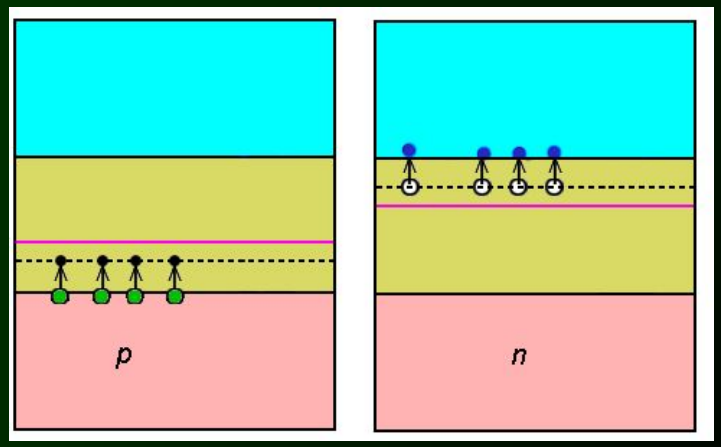
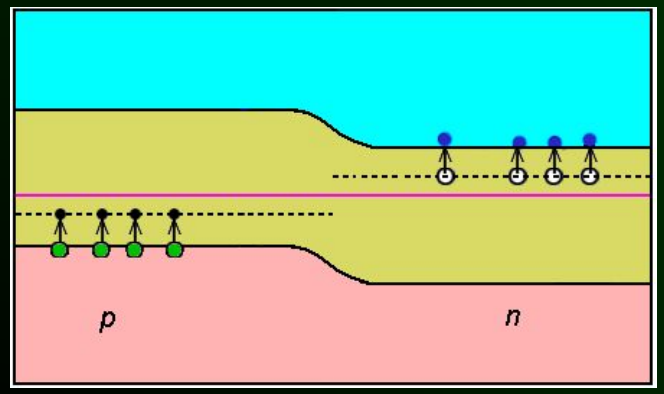
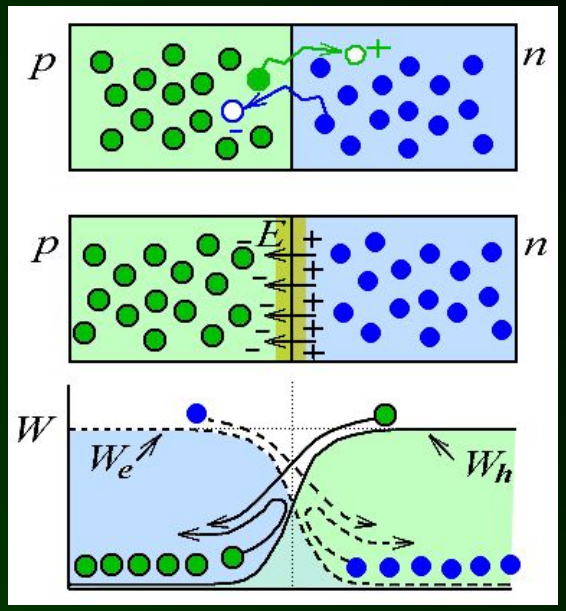
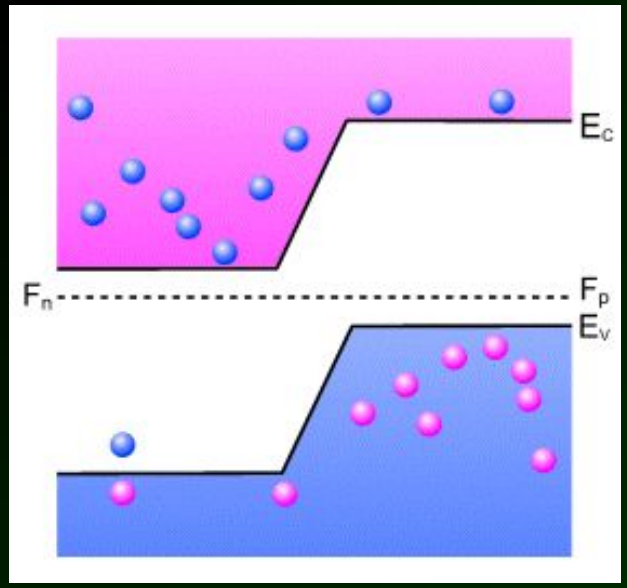
p–n переход

