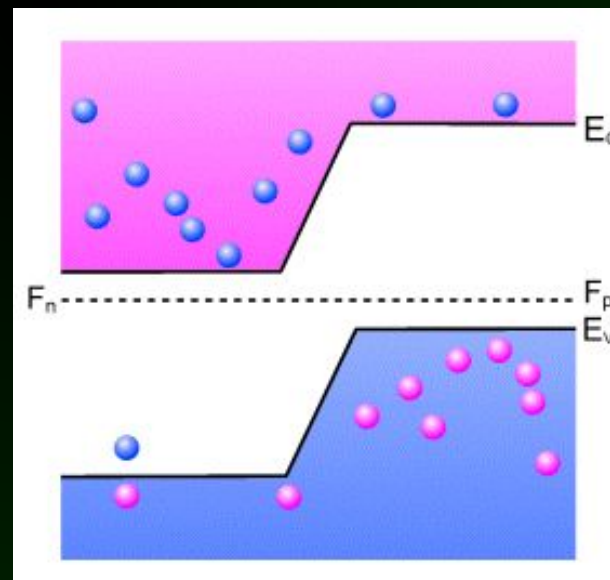
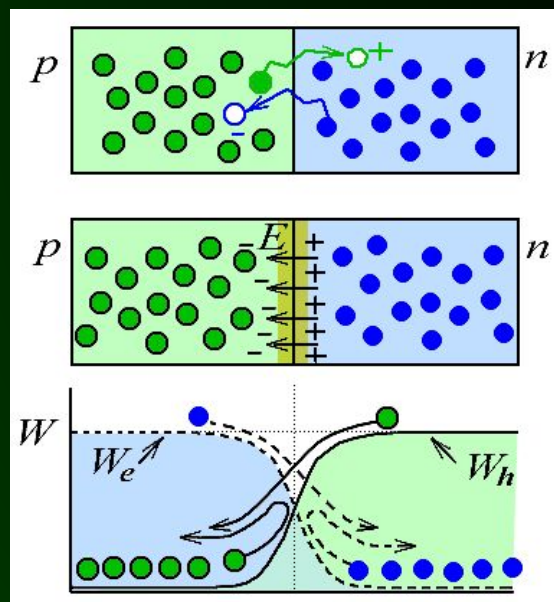
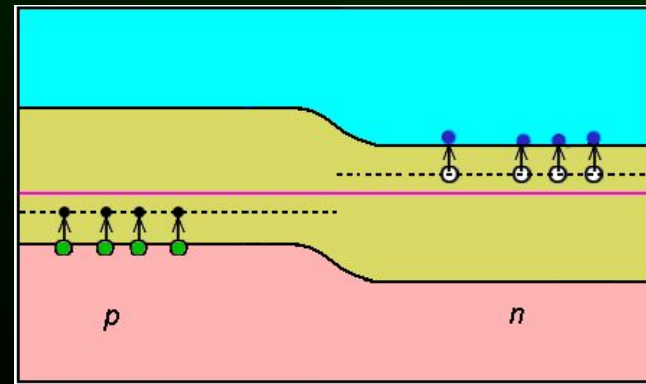
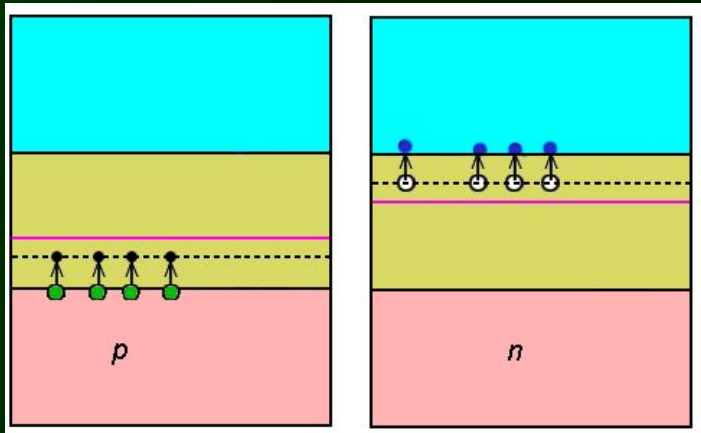
