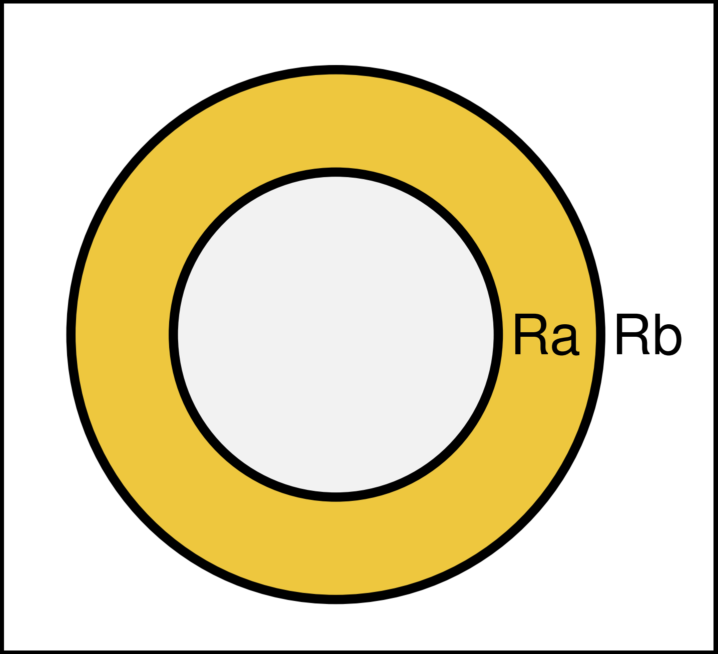
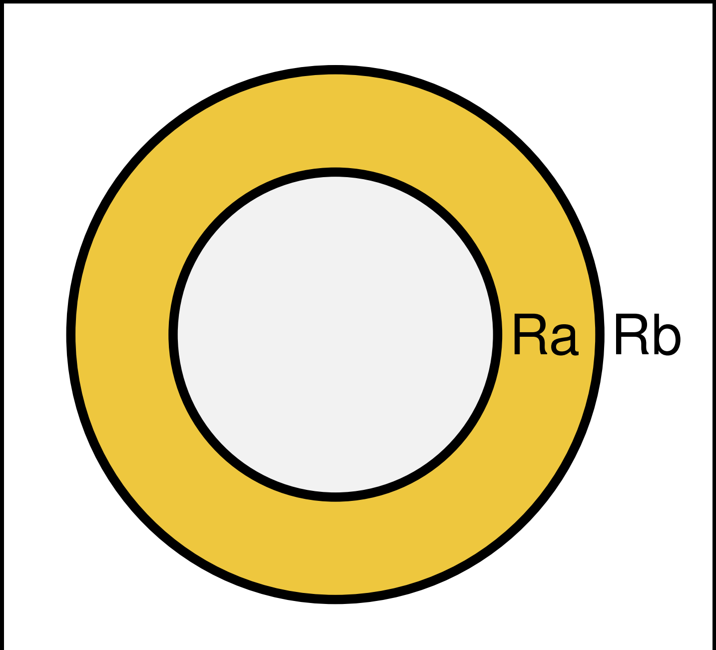
Sphère métallique de rayon R_a, charge totale Q_0,
couche diélectrique (lhi, ϵ) d'épaisseur $R_b - R_a$



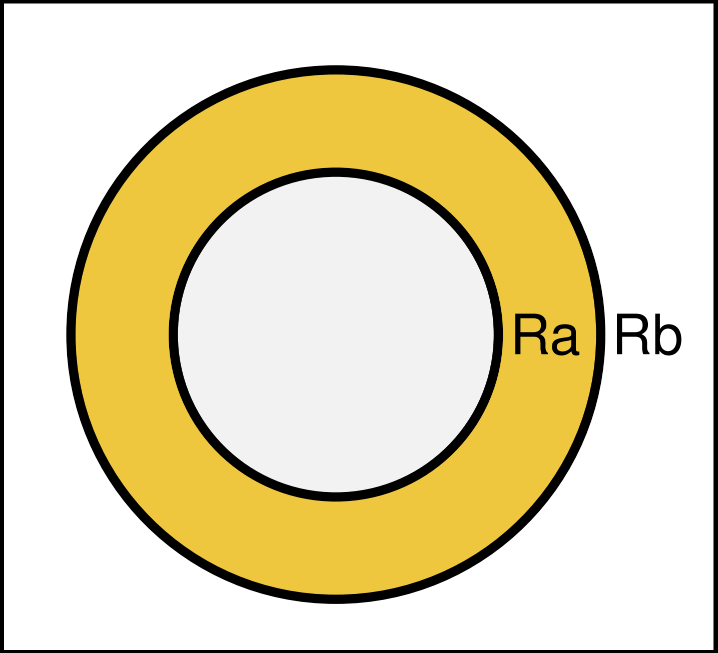
Quelle densité de charges pour ce problème ?

Sphère métallique de rayon R_a, charge totale Q_0, couche diélectrique (lhi, ϵ) d'épaisseur $R_b - R_a$

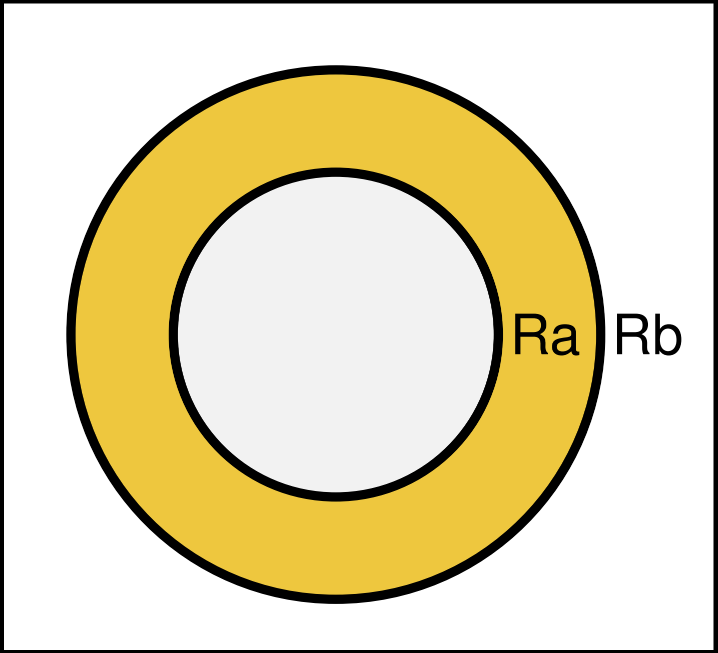


Quelle densité de charges pour ce problème ?

A. $\rho_s = Q_0/(4\pi R_a^2)$
B. $\rho = Q_0/(\frac{4}{3}\pi R_a^3)$
C. $\rho_s = Q_0/(4\pi R_b^2)$
D. $\rho = Q_0(\frac{4}{3}\pi R_b^3)$
E. Aucune bonne réponse.

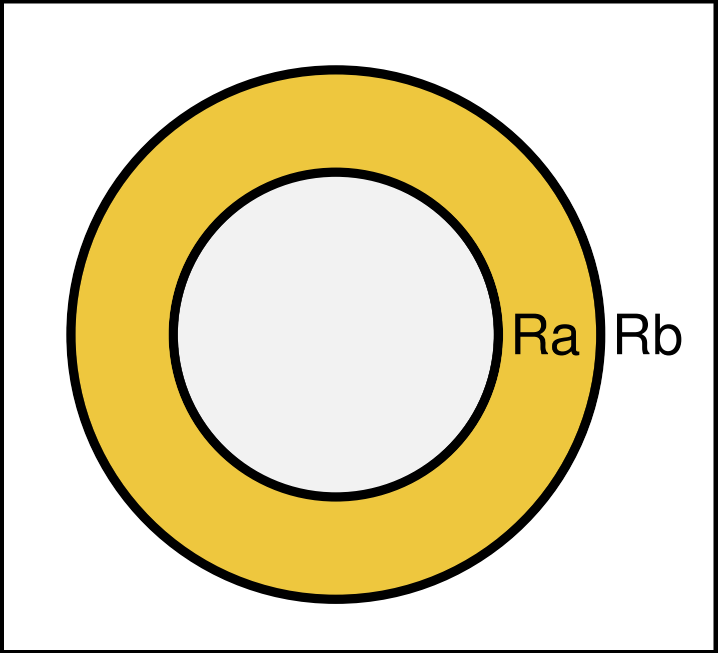


Comment démarrer pour arriver au champ $\vec{E}$?

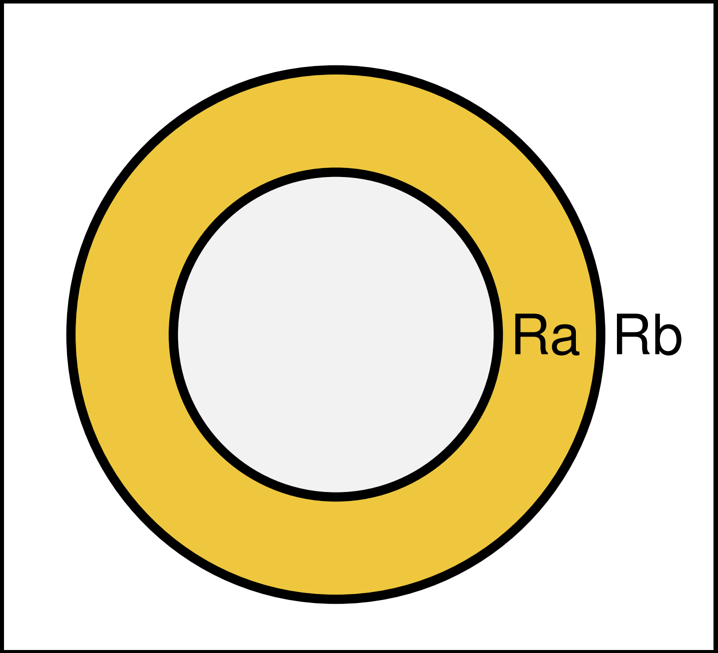


Comment démarrer pour arriver au champ $\vec{E}$?

A. Loi de Gauss intégrale sur $\vec{E}$.
B. Loi de Gauss intégrale sur $\vec{D}$.
C. Loi de Gauss locale sur $\vec{E}$.
D. Loi de Gauss locale sur $\vec{D}$.
E. Trouver les charges de polarisation à partir de $\vec{P}$.

