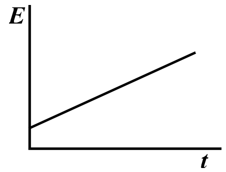
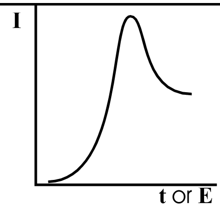
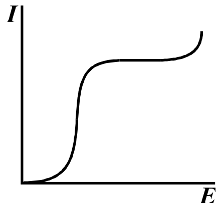
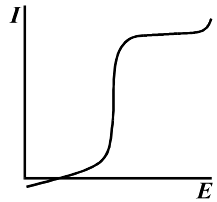
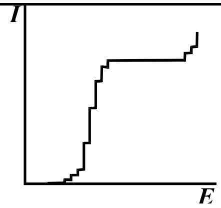
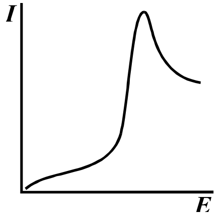
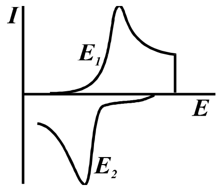
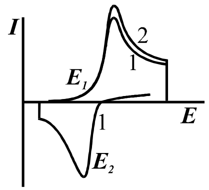
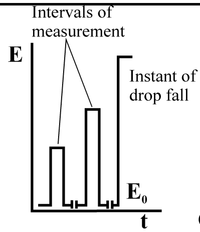
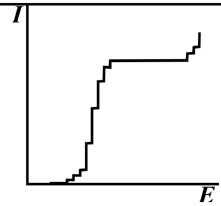
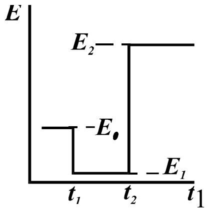
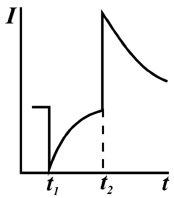
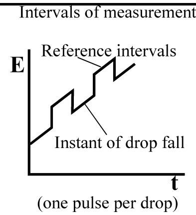
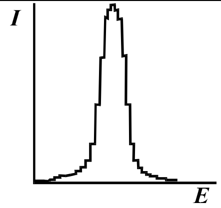
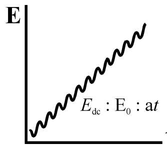
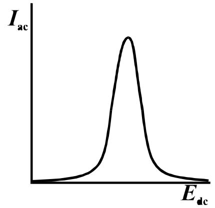
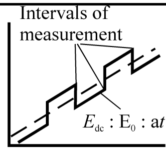
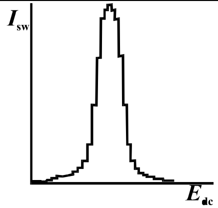
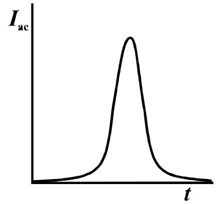
8.5.3 Voltammetric and related techniques (Techniques Involving Electrode Reactions and Variable Excitation Signals of Large Amplitude)

Recommended Name of Technique	Excitation Signal	Manner of Variation	System	Measured Response	Typical Response Curve	Remarks
Linear sweep voltammetry, stationary electrode voltammetry or chrono-amperometry with linear potential sweep	Applied potential $E = E_i \pm at$	$E = E_i \pm at$  1	Working electrode whose surface is not renewed, reference electrode and an auxiliary electrode. Diffusive mass transport to the working electrode	Current, $i\ (I) = f\ (t)$ or implicitly $f\ (E)$	 2	A measure of current as a function of time (and implicitly as a function of potential) when the potential of a working electrode is varied linearly with timein respect to the reference electrode with time. In aqueons solution the reference electrode often serves as auxiliary electrode.
Hydrodynamic voltammetry			Convective mass transfer to any working electrode whose surface is not renewed	Current, $i\ (I) = f\ (E)$	 3	A measure of current as a function of potential of a working electrode when convective mass transfer is employed.
Polarography			Dropping mercury (or other liquid conductor) electrode, or any other working electrode whose surface is renewed	Current, $i\ (I) = f\ (E)$	 4	A measure of current as a function of potential when the working electrode is a dropping mercury (or other liquid conductor) electrode and unstirred solutions are used. Because the current varies with drop growth and renewal, currents are often expressed as average or limiting values to provide an envelope of the current-voltage response. The rate of potential scan must give nearly constant potential on each drop.