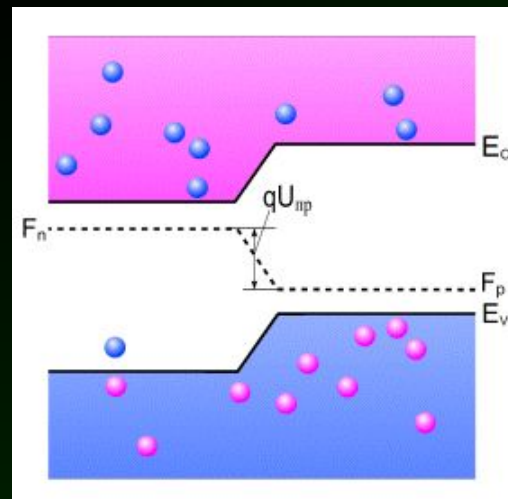
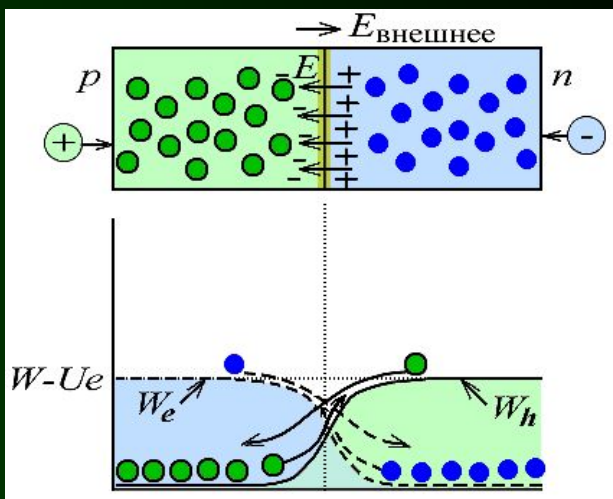
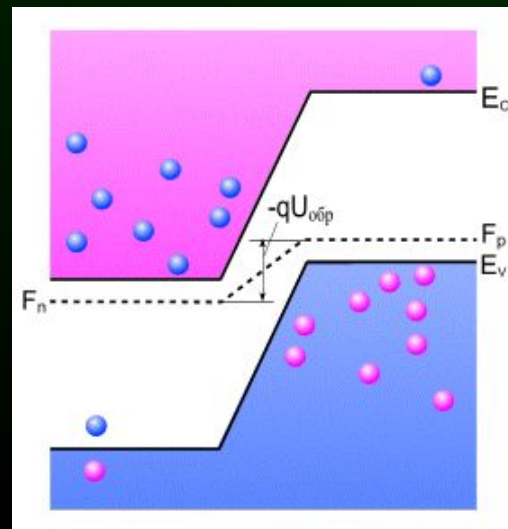
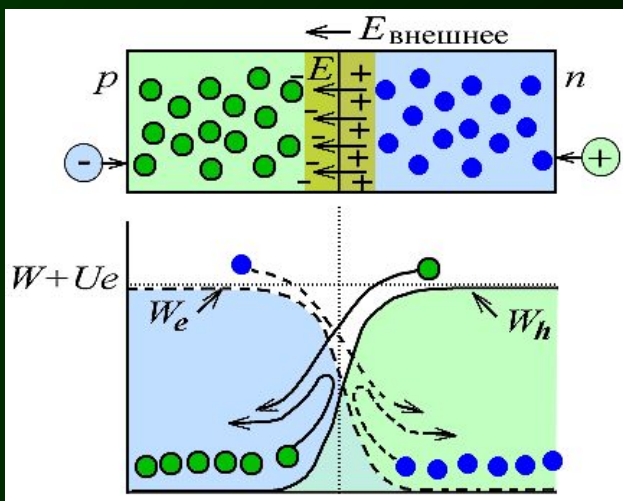


