

7(a)	$V_C = V_R$
7(b)(i)	$C = Q / V$
	$= (7.2 \times 10^{-3}) / 12 \text{ (= } 6.0 \times 10^{-4} \text{ F)}$
	$= 600 \mu\text{F}$
7(b)(ii)	$R = V / I$
	$= 12 / (1.5 \times 10^{-3}) \text{ (= } 8000 \Omega)$
	$= 8.0 \text{ k}\Omega$
7(b)(iii)	$\tau = RC$
	$= 8000 \times 6.0 \times 10^{-4}$
	$= 4.8 \text{ s}$
7(c)	<i>Any two points from:</i> - charge and current are both (directly) proportional to voltage - charge is (directly) proportional to current - current is the rate of change of charge
	Q is proportional to the rate of change of Q (so exponential variation)

6(a)(i)	conversion (from a.c.) to d.c.
6(a)(ii)	half-wave: voltage in one direction is removed
	full-wave: voltage in one direction is reversed
6(b)(i)	one gap connected by a single diode and other gap connected directly
	diode drawn (in a circuit) with correct circuit symbol
6(b)(ii)	smoothing
6(c)(i)	$E = \frac{1}{2}CV^2$
	$C = 2 \times 0.041 / 12^2 = 5.7 \times 10^{-4} \text{ F} = 570 \mu\text{F}$
6(c)(ii)	$8.0 = 12.0 \exp(-0.010 / RC)$
	$\ln(8.0 / 12.0) = -0.010 / (R \times 5.7 \times 10^{-4})$
	$R = 43 \Omega$

6(a)	- p.d. across capacitor proportional to charge on capacitor - p.d. across capacitor = p.d. across resistor - current in resistor proportional to p.d. across resistor - current in resistor = rate of decrease of charge on capacitor <i>Any two points, 1 mark each</i>
	charge proportional to current so rate of decrease of current decreases as current decreases (therefore exponential shape)
6(b)(i)	$R = V / I$ $= 12 / (0.13 \times 10^{-3})$
	$= 9.2 \times 10^4 \Omega$
6(b)(ii)	correct read-off of at least one pair of values for I and t
	attempted read-off of t when $I = 0.048 \text{ mA}$
	or
	substitution of a correct pair of values of I and t into $I = 0.13 \exp(-t / \tau)$
6(c)	$\tau = RC$
	$C = \tau / R = 4.3 / (9.2 \times 10^4)$
	$= 4.7 \times 10^{-5} \text{ F}$

5(a)(i)	correct circuit symbol for a diode shown correctly connected in series with the wires leading into and out of the dotted box
5(a)(ii)	smoothing / V_{OUT} is smoothed
5(b)(i)	frequency = $1 / 0.04$
	= 25 Hz
5(b)(ii)	$V = V_0 \exp(-t / RC)$ and $\tau = RC$ or $V = V_0 \exp(-t / \tau)$
	$3.25 = 5.50 \exp(-0.020 / \tau)$ leading to $\tau = 0.038 \text{ s}$
5(b)(iii)	$\tau = RC$
	capacitance = $0.038 / 14000$ $= 2.7 \times 10^{-6} \text{ F}$
5(c)	V_{IN} has constant magnitude in both positive and negative directions
	(so) V_{OUT} is (now) constant / V_{OUT} does not vary with time