

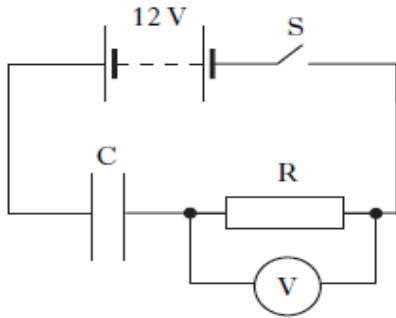
Exercise 9- Capacitance

Past Paper Homework Questions

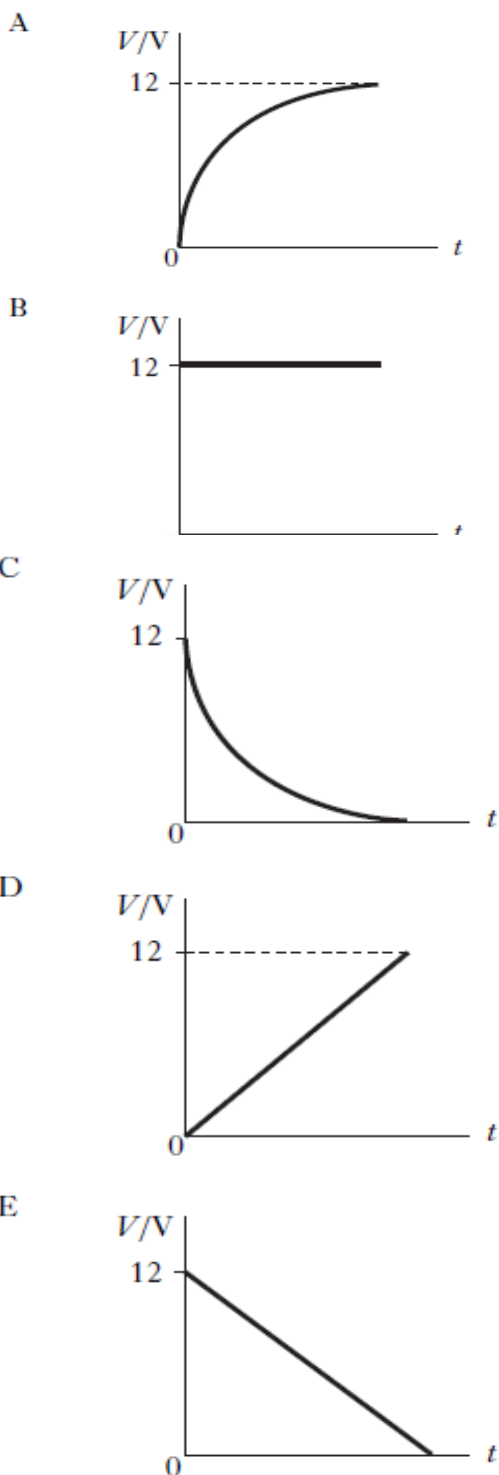
1. The unit for capacitance can be written as
- A VC^{-1}
 - B CV^{-1}
 - C Js^{-1}
 - D CJ^{-1}
 - E JC^{-1} .
2. Which of the following statements about capacitors is/are true?
- I Capacitors are used to block a.c. signals.
 - II Capacitors are used to block d.c. signals.
 - III Capacitors can store energy.
 - IV Capacitors can store electric charge.
- A I only
 - B I and III only
 - C II and III only
 - D II, III and IV only
 - E III and IV only
3. A student makes the following statements about capacitors.
- I Capacitors block a.c. signals.
 - II Capacitors store energy.
 - III Capacitors store charge.
- Which of these statements is/are true?
- A I only
 - B I and II only
 - C I and III only
 - D II and III only
 - E I, II and III
4. A $25.0\ \mu\text{F}$ capacitor is charged until the potential difference across it is $500\ \text{V}$. The charge stored in the capacitor is
- A $5.00 \times 10^{-8}\ \text{C}$
 - B $2.00 \times 10^{-5}\ \text{C}$
 - C $1.25 \times 10^{-2}\ \text{C}$
 - D $1.25 \times 10^4\ \text{C}$
 - E $2.00 \times 10^7\ \text{C}$.
5. In an experiment to find the capacitance of a capacitor, a student makes the following measurements.
- potential difference across capacitor = $(10.0 \pm 0.1)\ \text{V}$
- charge stored by capacitor = $(500 \pm 25)\ \mu\text{C}$
- Which row in the table gives the capacitance of the capacitor and the percentage uncertainty in the capacitance?