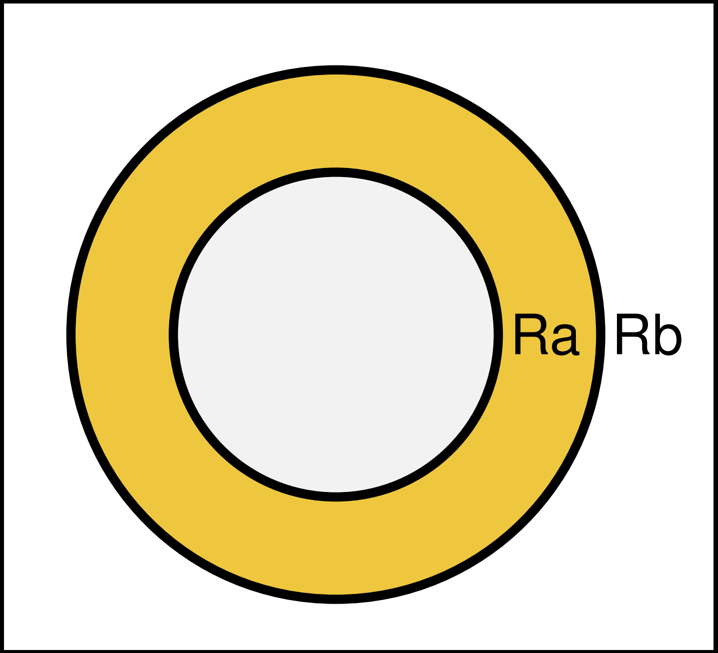


Que déduire des symmétries du problème ?

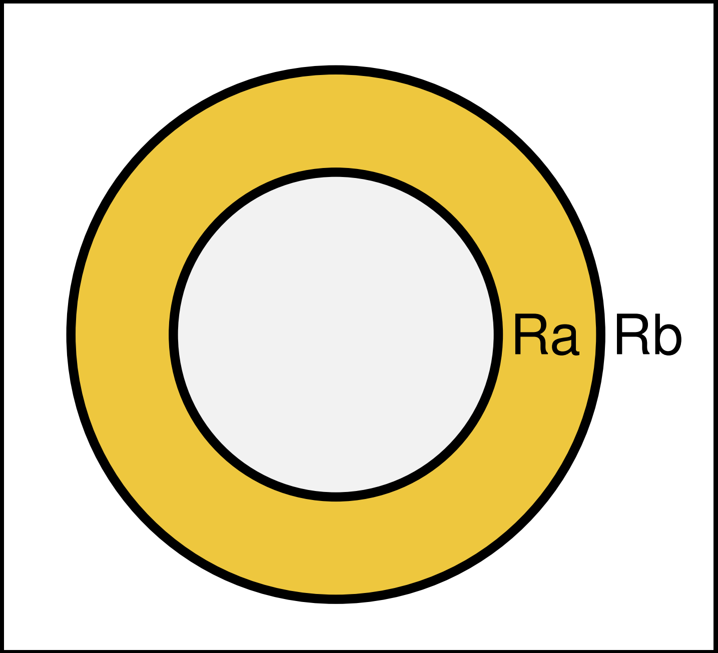


Que déduire des symmétries du problème ?

A. $\vec{\boldsymbol{D}}(\vec{\boldsymbol{r}}) = \vec{\boldsymbol{D}}(r)\hat{\boldsymbol{e}}_{\boldsymbol{r}}$
B. $\vec{\boldsymbol{D}}(\vec{\boldsymbol{r}}) = D(\vec{\boldsymbol{r}})\hat{\boldsymbol{e}}_{\boldsymbol{r}}$
C. $\vec{\boldsymbol{D}}(\vec{\boldsymbol{r}}) = D(\hat{\boldsymbol{r}})\hat{\boldsymbol{e}}_{\boldsymbol{r}}$
D. $\vec{\boldsymbol{D}}(\vec{\boldsymbol{r}}) = D(r)\hat{\boldsymbol{e}}_{\boldsymbol{r}}$

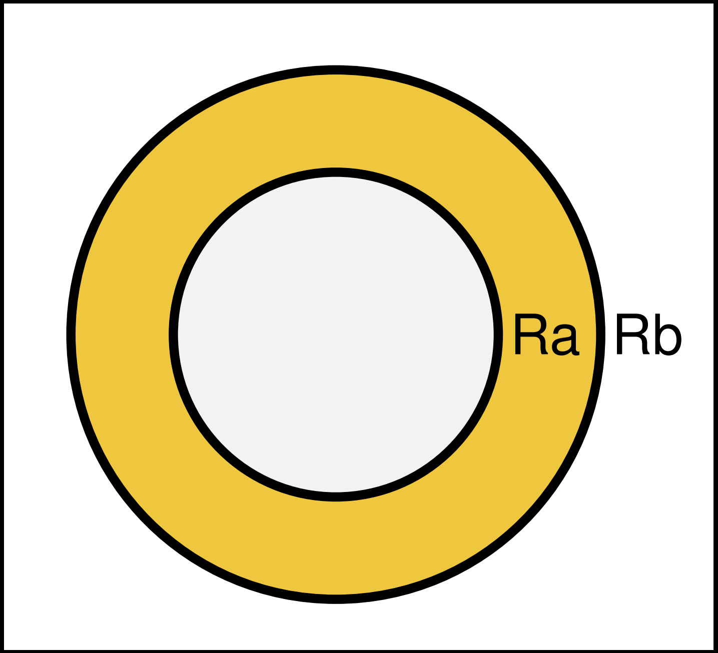


Quelle surface fictive S pour appliquer la loi de Gauss intégrale ?

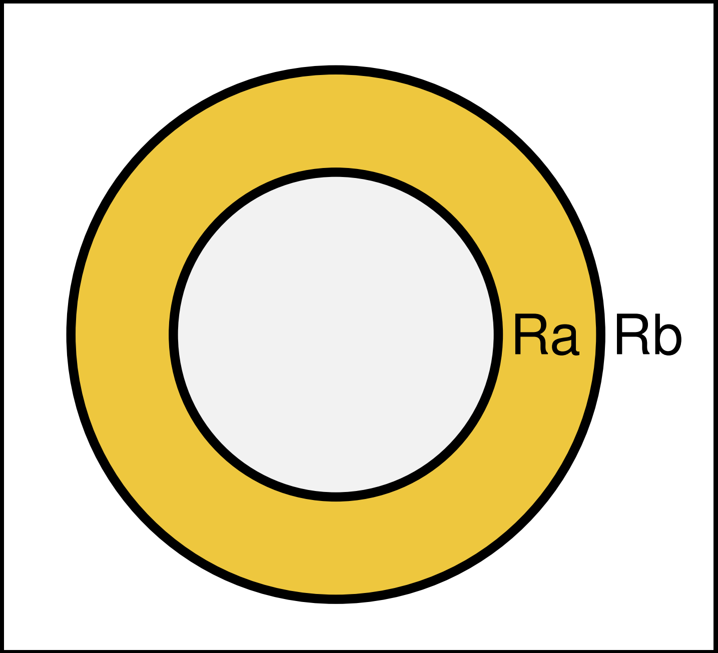


Quelle surface fictive S pour appliquer la loi de Gauss intégrale ?

A. Un cube.
B. Un cylindre.
C. Une sphère.
D. Peu importe, à condition d'avoir une surface fermée.

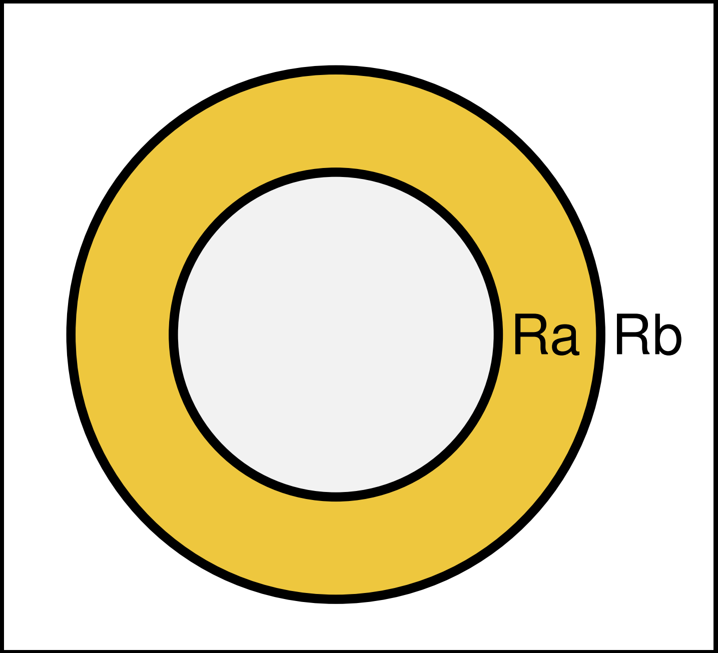


Quel rayon pour la sphère fictive S ?

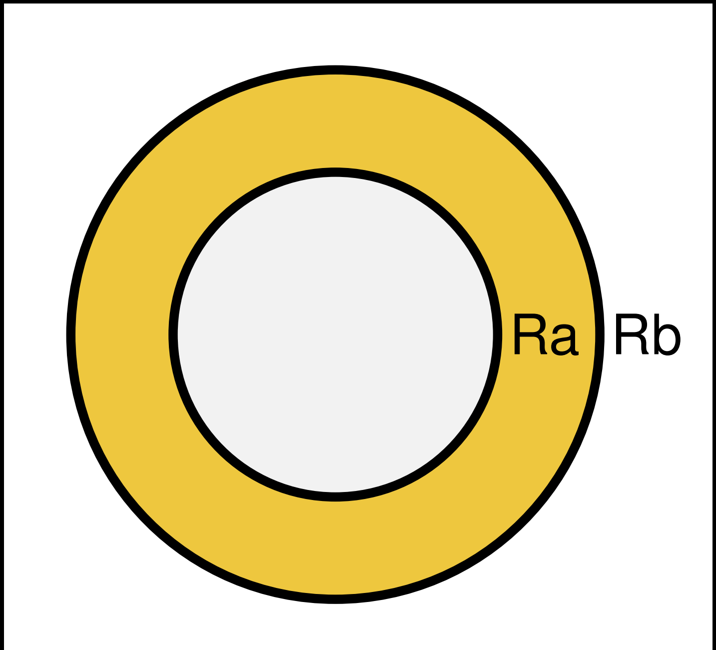


Quel rayon pour la sphère fictive S ?

