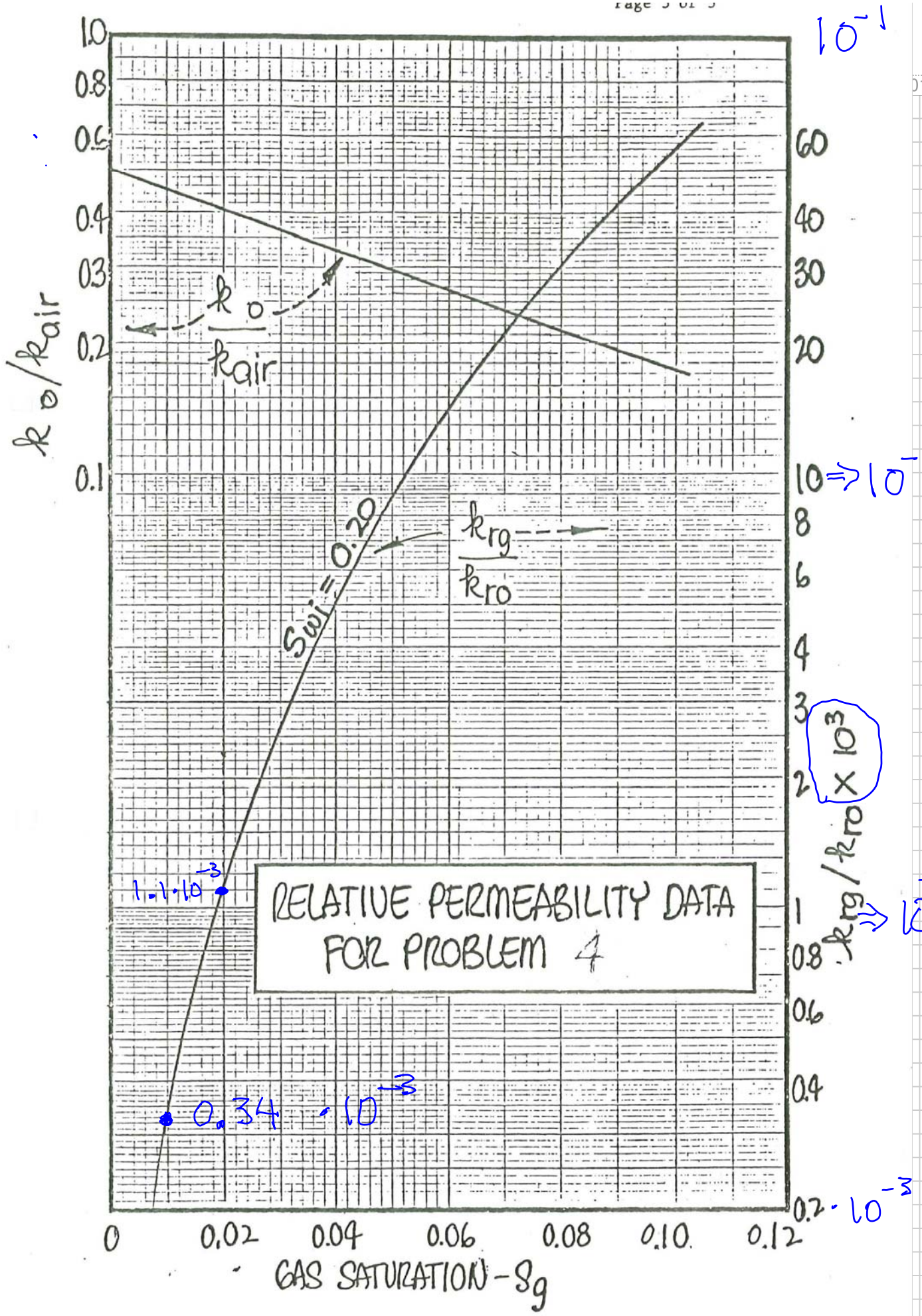

RELATIVE PERMEABILITY DATA FOR PROBLEM 4
k_o/k_{air}
$\frac{k_o}{k_{air}}$
$\frac{k_{rg}}{k_{ro}}$
$S_{wi} = 0.20$
k_{rg}/k_{ro} X 10^3
GAS SATURATION - S_g
1.0
0.8
0.6
0.4
0.3
0.2
0.1
60
40
30
20
10
8
6
4
3
2
1
0.8
0.6
0.4
0.2
0
0.02
0.04
0.06
0.08
0.10
0.12
10^{-1}
$10 \Rightarrow 10^{-2}$
$1 \Rightarrow 10^{-3}$
$1.1 \cdot 10^{-3}$
$0.34 \cdot 10^{-3}$
$0.2 \cdot 10^{-3}$