$p-n$ переход

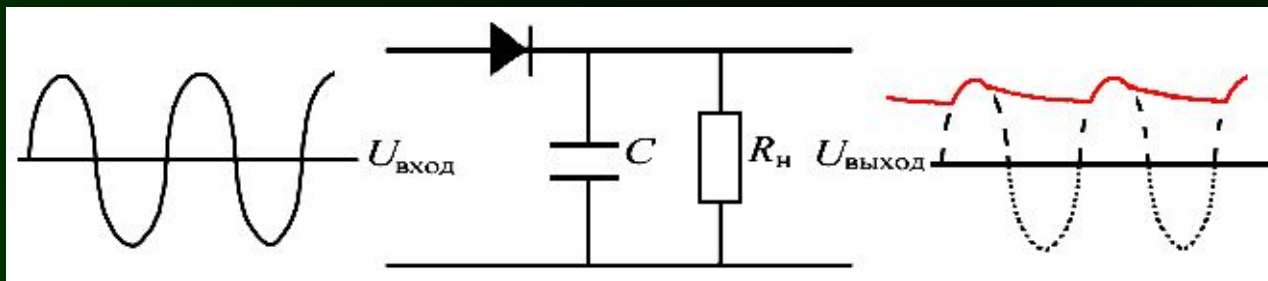
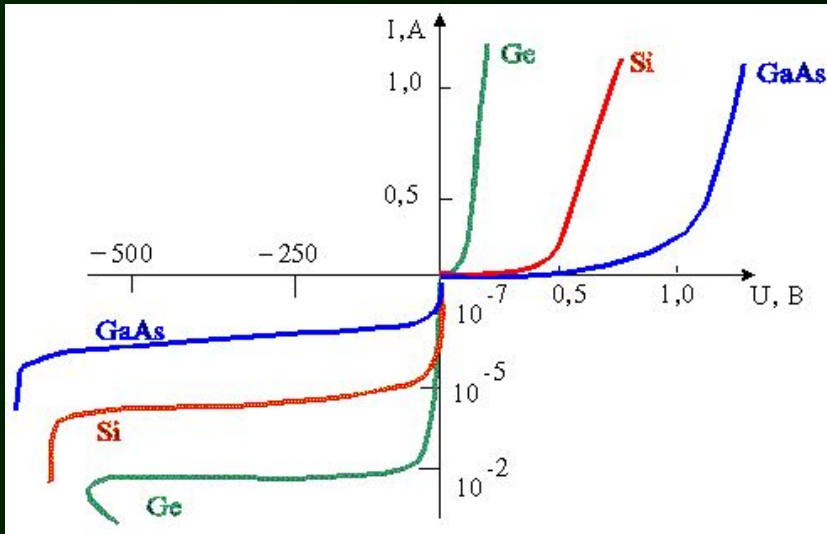


