1. What is the main purpose of an instrumentation amplifier and what are three of its key characteristics?

2. What components are needed to construct a basic instrumentation amplifier?

3. Refer to Figure 3.1, determine:

   (a) Voltage gains of op-amp A1 and A2

   (b) The overall voltage gain.

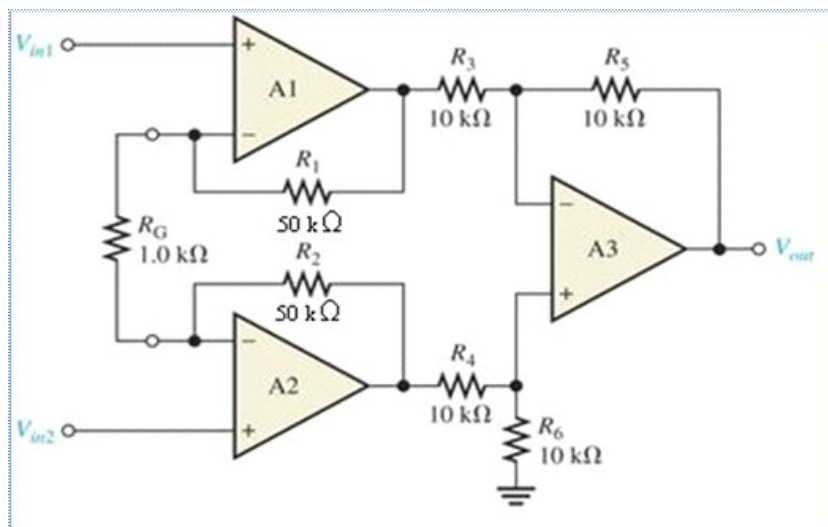   (c) The output voltage if $V_{in1}$ = 3 mV, $V_{in2}$ = 15 mV.



**Figure 3.1**

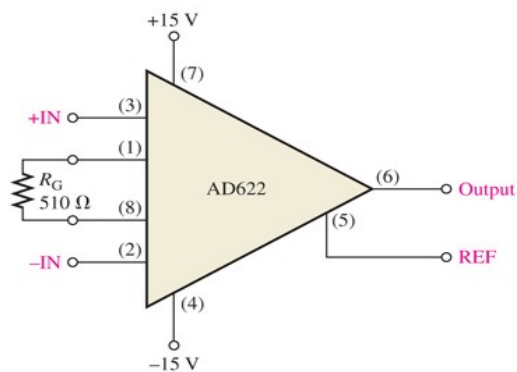4. Calculate the voltage gain for the instrumentation amplifier in Figure 3.2.



