Biological Information Engineering – Report 1

## Q1: The signal from a single cell is too weak to be measured.

Answer: × (False)  
Reason: Although signals from a single cell are weak, they can be measured using microelectrodes or patch-clamp techniques.

## Q2: An indifferent electrode is always required to detect bioelectricity in a volume conductor.

Answer: 〇 (True)  
Reason: An indifferent electrode is essential to serve as a voltage reference when detecting bioelectric signals.

## Q3: A pulse oximeter measures the oxygen saturation of venous blood using two wavelengths: red light and infrared light.

Answer: × (False)  
Reason: Pulse oximeters measure the oxygen saturation of arterial blood, not venous blood.

## Q4: The pulse oximeter's red light signal does not change during measurement.

Answer: × (False)  
Reason: The red light signal fluctuates with blood pulsation, which is necessary for calculating oxygen saturation.

## Q5: Presynaptic cell signals to postsynaptic neurons are input only from dendrites.

Answer: × (False)  
Reason: Signals can also be received at the soma or axon; dendrites are not the only site for input.

## Q6: Transmission of signals within neurons occurs only in one direction along the axon.

Answer: 〇 (True)  
Reason: Due to the refractory period, action potentials propagate only in one direction.

## Q7: Skeletal muscle cells have a structure that allows them to receive signals from multiple motor neurons.

Answer: × (False)  
Reason: Each skeletal muscle fiber is innervated by only one motor neuron.

## Q8: One cone cell transmits signals only to one ganglion cell.

Answer: × (False)  
Reason: Cone cells can signal to multiple ganglion cells through bipolar cell pathways.

## Q9: Cone cells respond even during scotopic vision, when there is very dim light.

Answer: × (False)  
Reason: Rod cells, not cone cells, are active in low-light (scotopic) conditions.

## Q10: Calculate the equilibrium potential (25°C) for K⁺, Na⁺, and Cl⁻ using the Nernst equation.

Answer:  
Nernst equation (25°C): E = 58 × log([out]/[in])  
  
K⁺: E = 58 × log(2.6 / 125) = 58 × (-1.68) ≈ -97.4 mV  
Na⁺: E = 58 × log(110 / 15) = 58 × (0.86) ≈ 49.9 mV  
Cl⁻: E = -58 × log(77 / 2.5) = -58 × (1.49) ≈ -86.4 mV