$p-n$ переход

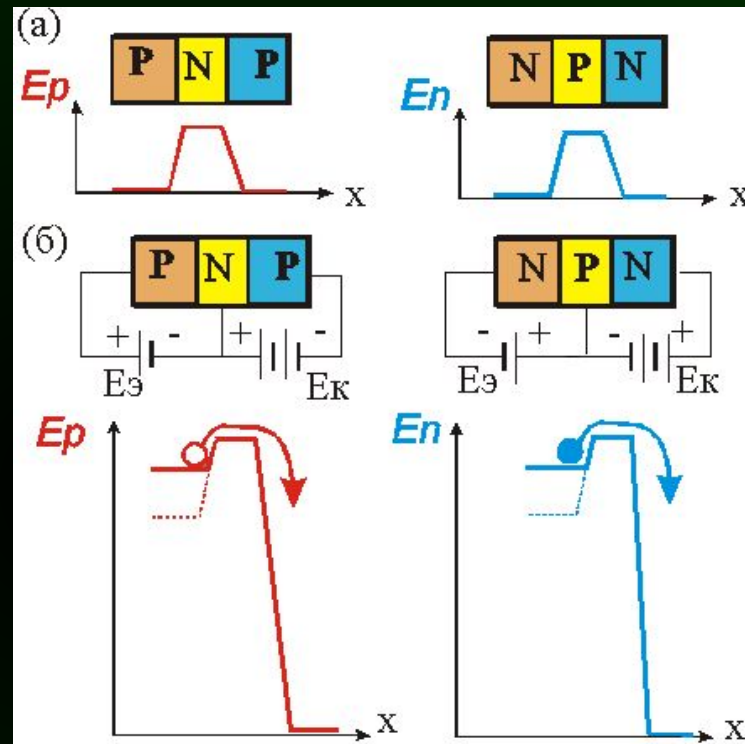
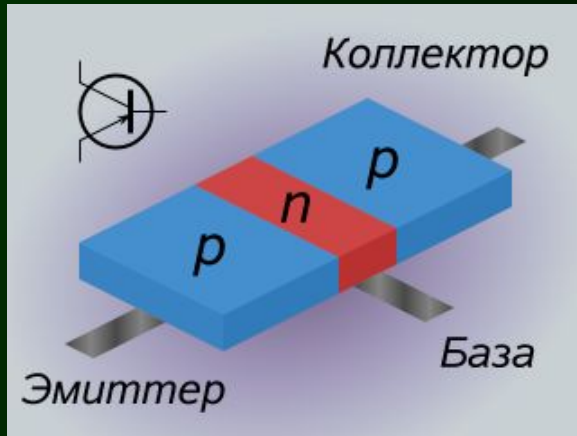


