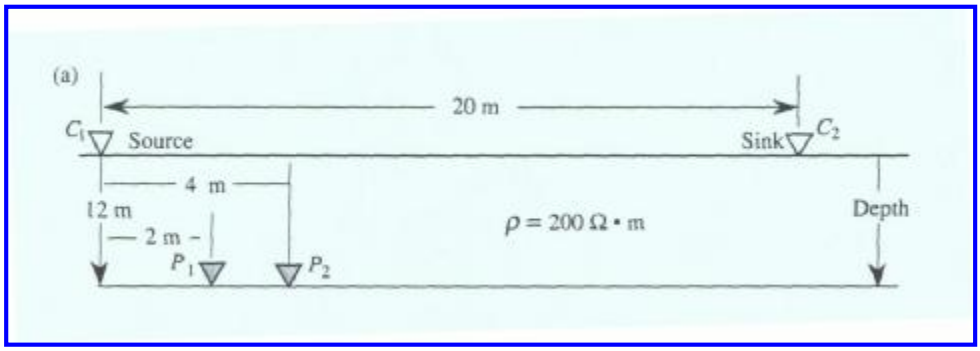
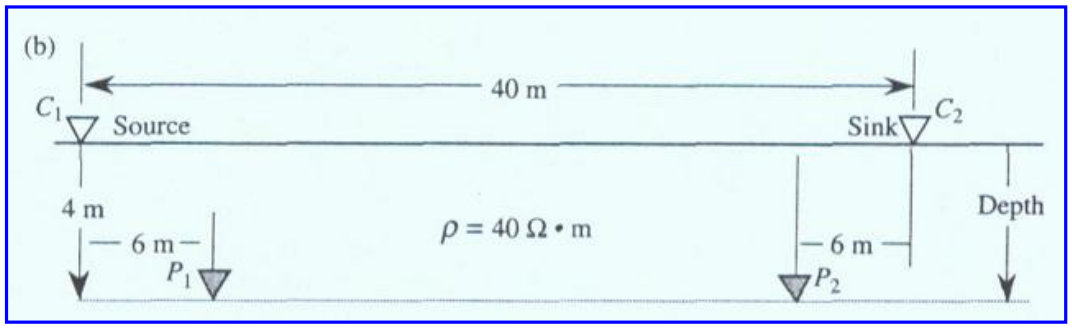
SOLVED PROBLEMS

1. Determine the potential difference between the two potential electrodes for cases (a) and (b). Assume a current of 0.6 ampere.





(a)

$$V_{P_1} = \frac{ir}{2pr_1} + \left(-\frac{ir}{2pr_2}\right) = \frac{ir}{2p}\left(\frac{1}{r_1} - \frac{1}{r_2}\right) = \frac{ir}{2p}\left(\frac{1}{12.17\ \text{m}} - \frac{1}{21.63\ \text{m}}\right)$$

$$V_{P_1} = 0.686\ \text{v}$$

$$V_{P_2} = \frac{ir}{2p}\left(\frac{1}{12.65\ \text{m}} - \frac{1}{20\ \text{m}}\right)$$

$$V_{P_2} = 0.555\ \text{v}$$

$$V_{P_1} - V_{P_2} = 0.131\ \text{v}$$

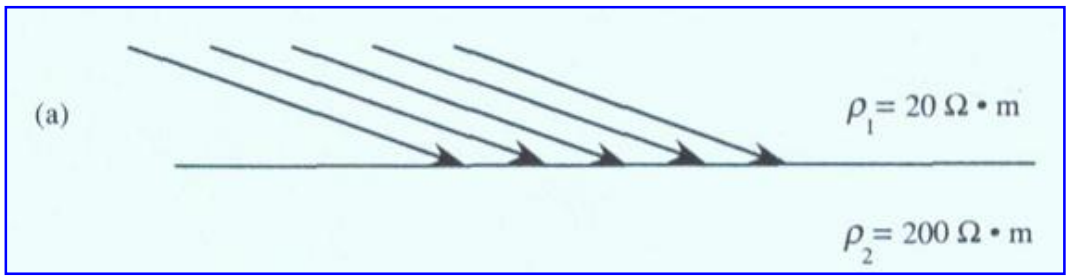
(b)

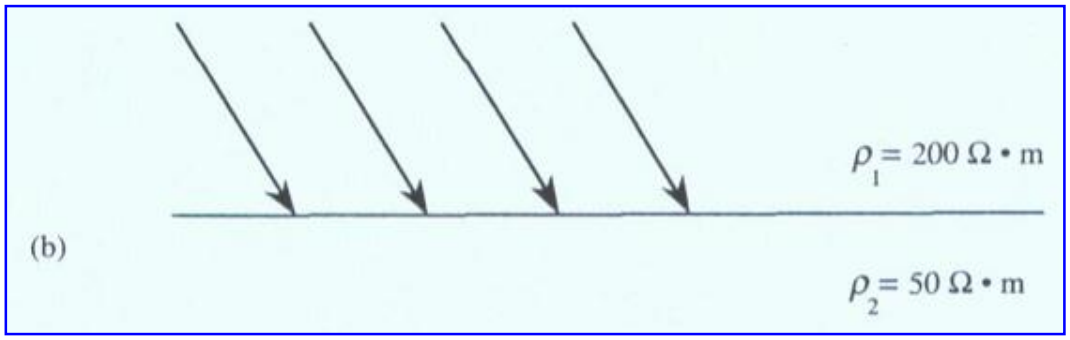
$$V_{P_1} = 0.418\ \text{v}$$

$$V_{P_2} = -0.418\ \text{v}$$

$$V_{P_1} - V_{P_2} = 0.836\ \text{v}$$

2. Construct the current-flow lines beneath the interface in (a) and (b).





(a)

