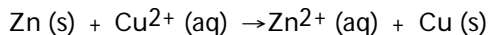


Name \_\_\_\_\_

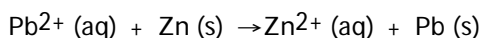
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) In the galvanic cell using the redox reaction below, the reduction half-reaction is \_\_\_\_\_.



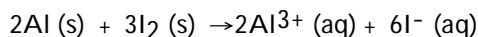
- A)  $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$       B)  $\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^-$       C)  $\text{Zn} + 2\text{e}^- \rightarrow \text{Zn}^{2+}$       D)  $\text{Cu}^{2+} \rightarrow \text{Cu} + 2\text{e}^-$
- Answer: A

- 2) The standard cell potential (
- $E^\circ_{\text{cell}}$
- ) for the reaction below is +0.63 V. The cell potential for this reaction is \_\_\_\_\_ V when
- $[\text{Zn}^{2+}] = 3.0 \text{ M}$
- and
- $[\text{Pb}^{2+}] = 2.0 \times 10^{-4} \text{ M}$
- .



- A) 0.51      B) 0.75      C) 0.86      D) 0.40      E) 0.63
- Answer: A

- 3) The standard emf for the cell using the overall cell reaction below is +2.20 V:

The emf generated by the cell when  $[\text{Al}^{3+}] = 3.5 \times 10^{-3} \text{ M}$  and  $[\text{I}^-] = 0.30 \text{ M}$  is \_\_\_\_\_ V.

- A) 2.23      B) 2.28      C) 2.36      D) 2.12      E) 2.20
- Answer: B

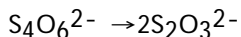
- 4) How many kilowatt-hours of electricity are used to produce 4.50 kg of magnesium in the electrolysis of molten
- $\text{MgCl}_2$
- with an applied emf of 5.00 V?

- A) 0.0201      B) 12.4      C) 49.6      D) 0.0496      E) 24.8
- Answer: C

- 5) How many grams of Ca metal are produced by the electrolysis of molten
- $\text{CaBr}_2$
- using a current of 30.0 amp for 8.0 hours?

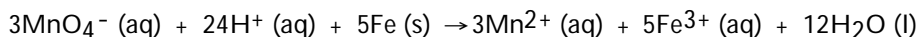
- A) 89.7      B) 0.0622      C) 17.9      D) 359      E) 179
- Answer: E

- 6) \_\_\_\_\_ electrons appear in the following half-reaction when it is balanced.



- A) 6      B) 4      C) 3      D) 2      E) 1
- Answer: D

7) The half-reaction occurring at the cathode in the balanced reaction shown below is \_\_\_\_\_.



- A)  $\text{MnO}_4^- (\text{aq}) + 8\text{H}^+ (\text{aq}) + 5\text{e}^- \rightarrow \text{Mn}^{2+} (\text{aq}) + 4\text{H}_2\text{O} (\text{l})$
- B)  $\text{Fe} (\text{s}) \rightarrow \text{Fe}^{2+} (\text{aq}) + 2\text{e}^-$
- C)  $\text{Fe} (\text{s}) \rightarrow \text{Fe}^{3+} (\text{aq}) + 3\text{e}^-$
- D)  $2\text{MnO}_4^- (\text{aq}) + 12\text{H}^+ (\text{aq}) + 6\text{e}^- \rightarrow 2\text{Mn}^{2+} (\text{aq}) + 3\text{H}_2\text{O} (\text{l})$
- E)  $\text{Fe}^{2+} (\text{aq}) \rightarrow \text{Fe}^{3+} (\text{aq}) + \text{e}^-$

Answer: A

8) The reduction half reaction occurring in the standard hydrogen electrode is \_\_\_\_\_.

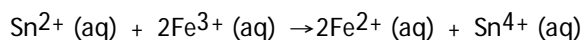
- A)  $2\text{H}^+ (\text{aq}) + 2\text{OH}^- \rightarrow \text{H}_2\text{O} (\text{l})$
- B)  $2\text{H}^+ (\text{aq}, 1\text{M}) + \text{Cl}_2 (\text{aq}) \rightarrow 2\text{HCl} (\text{aq})$
- C)  $\text{H}_2 (\text{g}, 1 \text{atm}) \rightarrow 2\text{H}^+ (\text{aq}, 1\text{M}) + 2\text{e}^-$
- D)  $\text{O}_2 (\text{g}) + 4\text{H}^+ (\text{aq}) + 4\text{e}^- \rightarrow 2\text{H}_2\text{O} (\text{l})$
- E)  $2\text{H}^+ (\text{aq}, 1\text{M}) + 2\text{e}^- \rightarrow \text{H}_2 (\text{g}, 1 \text{atm})$