A. R_a
B. R_b
C. R_g
D. ρ
E. r

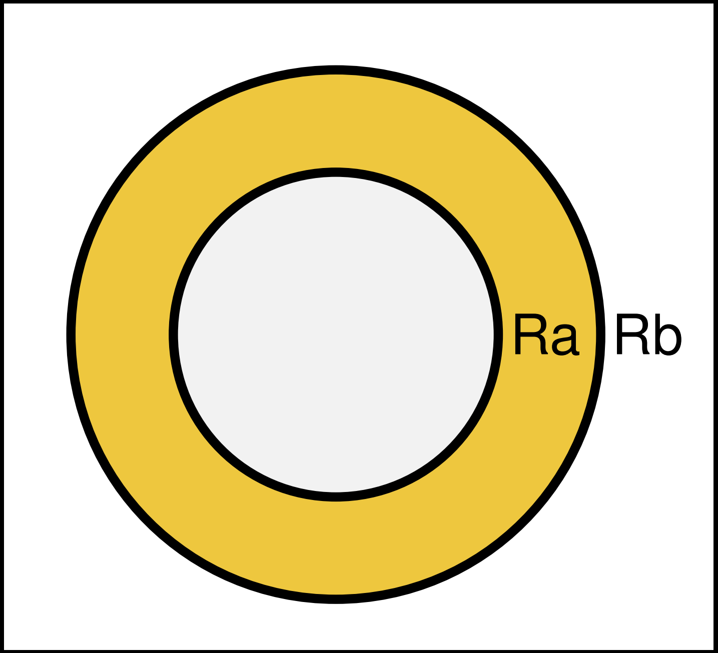


Quel est le flux de $\vec{D}$ à travers S ?



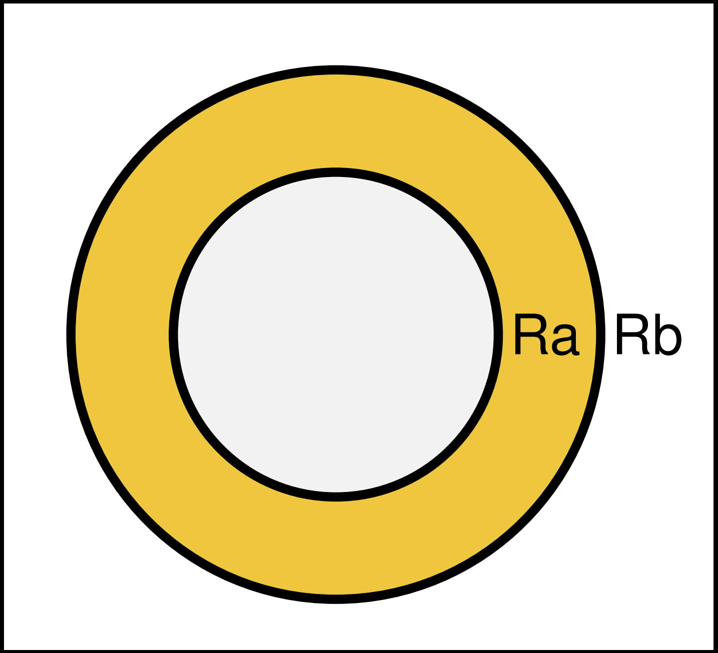
Quel est le flux de $\vec{\boldsymbol{D}}$ à travers S ?

$\oint_S \vec{\boldsymbol{D}}(\vec{\boldsymbol{r}}) \cdot \hat{\boldsymbol{n}}\, \mathrm{d}S =$



Quel est le flux de $\vec{\boldsymbol{D}}$ à travers S ?

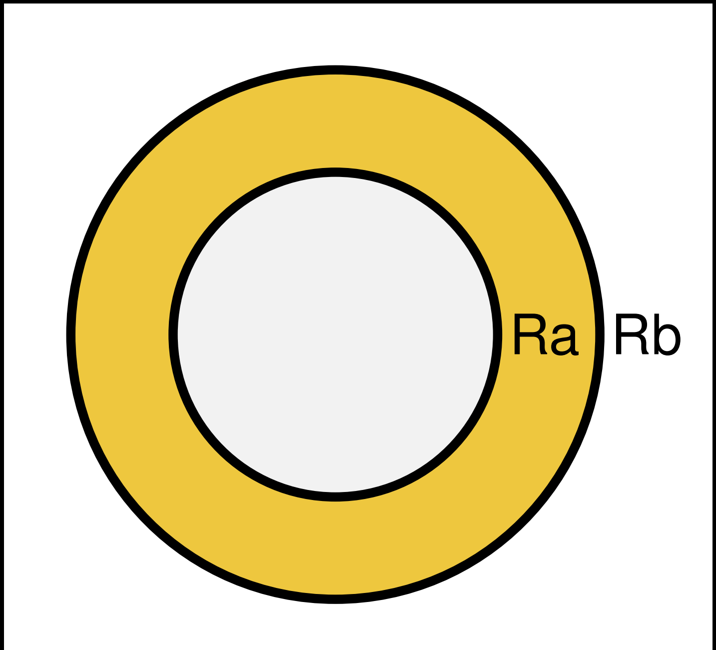
$\oint_S \vec{\boldsymbol{D}}(\vec{\boldsymbol{r}}) \cdot \hat{\boldsymbol{n}} \, \mathrm{d}S = \oint_S D(r) \hat{\boldsymbol{e}}_{\boldsymbol{r}} \cdot \hat{\boldsymbol{e}}_{\boldsymbol{r}} \, \mathrm{d}S =$



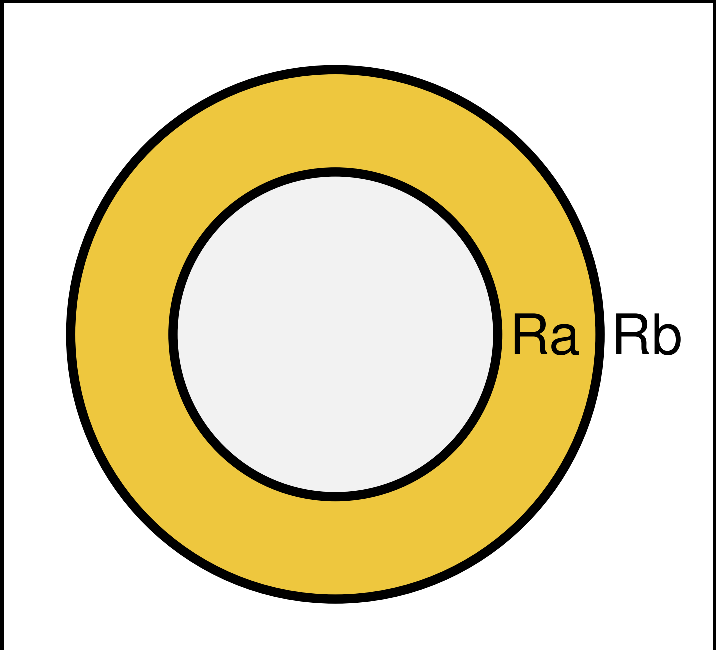
Quel est le flux de $\vec{\boldsymbol{D}}$ à travers S ?

$\oint_S \vec{\boldsymbol{D}}(\vec{\boldsymbol{r}}) \cdot \hat{\boldsymbol{n}} \, \mathrm{d}S = \oint_S D(r) \hat{\boldsymbol{e}}_{\boldsymbol{r}} \cdot \hat{\boldsymbol{e}}_{\boldsymbol{r}} \, \mathrm{d}S =$

A. $D(r) \oint_S \mathrm{d}S = D(r) 4\pi r^2$
B. $D(r) \oint_S \mathrm{d}S = D(r) 4\pi R_g^2$
C. $D(R_g) \oint_S \mathrm{d}S = D(R_g) 4\pi R_g^2$
D. $D(R_g) \oint_S \mathrm{d}S = D(R_g) \frac{4}{3}\pi R_g^3$
E. $D(R_g) \oint_S \mathrm{d}S = D(R_g) 2\pi R_g$

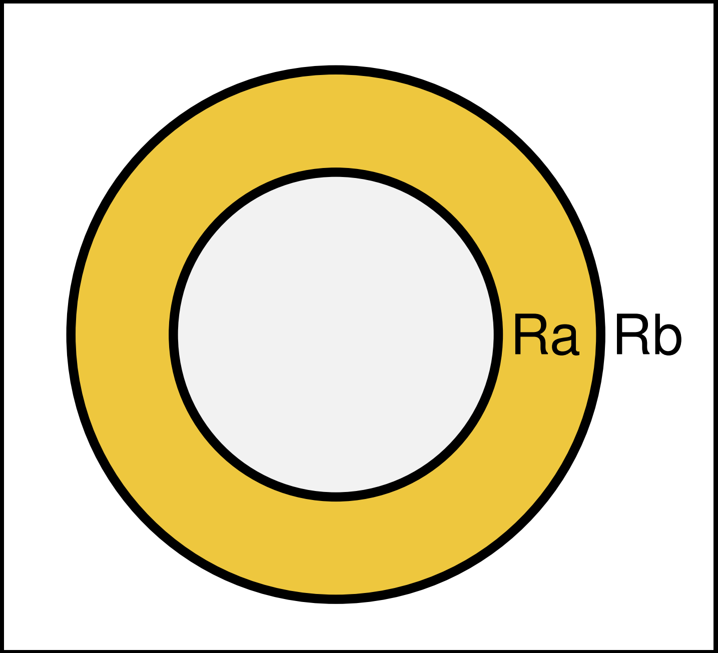


Quelle charge $Q_{\text{int libres}}$ dans les trois cas
i. $R_g < R_a$, ii. $R_a < R_g < R_b$ iii. $R_b < R_g$?

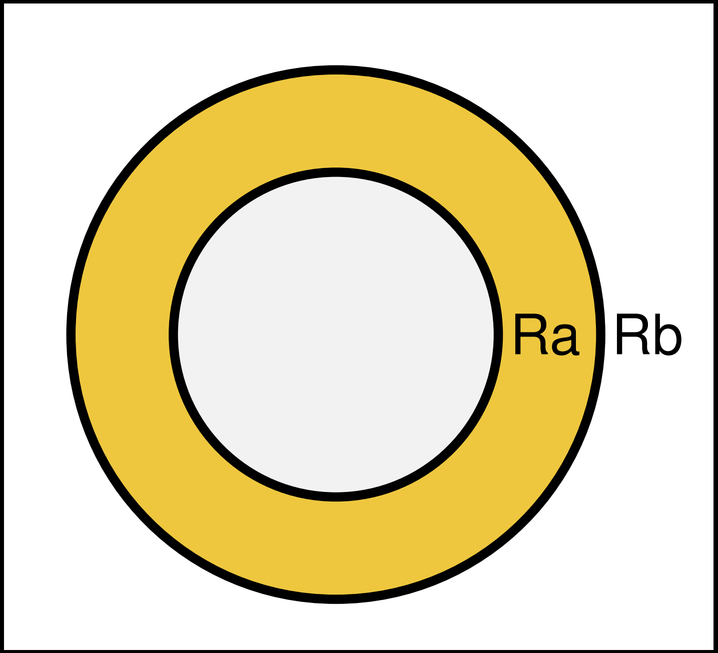


Quelle charge $Q_{\text{int libres}}$ dans les trois cas
i. $R_g < R_a$, ii. $R_a < R_g < R_b$ iii. $R_b < R_g$?

