Numerical 1:

In class AB-push pull power amplifier, load R_L is 15Ω, $V_{CC} = 22V$, $V_{EE} = -22V$. AC Input voltage is $20V$ peak, frequency is $1000Hz$. Calculate efficiency of the circuit
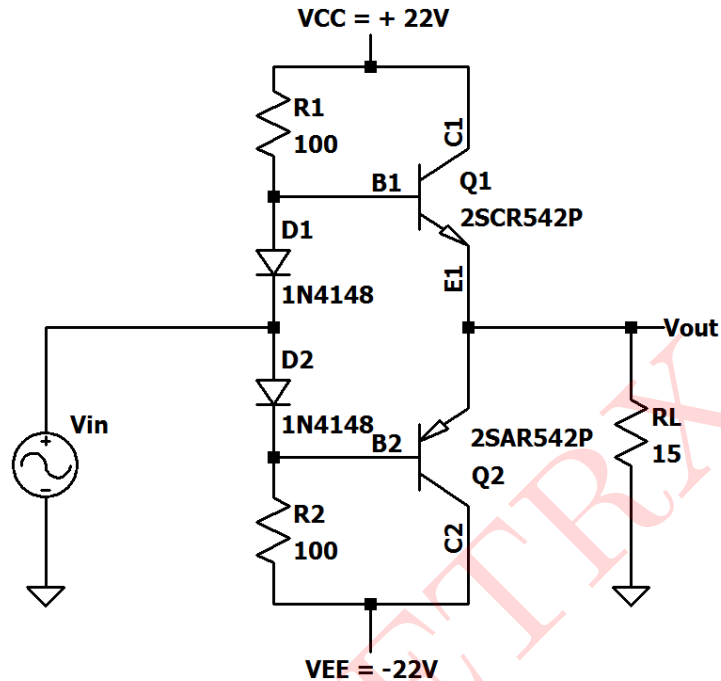

Figure 1: Circuit 1

Solution:

$V_{in} = V_m sin(\omega t) = V_m sin(2\pi f t) = 20 \times sin(2\pi 1000 t)$

$\boldsymbol{V_m = 20V}$

$P_{ac} = \dfrac{V_m{}^2}{2R_L} = \dfrac{20^2}{2 \times 15} = 13.33W$

$\boldsymbol{P_{ac} = 13.33W}$

$I_m = \dfrac{V_m}{R_L} = \dfrac{20}{15} = 1.333A$

$\boldsymbol{I_m = 1.333A}$

$P_{dc} = \dfrac{2V_{CC}I_m}{\pi} = \dfrac{2 \times 22 \times 1.333}{\pi} = 18.67W$

$\boldsymbol{P_{dc} = 18.67W}$

Efficiency $\eta = \dfrac{P_{ac}}{P_{dc}} = \dfrac{13.33W}{18.67W} = 0.714 = 71.4\%$

$\boldsymbol{\eta = 71.4\%}$

SIMULATED RESULTS:

Above circuit was simulated in LTSpice and results are presented below:

Pin (DC) = VCC x ICQ
= 44 x (Im/pi)
= 44 x (1.1312 A/pi)
= 18.38 W

Pout (AC) = Vorms x Iorms
= Vom x Iom x 0.5
= 19.68 x 1.312 x 0.5
= 12.911 W

% Efficiency = 100 x [Pout (AC) / Pin (DC)]
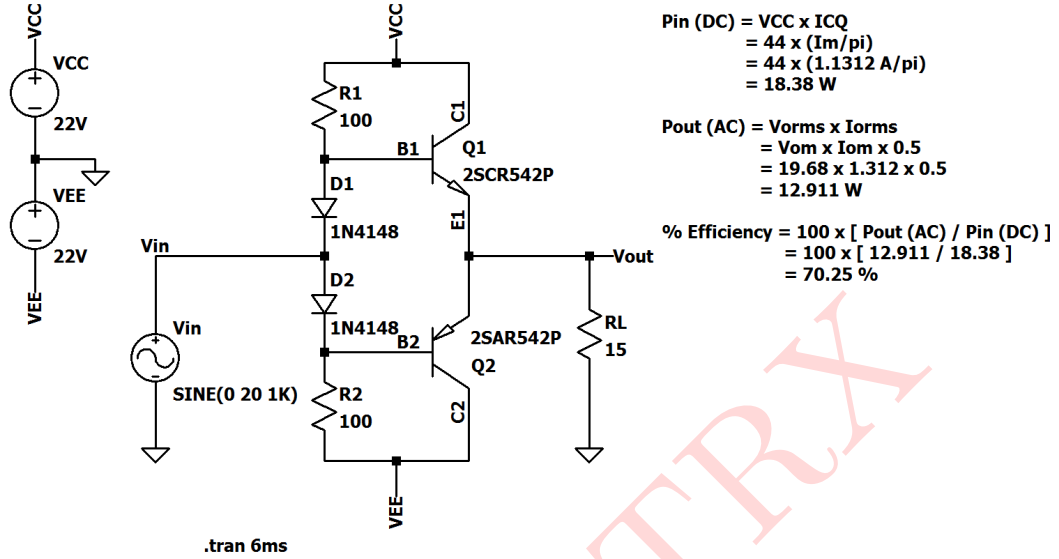= 100 x [12.911 / 18.38]
= 70.25 %

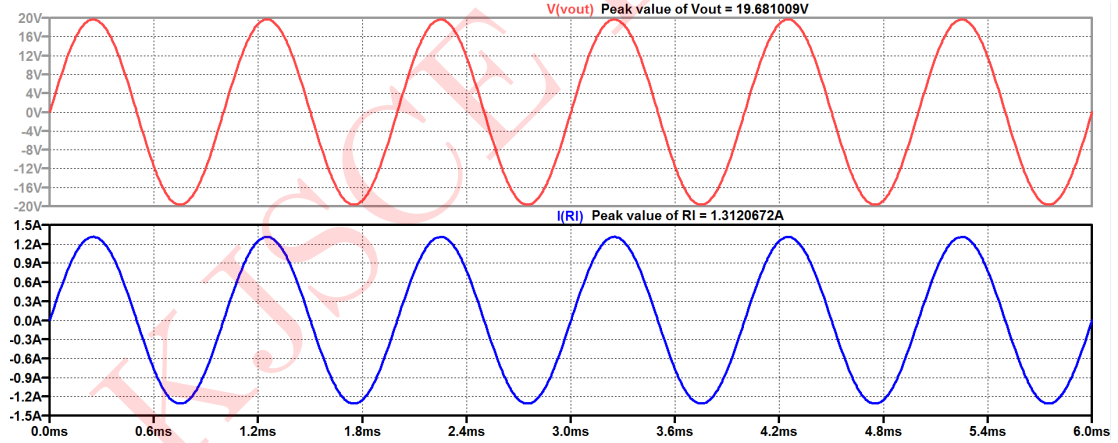Figure 2: Circuit Schematic 1 Results

Figure 3: Output load voltage and load current waveforms

Comparison of Theoretical and Simulated Values:

Parameters	Theoretical	Simulated
Input DC power	18.67W	18.38W
Input AC power	13.333W	12.911W
Efficiency	71.4%	70.25%

Table 1: Numerical 1

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