Выпрямление тока

Вольт-амперная характеристика диода



Транзистор

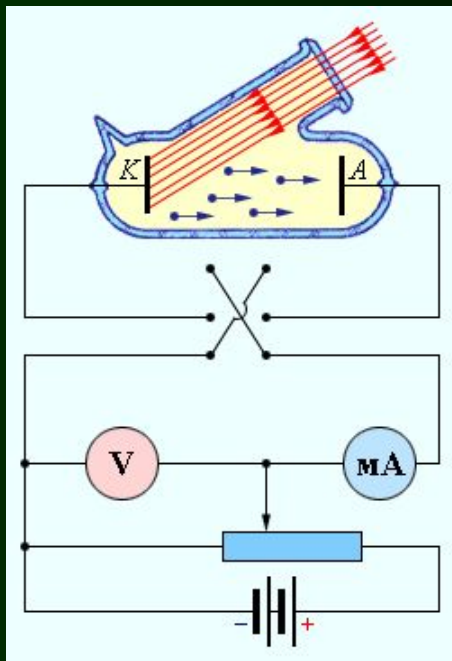


$$I_{\text{Э}} \approx I_{\text{К}} \quad R_{\text{ЭБ}} \ll R_{\text{БК}}$$

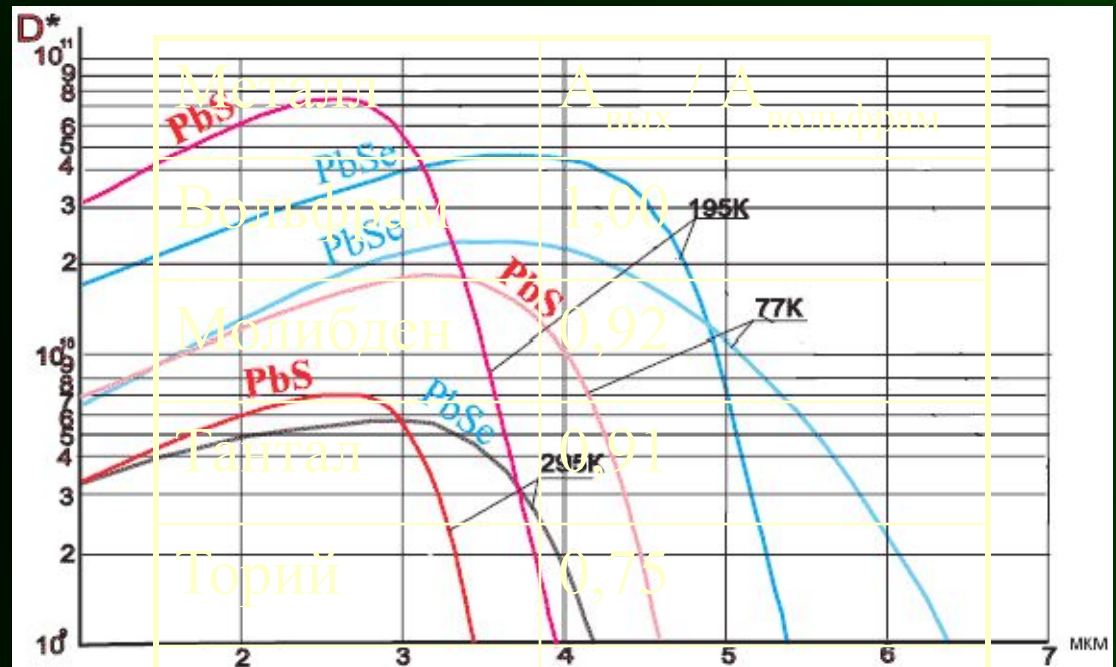
$$U_{\text{ВХ}} \ll U_{\text{ВЫХ}}$$

Фотоэлементы

Внешний фотоэффект



Внутренний фотоэффект
Вольфрам: $\Delta E = 4,3$ эВ [116]; $5,35$ эВ [110]

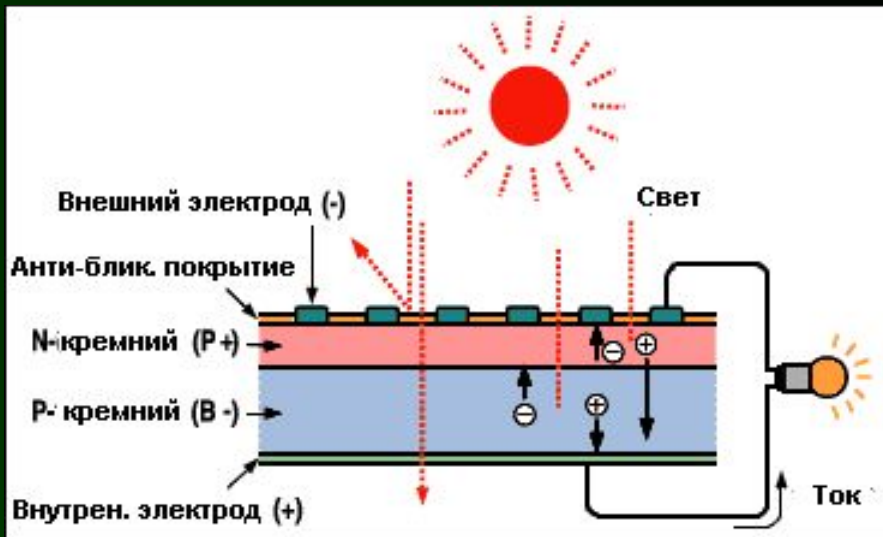
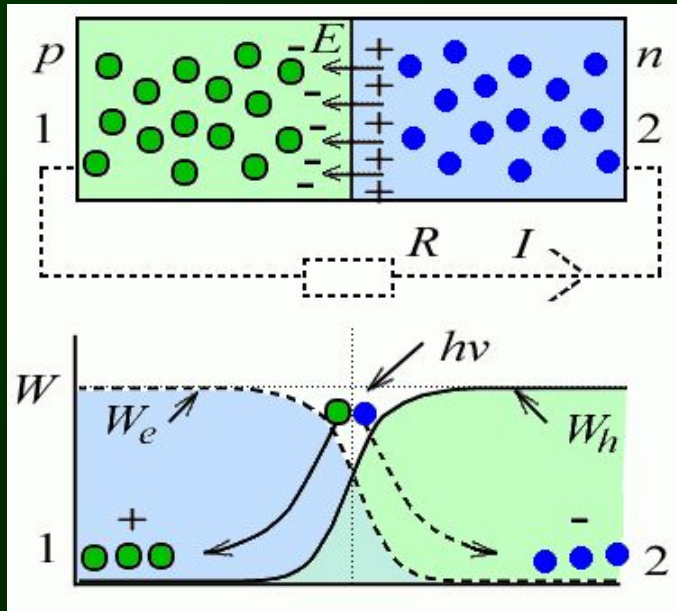


