
B	graph 1	graph 2
C	graph 2	graph 2
D	graph 2	graph 1

2)

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

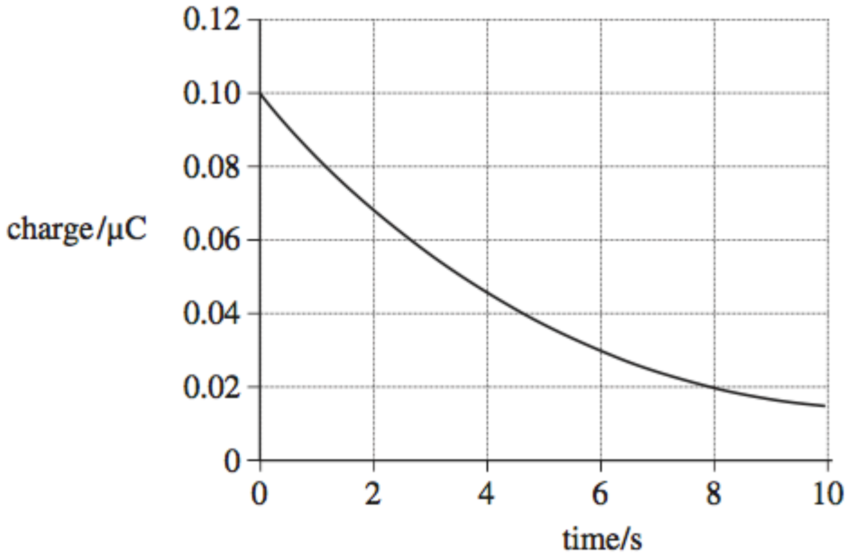
3)

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.

4)

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

5)

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

6)

An uncharged 4.7 nF capacitor is connected to a 1.5 V supply and becomes fully charged.

How many electrons are transfered to the negative plate of the capacitor during this charging process?

A 2.2×10^{10}

B 3.3×10^{10}

C 4.4×10^{10}

D 8.8×10^{10}

7)

When fully charged the 2.0 mF capacitor used as a backup for a memory unit has a potential difference of 5.0 V across it. The capacitor is required to supply a constant current of 1.0 μA and can be used until the potential difference across it falls by 10%. For how long can the capacitor be used before it must be recharged?

A 10 s

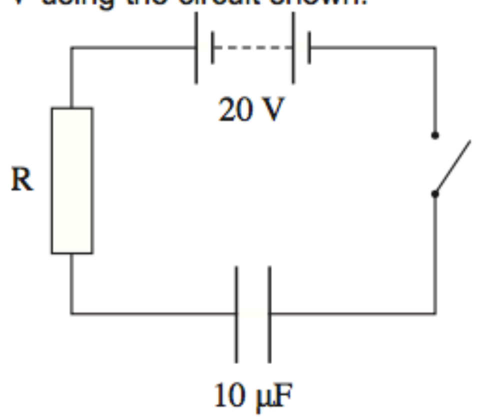
B 100 s

C 200 s

D 1000 s

8)

A capacitor of capacitance 10 μF is charged through a resistor R to a potential difference (pd) of 20 V using the circuit shown.



When the capacitor is fully charged which one of the following statements is **incorrect**?

A The energy stored by the capacitor is 2 mJ.

B The total energy taken from the battery during the charging process is 2 mJ.

C The pd across the capacitor is 20 V.

D The pd across the resistor is 0 V.

9)

Initially a charged capacitor stores 1600 μJ of energy. When the pd across it decreases by 2.0 V, the energy stored by it becomes 400 μJ.

What is the capacitance of this capacitor?

A 100 μF

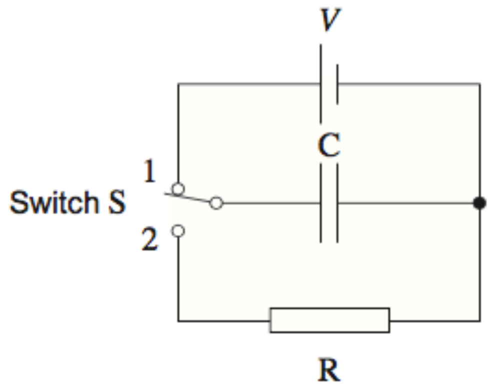
B 200 μF

C 400 μF

D 600 μF

10)

Switch S in the circuit is held in position 1, so that the capacitor C becomes fully charged to a pd V and stores energy E.