$$\frac{\tan q_1}{\tan q_2} = \frac{r_2}{r_1}$$

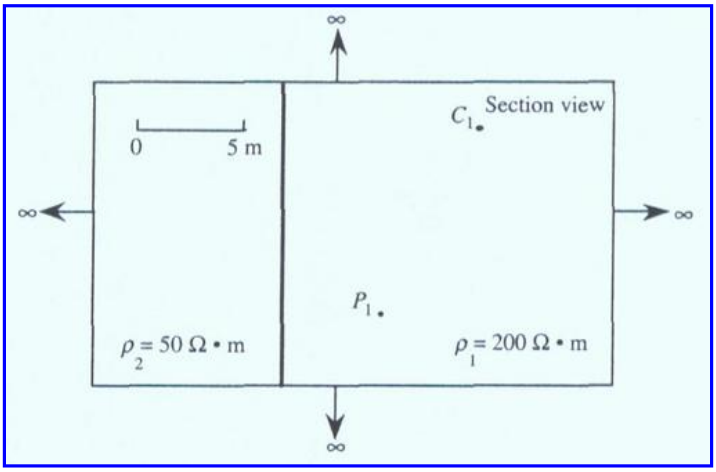
$$\tan q_2 = \tan 70° \frac{20\ \text{ohm} \cdot \text{m}}{200\ \text{ohm} \cdot \text{m}}$$

$$q_2 = 15.4°$$

(b)

$$q_2 = 66.6°$$

3. Calculate the potential at ρ1, due to a current at C, of 0.6 ampere. The material in this section view extends to infinity in all directions. The bold line represents an interface between p1- and p_2-material.



3.

$$V_{P_1} = \frac{ir_1}{4pr_1} + \frac{ikr_1}{4pr_2}, \qquad k = \frac{r_2 - r_1}{r_2 + r_1} = -0.6$$

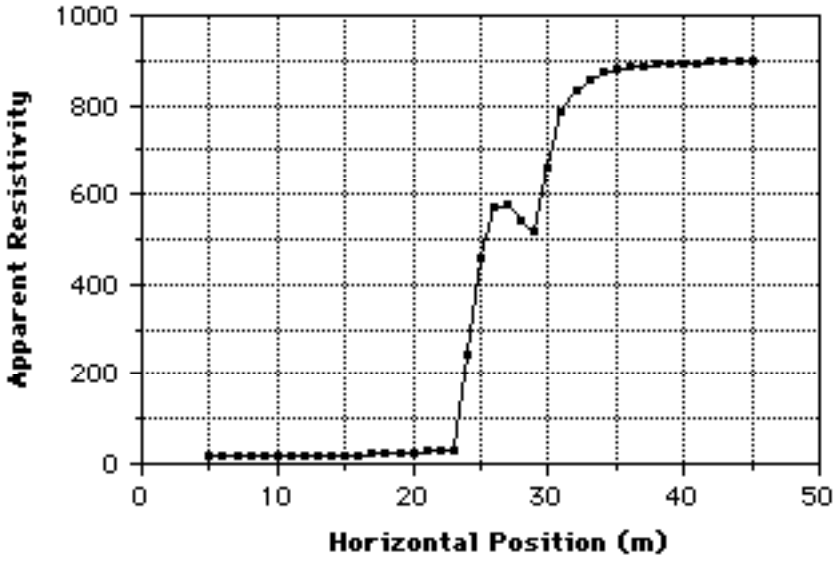
$$V_{P_1} = \frac{0.6\,\text{amp}\,(200\ \text{ohm}\cdot\text{m})}{4p\,(10\,\text{m})} + \frac{0.6\,\text{amp}(-0.6)(200\ \text{ohm}\cdot\text{m})}{4p\,(16.67\,\text{m})}$$

$$V_{P_1} = 0.611\ \text{v}$$

4. The following data were acquired using a constant-spread, Wenner traverse (a-spacing = 3m). Interpret the data as completely as possible.

Horizontal Position	pa	Horizontal Position (m)	pa	Horizontal Position (m)	Pa
5	20.05	19.00	22.55	33.00	858.94
6	20.06	20.00	25.32	34.00	872.33
7.00	20.07	21.00	28.45	35.00	880.40
8.00	20.08	22.00	27.97	36.00	885.58
9.00	20.10	23.00	27.11	37.00	889.07
10.00	20.12	24.00	242.39	38.00	891.51
11.00	20.15	25.00	460.00	39.00	893.26
12.00	20.19	26.00	572.39	40.00	894.57
13.00	20.24	27.00	580.25	41.00	895.55
14.00	20.32	28.00	541.30	42.00	896.31
15.00	20.44	29.00	519.88	43.00	896.90
16.00	20.61	30.00	660.54	44.00	897.38
17.00	20.91	31.00	785.22	45.00	897.76
18.00	21.45	32.00	834.74		

This data suggests a vertical discontinuity at 25 m horizontal position. Resistivity of the material to the left of the contact is 20 ohm·m and that of the material to the right is 900 ohm·m.



5. The following data were gathered with a Wenner, expanding-spread traverse in an area with thick alluvial deposits at the surface. What is the likely depth to the water table?

Electrode Spacing	pa	Electrode Spacing (m)	pa
0.47	198	6..81	84
0.69	160	10..00	82
1..00	140	14.68	92
1.47	112	21.54	101
2.15	95	31.62	100
3.16	84	46.42	102
4.64	79		

A consistent model shows that layer 1 is 1.3 m, 207 ohm·m; layer 2 is 15.7 m, 77 ohm·m; layer 3 is 107 ohm·m. A variety of input models produce similar results. The water table, therefore, is judged to be at a depth of approximately 1.3 m.