Барий 0,47

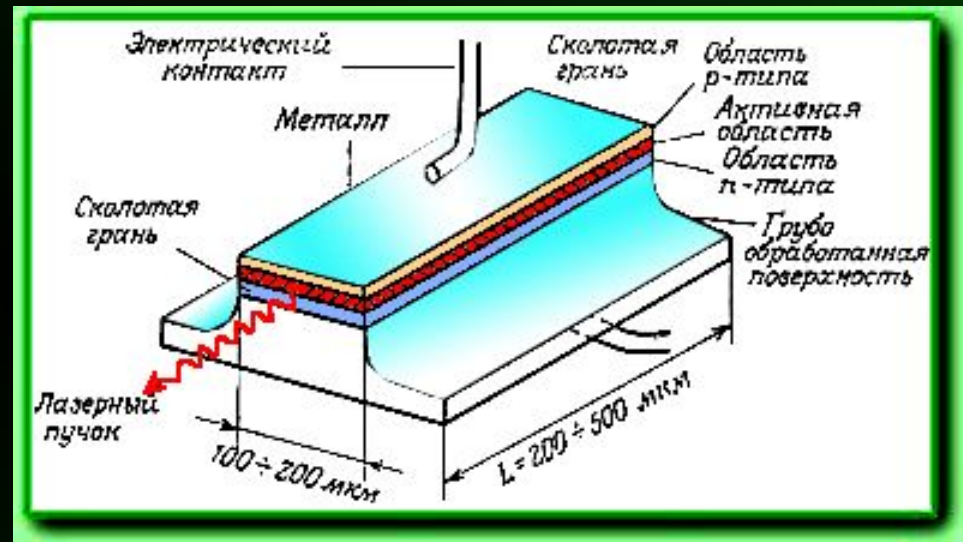
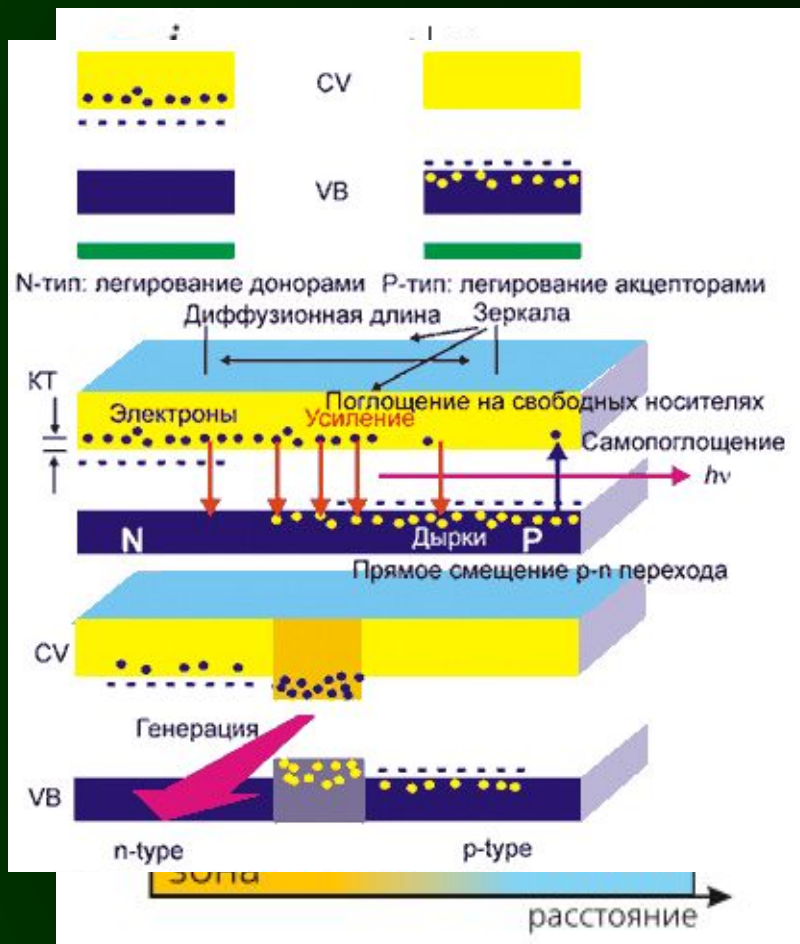
Цезий 0,04

