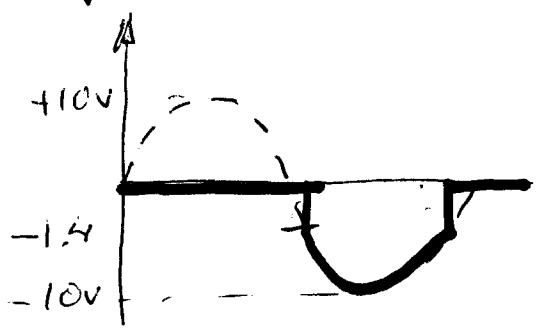
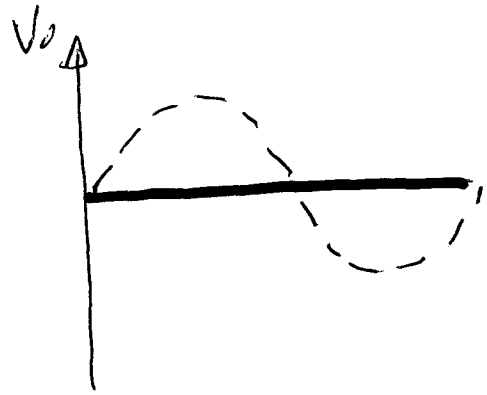
EXAMEN INTRA 31 MARS 2010
CORRIGÉ

Q1 -

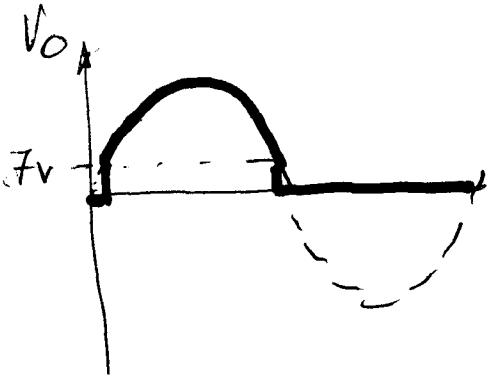
A)



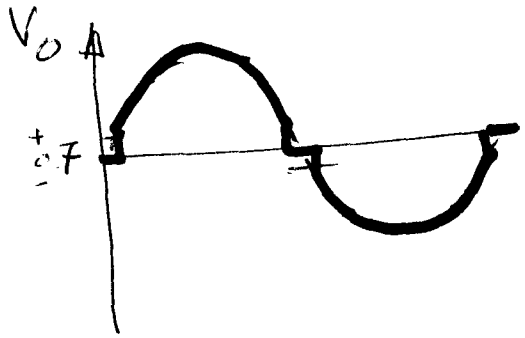
B



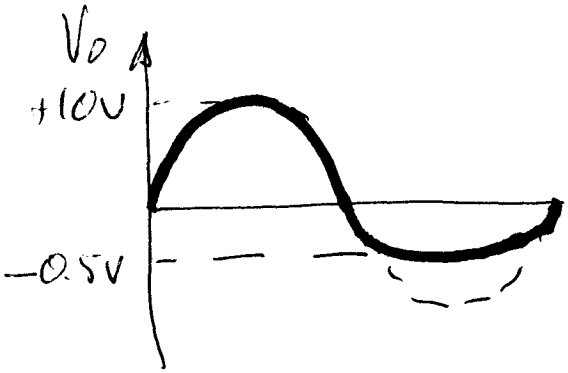
C)



D)



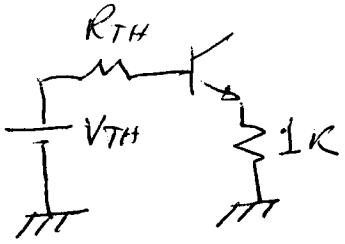
E)



Q2 -

a) FIG 2 - $\beta R_E \neq 10R_2$ ∴ $V_{TH} = 20\frac{10}{100} = 2V$.