	Capacitance/ μF	Percentage uncertainty
A	0.02	1
B	0.02	5
C	50	1
D	50	5
E	5000	6

6. A circuit is set up as shown.



The capacitor is initially uncharged. Switch S is now closed. Which graph shows how the potential difference, V , across R, varies with time, t ?



7. A student carries out an experiment to find the capacitance of a capacitor. The charge on the capacitor is measured for different values of p.d. across the capacitor. The results are shown.

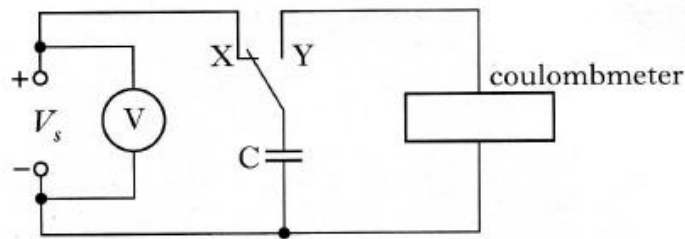
charge on capacitor/ μC	p.d. across capacitor/V
1.9	1.0
4.6	2.0
9.6	4.0

The best estimate of the capacitance is

- A $1.9\ \mu\text{F}$
 B $2.2\ \mu\text{F}$
 C $2.3\ \mu\text{F}$
 D $2.4\ \mu\text{F}$
 E $2.6\ \mu\text{F}$.
8. The capacitance of a capacitor is $1000\ \mu\text{F}$. The potential difference (p.d.) across the capacitor is $100\ \text{V}$. The charge stored by the capacitor is $0.10\ \text{C}$.
- The charge on the capacitor is now reduced to half its original value.
- Which row in the table shows the capacitance of the capacitor and the p.d. across the capacitor, for this new value of charge?

	Capacitance/ μF	p.d./V
A	1000	200
B	500	100
C	1000	100
D	500	50
E	1000	50

9. (a) In an experiment to measure the capacitance of a capacitor, a student sets up the following circuit.



When the switch is in position X, the capacitor charges up to the supply voltage, V_s . When the switch is in position Y, the coulombmeter indicates the charge stored by the capacitor.

The student records the following measurements and uncertainties.

Reading on voltmeter = $(2.56 \pm 0.01) \text{ V}$

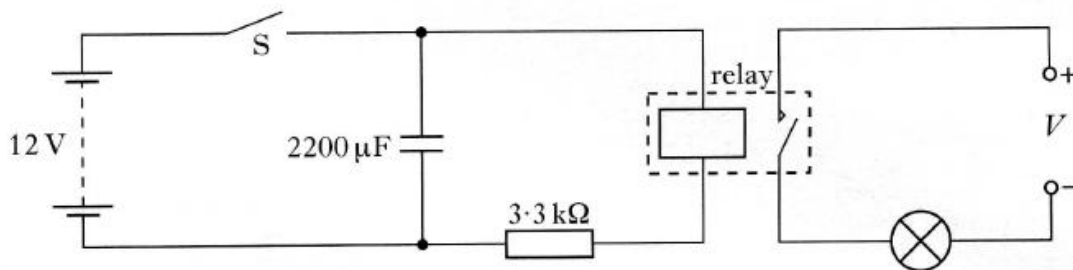
Reading on coulombmeter = $(32 \pm 1) \mu\text{C}$

Calculate the value of the capacitance and the percentage uncertainty in this value. You must give the answer in the form

value \pm percentage uncertainty.

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- (b) The student designs the circuit shown below to switch off a lamp after a certain time.



The 12 V battery has negligible internal resistance.

The relay contacts are normally open. When there is a current in the relay coil the contacts close and complete the lamp circuit.

Switch S is initially closed and the lamp is on.