A. 0, 0, 0
B. 0, 0, Q_0
C. 0, Q_0, 0
D. Q_0, 0, 0
E. 0, Q_0, Q_0
F. Q_0, 0, Q_0
G. Q_0, Q_0, 0
H. Q_0, Q_0, Q_0
I. Aucune bonne réponse.

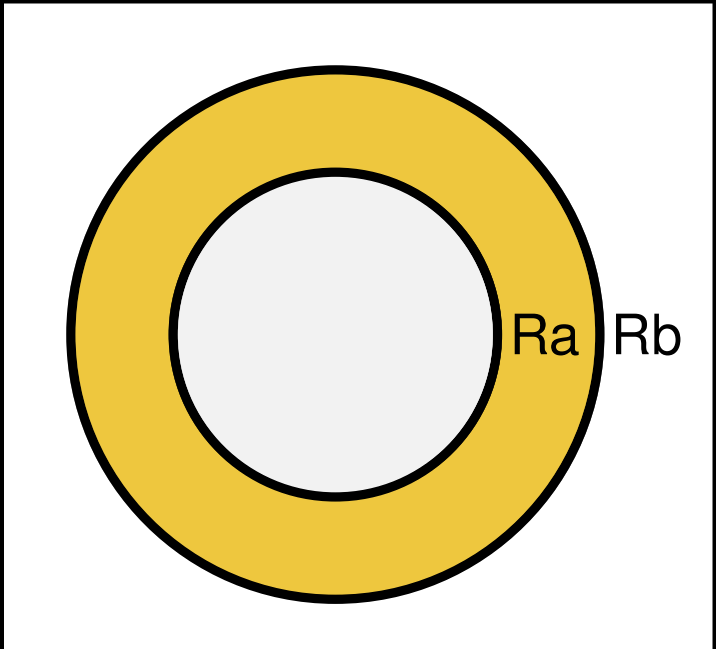


$$\vec{D} = \epsilon\vec{E} = \epsilon_0\epsilon_r\vec{E}$$



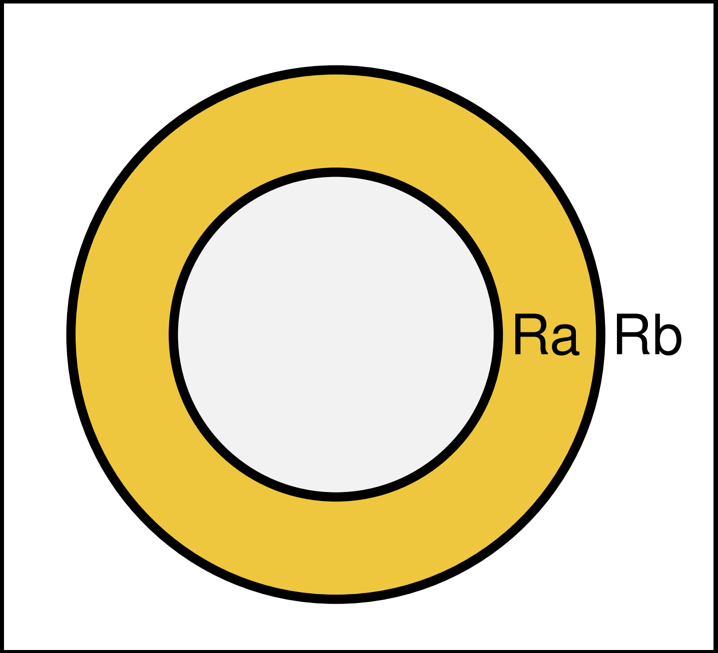
$$\vec{\boldsymbol{D}} = \epsilon \vec{\boldsymbol{E}} = \epsilon_0 \epsilon_r \vec{\boldsymbol{E}}$$

$$\vec{\boldsymbol{D}}(\vec{\boldsymbol{r}}) = \begin{cases} \vec{\mathbf{0}} & r < R_a \\ \frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} & R_a < r < R_b \\ \frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} & R_b < r \end{cases}$$

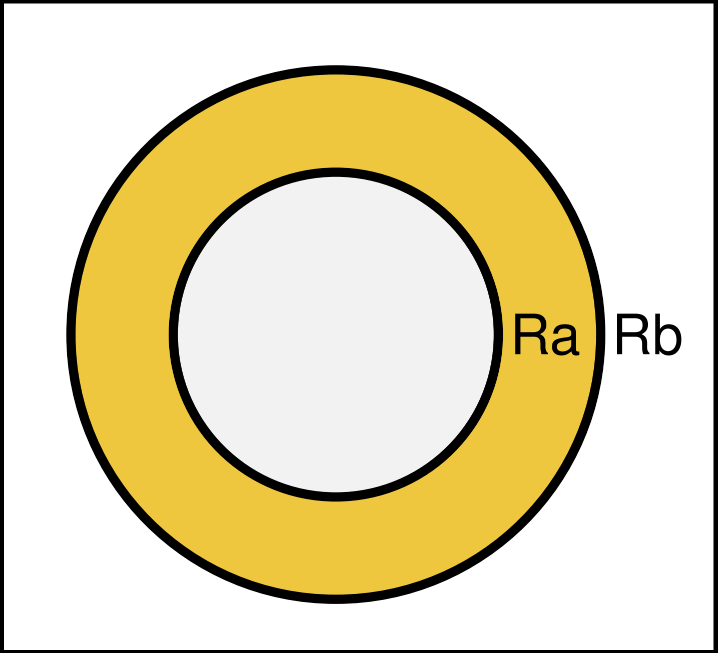


$$\vec{D} = \epsilon \vec{E} = \epsilon_0 \epsilon_r \vec{E}$$

$$\vec{D}(\vec{r}) = \begin{cases} \vec{0} & r < R_a \\ \frac{Q_0}{4\pi r^2} \hat{e}_r & R_a < r < R_b \\ \frac{Q_0}{4\pi r^2} \hat{e}_r & R_b < r \end{cases} \qquad \vec{E}(\vec{r}) = \begin{cases} \vec{0} & r < R_a \\ \frac{Q_0}{4\pi \epsilon_0 \epsilon_r r^2} \hat{e}_r & R_a < r < R_b \\ \frac{Q_0}{4\pi \epsilon_0 r^2} \hat{e}_r & R_b < r \end{cases}$$

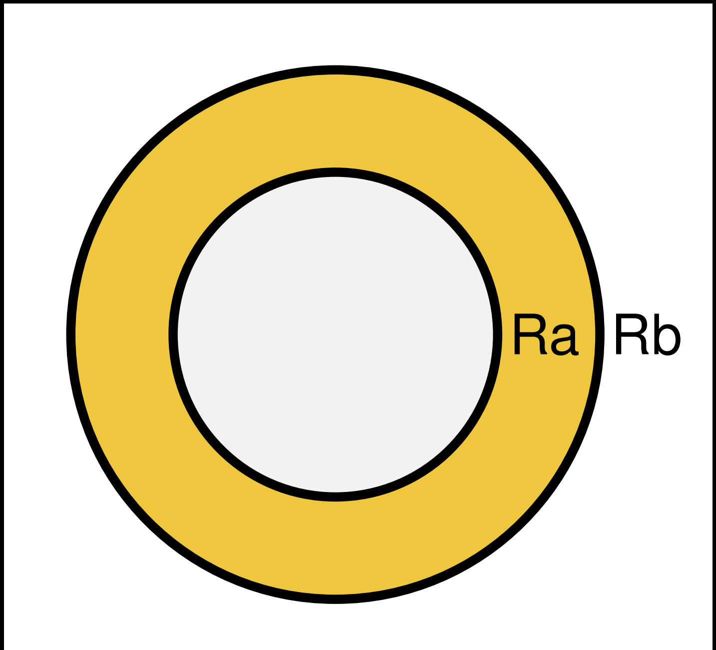


$$\vec{\boldsymbol{P}} = \epsilon_0 \chi_e \vec{\boldsymbol{E}}$$



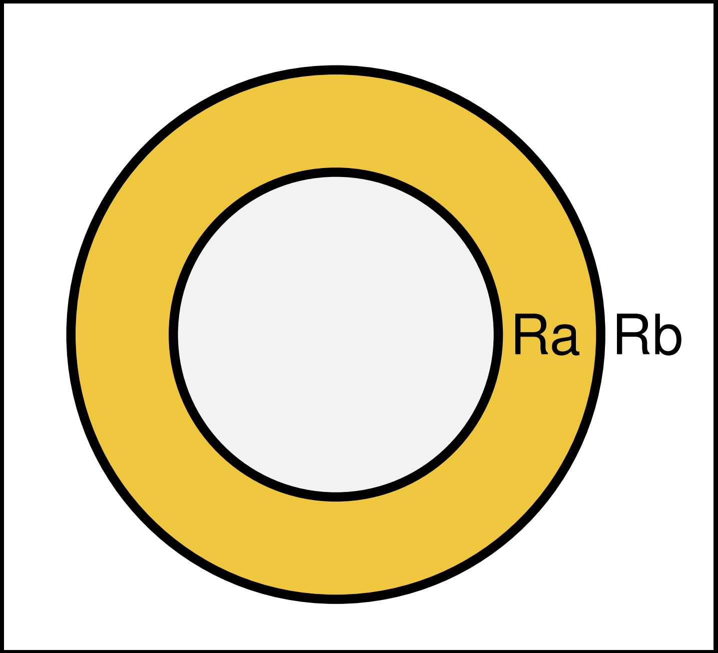
$$\vec{\boldsymbol{P}} = \epsilon_0 \chi_e \vec{\boldsymbol{E}}$$

$$\vec{\boldsymbol{E}}(\vec{\boldsymbol{r}}) = \begin{cases} \vec{\mathbf{0}} & r < R_a \\ \frac{Q_0}{4\pi\epsilon_0\epsilon_r r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} & R_a < r < R_b \\ \frac{Q_0}{4\pi\epsilon_0 r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} & R_b < r \end{cases}$$



$$\vec{\boldsymbol{P}} = \epsilon_0 \chi_e \vec{\boldsymbol{E}}$$

$$\vec{\boldsymbol{E}}(\vec{\boldsymbol{r}}) = \begin{cases} \vec{\mathbf{0}} & r < R_a \\ \frac{Q_0}{4\pi\epsilon_0\epsilon_r r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} & R_a < r < R_b \\ \frac{Q_0}{4\pi\epsilon_0 r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} & R_b < r \end{cases} \qquad \vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \begin{cases} \vec{\mathbf{0}} & r < R_a \\ \frac{\epsilon_0\chi_e Q_0}{4\pi\epsilon_0\epsilon_r r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} & R_a < r < R_b \\ ??? & R_b < r \end{cases}$$



