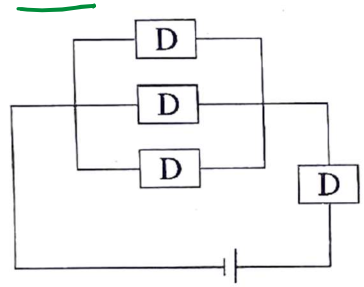
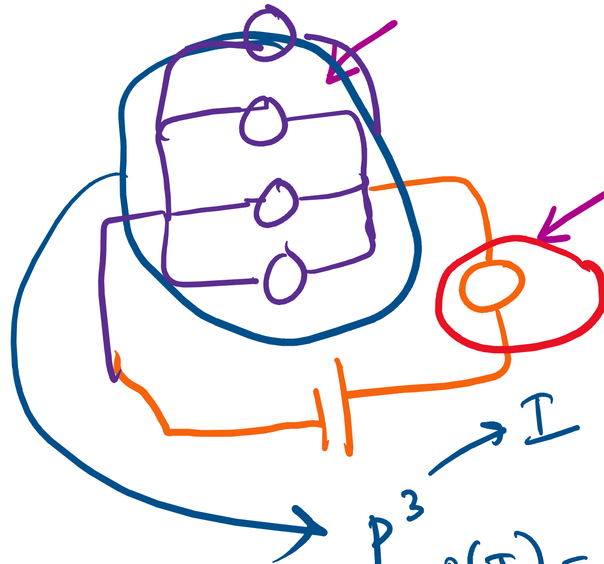
In the following circuit, each device D may be an insulator with probability p, or a conductor with probability $(1-p)$.

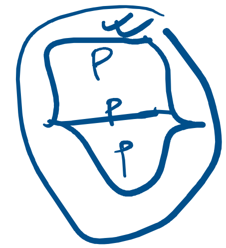


The probability that a non-zero current flows through the circuit is—

(A) $2-p-p^3$ (B) $(1-p)^4$

(C) $(1-p)^2p^2$ (D) $(1-p)(1-p^3)$ ✓





$P(I) = P$

$P(c) = (1-p)$

$p^3 \rightarrow I$

$P(I) = p^3$

$P(c) = 1 - p^3$

Total Probability $P = P_1(\ ) \cdot P_2(\ )$

$= (1-p^3)(1-p)$

The solution of the differential equation $x\frac{dy}{dx}+(1+x)y=e^{-x}$ with the boundary condition $y(x=1)=0$, is—

(A) $\frac{(x-1)}{x}e^{-x}$ (B) $\frac{(x-1)}{x^2}e^{-x}$

(C) $\frac{(1-x)}{x^2}e^{-x}$ (D) $(x-1)^2e^{-x}$

$$x\frac{dy}{dx}+(1+x)y=e^{-x}$$

$$\boxed{e^{\ln x}=x}$$

$$\frac{dy}{dx}+\left(\frac{1+x}{x}\right)y=\frac{e^{-x}}{x}$$

$$\frac{dy}{dx}+Py=Q$$

$$P=\frac{1+x}{x}$$

$$Q=\frac{e^{-x}}{x}$$

I.F

$$e^{\int P\,dx}=e^{\int\left(1+\frac{1}{x}\right)dx}=e^{\int\frac{dx}{x}}\cdot e^{\int dx}=e^{\ln x}\cdot e^{x}$$

$$=xe^{x}$$

$$y\cdot IF=\int Q\cdot I\,dx+c$$

$$y\cdot xe^{x}=\int\frac{e^{-x}}{x}\cdot xe^{x}\,dx+c$$

$$ye^{x}\cdot x=x+c$$

$$\boxed{y=0 \text{ at } x=1}$$

$$y\cdot 1=1+c$$

$$0=1+c\Rightarrow c=-1$$

$$yxe^{x}=x-1$$

$$y=\left[\frac{x-1}{x}\right]e^{-x}$$

http://bit.ly/PhysicsPlus