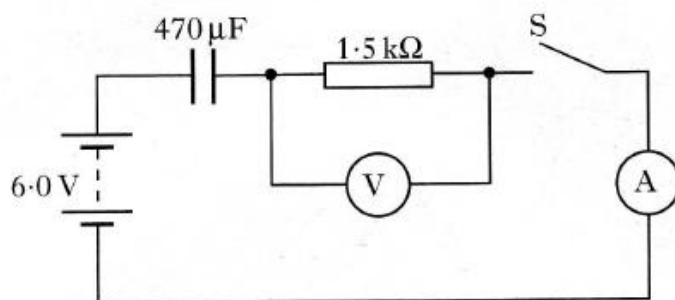
- (i) What is the maximum energy stored in the capacitor?
- (ii) (A) Switch S is now opened. Explain why the lamp stays lit for a few seconds.
- (B) The $2200 \mu\text{F}$ capacitor is replaced with a $1000 \mu\text{F}$ capacitor.

Describe and explain the effect of this change on the operation of the circuit.

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(9)

10. (a) The following diagram shows a circuit that is used to investigate the charging of a capacitor.



The capacitor is initially uncharged.

The capacitor has a capacitance of $470\ \mu\text{F}$ and the resistor has a resistance of $1.5\ \text{k}\Omega$.

The battery has an e.m.f. of $6.0\ \text{V}$ and negligible internal resistance.

- (i) Switch S is now closed. What is the initial current in the circuit?
 - (ii) How much energy is stored in the capacitor when it is fully charged?
 - (iii) What change could be made to this circuit to ensure that the **same** capacitor stores **more** energy?
- (b) A capacitor is used to provide the energy for an electronic flash in a camera.

When the flash is fired, $6.35 \times 10^{-3}\ \text{J}$ of the stored energy is emitted as light.

The mean value of the frequency of photons of light from the flash is $5.80 \times 10^{14}\ \text{Hz}$.

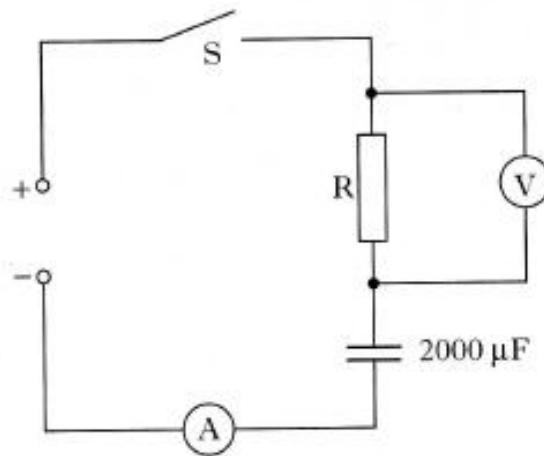
Calculate the number of photons emitted in each flash of light.

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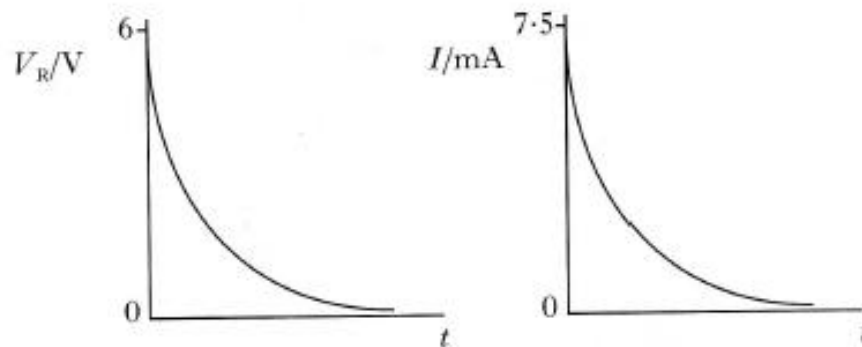
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(8)

11. (a) The circuit below is used to investigate the charging of a $2000\ \mu\text{F}$ capacitor. The d.c. supply has negligible internal resistance.



The graphs below show how the potential difference V_R across the **resistor** and the current I in the circuit vary with time from the instant switch S is closed.



- (i) What is the potential difference across the capacitor when it is fully charged?
- (ii) Calculate the energy stored in the capacitor when it is fully charged.
- (iii) Calculate the resistance of R in the circuit above.

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30 marks