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Chemistry 233 Final Practice Quest

1) Regarding chemical spontaneity, choose whether the systems described will be spontaneous, non-spontaneous, or not enough info. (3)

- $CO_{2(s)} \rightarrow CO_{2(g)}$ $\Delta H = 26$ kJ
- $Q = 2.4 \times 10^{-5}$, $K_{eq} = 6.8 \times 10^{-6}$
- $\Delta H < 0$, $\Delta S > 0$, $T = 298K$

2) Hunter creates a buffer by adding 0.5 mol of solid sodium hydroxide to 1.0 L of 1.0 M acetic acid. What can be said about the pH of the buffer? (2)

a) The pH will be equal to the pKa for acetic acid

b) The pH will be greater than the pKa for acetic acid

c) The pH will be less than the pKa for acetic acid

d) The pH will be equal to the pKa of acetic acid minus 0.30

e) The pH will be less than the value in answer d.

3) Using reduction half-reaction potentials, calculate $\Delta G°$ for the following balanced redox reaction: (3)

$3I_{2(s)} + 2Al_{(aq)} \rightarrow 2Al^{3+}_{(aq)} + 6I^{-}_{(aq)}$

4) Which of the following is NOT a structural isomer of 2-methyl-3-ethylheptane? (2)

(A) 5-methylnonane

(B) 2-methyl-4-ethylheptane

(C) 2,2,3,4,4-pentamethylpentane

(D) 2,4-diethyl-3-propylpentane

(E) decane

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5) What is the Ka for a 25 L solution of 0.800M weak acid, HA, that reads a pH of 2.95? (2)

6) With respect to acids and bases (select all that are true) (3)

-A CH_3NH_3Br solution is acidic

-NO_2^- is a stronger base than $H_2AsO_3^-$

-Adding some solid sodium acetate, NaC2H3O2, to aqueous HC2H3O2 will decrease the pH

-Titration of a weak acid with a strong base will have a pH below 7 at the equivalence point

-$CaCO_3$ is more soluble in an acidic solution than in pure water

7)The splitting of the d orbitals in a transition metal complex is 171 kJ/mol. What color does this transition metal complex appears to be in transmission? (what color should you expect to see) (3)

(A) green

(B) blue

(C) violet

(D) red

(E) orange

8) When the reaction $Mo_{(s)} + Cr_2O_7^{2-}{}_{(aq)} \rightarrow Cr^{2+}{}_{(aq)} + Mo^{4+}{}_{(aq}$ is correctly balanced in acid, how many H^+ protons will be consumed? (2)

a) 4
b) 8
c) 12
d) 14
e) 16
f) 40

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9) With respect to electrochemistry (select all that are true) (3)

-Potassium is a stronger reducing agent than Na

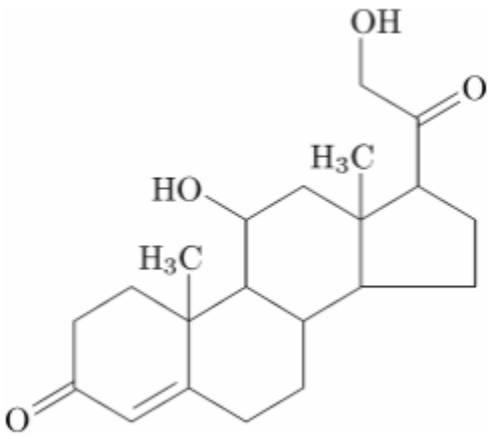
-Gold will dissolve in HCl and HNO_3 whereas copper only dissolves in HCl

-H_2O_2 is a stronger oxidizing agent than O_2

-A spontaneous reaction is possible when E^0cell > 0 and K > 1

-For electrolysis of PbI_2, the cathode is $2I^-$

10) The structure of Jamesonnium is shown below



Jamesonnium contains (select all) (2)

-an alcohol group

-an aldehyde group

-a ketone group

-an ether group

-a carboxylic acid group

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11) With respect to organic chemistry (select all that are true) (2)

-The addition of water to 2-pentene forms 3-pentanol and 4-pentanol

-Cyclohexane is a saturated hydrocarbon

-A molecule such as 2-pentene can exhibit cis-trans isomers but 2-pentane and 2-pentyne cannot

-The product of an amine and a carboxylic acid is an amide

-$CH_3CH_2CHClCH_3$ contains optical isomerism

12) What mass of ammonium chloride, NH_4Cl, should be added to 2.55 L of 0.155 M NH_3 to obtain a buffer with pH of 9.55? (2)

13) Determine the cell potential for the reaction below at 25 deg C (2)

$$Sn_{(s)} + Cr^{3+}_{(aq)} \rightarrow Sn^{2+}_{(aq)} + Cr^{2+}_{(aq)}$$

$[Sn^{2+}] = 0.0100M$ $[Cr^{3+}] = 2.00\ M$ $[Cr^{2+}] = 0.500M$

14) In the reaction $MnO_4^-{}_{(aq)} + Br^-_{(aq)} \rightarrow BrO_3^-{}_{(aq)} + MnO_{2(s)}$, identify reducing agent in a basic solution (2)

a) MnO_4^-
b) Br^-
c) Mn
d) O
e) BrO_3^-
f) MnO_2

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15) With respect to coordination compounds (select all that are correct) (3)

-In $Na[M(Cl)_2(NH_3)_2(ox)]^{+1}$, M has an oxidation state of M^{+1}

-$[M(en)_3]^{3+}$ has a coordination number of 6 and only has optical isomers

-Coordination compounds such as $[CoBr_2(CN^-)_4]$ and $Na[Pt(NH_3)_2(Cl)_2]$ both contain cis-trans isomers

-Optical isomerism is only found in molecules with non-superimposable mirror images, also known as enantiomers

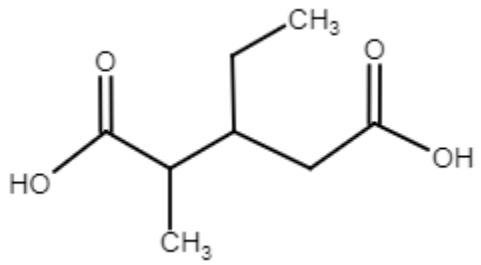
-The only isomers in $Na[M(NO_2)_3BrCl_2]$ are cis-trans, fac-mer, coordination, and linkage isomers

-$[Mn(CN)_6]^{4-}$ is a low spin complex with five unpaired electrons

16) What is the pH of a 0.250 M KH_2AsO_4 solution? (3)

17) What is the equilibrium constant at 25 deg C for the following reaction? (3)

$$CH_{4(g)} + 2H_2O_{(g)} \rightleftharpoons CO_{2(g)} + 4H_{2(g)}$$



18) Name the above compound using proper IUPAC naming format (3)

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19) What is the pH at the equivalence point if 25.00 mL solution of 0.200M $HC_3H_5O_2$ is completely titrated by 0.1250 M LiOH? (3)

20) The solubility product constant of partially soluble solid $M_3(OH)_2$ is 1.2×10^{-29} at 25 deg C. Determine $\Delta G_{rxn,}$ in kJ, at this temperature when the pH of the saturated $M_3(OH)_2$ is 8.11. (2)