Essential Pre-Uni Physics I1.1

A Level

Complete the questions in the table.

Capacitance	Voltage / V	Charge / C	Energy / J
$100\,\mu\text{F}$	6.0	(a)	(b)

Part A Charge

a) What is the charge stored in the capacitor?

Part B Energy

b) What is the energy stored in the capacitor?

Essential Pre-Uni Physics I1.5

A Level

Calculate the capacitance of a capacitor needed in a back up power supply if it needs to store $0.24\,\mathrm{J}$ of electrical energy when connected to a $12\,\mathrm{V}$ power supply.

Gameboard:

STEM SMART Physics 34 - Exponentials in capacitors

Essential Pre-Uni Physics I1.8

A Level

A mystery capacitor can store $3.0\,\mathrm{J}$ of energy when connected to a $10\,\mathrm{V}$ supply. How much energy can it store when connected to a $5.0\,\mathrm{V}$ supply?

Gameboard:

STEM SMART Physics 34 - Exponentials in capacitors

Essential Pre-Uni Physics I2.1

A Level

Calculate the capacitance of each of the following combinations:

Part A Two capacitors in parallel

a) A $3.0\,\mu\text{F}$ capacitor connected in parallel with a $2.0\,\mu\text{F}$ capacitor.

Part B Two capacitors in series

b) A $3.0\,\mu\text{F}$ capacitor connected in series with a $2.0\,\mu\text{F}$ capacitor.

Part C Combining series and parallel

c) A $6.0\,\mu\text{F}$ capacitor is connected in parallel with a $4.0\,\mu\text{F}$ capacitor. The combination is then connected in series with a $20\,\mu\text{F}$ capacitor

Part D Another combination

d) A $220\,\text{nF}$ capacitor is connected in series with a $440\,\text{nF}$ capacitor. The combination is connected in parallel with a $1.0\,\mu\text{F}$ capacitor.

Part E Three capacitors in parallel

e) A $1.0\,\text{nF}$, $2.0\,\text{nF}$ and $3.0\,\text{nF}$ capacitor, all connected in parallel.

Part F Three capacitors in series

f) A $1.0\,\text{nF}$, $2.0\,\text{nF}$ and $3.0\,\text{nF}$ capacitor, all connected in series.

Gameboard:

STEM SMART Physics 34 - Exponentials in capacitors

Essential Pre-Uni Physics I2.4

A Level

C C C

A $470\,\mu\text{F}$ capacitor is charged using a $10\,\text{V}$ battery. It is then disconnected, and connected to an uncharged $220\,\mu\text{F}$ capacitor. Calculate the voltage across the capacitors once the current has stopped flowing. (Hint: capacitors are effectively in parallel, and total charge has not changed.)

Gameboard:

STEM SMART Physics 34 - Exponentials in capacitors

Essential Pre-Uni Physics I3.1

A Level

Complete the questions in the table, giving your answers to 2 significant figures.

Capacitance	Resistance	Time constant	Halving time
$100\,\mu\text{F}$	$200\,\text{k}\Omega$	(a)	(b)

Part A Time constant

a) What is the time constant?

Part B Halving time

b) What is the halving time?

Gameboard:

STEM SMART Physics 34 - Exponentials in capacitors

Essential Pre-Uni Physics I3.6

A Level

This question is about a $2200\,\mu\text{F}$ capacitor which is charged with a $12\,\text{V}$ battery. It is then discharged through a $10\,\text{k}\Omega$ resistor.

Part A Initial discharge current

What is the initial discharge current?

Part B Discharging at a constant rate

Calculate how long the capacitor would take to discharge if the initial rate of discharge were maintained.

Part C Voltage after $22\,\text{s}$

What will the voltage be across the capacitor after $22\,\text{s}$?

Part D Current when voltage has halved

What will the current be when the voltage across the capacitor has halved?

Part E Voltage of $3.0\,\text{V}$

How much time will it take before the capacitor has a voltage of $3.0\,\text{V}$ across it?

Gameboard:

STEM SMART Physics 34 - Exponentials in capacitors

Capacitors and Resistors 33.5

A Level

A capacitor with $C = 10\,\text{nF}$ and initial charge $1.5 \times 10^{-7}\,\text{C}$ is discharged through a resistor with $R = 10\,\text{M}\Omega$. What is the current after $0.25\,\text{s}$?

Gameboard:

STEM SMART Physics 34 - Exponentials in capacitors

Capacitors and Resistors 33.6

A Level

An initially uncharged $0.0020\,\mathrm{F}$ capacitor is connected to a $6.0\,\mathrm{V}$ battery via a $9.0\,\Omega$ resistor. How much charge has entered the capacitor after the first $0.020\,\mathrm{s}$?

Gameboard:

STEM SMART Physics 34 - Exponentials in capacitors

Exponential Decay - Using Logarithms 35.9

A Level

P P P

The capacitor in a timer is charged quickly to a battery voltage of $5.3\,\mathrm{V}$. It then discharges through a resistor. The charge and the voltage drop to one third of their initial value in ten seconds.

How long does it take the capacitor voltage to fall from the original value to $2.56\,\mathrm{V}$?