$$\vec{\boldsymbol{P}} = \epsilon_0 \chi_e \vec{\boldsymbol{E}}$$

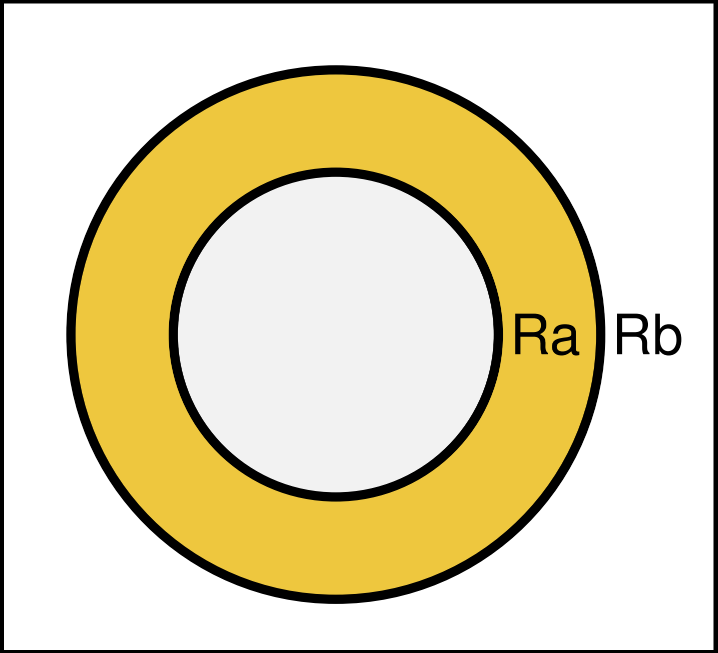
$$\vec{\boldsymbol{E}}(\vec{\boldsymbol{r}}) = \begin{cases} \vec{\mathbf{0}} & r < R_a \\ \frac{Q_0}{4\pi\epsilon_0\epsilon_r r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} & R_a < r < R_b \\ \frac{Q_0}{4\pi\epsilon_0 r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} & R_b < r \end{cases} \qquad \vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \begin{cases} \vec{\mathbf{0}} & r < R_a \\ \frac{\epsilon_0\chi_e Q_0}{4\pi\epsilon_0\epsilon_r r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} & R_a < r < R_b \\ ??? & R_b < r \end{cases}$$

A. $\frac{\epsilon_0\chi_e Q_0}{4\pi\epsilon_0 r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}}$

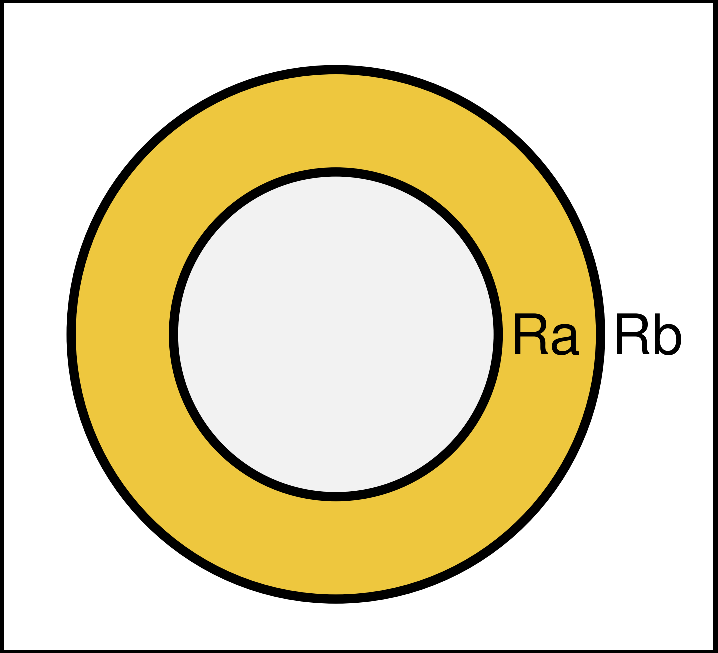
B. $\frac{\epsilon_r\chi_e Q_0}{4\pi\epsilon_0 r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}}$

C. $\vec{\mathbf{0}}$

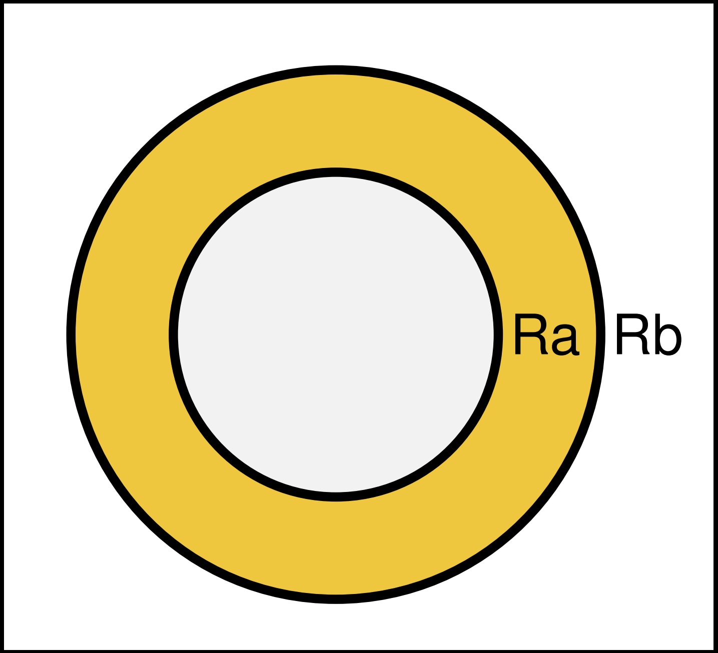
D. Aucune bonne réponse.



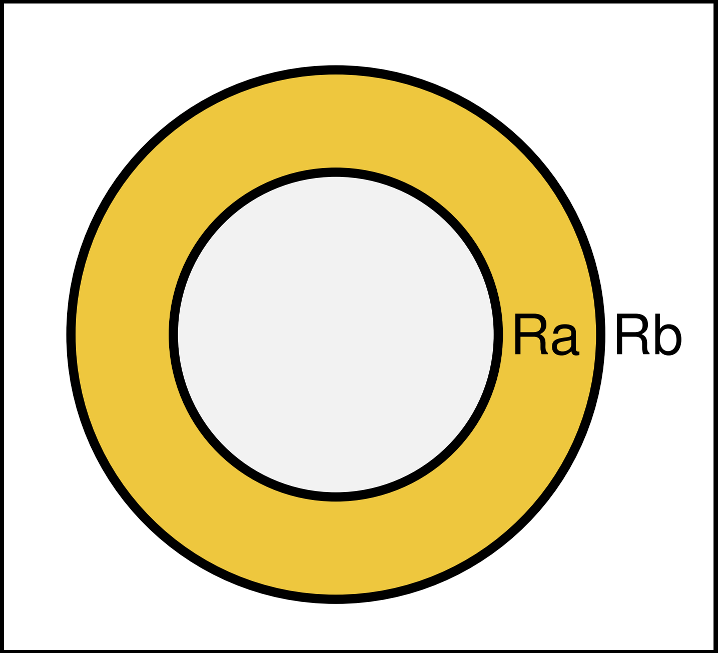
$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\epsilon_0 \chi_e Q_0}{4\pi\epsilon_0\epsilon_r r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}}$$



$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\epsilon_0 \chi_e Q_0}{4\pi\epsilon_0\epsilon_r r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}}$$

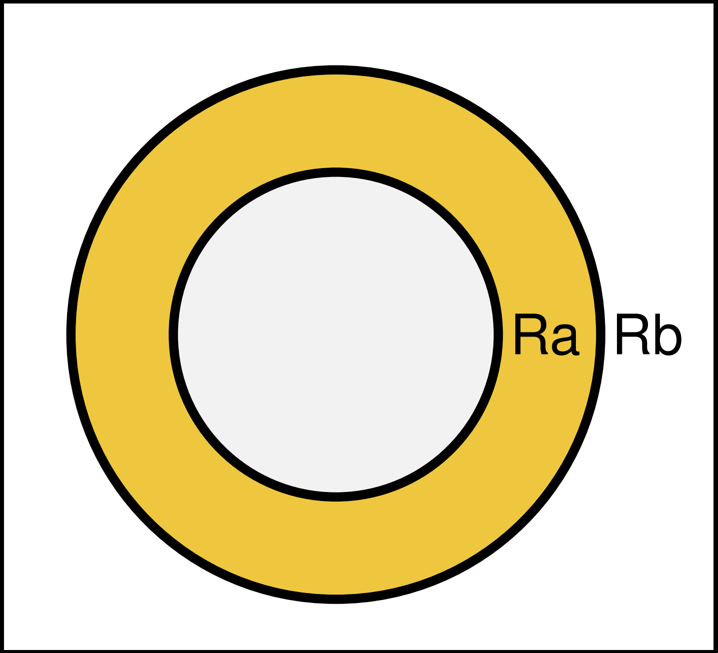


$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\epsilon_0 \chi_e Q_0}{4\pi\epsilon_0\epsilon_r r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$