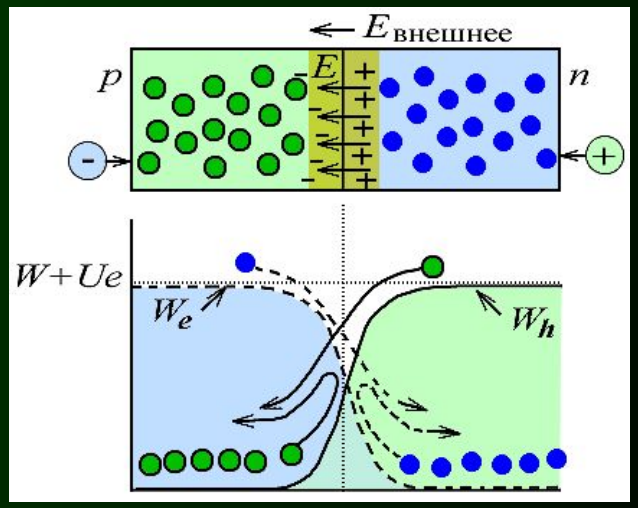


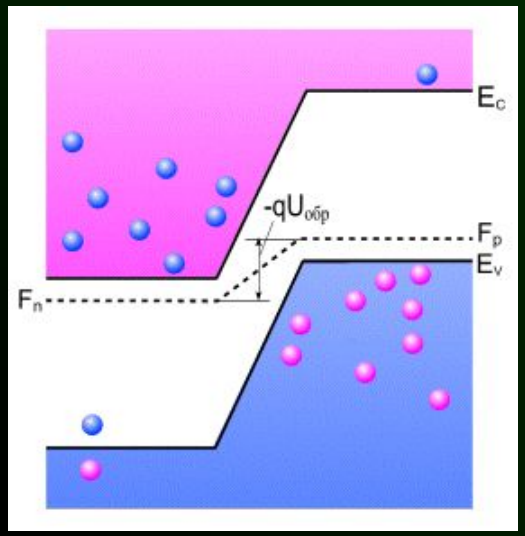


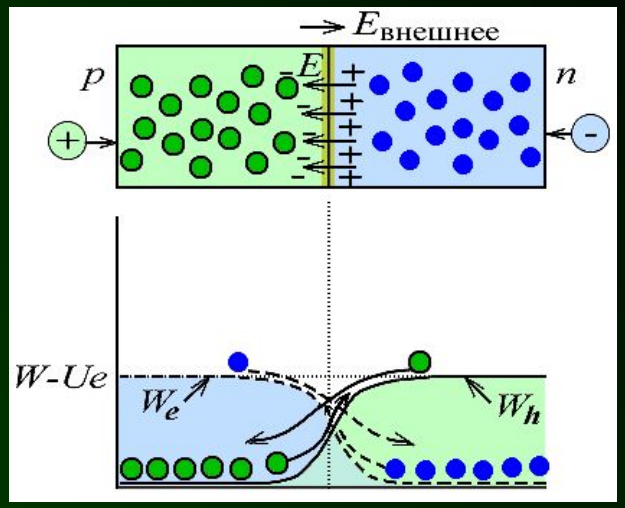


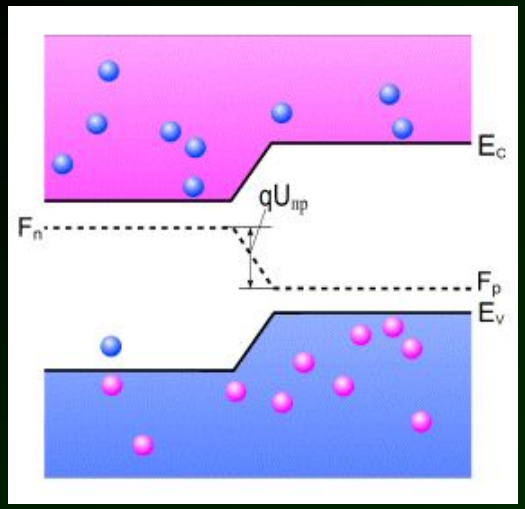


p–n переход


E внешнее
p
n
E