**Figure 3.2**

5. Determine the total gain of the 3656KG isolation amplifier in Figure 3.3.
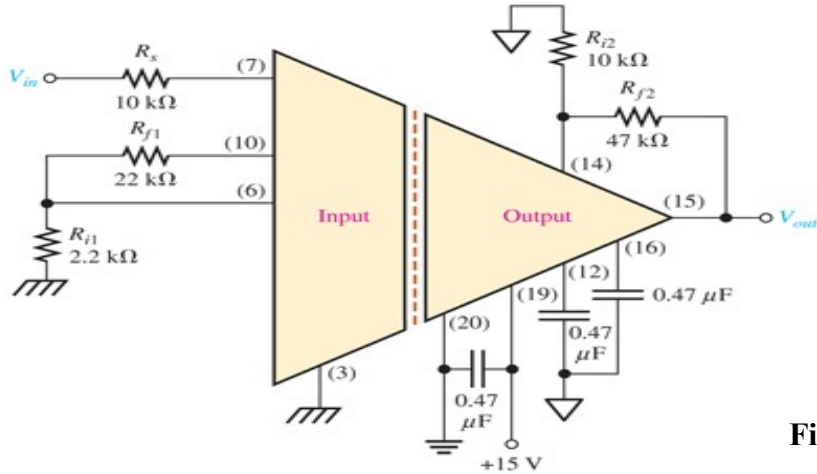


**Figure 3.3**

6. In what types of applications are isolation amplifiers used?

7. What are the two stages in a typical isolation amplifier and what is the purpose of having two stages?

8. What purpose does the diode or transistor perform in the feedback loop of a log amplifier.

9. Why is the output of a log amplifier limited to about 0.7 V?

10. What are the factors that determine the output voltage of a basic log amplifier?

11. In terms of implementation, how does a basic antilog amplifier differ from a basic log amplifier?

12. Determine the output voltage for the amplifier in Figure 3.4. Assume $I_R = 50$ nA.



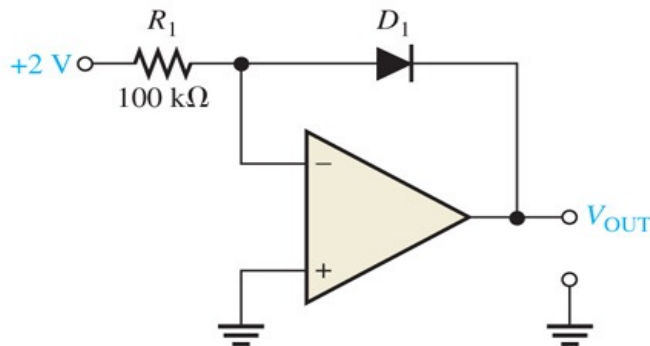**Figure 3.4**

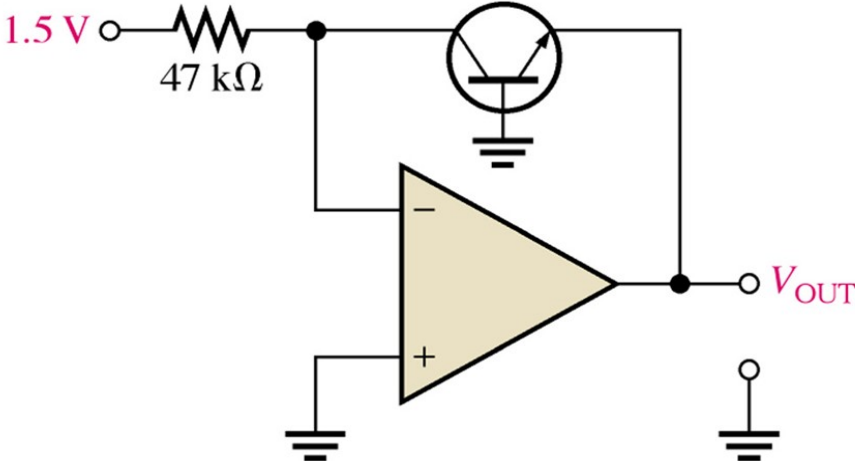13. Determine the output voltage for the log amplifier in Figure 3.5. Assume $I_{EBO}$ = 60 nA.



**Figure 3.5**

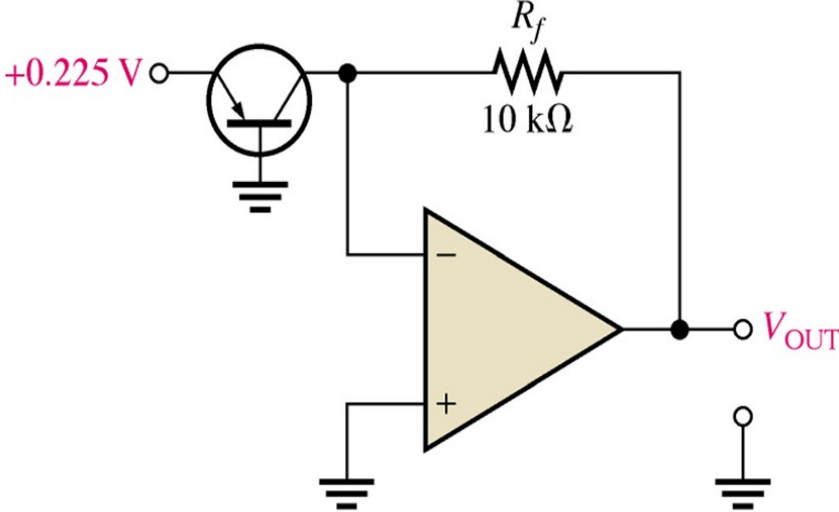14. Determine the output for the antilog amplifier in Figure 3.6. Assume $I_{EBO}$ = 60 nA.



**Figure 3.6**