

## 1062-3rd Chem Exam-1070620 (A)

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

- 1) If each of the following represents an alkane, and a carbon atom is located at each vertex with the proper number of hydrogen atoms also bonded to it, which one is the most reactive?

A)



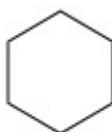
B)



C)



D)



E) They are all equally reactive since they are all alkanes.

Answer: B

- 2) The oxidation of ethanol produces \_\_\_\_\_.

A) oxalic acid

B) formic acid

C) lactic acid

D) acetic acid

E) citric acid

Answer: D

- 3) Which of the following compounds do not contain an  $sp^3$  hybridized oxygen atom?

A) esters

B) ketones

C) water

D) alcohols

E) ethers

Answer: B

- 4) How many isomers of  $C_2H_2Cl_2$  are polar?

A) none

B) 3

C) 1

D) 2

E) It is impossible to tell without more information.

Answer: D

- 5) The principal difference between fructose and glucose is that \_\_\_\_\_.

A) glucose is chiral and fructose is not

B) fructose is a monosaccharide and glucose is a disaccharide

C) fructose is a ketone sugar and glucose is an aldehyde sugar

D) fructose is a disaccharide and glucose is a monosaccharide

E) fructose is chiral and glucose is not

Answer: C

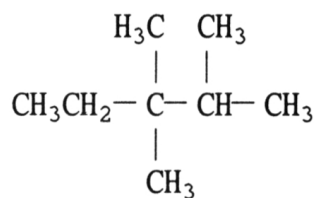
6) Optically active molecules that are mirror images of each other are called \_\_\_\_\_.

- A) enantiomers
- B) chiral compounds
- C) geometrical isomers
- D) allotropes
- E) cofactors

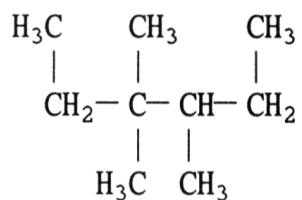
Answer: A

7) The structure of 2,3-dimethylheptane is \_\_\_\_\_.

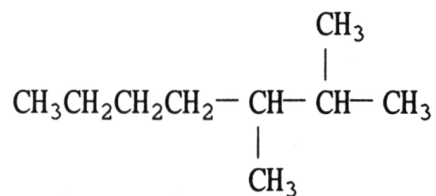
A)



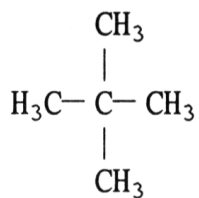
B)



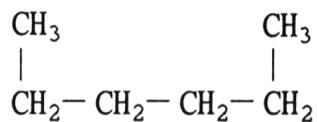
C)



D)



E)



Answer: C

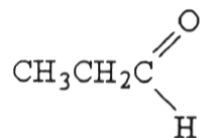
8) The addition of HBr to 2-butene produces \_\_\_\_\_.

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

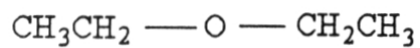
Answer: A

9) Which structure below is not correctly drawn?

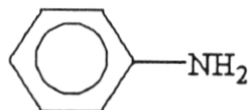
A)



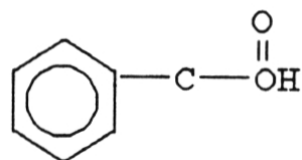
B)



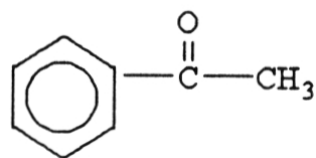
C)



D)



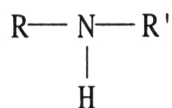
E)



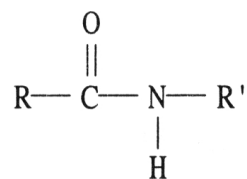
Answer: D

10) Which of the following contains a peptide linkage?

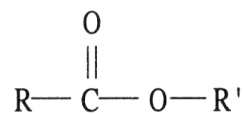
A)



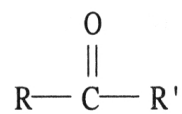
B)



C)



D)



E) none of the above

Answer: B

11) Which transformation could take place at the anode of an electrochemical cell?

- A)  $O_2$  to  $H_2O$
- B)  $HAsO_2$  to  $As$
- C)  $F_2$  to  $F^-$
- D)  $Cr_2O_7^{2-} \rightarrow Cr^{2+}$
- E) None of the above could take place at the anode.

Answer: E

Table 20.2

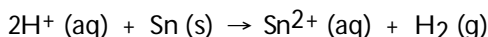
Half-reaction	$E^\circ$ (V)
$Cr^{3+} (aq) + 3e^- \rightarrow Cr (s)$	-0.74
$Fe^{2+} (aq) + 2e^- \rightarrow Fe (s)$	-0.440
$Fe^{3+} (aq) + e^- \rightarrow Fe^{2+} (s)$	+0.771
$Sn^{4+} (aq) + 2e^- \rightarrow Sn^{2+} (aq)$	+0.154

12) Which of the following reactions will occur spontaneously as written?