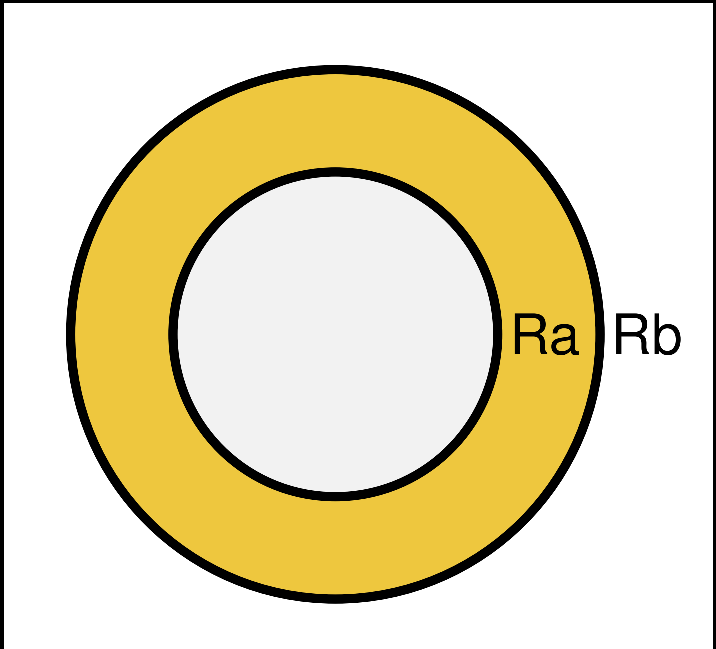
$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\epsilon_0 \chi_e Q_0}{4\pi\epsilon_0\epsilon_r r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$

$$\rho_{\text{pol}} =$$



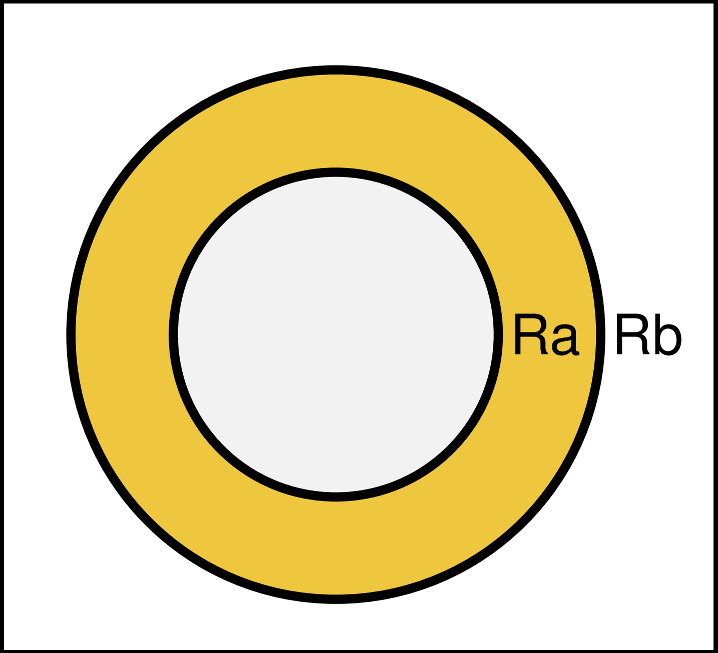
$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\epsilon_0 \chi_e Q_0}{4\pi\epsilon_0\epsilon_r r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$

$$\rho_{\mathsf{pol}} = -\mathsf{div}\vec{\boldsymbol{P}}$$

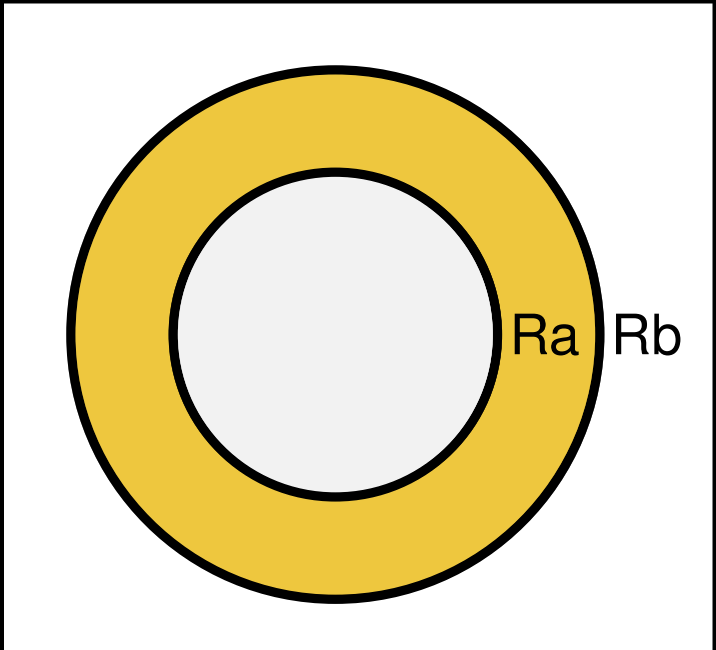


$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\epsilon_0 \chi_e Q_0}{4\pi\epsilon_0\epsilon_r r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$

$$\rho_{\text{pol}} = -\text{div}\vec{\boldsymbol{P}} = 0$$



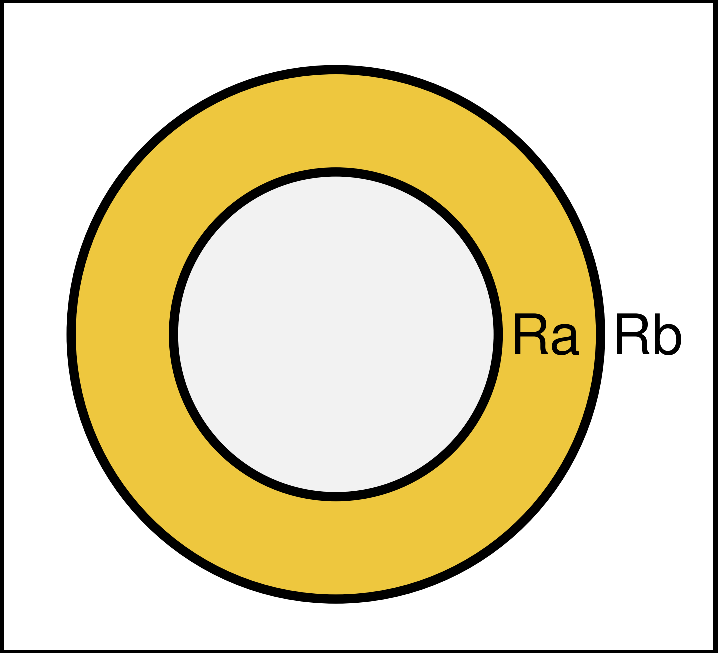
$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$



$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$

Quelle densité de charge surfacique de polarisation à R_b ?

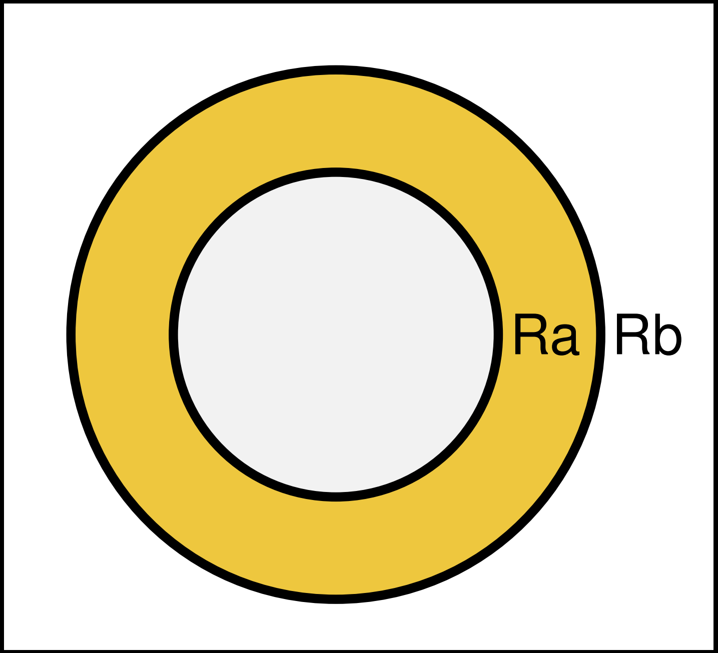
$\rho_{\text{s pol}} =$



$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$

Quelle densité de charge surfacique de polarisation à R_b ?

$\rho_{\text{s pol}} = \vec{\boldsymbol{P}} \cdot \hat{\boldsymbol{n}} =$



$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$

Quelle densité de charge surfacique de polarisation à R_b ?

$\rho_{\text{s pol}} = \vec{\boldsymbol{P}} \cdot \hat{\boldsymbol{n}} =$

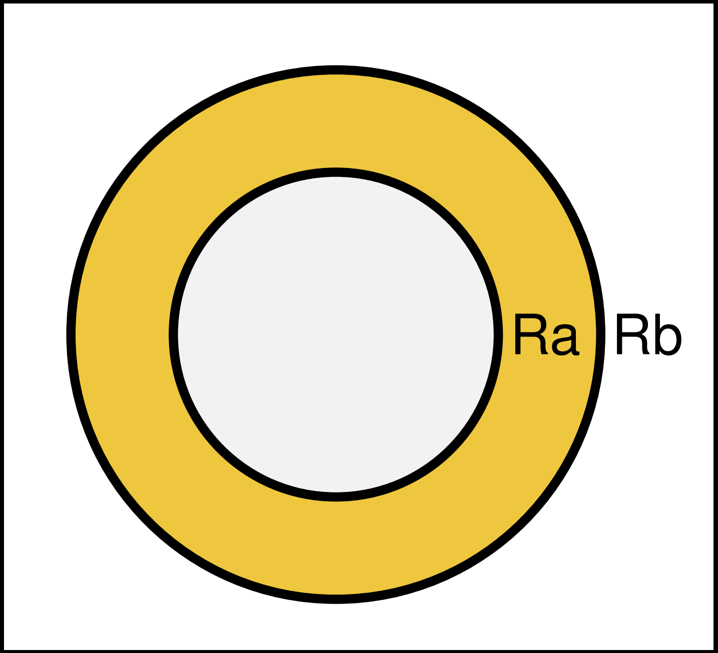
A. $\frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}$

B. $-\frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}$

C. $\frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}$

D. $-\frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}$

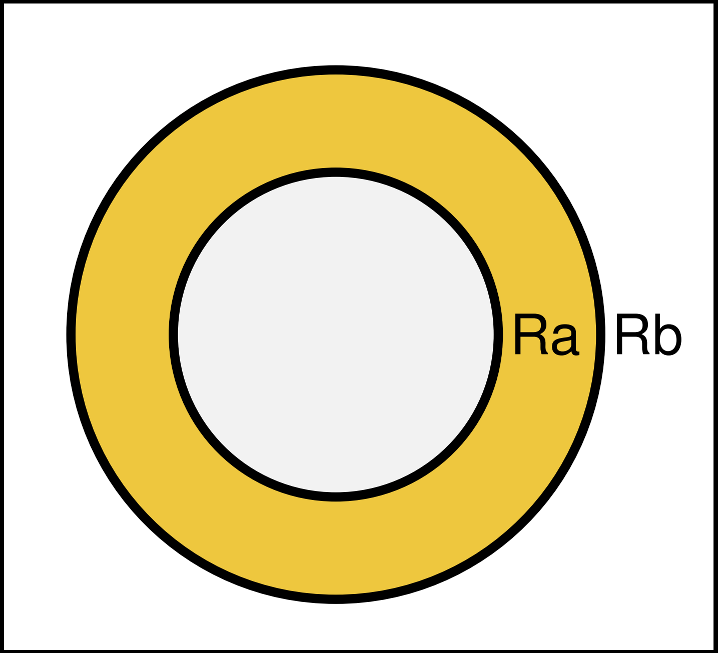
E. Aucune bonne réponse.



$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$

Quelle densité de charge surfacique de polarisation à R_a ?

$\rho_{\text{s pol}} = \vec{\boldsymbol{P}} \cdot \hat{\boldsymbol{n}} =$



$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$

Quelle densité de charge surfacique de polarisation à R_a ?

