Abbreviations

Abbreviation	Term
cm	centimetres
ID	inside diameter
kg	kilogram
kg/cm^2	kilogram per centimetre squared
kg/l	kilogram per litre
$kg/cm^2/m$	kilogram per centimetre squared per metre
l	litres
l/m	litres per metre
l/min	litres per minute
m	meters
MD	measured depth
mm	millimetres
OD	outside diameter
SICHP	shut-in casing head pressure
SITHP	shut-in tubing head pressure
TVD	true vertical depth
V	volume

Constant factors	
Constant factor pressure	0.0981
Constant factor capacity (using mm)	0.0007854
Constant factor capacity (using inches)	1.9735

Formulas

1. **Pressure gradient ($kg/cm^2/m$)**

   fluid density (kg/l) × 0.0981

2. **Fluid density (kg/l)**

   hydrostatic pressure (kg/cm^2) ÷ TVD (m) ÷ 0.0981

   or

   $$\frac{\text{hydrostatic pressure } (kg/cm^2)}{\text{TVD (m)} \times 0.0981}$$

3. **Hydrostatic pressure (kg/cm^2)**

   fluid density (kg/l) × 0.0981 × TVD (m) **or** pressure gradient (kg/cm^2) × TVD (m)

4. **Formation pressure (kg/cm^2)**

   SITHP (kg/cm^2) + hydrostatic column pressure to the top perforation (kg/cm^2)

5. Kill weight gradient ($kg/cm^2/m$)

$$\frac{\text{(well fluid gradient } (kg/cm^2/m) \times \text{TVD to point of circulation (m))} + \text{SITHP } (kg/cm^2) + \text{overbalance* } (kg/cm^2)}{\text{TVD to point of circulation (m)}}$$

*overbalance is variable and will be stated

6. Tubing capacity (l/m)

$$\frac{\text{tubing ID}^2\text{ (inches)}}{1.9735} \quad \textbf{or} \quad \text{tubing ID}^2\text{ (mm)} \times 0.0007854$$

7. Annulus capacity (l/m)

$$\frac{\text{casing ID}^2\text{ (inches)} - \text{tubing OD}^2\text{ (inches)}}{1.9735}$$

or

$$(\text{casing ID}^2\text{ (mm)} - \text{tubing OD}^2\text{ (mm)}) \times 0.0007854$$

8. Volume (l)

capacity (l/m) × MD (m)

9. Time to pump/displace (minutes)

$$\frac{\text{capacity (l/m)} \times \text{MD (m)}}{\text{pump rate (l/min)}} \quad \textbf{or} \quad \frac{\text{volume (l)}}{\text{pump rate (l/min)}}$$

10. Area of a circle (cm^2)

$0.785 \times \text{diameter}^2$ (cm)

11. Force (kg force)

area (cm^2) × applied pressure (kg/cm^2)

12. New pump/circulating pressure (kg/cm^2)

$$\text{pump pressure } (kg/cm^2) \times \left(\frac{\text{new pump rate (l/min)}}{\text{old pump rate (l/min)}}\right)^2$$

13. Basic gas law

$$P_1 \times V_1 = P_2 \times V_2 \qquad P_2 = \frac{P_1 \times V_1}{V_2} \qquad V_2 = \frac{P_1 \times V_1}{P_2}$$