SGD MB : $p_R(Q_p)$: Single RFU

$$q_{RFU} = \frac{dQ_p}{dt} = \sum_{w=1}^{N_w} q_w \simeq \underbrace{N_w \bar{q}_w}$$

↑ Single Well

$$q_o = J\left(p_R^2 - p_{wf}^2\right)$$ Fetkovich SGD

$$J_w = \frac{\bar{k}_{ro}(kh)\cancel{p_R}\left[1 - \cancel{\left(\frac{p_{wf}}{p_R}\right)^2}\right]}{2(141.2)\mu_o B_o \underbrace{\left[\ln\frac{r_e}{r_w} - \frac{3}{4} + s\right]}_{\sim 8}}$$

All wells in a RFU ~ p_R same

$$\Rightarrow \simeq \left(\bar{k}_{ro}/\mu_o B_o\right) p_R$$

Varies for each well in RFU :

- $(kh)_w$
- S_w
- (p_{wf}) ~ similar

Artificial lift

Production Pipe "Tubing"

"PDO"

PUD : Plan for Utvikling og Drift

Development & Operation

(Production)

Rate-Time Forecasting $q_F(t) \Rightarrow$ Revenue (t)

vs

Cost & Expenditures

Prof. Milan Stanko : Field Development Course

$$q_F(t) = \sum_{w=1}^{N_w} q_w\left(\underbrace{\Delta p_R}_{\text{"R"}}\ \underbrace{J_w}_{(kh)_w, s_w};\ \underbrace{\Delta p_T}_{\text{"T"}}\ d_t, h_w, TVD, \ldots;\ p_{surface\ constraint}\right)$$

$q_F(t)$ ↑

M.B. $\begin{cases} p_R(t) \\ Q_p(t) \end{cases}$

d_t: Gas

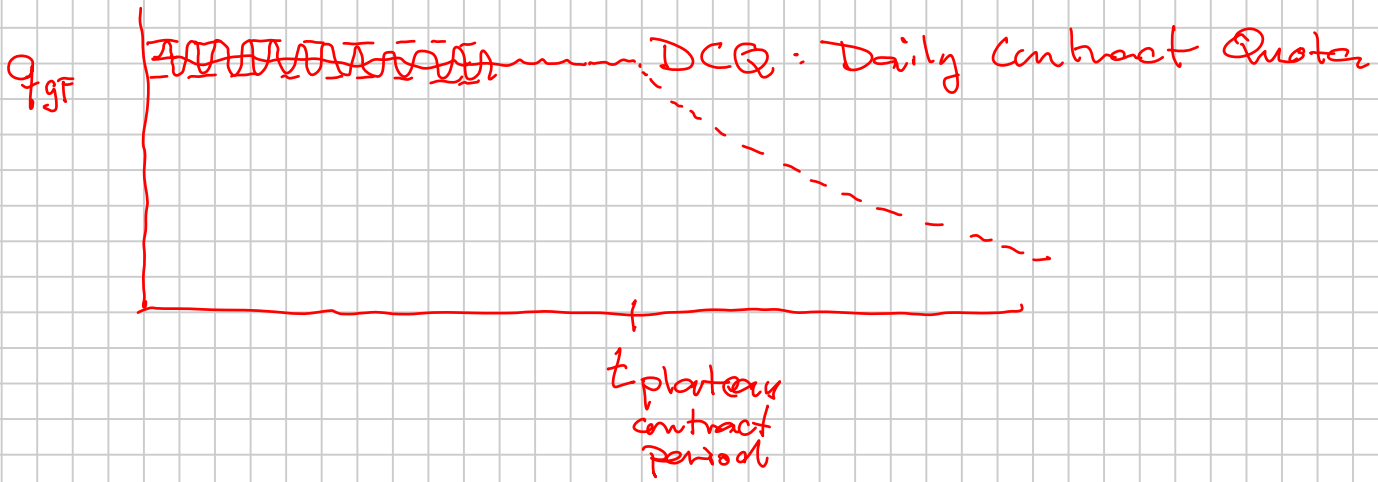
oil: Artificial Lift

$p_{surface\ constraint}$ ↑ p_{sp}, $p_{pipeline}$, p_{atm}

Frigg:

Δp_R	Δp_t
<5%	>95%

* Gas Field Development: Offshore (Large Onshore)



Oil Field Development:

* (a) - Huge (Giant) Fields - $q_F \sim const$ t_p

(b) - Other : Produce what you can $p_{wf,min}$

$q_F(t)$: Given

(MB + IPR) ?

Define { $p_{wf,min}$ = J_w } at any time $\bar{P}_R$ (M.B.)

$q_{w,max}(\bar{P}_R)$

$$\min N_w(t) = \frac{q_F \ (= DCQ)}{q_{w,max}(P_R)}$$

P_R at t

First Order Cost