$\rho_{\text{s pol}} = \vec{\boldsymbol{P}} \cdot \hat{\boldsymbol{n}} =$

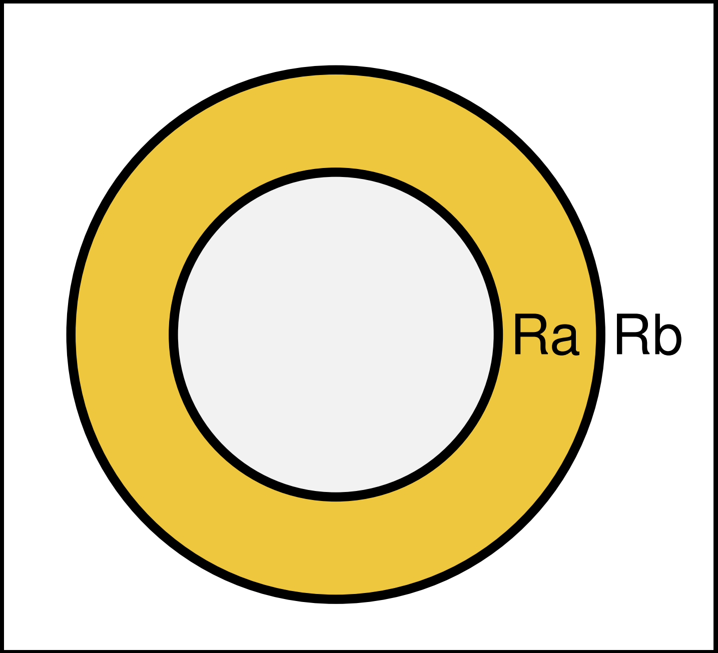
A. $\frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}$

B. $-\frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}$

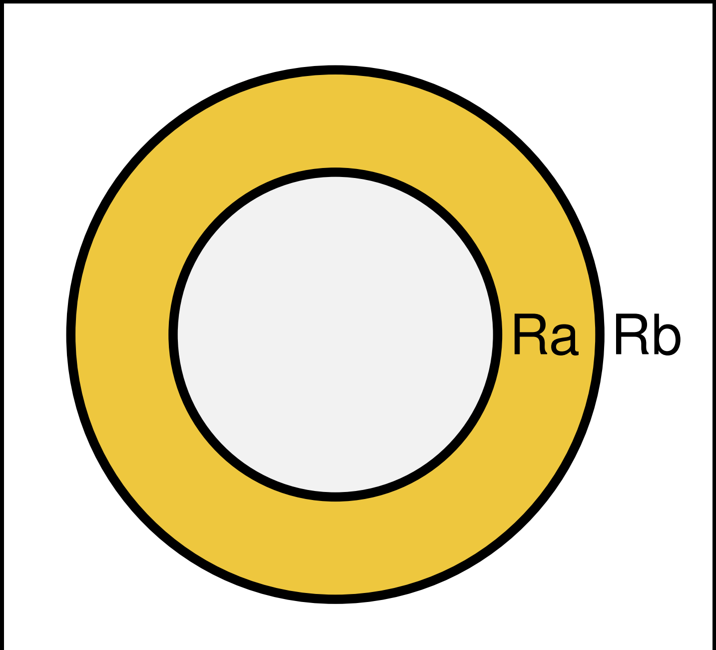
C. $\frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}$

D. $-\frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}$

E. Aucune bonne réponse.

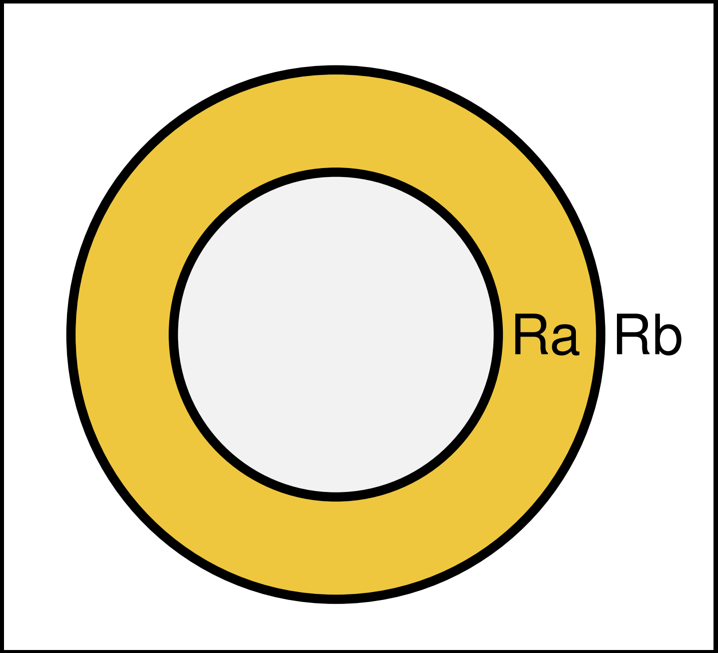


$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$



$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$

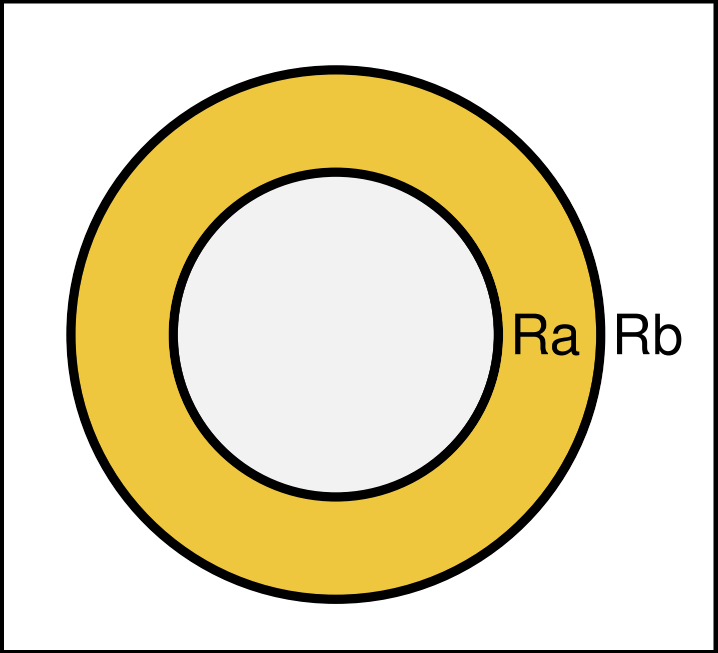
Quelles densités de charge pour ce problème ? Quelles charges ?



$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$

Quelles densités de charge pour ce problème ? Quelles charges ?

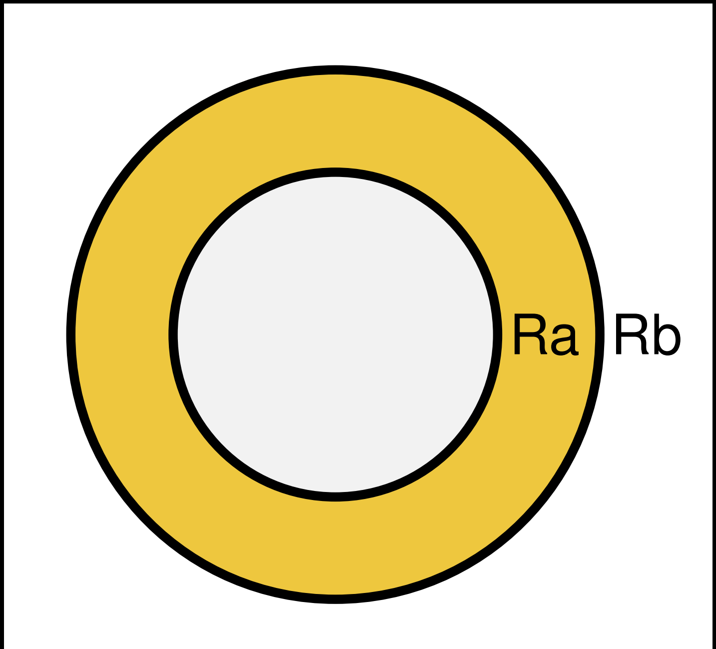
- à R_a : $\rho_s = \frac{Q_0}{4\pi R_a^2} + \left(-\frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}\right)$



$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$

Quelles densités de charge pour ce problème ? Quelles charges ?

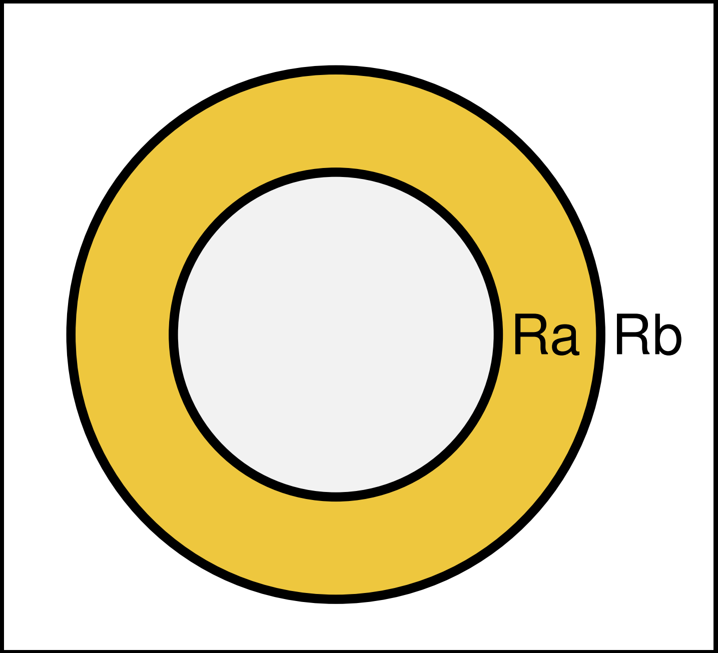
- à R_a : $\rho_s = \frac{Q_0}{4\pi R_a^2} + \left(-\frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}\right) = \frac{1}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}$



$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$

Quelles densités de charge pour ce problème ? Quelles charges ?