Recommended Name of Technique	Excitation Signal	Manner of Variation	System	Measured Response	Typical Response Curve	Remarks
Tast polarography	As for linear sweep voltammetry		As for polarography, but with recording of current only during the interval $t_i \leq t < t_i + \Delta t$ during the drop life, the recording device being disconnected between successive intervals	Current, $i\ (I) = f\ (E)$	 5	Polarography with current sampled only during a specific time interval during the life of each drop of the dropping mercury electrode. The sampled current vs. potential is the observed response.
Single drop sweep polarography		Entire scan on one drop	As for polarography		 6	Recommend using "dropping electrode chronoamperometry with linear potential sweep". This latter terminology uses generic nomenclature, and therefore requires no new entry, except for the recommended substitution.
Triangular wave voltammetry			As for linear sweep voltammetry		 7	Recommend using "chronoamperometry with triangular potential sweep". This latter terminology uses generic nomenclature, and therefore requires no new entry, except for the recommended substitution.
Cyclic voltammetry, cyclic triangular wave voltammetry					 8	Recommend "chronoamperometry with multiple triangular potential sweeps". This latter terminology uses generic nomenclature, and therefore requires no new entry, except for the recommended substitution.

Recommended Name of Technique	Excitation Signal	Manner of Variation	System	Measured Response	Typical Response Curve	Remarks
Normal pulse polarography	 9		As for single sweep voltammetry	Current, $i\ (I) = f\ (E)$	 10	A measure of current at a dropping electrode sampled during a voltage pulse from some initial potential. One pulse is applied during each drop lifetime; successive pulses increase linearly such that a polarographic step-type current-potential response is obtained, when sampled current is plotted against potential pulse value.
Double potential step chrono-amperometry	 11		Working electrode stationary in unstirred solution	Current, $i\ (I) = f\ [(t - t_1)$ and $(t - t_2)]$	 12	In this and the following technique E_1 must differ from the open-circuit potential : if it does not, the techniques are properly called "chronoamperometry" and "chrono-coulometry", respectively.

Recommended Name of Technique	Excitation Signal	Manner of Variation	System	Measured Response	Typical Response Curve	Remarks
Differential pulse polarography	 13		As for polarography	Difference of current, $i\ (I) = f\ (E_0 \text{ or } E_1)$	 14	A measure of the difference in current sampled before and after a small pulse superimposed on a linear potential sweep applied to a dropping electrode. Each pulse is synchronized with the start of drop life. A plot of current difference values vs. ramp potential produces a derivative type polarographic curve. The measured response is the difference between the direct current that flows during the interval of measurement and the direct current that flowed during a short interval that just preceded the application of the pulse.
AC-polarography	 15			Alternating current, $i_{ac}\ (I_{ac}) = f\ (E_{dc})$	 16	A measure of the AC component of the cell current when a small amplitude a AC potential is superimposed on a linear potential sweep applied to a dropping electrode. A plot of the AC current vs. sweep potential produces a derivative type polarographic curve. The frequency of the alternating component of the applied E.M.F. or potential is usually below1 kHz and is most often 50-60 Hz. The periodic component of the excitation signal may be nonsinusoidal (e.g., triangular, sawtooth, etc.), and the technique should then be termed "polarography with superimposed periodic potential" or, more specifically, "polarography with superimposed triangular potential" etc. See also square-wave polarography.

Recommended Name of Technique	Excitation Signal	Manner of Variation	System	Measured Response	Typical Response Curve	Remarks
Square - wave polarography	 17			Square wave current, i_{sw} (I_{sw}) = f (E_{dc})	 18	A measure of alternating current obtained by sampling the current on alternate half cycles when small amplitude square wave is superimposed on a linear potential sweep applied to a dropping electrode. A plot of the measured periodic current vs. sweep voltage produces a derivative type polarographic curve. This techniques may be regarded as a small-amplitude analog of one variant of Kalousek polarography. It is distinguished from differential pulse polarography by involving the measurement of a periodic current rather than a direct current.
Alternating voltage chrono-potentiometry	i_{dc} (I_{dc}) = constant $E_{ac} = E_{ac} \sin \omega t$			Alternating current, i_{ac} (I_{ac}) = f (t)	 19	