W+Ue
We
Wh

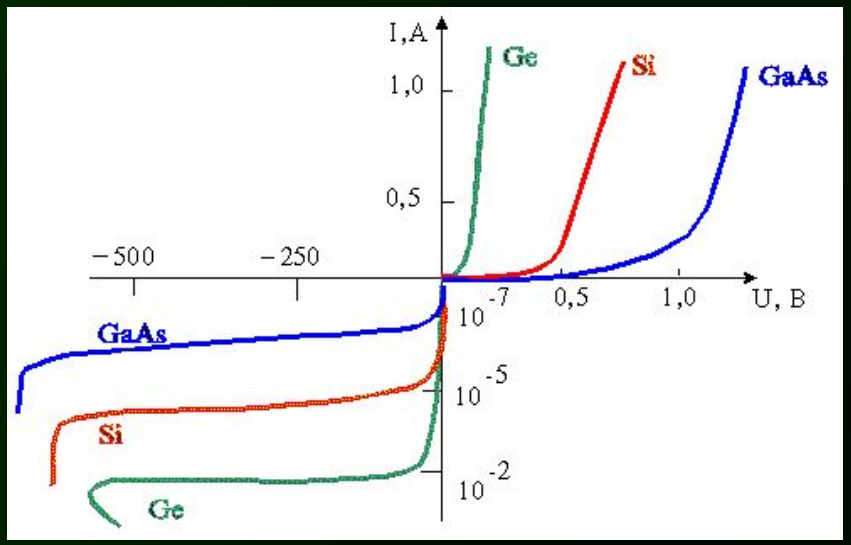

Ec
-qUобр
Fp
Ev
Fn

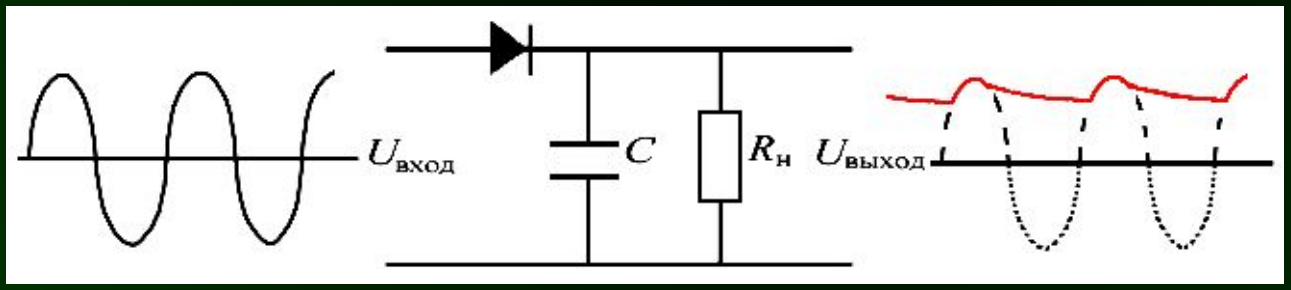

E внешнее
p
n
E
W-Ue
We
Wh


Ec
qUпр
Fn
Fp
Ev

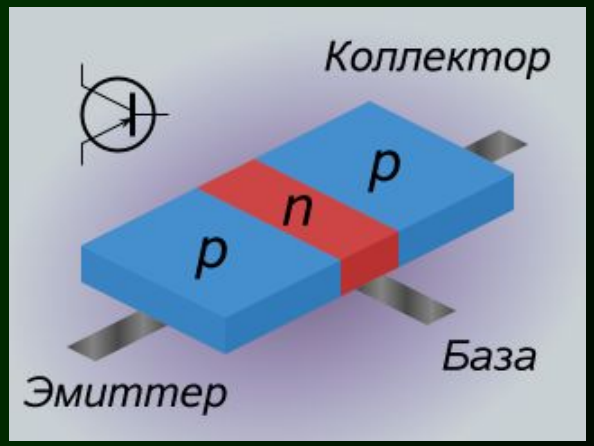