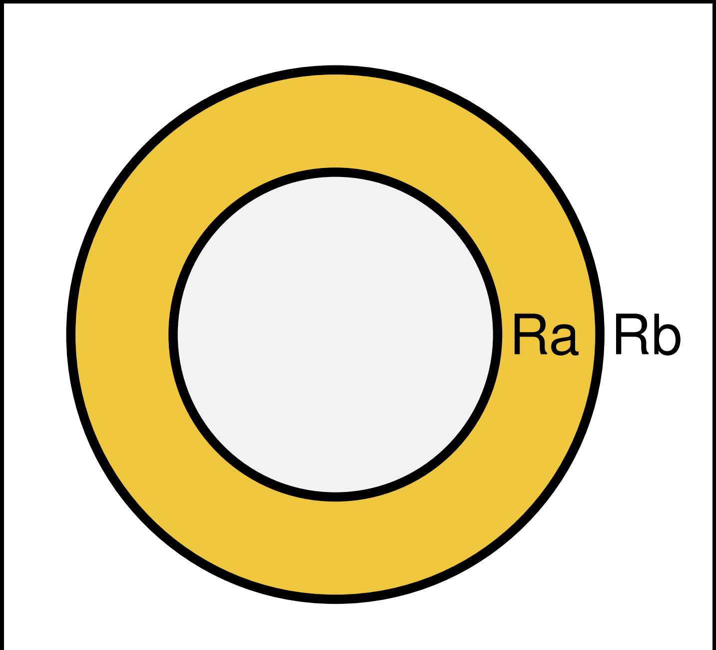
- à R_a : $\rho_s = \frac{Q_0}{4\pi R_a^2} + \left(-\frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}\right) = \frac{1}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}$
  $\Rightarrow Q_a = \int_S \rho_s \, \mathrm{d}S =$



$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$

Quelles densités de charge pour ce problème ? Quelles charges ?

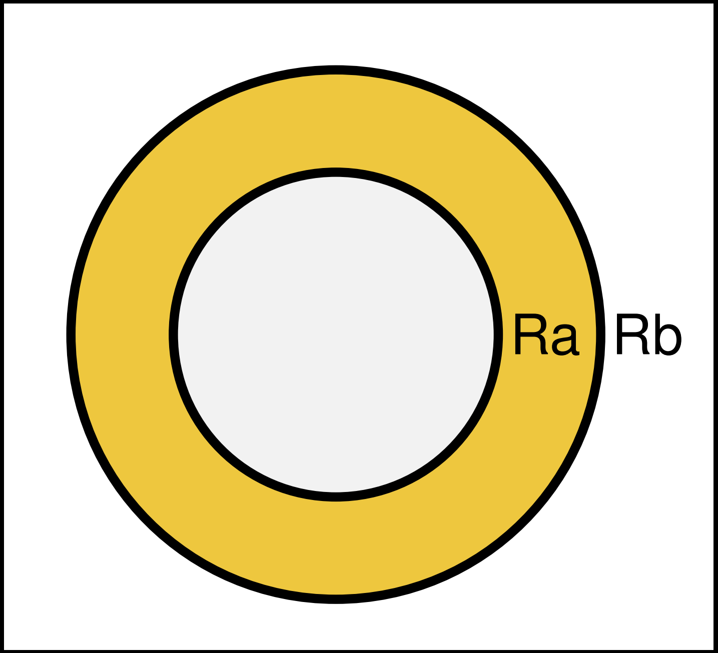
- à R_a : $\rho_s = \frac{Q_0}{4\pi R_a^2} + \left(-\frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}\right) = \frac{1}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}$
  $\Rightarrow Q_a = \int_S \rho_s \, \mathrm{d}S = \frac{1}{1+\chi_e} Q_0$



$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$

Quelles densités de charge pour ce problème ? Quelles charges ?

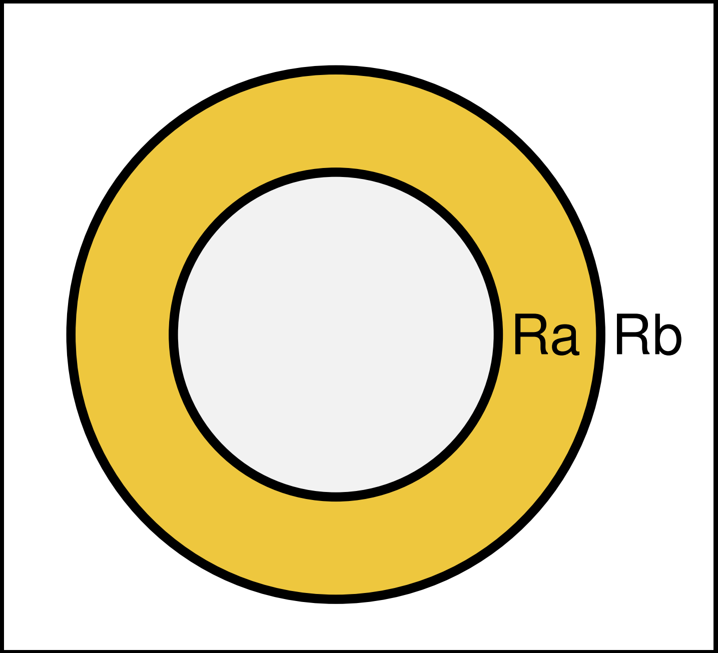
- à R_a : $\rho_s = \frac{Q_0}{4\pi R_a^2} + \left(-\frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}\right) = \frac{1}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}$
  $\Rightarrow Q_a = \int_S \rho_s \,\mathrm{d}S = \frac{1}{1+\chi_e}Q_0$
- à R_b : $\rho_s = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi R_b^2}$



$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$

Quelles densités de charge pour ce problème ? Quelles charges ?

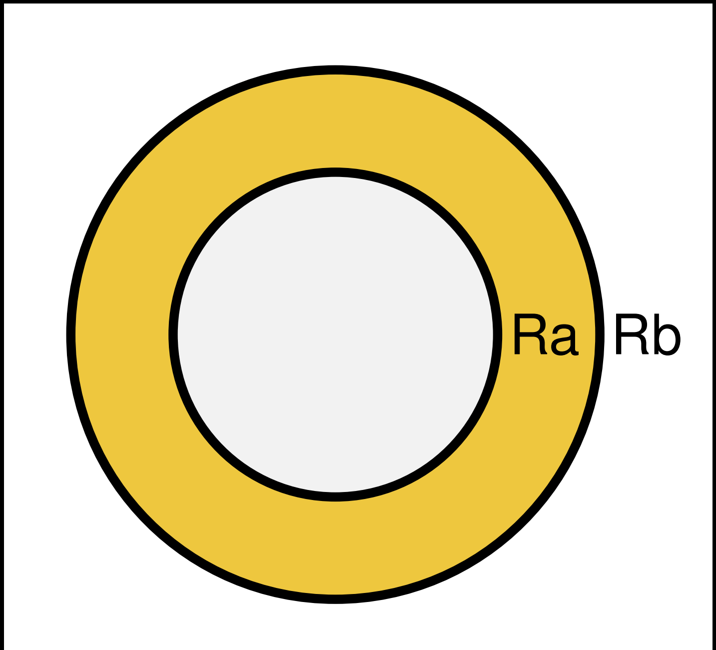
- à R_a : $\rho_s = \frac{Q_0}{4\pi R_a^2} + \left(-\frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}\right) = \frac{1}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}$
  $\Rightarrow Q_a = \int_S \rho_s \, \mathrm{d}S = \frac{1}{1+\chi_e}Q_0$
- à R_b : $\rho_s = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi R_b^2} \Rightarrow Q_b = \int_S \rho_s \, \mathrm{d}S =$



$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$

Quelles densités de charge pour ce problème ? Quelles charges ?

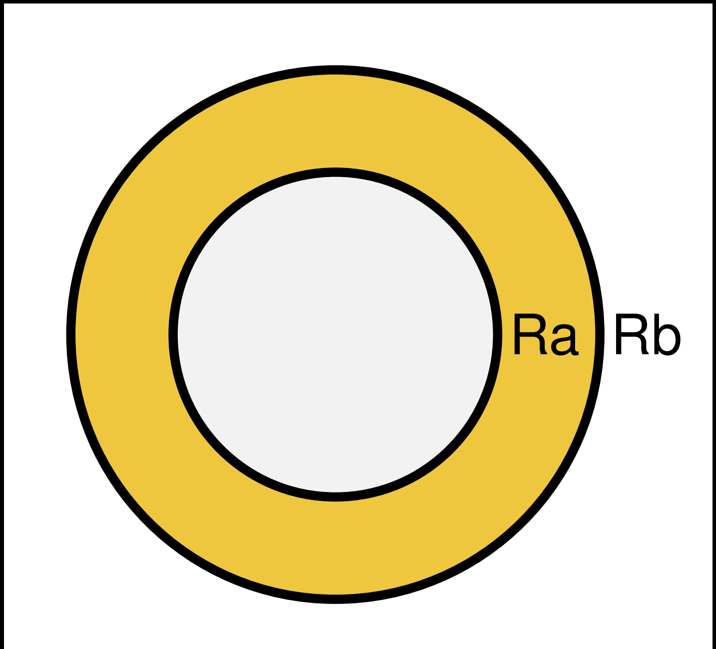
- à R_a : $\rho_s = \frac{Q_0}{4\pi R_a^2} + \left(-\frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}\right) = \frac{1}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}$
  $\Rightarrow Q_a = \int_S \rho_s \,\mathrm{d}S = \frac{1}{1+\chi_e}Q_0$
- à R_b : $\rho_s = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi R_b^2} \Rightarrow Q_b = \int_S \rho_s \,\mathrm{d}S = \frac{\chi_e}{1+\chi_e}Q_0$



$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$

Quelles densités de charge pour ce problème ? Quelles charges ?

- à R_a : $\rho_s = \frac{Q_0}{4\pi R_a^2} + \left(-\frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}\right) = \frac{1}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}$
  $\Rightarrow Q_a = \int_S \rho_s \,\mathrm{d}S = \frac{1}{1+\chi_e}Q_0$
- à R_b : $\rho_s = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi R_b^2} \Rightarrow Q_b = \int_S \rho_s \,\mathrm{d}S = \frac{\chi_e}{1+\chi_e}Q_0$
  $Q_a + Q_b =$



$$\vec{\boldsymbol{P}}(\vec{\boldsymbol{r}}) = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi r^2}\hat{\boldsymbol{e}}_{\boldsymbol{r}} \quad (R_a < r < R_b)$$

Quelles densités de charge pour ce problème ? Quelles charges ?

- à R_a : $\rho_s = \frac{Q_0}{4\pi R_a^2} + \left(-\frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}\right) = \frac{1}{1+\chi_e}\frac{Q_0}{4\pi R_a^2}$
  $\Rightarrow Q_a = \int_S \rho_s \,\mathrm{d}S = \frac{1}{1+\chi_e}Q_0$
- à R_b : $\rho_s = \frac{\chi_e}{1+\chi_e}\frac{Q_0}{4\pi R_b^2} \Rightarrow Q_b = \int_S \rho_s \,\mathrm{d}S = \frac{\chi_e}{1+\chi_e}Q_0$
  $Q_a + Q_b = Q_0$