Q1. An uncharged 4.7 nF capacitor is connected to a 1.5 V supply and becomes fully charged.

How many electrons are transferred 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}

(Total 1 mark)

Q2. 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

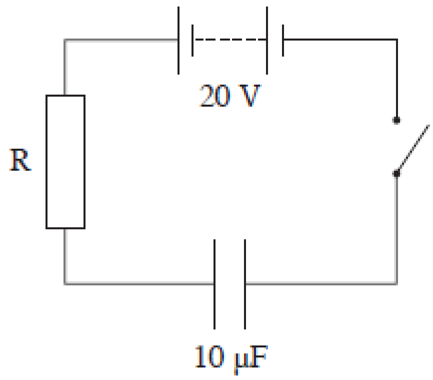
B 100 s

C 200 s

D 1000 s

(Total 1 mark)

Q3. 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.

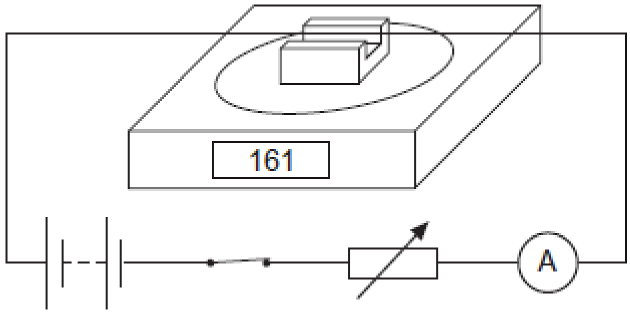
B The total energy taken from the battery during the charging process is 2 mJ.

C The pd across the capacitor is 20 V.

D The pd across the resistor is 0 V.

(Total 1 mark)

Q4. The diagram shows a rigidly-clamped straight horizontal current-carrying wire held mid-way between the poles of a magnet on a top-pan balance. The wire is perpendicular to the magnetic field direction.



The balance, which was zeroed before the switch was closed, read 161 g after the switch was closed. When the current is reversed and doubled, what would be the new reading on the balance?

A −322 g

B −161 g

C zero

D 322 g

(Total 1 mark)

Q5. Which 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 1 V.

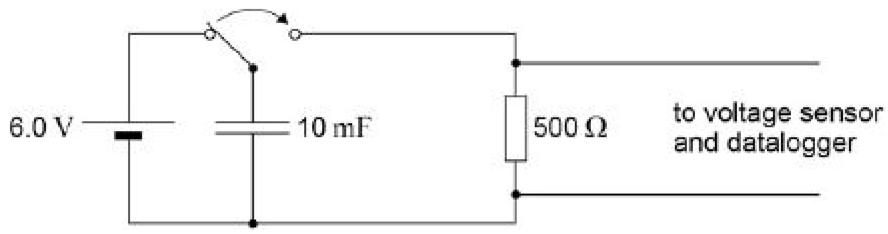
B A uniform electric field exists between the plates of the capacitor.

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.

(Total 1 mark)

Q6.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.



After a time equal to the time constant of the discharge circuit, which one of the rows gives the pd and the number of readings made?

	Potential difference / V	**Number of readings**	
A	2.2	50	☐
B	3.8	50	☐
C	3.8	500	☐
D	2.2	500	☐

(Total 1 mark)

Q7. 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

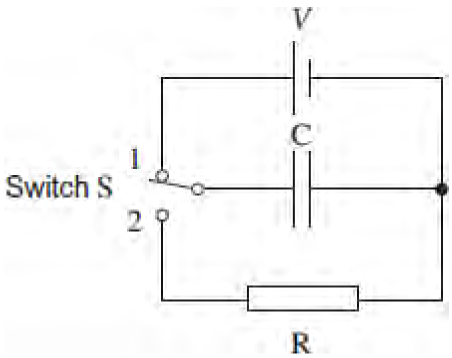
B 200 μF

C 400 μF

D 600 μF

(Total 1 mark)

Q8. 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

(Total 1 mark)