Выпрямление тока

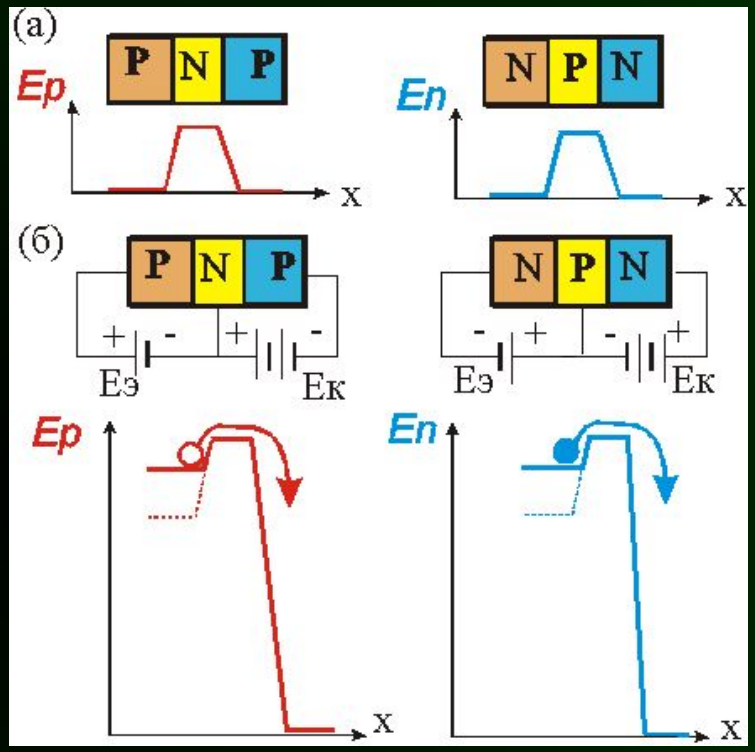
Вольт-амперная характеристика диода





Транзистор



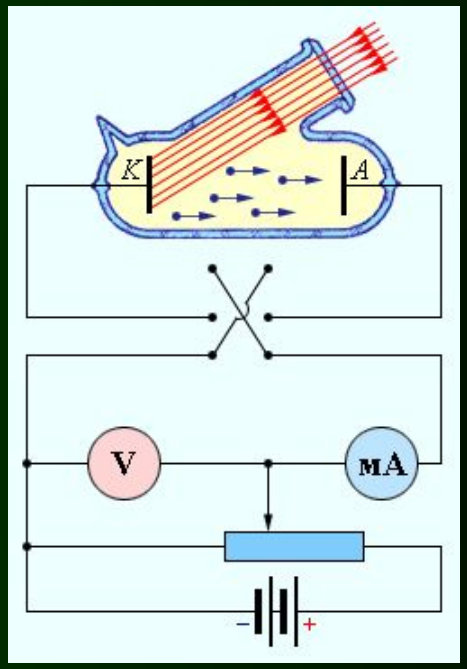


$I_Э \approx I_К \quad R_{ЭБ} << R_{БК}$