$$R_{TH} = \frac{10 \cdot 90}{100} = 9K\Omega$$



$$2V = I_b 9K + 0.7 + I_b(\beta+1)\cdot 1K$$

$$2 = 0.7 + I_b \cdot 50K$$

$$I_b = \frac{1.3}{50K} = 26\mu A$$

$$I_E = 41 \cdot 26\mu A = 1.07mA$$

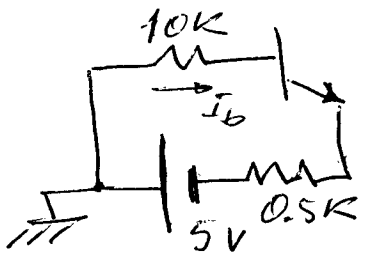
$$I_C = \frac{40}{41} \cdot 1.07 = 1.04mA$$

$$V_1 = 20 - 1.04 \cdot 3.3 = 20 - 3.44 = 16.56V$$

$$V_2 = 0.7 + 1.07 \cdot 1K = 1.77V.$$

---

b) FIG 3



$$5 = 10K \cdot I_b + 0.7 + 41 \cdot 0.5K \cdot I_b$$

$$I_b = \frac{4.3}{30.5K} = 140\mu A.$$

$$I_E = 41 \cdot 0.140 = 5.7mA$$

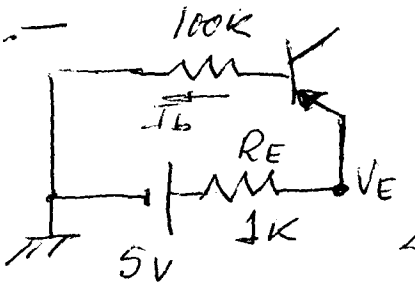
$$I_C = 5.6mA$$

$$V_3 = 20 - 18.3 = 1.7V$$

$$V_4 = 0.7 + 5.7 \cdot 0.5K = 3.55V$$

Q3.—

a)



$$5V = (\beta+1)\cdot 1K\, I_b + 0.7 + I_b \cdot 100K$$

$$4.3V = I_b\,(201\cdot 1K + 100K) = 301K \cdot I_b$$

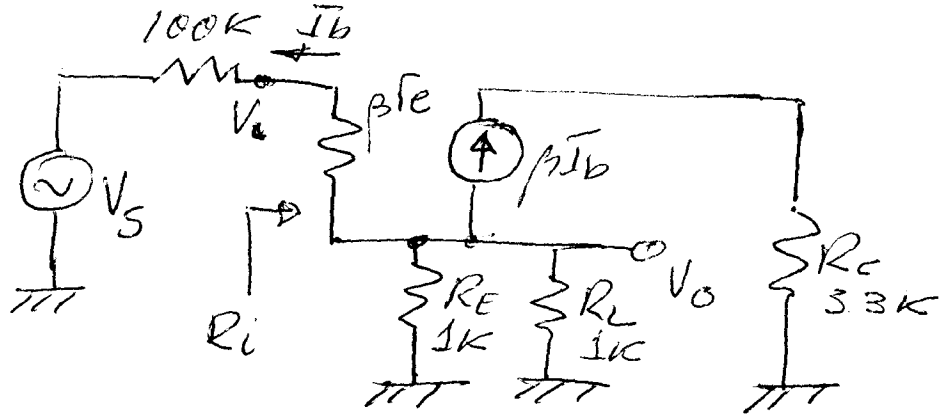
$$I_b = \frac{4.3}{301K} = 14\mu A$$

$$I_C \simeq I_E = 201 \cdot 14\mu A = 2.81\,mA \qquad r_e = \frac{26}{2.81} = 9.2\Omega$$

$$V_C = 3.3 - 2.81 - 5 = 4.27\,V.$$

$$V_E = 5V - 2.81\cdot 1K = 2.19\,V.$$

b)



$$V_i + I_b \cdot \beta r_e = V_o$$

$$I\,(R_E \| R_L) = (\beta+1) I_b = -\frac{V_o}{R_E \| R_L}$$

$$V_o = -(R_E \| R_L)(\beta+1) I_b$$

Por sustitución

$$V_i = V_o + \frac{V_o}{(\beta+1)(R_E \| R_L)} \cdot \beta r_e$$

$$\therefore \quad \frac{V_o}{V_i} = \frac{(\beta+1)(R_E \| R_L)}{\beta r_e + (\beta+1)(R_E \| R_L)} \simeq \frac{R_E \| R_L}{r_e + (R_E \| R_L)}$$

$$\frac{V_o}{V_i} = \frac{0.5K}{9.2 + 0.5K} = \frac{500}{509} = 0.98$$

Q3 (cont)