Q9. 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

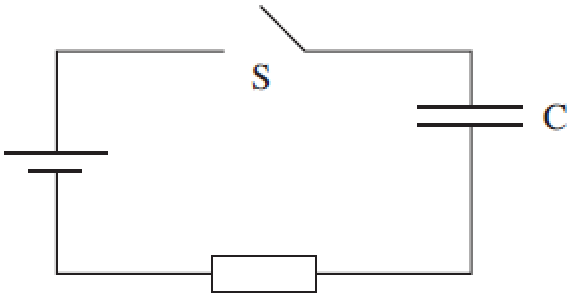
B 0.02 F

C 2 F

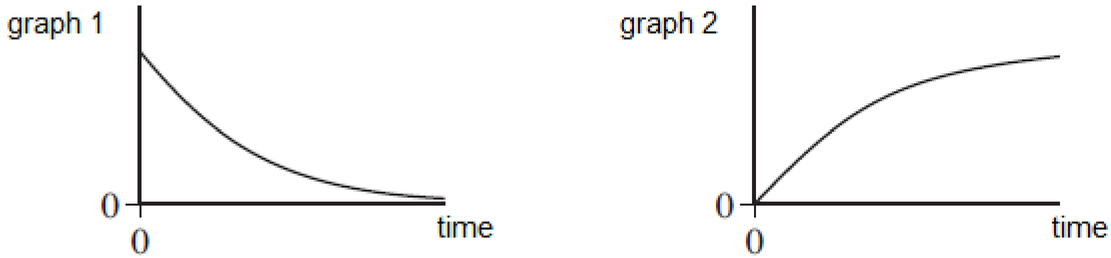
D 100 F

(Total 1 mark)

Q10. 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

(Total 1 mark)

Q11.The voltage across a capacitor falls from 10 V to 5 V in 48 ms as it discharge through a resistor. What is the time constant of the circuit?

A 24 ms

B 33 ms

C 69 ms

D 96 ms

(Total 1 mark)

Q12.An initially uncharged capacitor of capacitance 20 μF is charged by a constant current of 80 μA. 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}

(Total 1 mark)

Q13.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.**

(Total 1 mark)

Q14. 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 $\frac{1}{1000}$

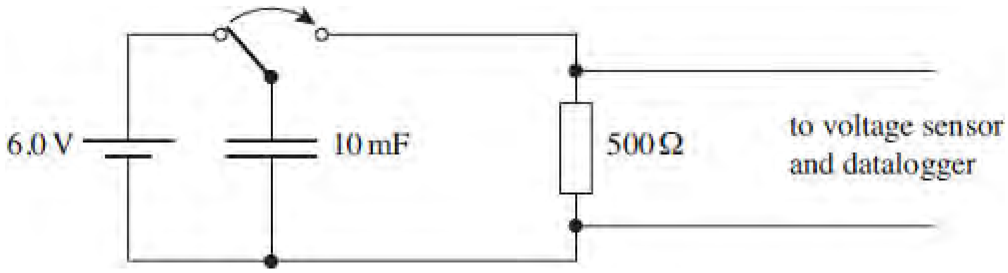
B $\frac{1}{100}$

C $\frac{1}{10}$

D **10**

(Total 1 mark)

Q15. 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

(Total 1 mark)

Q16. 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

(Total 1 mark)

Q17. A capacitor stores a charge of 600 µC when charged to a potential difference (pd) of 6.0 V. What will be the pd across the plates if the charge stored increases by 50%?

A 3.0 V

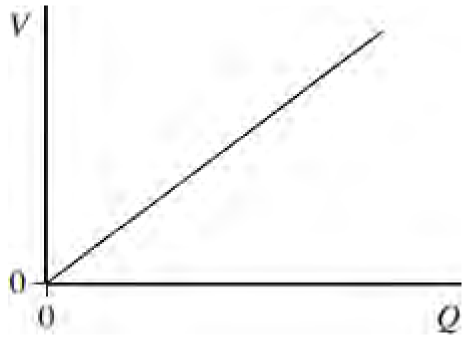
B 4.5 V

C 9.0 V

D 12.0 V

(Total 1 mark)

Q18. The graph shows the results of an experiment which was carried out to investigate the relationship between the charge *Q* stored by a capacitor and the pd *V* across it.



Which one of the following statements is not correct?

A The energy stored can be calculated by finding the area under the line.

B If a capacitor of smaller capacitance had been used the gradient of the graph would be steeper.

C If *Q* were doubled, the energy stored would be quadrupled.

D The gradient of the graph is equal to the capacitance of the capacitor.

(Total 1 mark)

Q19. A 10 μF capacitor is fully charged to a pd of 3.0 kV. The energy stored in the capacitor can be used to lift a load of 5.0 kg through a vertical height ***h***.

What is the approximate value of *h*?