$U_{вх} << U_{вых}$

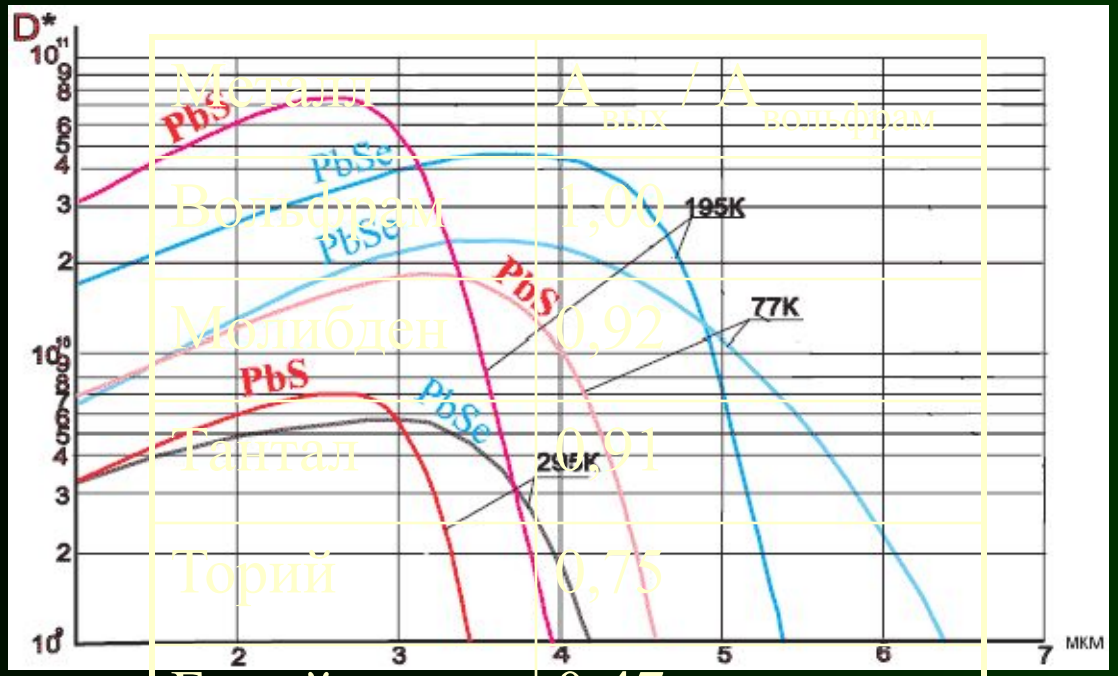
Фотоэлементы

Внешний фотоэффект



Внутренний фотоэффект

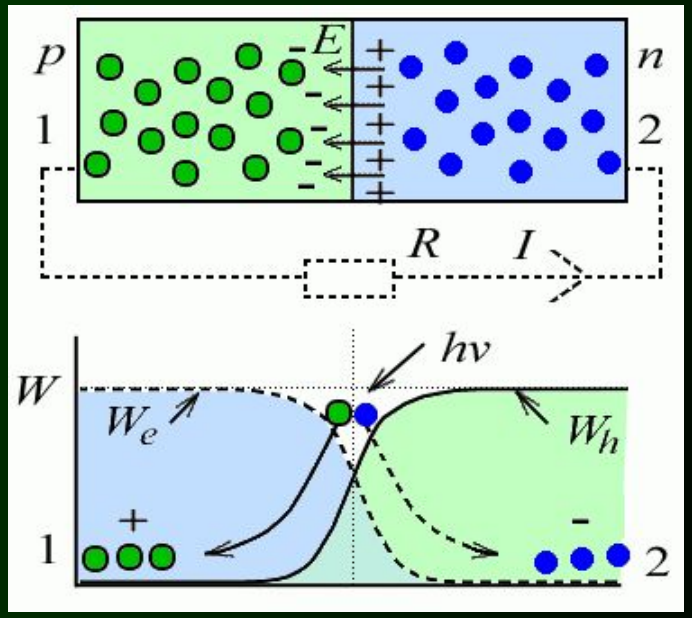
Вольфрам: А=4,3 эВ [116]; 5,35 эВ [110]

