Chemistry 12

Electrochemistry

version 1

Blue

Name: Key

Block: _____

Part 1: Multiple Choice

Outcome 1	Outcome 2	Outcome 3	Review
1. C	11. A	21. D	31. A
2. C	12. A	22. C	32. D
3. A	13. B	23. D	33. B
4. D	14. D	24. C	34. C
5. B	15. B	25. D	35. C
6. D	16. B	26. B	36. D
7. B	17. D	27. D	37. C
8. C	18. C	28. A	38. D
9. A	19. D	29. B	39. B
10. D	20. A	30. A	40. A

Name: Key
Date:
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Electrochemistry Test

Written Part

1. Balance the following redox reaction: **(4 marks)**

$$Mn^{2+} + BiO_3^- \rightarrow MnO_4^- + Bi^{3+} \quad \text{(acidic)}$$

$2(Mn^{+2} + 4H_2O \rightarrow MnO_4^- + 8H^+ + 5e^-)$

$5(BiO_3^- + 6H^+ + 2e^- \rightarrow Bi^{+3} + 3H_2O)$

$2Mn^{+2} + 8H_2O \rightarrow 2MnO_4^- + 16H^+ + 10e^-$

$5BiO_3^- + 30H^+ + 10e^- \rightarrow 5Bi^{+3} + 15H_2O$

$2Mn^{+2} + 5BiO_3^- + 14H^+ \rightarrow 2MnO_4^- + 5Bi^{+3} + 7H_2O$

2. Consider the following reaction:

$$Cr_2O_7^{2-} + 6Br^- + 14H^+ \rightarrow 2Cr^{3+} + 3Br_2 + 7H_2O$$

In a redox titration, 15.58 mL of 0.125 M $Cr_2O_7^{2-}$ was needed to completely oxidize the Br^- in a 25.00 mL sample of NaBr. Calculate the $[Br^-]$ in the original solution. **(3 marks)**

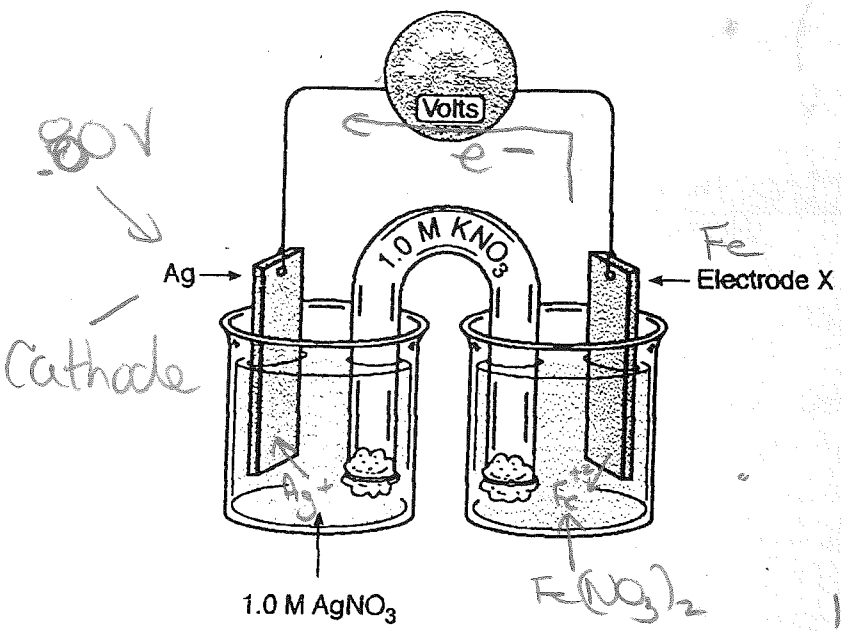
$mol\ Cr_2O_7^{-2} = .125M(.01558L)$

$= 0.0019479\ mol$

$0.0019479 mol Cr_2O_7^{-2} \left(\frac{6 mol Br^-}{1 mol}\right) = 0.011689 mol\ Br^-$

$\frac{0.011689 mol\ Br^-}{.025L} = 0.467\ M\ Br^-$

3. Consider the following electrochemical cell:



.80 V

Cathode

Fe

1.25 = x − .8

x = 2.05

↳ none

$E^\circ = E_R - E_O$

1.25 V = .80 − x

x = −.45 = Fe

a) The initial cell voltage in the diagram above is 1.25 V. Identify electrode **X**. **(1 mark)**

Fe (iron)

b) Towards which electrode will the K^+ ions migrate? **(1 mark)**

Ag

c) Write the equation for the reduction half-reaction that occurs. **(1 mark)**

$Ag^+ + e^- \rightarrow Ag$

d) On the diagram, indicate the direction of electron flow. **(1 mark)**

4. Using E° values, explain why Cu will react with 1.0 M HNO_3, but not with 1.0 M HCl. **(3 marks)**

$Cu + HNO_3$

$E° = R - O$

$= .8 - .34$

$= .46V$

↳ produces E

∴ spontaneous

$Cu + HCl \rightarrow H^+$ is it

$E° = R - O$

$= 0 - .34$

$= -.34V$

↳ requires E

∴ not

5. The overall reaction in a fuel cell is:

$$2H_2 + O_2 \rightarrow 2H_2O$$ (spontaneous).

a) Write the equation for the half-reaction at the anode. ox **(1 mark)**

$H_2 + 2\,OH^- \rightarrow 2\,H_2O + 2e^-$

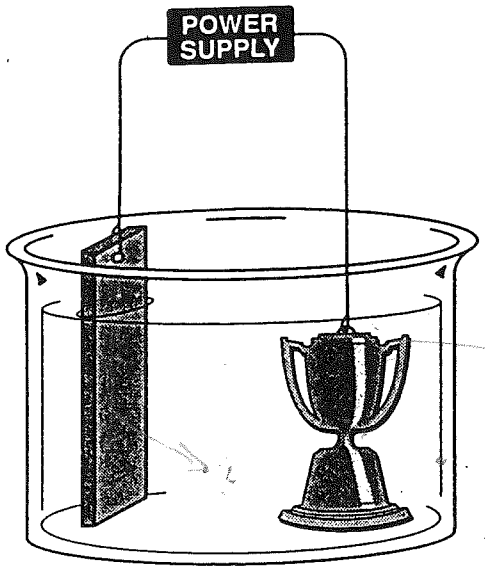
b) Is the overall reaction spontaneous? Explain. **(1 mark)**

yes because O_2 = reduced ; H_2 = oxidized

∴ $E° = .82 + .41 = 1.23V$

↳ since $E°$ is +ve energy is produced ∴ spontaneous

6. A trophy manufacturer electroplates an iron trophy with gold.



a) Write the equation for the half-reaction that occurs at the iron trophy. **(1 mark)**

$Au^{+3} + 3e^- \rightarrow Au_{(s)}$

b) Identify an appropriate electrolyte. **(1 mark)**

$Au(NO_3)_3(aq)$

c) Identify the cathode. **(1 mark)**

-trophy.

d) Explain how to maintain a constant metal ion concentration in the electrolyte. **(1 mark)**

-the anode should be made of $Au_{(s)}$