The switch is then moved quickly to position 2, allowing C to discharge through the fixed resistor R. It takes 36 ms for the pd across C to fall to $\frac{V}{2}$. What period of time must elapse, after the switch has moved to position 2, before the energy stored by C has fallen to $\frac{E}{16}$?

A 51 ms

B 72 ms

C 432 ms

D 576 ms

11)

A nuclear fusion device is required to deliver at least 1 MJ of energy using capacitors.
If the largest workable potential difference is 10 kV, what is the minimum capacitance of the capacitors that should be used?

A 0.01 F

B 0.02 F

C 2 F

D 100 F

12)

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

13)

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 $\frac{1}{1000}$

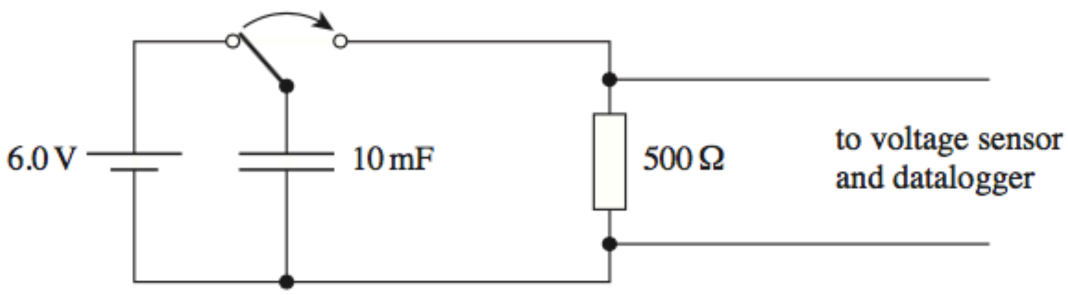
B $\frac{1}{100}$

C $\frac{1}{10}$

D 10

14)

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 time constant 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

15)

When a 220 μF capacitor is discharged through a resistor R, the capacitor pd decreases from 6.0 V to 1.5 V in 92 s.

What is the resistance of R?

A 210 kΩ

B 300 kΩ

C 420 kΩ

D 440 kΩ

16)

A 400 μF capacitor is charged so that the voltage across its plates rises at a constant rate from 0 V to 4.0 V in 20 s. What current is being used to charge the capacitor?

A 5 μA
B 20 μA
C 40 μA
D 80 μA

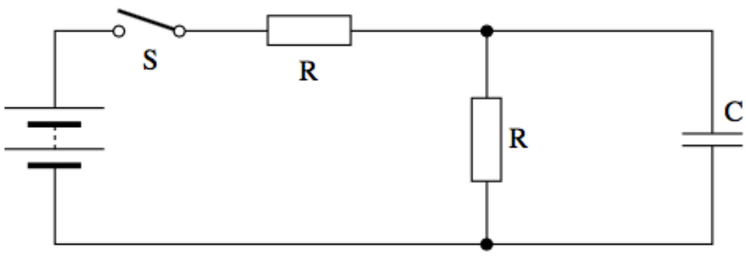
17)

When a capacitor discharges through a resistor it loses 50% of its charge in 10 s. What is the time constant of the capacitor-resistor circuit?

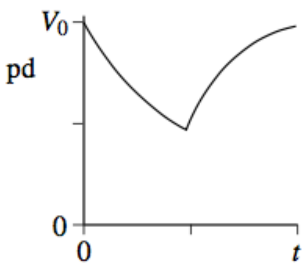
A 0.5 s
B 5 s
C 14 s
D 17 s

18)

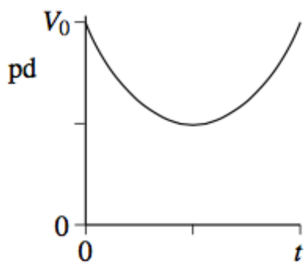
When switch S in the circuit is closed, the capacitor C is charged by the battery to a pd V_0.
The switch is then opened until the capacitor pd decreases to 0.5 V_0, at which time S is closed again. The capacitor then charges back to V_0.



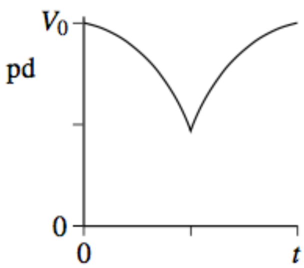
Which graph best shows how the pd across the capacitor varies with time, t, after S is opened?



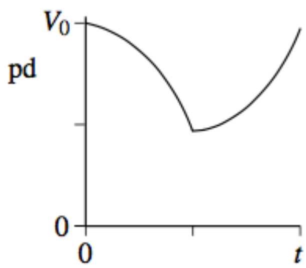
A



B



C



D