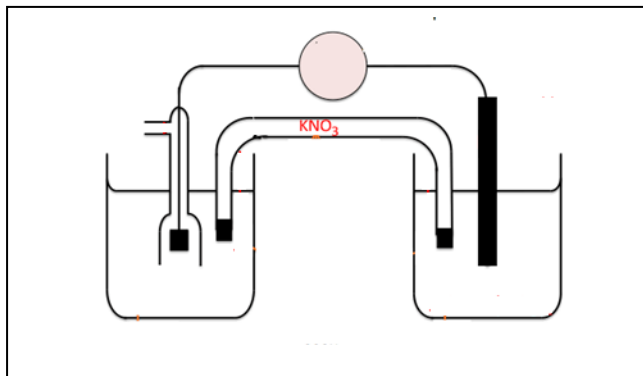Redox reactions – galvanic cells revision

Lesson 5

1) Below is a diagram showing part of the electrochemical series and an unlabelled galvanic cell.

Half reaction	E^o
$O_2(g) + 2H_2O(l) + 4e^- \rightleftharpoons 4OH^-(aq)$	+0.40
$Cu^{2+}(aq) + 2e^- \rightleftharpoons Cu(s)$	+0.34
$Sn^{4+}(aq) + 2e^- \rightleftharpoons Sn^{2+}(aq)$	+0.15
$S(s) + 2H^+(aq) + 2e^- \rightleftharpoons H_2S(g)$	+0.14
$2H^+(aq) + 2e^- \rightleftharpoons H_2(g)$	0.00
$Pb^{2+}(aq) + 2e^- \rightleftharpoons Pb(s)$	−0.13
$Sn^{2+}(aq) + 2e^- \rightleftharpoons Sn(s)$	−0.14
$Ni^{2+}(aq) + 2e^- \rightleftharpoons Ni(s)$	−0.23
$Co^{2+}(aq) + 2e^- \rightleftharpoons Co(s)$	−0.28

a) The E^o values shown above are measured at standard conditions. What are the standard conditions that E^o values for each half cell are measured at?

b) Using the diagram above, construct a galvanic cell that will deliver 0.63V under standard conditions.
   Clearly label or give the following

i.	The direction of electron flow
ii.	The anode and cathode
iii.	The polarity of each electrode
iv.	The material each electrode is made up of.
v.	The substance forming the salt bridge
vi.	Direction of anion and cation movement
vii.	The oxidant
viii.	The reductant
ix.	The oxidation half equation
x.	The reduction half equation
xi.	Overall equation

c) One of the electrodes starts to corrode as the cell discharges. If 1.1012 mol of electrons flow through the external circuit of the galvanic cells while discharging, what is the mass loss of the electrode given to the right number of significant figures. The data book should be used.

2) A galvanic cell consists of one half cell that is made up of an inert graphite electrode in a solution containing 1.0 M Fe^{2+}(aq) and 1.0 M Fe^{3+}(aq) at 25°C.
Which of the following could be used as the second half cell so that the polarity of the electrode in this second half cell is positive? Explain
  i. a lead electrode in a solution of 1.0 M Pb^{2+}(aq)
  ii. a silver electrode in a solution of 1.0 M Ag^{+}(aq)
  iii. A cobalt electrode in a solution of 1.0 M Co^{2+}(aq)
  iv. an inert graphite electrode in a solution of 1.0 M Sn^{4+}(aq) and 1.0M Sn^{2+}(aq)

$$O_2(g) + 4H^+(aq) + 4e^- \rightleftharpoons 2H_2O(l)$$
$$Br_2(l) + 2e^- \rightleftharpoons 2Br^-(aq)$$
$$Ag^+(aq) + e^- \rightleftharpoons Ag(s)$$
$$Fe^{3+}(aq) + e^- \rightleftharpoons Fe^{2+}(aq)$$
$$O_2(g) + 2H^+(aq) + 2e^- \rightleftharpoons H_2O_2(aq)$$
$$I_2(s) + 2e^- \rightleftharpoons 2I^-(aq)$$
$$O_2(g) + 2H_2O(l) + 4e^- \rightleftharpoons 4OH^-(aq)$$
$$Cu^{2+}(aq) + 2e^- \rightleftharpoons Cu(s)$$
$$Sn^{4+}(aq) + 2e^- \rightleftharpoons Sn^{2+}(aq)$$
$$S(s) + 2H^+(aq) + 2e^- \rightleftharpoons H_2S(g)$$
$$2H^+(aq) + 2e^- \rightleftharpoons H_2(g)$$
$$Pb^{2+}(aq) + 2e^- \rightleftharpoons Pb(s)$$
$$Sn^{2+}(aq) + 2e^- \rightleftharpoons Sn(s)$$
$$Ni^{2+}(aq) + 2e^- \rightleftharpoons Ni(s)$$
$$Co^{2+}(aq) + 2e^- \rightleftharpoons Co(s)$$

Clearly label or give the following

xii.	The direction of electron flow
xiii.	The anode and cathode
xiv.	The polarity of each electrode
xv.	The material each electrode is made up of.
xvi.	The substance forming the salt bridge
xvii.	Direction of anion and cation movement
xviii.	The oxidant
xix.	The reductant
xx.	The oxidation half equation
xxi.	The reduction half equation
xxii.	Overall equation