

Model Answer

Physics and the Art of Scientific Modeling

Module C – RC Circuits

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Q.C.02(a)

Parameters	Variables	Step 0	Step 1
$V \text{ (V)} = 5$	$t \text{ (}\mu\text{s)}$	$t^{\text{new}} = 0$	$t^{\text{new}} = t^{\text{old}} + \delta t$
$R \text{ (}\Omega\text{)} = 10$	$\delta q \text{ (}\mu\text{C)}$		$\delta q^{\text{new}} = i^{\text{old}} * \delta t$
$C \text{ (}\mu\text{F)} = 1$	$q \text{ (}\mu\text{C)}$	$q^{\text{new}} = 0$	$q^{\text{new}} = q^{\text{old}} + \delta q^{\text{new}}$
$\delta t \text{ (}\mu\text{s)} = 8$	$i \text{ (A)}$	$i^{\text{new}} = V/R - q^{\text{new}}/\tau$	$i^{\text{new}} = V/R - q^{\text{new}}/\tau$
$\tau \text{ (}\mu\text{s)} = R * C$			

Unit checks

$$\tau [=] (\Omega)(\mu\text{F}) = \left(\frac{\text{V}}{\text{A}}\right) \left(\frac{\mu\text{C}}{\text{V}}\right) = \frac{\mu\text{C}}{\frac{\text{C}}{\text{s}}} = \mu\text{s}$$

$$\delta q^{\text{new}} [=] (\text{A})(\mu\text{s}) = \left(\frac{\text{C}}{\text{s}}\right) (\mu\text{s}) = \mu\text{C}$$

$$i [=] \left(\frac{\text{V}}{\Omega}\right) + \left(\frac{\mu\text{C}}{\mu\text{s}}\right) = \text{A} + \text{A} = \text{A}$$

Q.C.02(b)

$t \text{ (}\mu\text{s)}$	$\delta q \text{ (}\mu\text{C)}$	$q \text{ (}\mu\text{C)}$	$i \text{ (A)}$
0		0	0.5
8	4	4	0.1
16	0.8	4.8	0.02



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