- A)  $Sn^{4+} (aq) + Fe^{2+} (aq) \rightarrow Sn^{2+} (aq) + Fe (s)$
- B)  $3Fe (s) + 2Cr^{3+} (aq) \rightarrow 2Cr (s) + 3Fe^{2+} (aq)$
- C)  $3Fe^{2+} (aq) \rightarrow Fe (s) + 2Fe^{3+} (aq)$
- D)  $3Sn^{4+} (aq) + 2Cr (s) \rightarrow 2Cr^{3+} (aq) + 3Sn^{2+} (aq)$
- E)  $Sn^{4+} (aq) + Fe^{3+} (aq) \rightarrow Sn^{2+} (aq) + Fe^{2+} (aq)$

Answer: D

13) Consider an electrochemical cell based on the reaction:



Which of the following actions would change the measured cell potential?

- A) increasing the pressure of hydrogen gas in the cathode compartment
- B) lowering the pH in the cathode compartment
- C) increasing the  $[Sn^{2+}]$  in the anode compartment
- D) increasing the pH in the cathode compartment
- E) Any of the above will change the measure cell potential.

Answer: E

14) What is the anode in an alkaline battery?

- A) KOH
- B) Zn powder
- C)  $MnO_2$
- D)  $Mn_2O_3$
- E) Pt

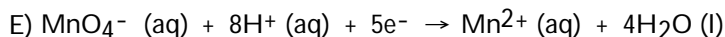
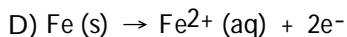
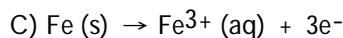
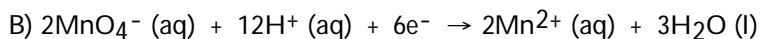
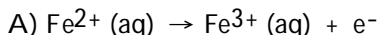
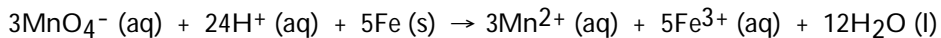
Answer: B

15) Cathodic protection of a metal pipe against corrosion usually entails \_\_\_\_\_.

- A) attaching a dry cell to reduce any metal ions which might be formed
- B) attaching an active metal to make the pipe the anode in an electrochemical cell
- C) coating the pipe with another metal whose standard reduction potential is less negative than that of the pipe
- D) attaching an active metal to make the pipe the cathode in an electrochemical cell
- E) coating the pipe with a fluoropolymer to act as a source of fluoride ion (since the latter is so hard to oxidize)

Answer: D

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

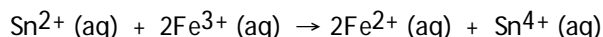


Answer: C

Table 20.2

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

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



A) +1.39

B) +1.21

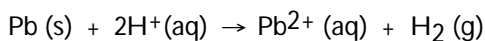
C) +0.617

D) +0.46

E) -0.46

Answer: C

18) The standard cell potential ( $E^\circ_{\text{cell}}$ ) of the reaction below is +0.126 V. The value of  $\Delta G^\circ$  for the reaction is \_\_\_\_\_ kJ/mol.



A) +12.6

B) -50.8

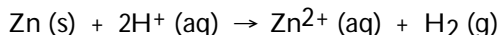
C) -24.3

D) +24.3

E) -12.6

Answer: C

19) The standard cell potential ( $E^\circ$ ) of a voltaic cell constructed using the cell reaction below is 0.76 V:



With  $P_{\text{H}_2} = 1.0$  atm and  $[\text{Zn}^{2+}] = 1.0$  M, the cell potential is 0.53 V. The concentration of  $\text{H}^+$  in the cathode compartment is \_\_\_\_\_ M.

A)  $1.3 \times 10^{-4}$

B)  $7.7 \times 10^3$

C)  $1.1 \times 10^{-2}$

D)  $1.3 \times 10^{-11}$

E)  $1.7 \times 10^{-8}$

Answer: A

20) How many minutes will it take to plate out 16.22 g of Al metal from a solution of  $\text{Al}^{3+}$  using a current of 14.6 amps in an electrolytic cell?

A) 66.2

B) 153

C) 11900

D) 199

E) 53.0

Answer: D

21) Which one of the following is a correct representation of an alpha particle?

- A)  ${}^0_1\text{H}$       B)  ${}^0_{-1}\text{e}$       C)  ${}^1_0\text{H}$       D)  ${}^4_2\text{He}$       E)  ${}^2_4\text{H}$

Answer: D

22) What radioactive element is used to diagnose medical conditions of the heart and arteries?

- A) thallium-201  
B) thorium-234  
C) cobalt-60  
D) radium-226  
E) radon-222

Answer: A

23) Carbon-11 decays by \_\_\_\_\_.

- A) beta emission  
B) positron emission  
C) neutron capture  
D) photon emission  
E) alpha emission

Answer: B

24) Which of these nuclides is most likely to be radioactive?