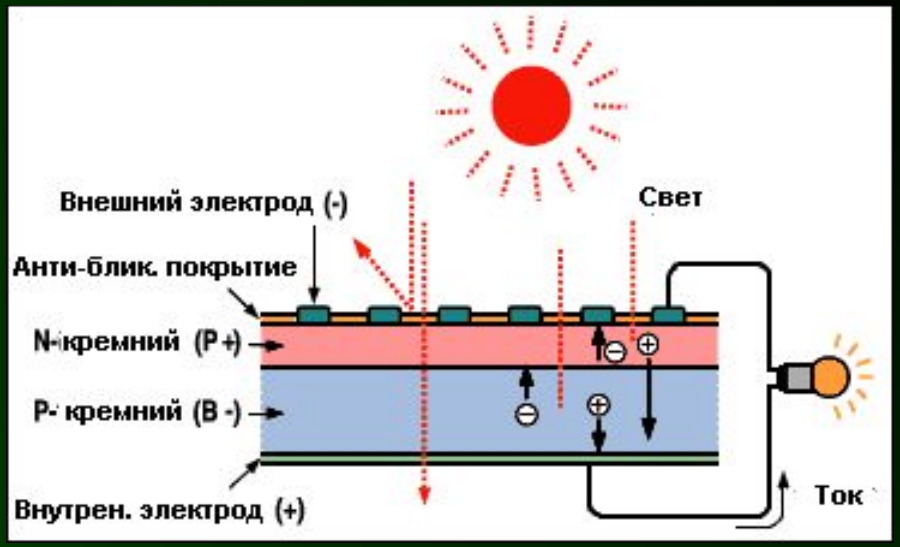


Металл	$A_{max} / A_{вольфрам}$
Вольфрам	1,00
Молибден	0,92
Тантал	0,91
Торий	0,75
Барий	0,47
Цезий	0,04

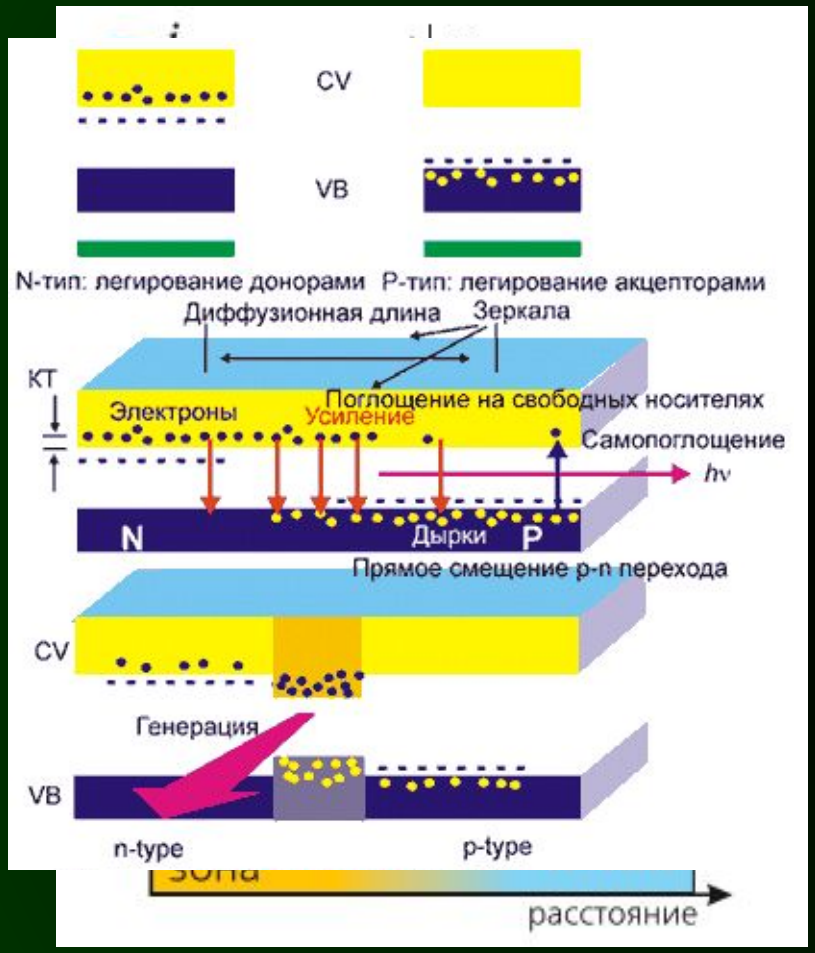
$\Delta E = 1$ эВ $\Rightarrow \lambda_{max} = 1{,}23$ мкм