$$\Delta E = 1 \text{ эВ} \Rightarrow \lambda_{\max} = 1,23 \text{ мкм}$$

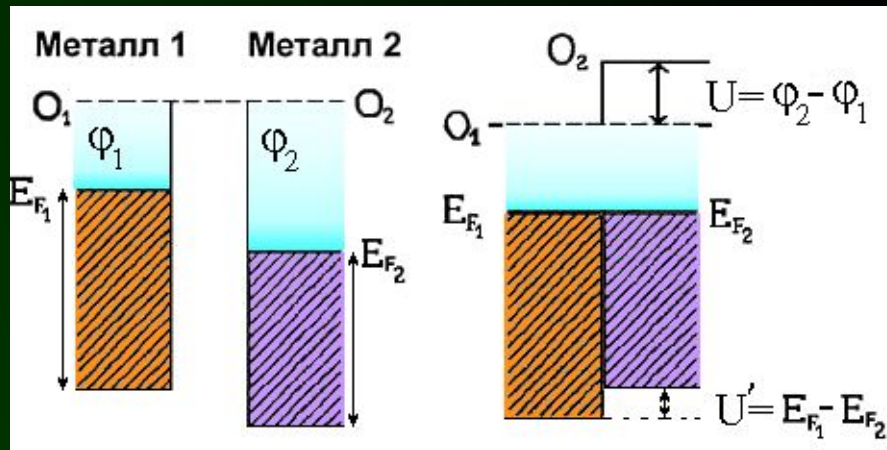
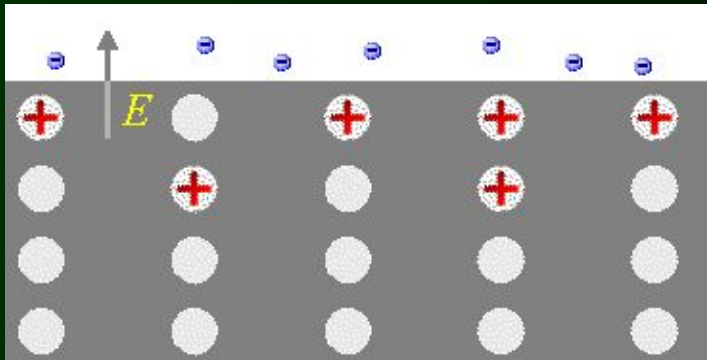
Солнечные батареи