- A)  ${}^{39}_{19}\text{K}$       B)  ${}^{243}_{95}\text{Am}$       C)  ${}^{127}_{53}\text{I}$       D)  ${}^{27}_{13}\text{Al}$       E)  ${}^{209}_{83}\text{Bi}$

Answer: B

25) Which one of the following can be done to shorten the half-life of the radioactive decay of uranium-238?

- A) heat it  
B) oxidize it to the +2 oxidation state  
C) convert it to  $\text{UF}_6$   
D) freeze it  
E) none of the above

Answer: E

26) Cesium-137 undergoes beta decay and has a half-life of 30.0 years. How many beta particles are emitted by a 14.0-g sample of cesium-137 in three minutes?

- A)  $6.1 \times 10^{13}$       B)  $8.4 \times 10^{15}$       C)  $8.1 \times 10^{15}$       D)  $6.2 \times 10^{22}$       E)  $1.3 \times 10^{-8}$

Answer: C

27) Which one of the following is true?

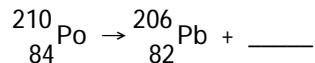
- A) There is no relationship between exothermicity and spontaneity in nuclear reactions.  
B) Some spontaneous nuclear reactions are exothermic.  
C) All spontaneous nuclear reactions are endothermic.  
D) Some spontaneous nuclear reactions are endothermic.  
E) All spontaneous nuclear reactions are exothermic.

Answer: E

- 28) 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  $^{56}\text{Fe}$  atom is  $9.289 \times 10^{-23}$  g. What is the nuclear binding energy (in J) for a  $^{56}\text{Fe}$  nucleus? ( $c = 3.00 \times 10^8$  m/s)
- A)  $7.65 \times 10^{-11}$       B)  $6.07 \times 10^6$       C)  $7.72 \times 10^{-8}$       D)  $2.57 \times 10^{-16}$       E)  $8.36 \times 10^{-9}$

Answer: A

- 29) This reaction is an example of \_\_\_\_\_.



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

Answer: A

- 30) What exposure level to radiation is fatal to most humans?
- A) 100 rem      B) 200 rem      C) 600 rem      D) 300 rem      E) 1000 rem

Answer: C

- 31) What two oxidation states are more frequently observed in the first transition series than in the third?
- A) +2 and +3      B) +3 and +5      C) +5 and +6      D) +2 and +7      E) +3 and +7

Answer: A

- 32) Changes in the coordination sphere of a complex compound may lead to changes in \_\_\_\_\_.

- A) physical properties  
B) stability  
C) color  
D) chemical properties  
E) all of the above

Answer: E

- 33) The coordination number and oxidation number of the central atom in  $[\text{Mn}(\text{CO})_4\text{Br}_2]$  are \_\_\_\_\_ and \_\_\_\_\_, respectively.

- A) 4, +1      B) 6, +2      C) 5, +2      D) 4, +2      E) 6, +1

Answer: B

- 34) What form of hemoglobin is purplish-red?

- A) deoxyhemoglobin  
B) heme  
C) oxyhemoglobin  
D) myoglobin  
E) none of the above

Answer: A

35) The chelate effect is best attributed to considerations of which type?

- A) hydration
- B) entropy
- C) enthalpy
- D) hydrogen bonding
- E) resonance

Answer: B

36) Does either or both cis- or trans- $[\text{Mn}(\text{en})_2\text{Br}_2]$  have optical isomers?

- A) cis only
- B) trans only
- C) both cis and trans
- D) neither cis nor trans
- E)  $[\text{Mn}(\text{en})_2\text{Br}_2]$  does not exhibit cis-trans isomerism.

Answer: A

37) A racemic mixture is \_\_\_\_\_.

- A) an equal mixture of both enantiomers of an optically active species
- B) an equal mixture of cis- and trans-isomers
- C) a mixture of an optically active species with an optically inactive species
- D) a mixture of structural isomers
- E) a mixture of metal ions and ligands in equilibrium

Answer: A

38) A metal complex absorbs light mainly at 420 nm. What is the color of the complex?

- A) red
- B) purple
- C) yellow
- D) green
- E) orange

Answer: C

39) Using the following abbreviated spectrochemical series, determine which complex ion is most likely to absorb light in the red region of the visible spectrum.

small splitting  $\text{Cl}^- < \text{H}_2\text{O} < \text{NH}_3 < \text{CN}^-$  large splitting

- A)  $[\text{Cu}(\text{CN})_4]^{2-}$
- B)  $[\text{CuCl}_4]^{2-}$
- C)  $[\text{Cu}(\text{NH}_3)_4]^{2+}$
- D)  $[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$
- E) not enough information given to determine

Answer: B

40) Which one of the following complex ions will be paramagnetic?

- A)  $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$  (low spin)
- B)  $[\text{Zn}(\text{H}_2\text{O})_4]^{2+}$
- C)  $[\text{Zn}(\text{NH}_3)_4]^{2+}$
- D)  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$  (low spin)
- E)  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$  (low spin)

Answer: D