A 0.03 mm

B 0.9 mm

C 0.3 m

D 0.9 m

(Total 1 mark)

Q20. 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

(Total 1 mark)

Q21. **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

(Total 1 mark)

Q22. **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.**

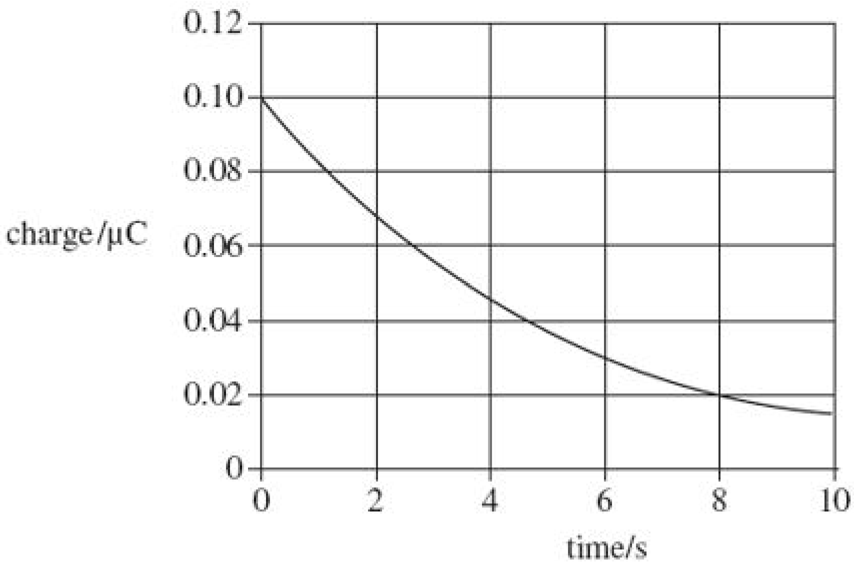
B **The time constant will increase if *R* is increased.**

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.**

(Total 1 mark)

Q23. **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**

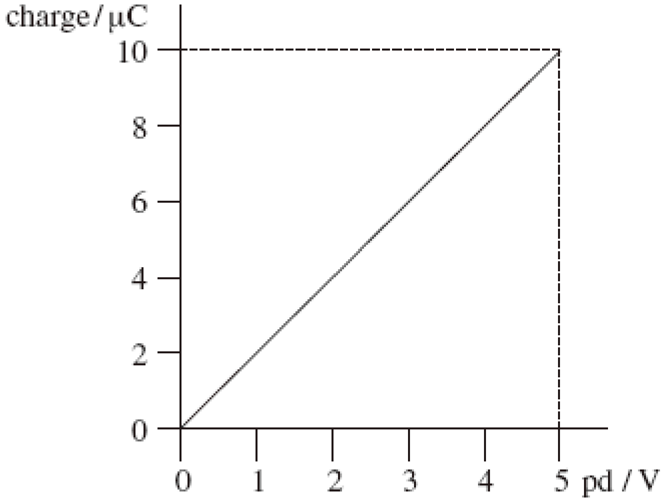
B **4.0 s**

C **5.0 s**

D **8.0 s**

(Total 1 mark)

Q24. 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

(Total 1 mark)

Q25. **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**

(Total 1 mark)

Q26. **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**

(Total 1 mark)

Q27. A 2.0 mF capacitor, used as the backup for a memory unit, has a potential difference of 5.0 V across it when fully charged. 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%. How long can the capacitor be used for before it must be recharged?

