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Unit 12 - Week 11

Course outline

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Lecture 27: pH and Viscosity Measurement

Lecture 28: Signal Conditioning Integrated Circuits

Quiz : Week-11 Assignment on pH and viscosity measurement

Assignment Solution

Week 12

Week-11 Assignment on pH and viscosity measurement

1) 2 points
The hydroxide (OH^-) ion concentration of an aqueous solution is 1.0×10^{-4} moles/litre. What is the pH of the solution at standard 25 °C?

- a) 4
- b) 6
- c) 10
- d) 12

Accepted Answers:

c) 10

2) 2 points
At 100 °C, pH of pure water is 6.14. An aqueous solution has a pH of 7.0 at this temperature. What is the condition of the aqueous solution and pure water at this temperature, respectively?

- a) basic, acidic
- b) basic, neutral
- c) acidic, neutral
- d) acidic, basic

Accepted Answers:

b) basic, neutral

3) 4 points

The pH electrode is connected through a shielded cable to a non-inverting amplifier as shown in figure 1. The input resistance of the inverting amplifier is given by, $R = R_1(1 + A_o \frac{R_F}{R_1})$; where A_o is the open loop gain and R_i is the input resistance of opamp. Find the voltage V_o of the circuit when a 100 mV signal is generated at the electrode.

Data given: Resistance of the electrode = $10^{11} \Omega$; leakage resistance of the shielded cable = $10^{11} \Omega$; 10^6 ; $R_i = 10^5 \Omega$ and $\frac{R_F}{R_1} = 1$.

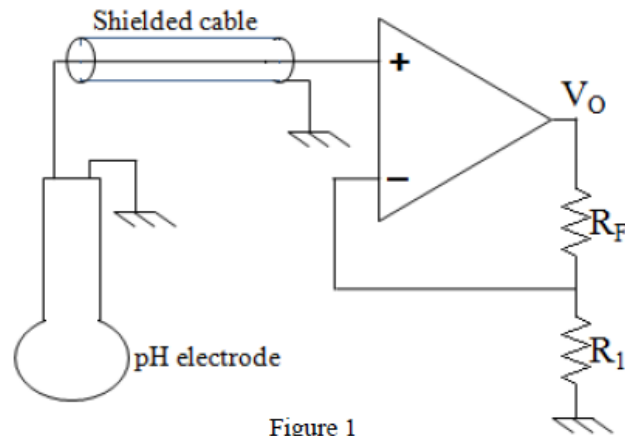


Figure 1

- a) 33.33 mV
- b) 66.67 mV
- c) 200 mV
- d) 333.3 mV

Accepted Answers:

b) 66.67 mV

4)

3 points

A solid cylinder of radius $R_1 = 130$ mm rotates concentrically inside a fixed hollow cylinder of inner radius $R_2 = 135$ mm. Both cylinders are 250 mm long. Determine the viscosity of liquid which fills the space between cylinders if a torque of 1.5 N-m is required to maintain the angular speed of 60 rpm.

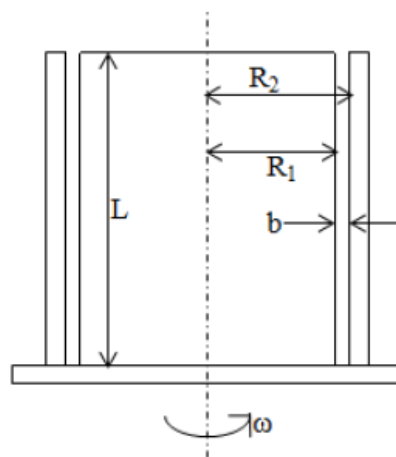


Figure 2

- a) 0.111 PI
- b) 0.222 PI
- c) 0.333 PI
- d) None of these

Accepted Answers:

c) 0.333 PI

5)

3 points

In the above problem, let us say R_2 is given by, $R_2 = (135 \pm 2)$ mm. Find out the maximum error in the measurement of viscosity (in the unit of PI).

- a) 0.13 PI
- b) 0.23 PI
- c) 0.33 PI
- d) 0.47 PI

Accepted Answers:

a) 0.13 PI

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