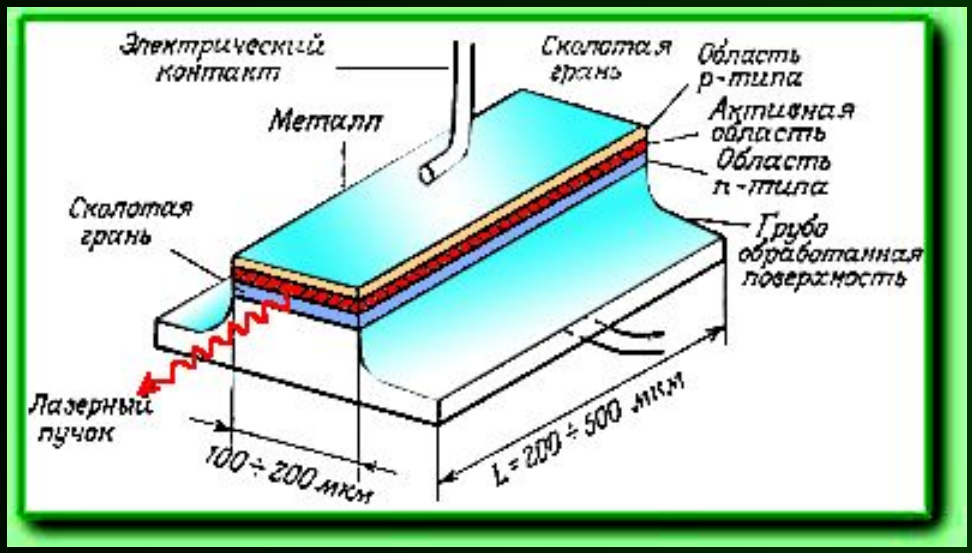
Солнечные батареи



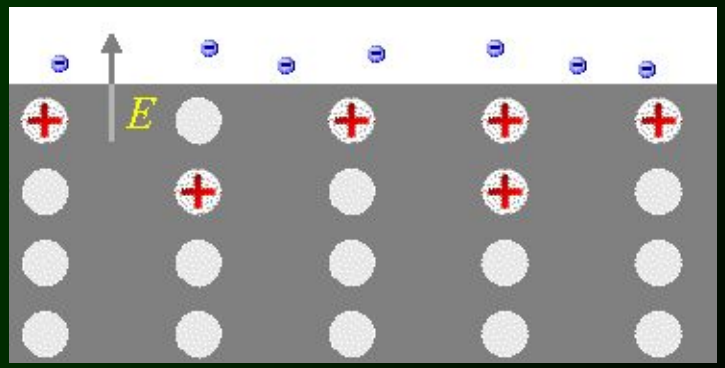


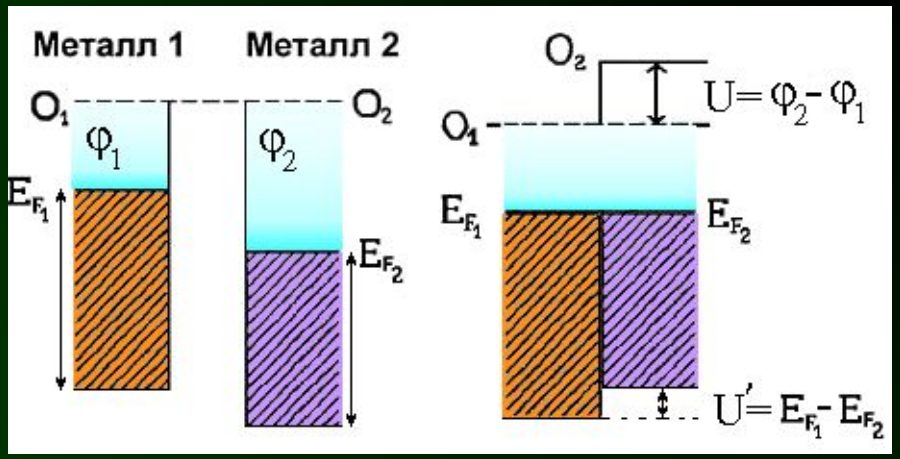
Светодиоды и лазеры



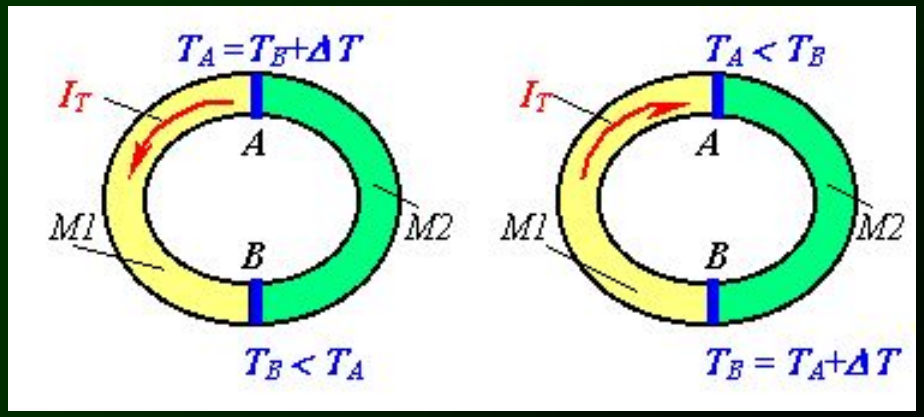


Контактная разность потенциалов





ТермоЭДС (эффект Зеебека)

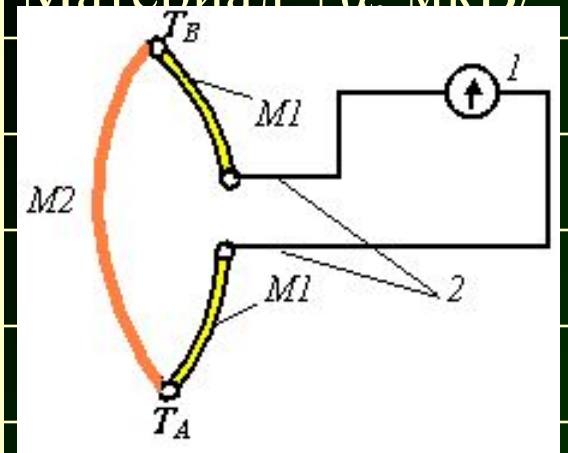


1. Диффузия электронов или дырок
2. Увлечение носителей фононами
