1. a) Sup de cada cavidad $-q$. Superficie externa Q'. Como

$$Q' - 2q = Q \Rightarrow Q' = Q + 2q$$

b) $\vec{E}_{(\vec{r})} = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}\hat{r}$, para $0 < r < R$

c) $V_{(r)} = \frac{q}{4\pi\varepsilon_0 r} + cte$ como $V_{(R)} = V = \frac{q}{4\pi\varepsilon_0 R} + cte$,

$$cte = V - \frac{q}{4\pi\varepsilon_0 R} \Rightarrow V_{(r)} = \frac{q}{4\pi\varepsilon_0}\left(\frac{1}{r} - \frac{1}{R}\right) + V$$

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2. a) Si θ aumenta, el flujo aumenta
la corriente hace que el flujo disminuya
(Ley de Lenz), $\Rightarrow$ i en sentido horario (fig. izq)

b) Area $= \frac{1}{2}a^2\theta = \frac{1}{2}a^2\omega t \Rightarrow \Phi = \frac{1}{2}a^2\omega t B$; $\mathcal{E} = -\frac{d\Phi}{dt} = -\frac{1}{2}a^2\omega B$

$$|\mathcal{E}| = Ri \Rightarrow \boxed{i = \frac{\frac{1}{2}a^2\omega B}{R} = \frac{1}{2}\frac{a^2\omega B}{R}} \text{ (en el sentido indicado)}$$

c) $dF = \left|i\,d\vec{\ell} \wedge \vec{B}\right| = i\,B\cdot d\ell$

$dM = iB\cdot\ell\, d\ell \Rightarrow$

$$\boxed{M = iB\int_0^a \ell\, d\ell = iB\frac{a^2}{2} = \frac{1}{2}\frac{a^2\omega B}{R}\frac{Ba^2}{2} = \frac{1}{4}\frac{B^2a^4}{R}\omega}$$

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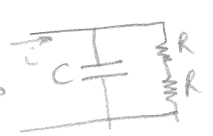
3. a) i)

$\Rightarrow i = \frac{V_0}{R} = \frac{10}{10^3} = 10\,mA$

ii)



$\Rightarrow i = \frac{V_0}{2R} = \frac{10}{2\times10^3} = 5\,mA$

b) i) $Z = \frac{R\left(R + \frac{1}{j\omega C}\right)}{R + R + \frac{1}{j\omega C}} = \frac{R(j\omega CR + 1)}{2Rj\omega C + 1}$; $|Z| = \frac{R\sqrt{1+(\omega CR)^2}}{\sqrt{1+(2\omega CR)^2}}$

$$i_{ef} = \frac{V_{ef}}{|Z|} = \frac{\frac{V_0}{\sqrt{2}}\sqrt{1+(2\omega CR)^2}}{R\sqrt{1+(\omega CR)^2}}$$

ii) $Z = \frac{2R\cdot\frac{1}{j\omega C}}{2R + \frac{1}{j\omega C}} = \frac{2R}{1 + 2Rj\omega C} \Rightarrow |Z| = \frac{2R}{\sqrt{1+(2\omega CR)^2}}$

$$i_{ef} = \frac{V_{ef}}{|Z|} = \frac{V_0}{\sqrt{2}}\frac{\sqrt{1+(2\omega CR)^2}}{2R}$$

c) $\frac{V_0}{\sqrt{2}R}\frac{\sqrt{1+(2\omega CR)^2}}{\sqrt{1+(\omega CR)^2}} = \frac{V_0}{\sqrt{2}}\frac{\sqrt{1+(2\omega CR)^2}}{2R}$; $\sqrt{1+(\omega CR)^2} = 2$

$(\omega CR)^2 = 3$; $\omega CR = \sqrt{3}$; $\omega = \frac{\sqrt{3}}{10^{-6}\times10^3} = \sqrt{3}\times10^3\ rad/s = 1732\ rad/s$

$= 276\ Hz$