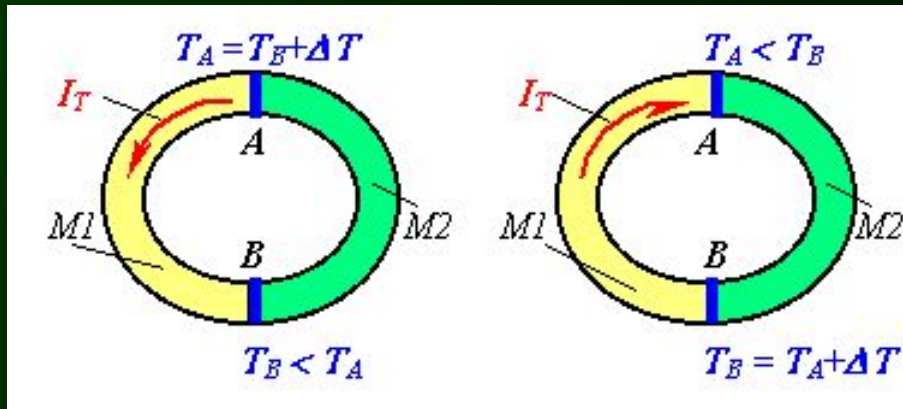
Светодиоды и лазеры



Контактная разность потенциалов



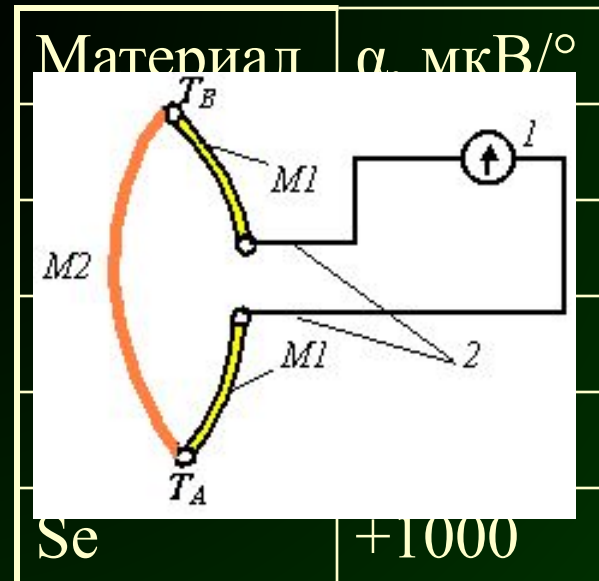
ТермоЭДС (эффект Зеебека)



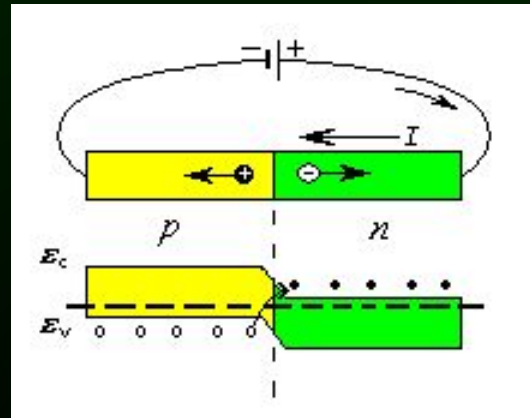
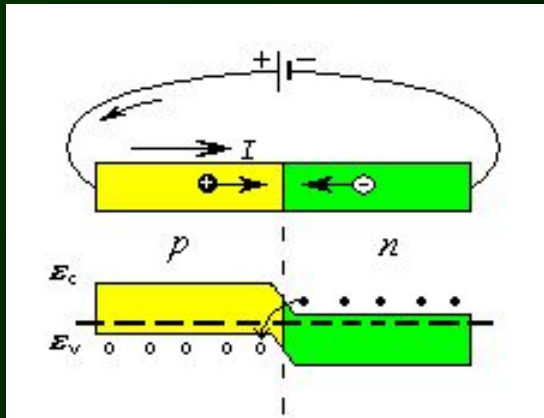
1. Диффузия электронов или дырок
2. Увлечение носителей фононами
3. Зависимость $E_F(T)$

$$E = -\frac{d\phi}{dl} = -\frac{d\phi}{dT} \frac{dT}{dl} = -\beta \frac{dT}{dl}$$

$$\tilde{\alpha} = \int_{T_1}^{T_2} \left(\beta - \frac{1}{l} \frac{dE_F}{dT} \right) dT$$



Эффект Пельтье



$$Q_{AB} = \Pi_{AB} I t$$