Answer: E

Table 20.2

Half-reaction	$E^\circ (\text{V})$
$\text{Cr}^{3+} (\text{aq}) + 3\text{e}^- \rightarrow \text{Cr} (\text{s})$	-0.74
$\text{Fe}^{2+} (\text{aq}) + 2\text{e}^- \rightarrow \text{Fe} (\text{s})$	-0.440
$\text{Fe}^{3+} (\text{aq}) + \text{e}^- \rightarrow \text{Fe}^{2+} (\text{s})$	+0.771
$\text{Sn}^{4+} (\text{aq}) + 2\text{e}^- \rightarrow \text{Sn}^{2+} (\text{aq})$	+0.154

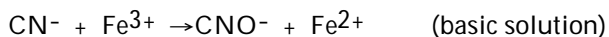
9) The standard cell potential ( $E^\circ_{\text{cell}}$ ) for the voltaic cell based on the reaction below is \_\_\_\_\_ V.



- A) +0.46
- B) +0.617
- C) +1.39
- D) +1.21
- E) -0.46

Answer: B

10) What is the coefficient of  $\text{Fe}^{3+}$  when the following equation is balanced?



- A) 1
- B) 2
- C) 3
- D) 4
- E) 5

Answer: B

11) Which one of the following processes results in a decrease in the number of neutrons?

- A) gamma emission
- B) alpha emission
- C) corrosion
- D) positron emission
- E) electron capture

Answer: B

- 12) The product of the nuclear reaction in which Ar-40 is subjected to neutron capture followed by alpha emission is \_\_\_\_\_.
- A) Ar-41                      B) Ar-35                      C) S-37                      D) S-36                      E) Ca-45

Answer: C

- 13) The half-life of cobalt-60 is 5.20 yr. How many milligrams of a 2.000-mg sample remain after 9.50 years?
- A) 0.565                      B)  $7.03 \times 10^{-22}$                       C) 7.076                      D) 1.435                      E) 1.095

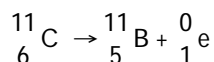
Answer: A

- 14) If we start with 1.000 g of cobalt-60, 0.400 g will remain after 7.00 yr. This means that the half-life of cobalt-60 is \_\_\_\_\_ yr.

A) 2.80                      B) 7.65                      C) 12.1                      D) 5.30                      E) 17.5

Answer: D

- 15) Carbon-11 decays by positron emission:



The decay occurs with a release of  $2.87 \times 10^{11}$  J per mole of carbon-11. When 5.00 g of carbon-11 undergoes this radioactive decay, \_\_\_\_\_ g of mass is converted to energy.

A)  $1.45 \times 10^{-6}$                       B)  $1.45 \times 10^{-3}$                       C)  $1.59 \times 10^{-2}$                       D)  $4.35 \times 10^5$                       E)  $6.90 \times 10^2$

Answer: B

- 16) The mass of a proton is  $1.673 \times 10^{-24}$  g. The mass of a neutron is  $1.675 \times 10^{-24}$  g. The mass of the nucleus of an  ${}^{59}\text{Fe}$  atom is  $9.787 \times 10^{-23}$  g. What is the nuclear binding energy (in J) for a  ${}^{59}\text{Fe}$  nucleus? ( $c = 3.00 \times 10^8$  m/s)

A)  $8.13 \times 10^{-11}$  J  
B)  $-9.74 \times 10^{-10}$  J  
C)  $8.13 \times 10^{-8}$  J  
D)  $2.71 \times 10^{-19}$  J  
E)  $4.00 \times 10^{-9}$  J

Answer: A

- 17) The mass of a proton is 1.00728 amu and that of a neutron is 1.00867 amu. What is the mass defect (in amu) of a  ${}^{57}\text{Ni}$  nucleus? (The mass of a nickel-60 nucleus is 59.9308 amu.)

A) 28.76 amu                      B) -0.4932 amu                      C) 0.5155 amu                      D) 1.031 amu                      E) 0.5141 amu

Answer: C

- 18) What is the largest number of protons that can exist in a nucleus and still be stable?

A) 84                      B) 50                      C) 92                      D) 206                      E) 83

Answer: E

- 19) Bombardment of uranium-235 with a neutron generates tellurium-135, 3 neutrons, and \_\_\_\_\_.
- A) strontium-99.
  - B) zirconium-98.
  - C) krypton-103.
  - D) krypton-101.
  - E) zirconium-99.

Answer: B

- 20) What order process is radioactive decay?
- A) zeroth
  - B) first
  - C) second
  - D) third
  - E) fourth

Answer: B

- 21) Which one of the following species is paramagnetic?
- A)  $\text{Zn}^{2+}$
  - B) Cu
  - C)  $\text{Y}^{3+}$
  - D) Ne
  - E) Ra

Answer: B

- 22) Which element has the largest bonding atomic radius?
- A) titanium
  - B) vanadium
  - C) chromium
  - D) manganese
  - E) scandium

Answer: E

- 23) Which of the following is not a chelating agent?