3. Зависимость $E_F(T)$

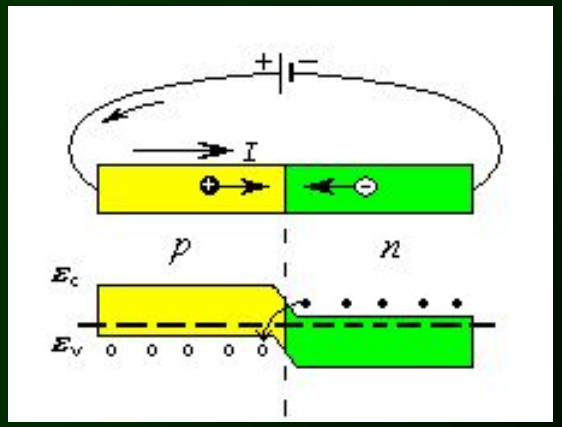
$$E = -\frac{d\varphi}{dl} = -\frac{d\varphi}{dT}\frac{dT}{dl} = -\beta\frac{dT}{dl}$$

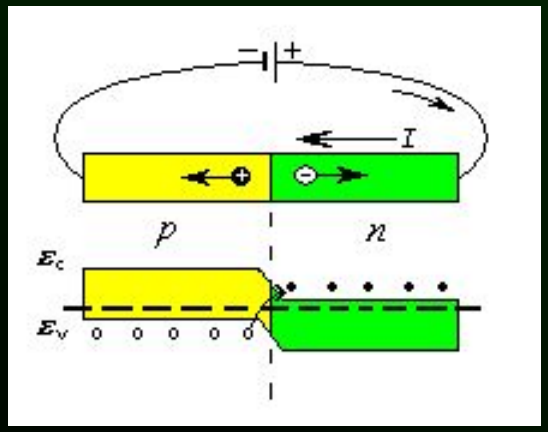
$$\text{õ}_{\text{òåðì î}} = \int_{T_1}^{T_2}\left(\beta - \frac{1}{l}\frac{dE_F}{dT}\right)dT$$

Материал	α, мкВ/°
Se	+1000



Эффект Пельтье





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