A 10 s

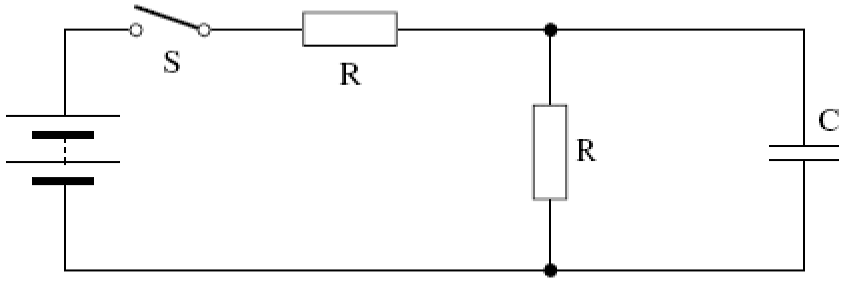
B 100 s

C 200 s

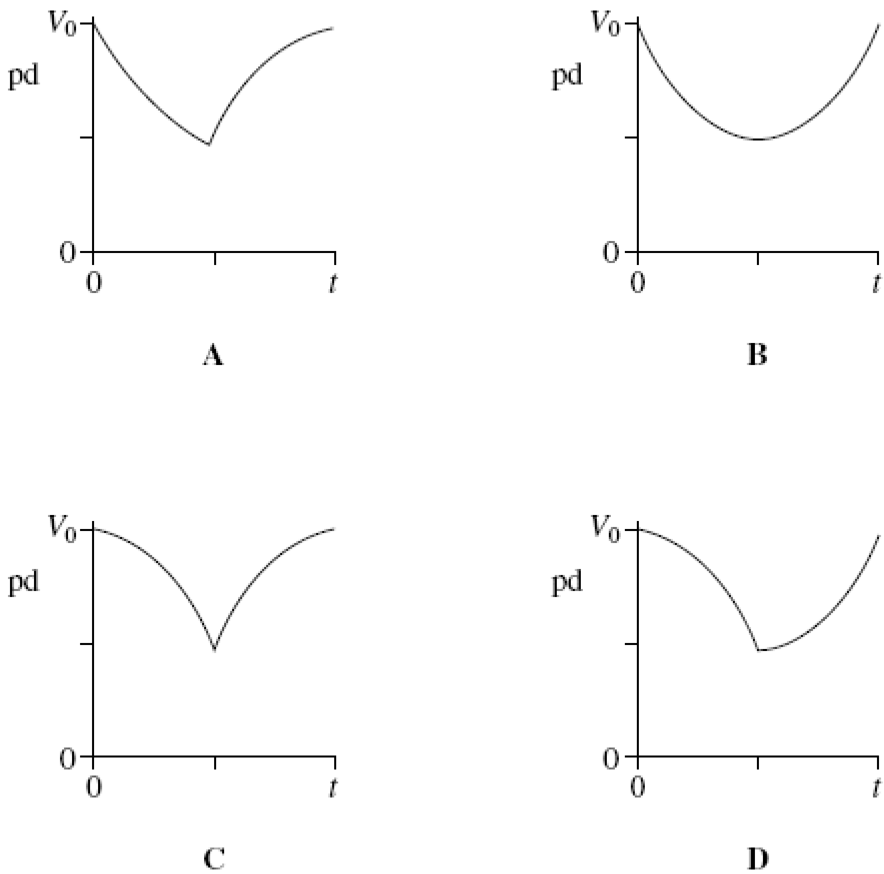
D 1000 s

(Total 1 mark)

Q28. 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?



(Total 1 mark)

Q29. 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

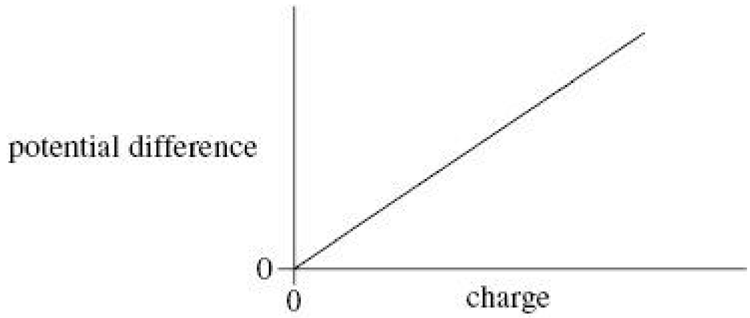
B 5 s

C 14 s

D 17 s

(Total 1 mark)

Q30. The graph shows how the potential difference across a capacitor varies with the charge stored by it.



Which one of the following statements is correct?

A The gradient of the line equals the capacitance of the capacitor.

B The gradient of the line equals the energy stored by the capacitor.

C The reciprocal of the gradient equals the energy stored by the capacitor.

D The reciprocal of the gradient equals the capacitance of the capacitor.

(Total 1 mark)

Q31. An initially uncharged capacitor of capacitance 10 μF is charged by a constant current of 200 μA. After what time will the potential difference across the capacitor be 2000 V?

A 50 s

B 100 s

C 200 s

D 400 s

(Total 1 mark)

Q32. A 1000 μF capacitor, X, and a 100 μF capacitor, Y, are charged to the same potential difference. Which row, A to D, in the table gives correct ratios of charge stored and energy stored by the capacitors?

	$\frac{\text{charge stored by X}}{\text{charge stored by Y}}$	$\frac{\text{energy stored by X}}{\text{energy stored by Y}}$
A	1	1
B	1	10
C	10	1
D	10	10

(Total 1 mark)