- A) ortho-phenanthroline
- B) carbonate ion
- C) triphosphate ion
- D) ethylenediamine
- E) water

Answer: E

- 24) Which one of the following is the correct formula for pentaamminechlorocobalt (III) chloride?

- A)  $[\text{Co}(\text{NH}_3)_4\text{Cl}]\text{Cl}_2$
- B)  $[\text{Cl}(\text{NH}_3)_5\text{Co}]\text{Co}_2$
- C)  $[\text{Co}(\text{NH}_3)_5]\text{Cl}_4$
- D)  $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$
- E)  $[\text{Co}(\text{NH}_3)_6\text{Cl}]\text{Cl}_2$

Answer: D

- 25) How many d electrons are associated with the metal ion in  $[\text{Cr}(\text{NH}_3)_6]^{3+}$ ?

- A) 1
- B) 2
- C) 4
- D) 3
- E) 0

Answer: D

- 26) During the formation of a coordination compound, the metal acts as a \_\_\_\_\_.

- A) Brønsted base
- B) Lewis acid
- C) Brønsted acid
- D) Arrhenius acid
- E) Lewis base

Answer: B

- 27) How many iron atoms are coordinated in a hemoglobin molecule?  
 A) 1                      B) 2                      C) 3                      D) 4                      E) 5  
 Answer: D
- 28) A geometrical isomer with like groups located on opposite sides of the metal atom is denoted with the prefix \_\_\_\_\_.  
 A) bis-                      B) cis-                      C) trans-                      D) d-                      E) tetrakis-  
 Answer: C
- 29) Linkage isomerism can only occur \_\_\_\_\_.  
 A) with cobalt complexes  
 B) in cis-isomers of octahedral complexes  
 C) with tetrahedral complexes  
 D) with coordination number 6  
 E) with ligands that have more than one possible donor atom  
 Answer: E
- 30) Metals with \_\_\_\_\_ electron configurations characteristically form diamagnetic, square planar complexes.  
 A)  $d^9$                       B)  $d^8$                       C)  $d^0$                       D)  $d^{10}$                       E)  $d^6$   
 Answer: B
- 31) Which one of the following could be a straight-chain alkane?  
 A)  $C_4H_6$                       B)  $C_5H_4$                       C)  $C_3H_3$                       D)  $C_9H_{20}$                       E)  $C_3H_6$   
 Answer: D
- 32) Pentane has \_\_\_\_\_ structural isomers.  
 A) 4                      B) 3                      C) 5                      D) 2                      E) 1  
 Answer: B
- 33) Hybridization of the carbon atom indicated by (\*) in  $CH_3-^*CH_2-CH_3$ ,  $^*CH_2=CH_2$ , and  $CH_3-^*C\equiv CH$  is \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_, respectively.  
 A)  $sp^3$ ,  $sp$ ,  $sp^2$   
 B)  $sp$ ,  $sp^2$ ,  $sp^3$   
 C)  $sp^3$ ,  $sp^2$ ,  $sp$   
 D)  $sp$ ,  $sp^3$ ,  $sp^2$   
 E)  $sp^2$ ,  $sp^3$ ,  $sp$   
 Answer: C
- 34) The melting and boiling points of hydrocarbons are determined by \_\_\_\_\_.  
 A) hydrogen bonding  
 B) ion-dipole attraction  
 C) dipole-dipole attraction  
 D) London forces  
 E) ionic bonding  
 Answer: D

35) Isooctane is assigned an octane number of 100, whereas \_\_\_\_\_ is assigned an octane number of 0.

- A) nitrous oxide
- B) propane
- C) benzene
- D) heptane
- E) methane

Answer: D

36) In general, \_\_\_\_\_ are the most reactive hydrocarbons.

- A) olefins
- B) alkanes
- C) cycloalkanes
- D) alkynes
- E) alkenes

Answer: D

37) The addition of HBr to 2-butene produces \_\_\_\_\_.

- A) 1,2-dibromobutane
- B) no reaction
- C) 2-bromobutane
- D) 1-bromobutane
- E) 2,3-dibromobutane

Answer: C

38) The secondary structure of a protein is the result of \_\_\_\_\_ bonding.

- A) hydrogen
- B) covalent
- C) peptide
- D) ionic
- E) none of the above

Answer: A

39) The oxidation of ethanol produces \_\_\_\_\_.

- A) acetic acid
- B) lactic acid
- C) citric acid
- D) oxalic acid
- E) formic acid

Answer: A

40) Consider the following types of compounds:

- (i) amino acid
- (ii) nitrogen-containing organic base
- (iii) phosphoric acid
- (iv) five-carbon sugar

From which of the above compounds are the monomers of nucleic acids, called nucleotides, formed?

- A) (i) and (ii)
- B) (ii) and (iv)
- C) all
- D) (ii), (iii), and (iv)
- E) none

Answer: D