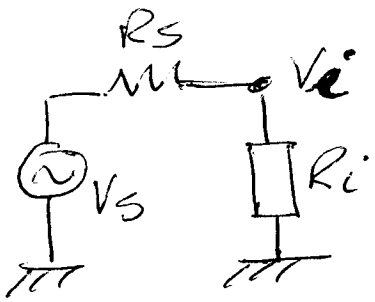
c) $V_i = V_o - I_b \cdot \beta r_e$

$V_i = -(R_E \| R_L)(\beta+1) I_b - I_b \beta r_e$

$-\frac{V_i}{I_b} = R_i = \beta r_e + (\beta+1)(R_E \| R_L) \approx \beta (r_e + R_E \| R_L)$

$R_i = 200(9.2 + 500) = \underline{101\ k\Omega}$

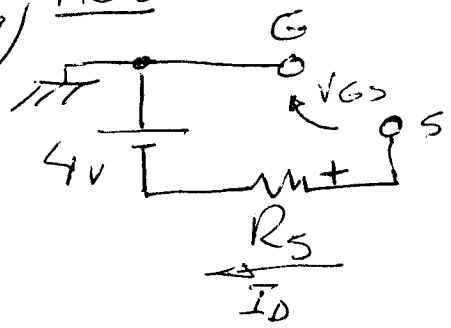
d) $\frac{V_o}{V_s} = \frac{V_i}{V_s} \cdot \frac{V_o}{V_i} = \frac{R_i}{R_s + R_i} \cdot 0.98 = \frac{101}{201} \cdot 0.98$



$\frac{V_o}{V_s} = 0.49$

Q4

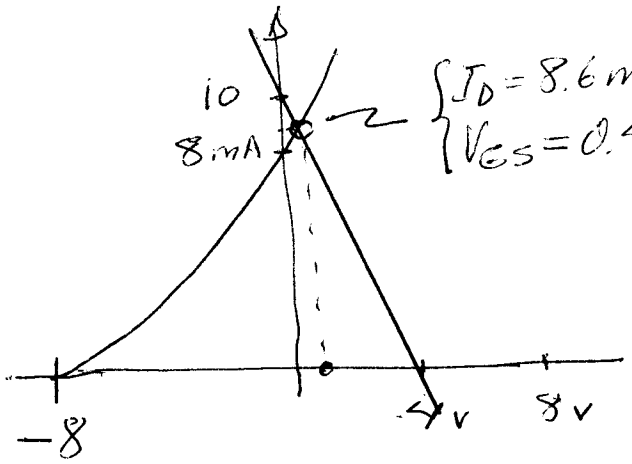
a) FIG 5



$$\left.\begin{aligned} V_{GS} &= 4 - R_S I_D \\ I_D &= 8mA\left(1 - \frac{V_{GS}}{-8}\right)^2 \end{aligned}\right\}$$

Pour $V_{GS}=0 \rightarrow I_D = 10mA$

$I_D = 0 \rightarrow V_{GS} = 4$



$\begin{cases} I_D = 8.6mA \\ V_{GS} = 0.48V. \end{cases}$

POINT DE FONCTIONNEMENT:

$$\boxed{\begin{aligned} I_D &= 8.6mA \\ V_{GS} &= +0.48V. \end{aligned}}$$

$V_D = 18 - 8.6 \cdot 2.2k = -0.96V.$

b) FIG 6

$V_{GS} = 0V$

$I_D = I_{DSS} = 6mA$

$V_D = 20 - 6 \cdot 2.2 = \underline{\underline{6.8V}}$