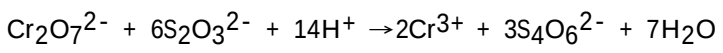
1072-3rd-Chem Exam-1080619(A)

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

1) _____ is the reducing agent in the reaction below.

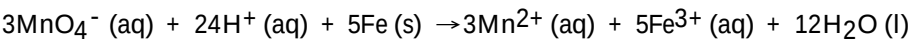


$$Cr_2O_7^{2-} + 6S_2O_3^{2-} + 14H^+ \rightarrow 2Cr^{3+} + 3S_4O_6^{2-} + 7H_2O$$

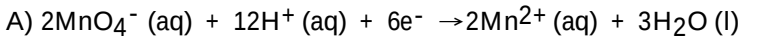
A) H^+ B) $S_2O_3^{2-}$ C) $S_4O_6^{2-}$ D) Cr^{3+} E) $Cr_2O_7^{2-}$

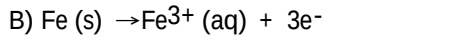
Answer: B

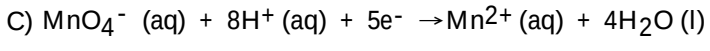
2) The half-reaction occurring at the cathode in the balanced reaction shown below is _____.

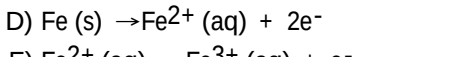


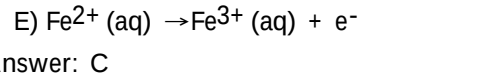
$$3MnO_4^-(aq) + 24H^+(aq) + 5Fe(s) \rightarrow 3Mn^{2+}(aq) + 5Fe^{3+}(aq) + 12H_2O(l)$$

A) 
$2MnO_4^-(aq) + 12H^+(aq) + 6e^- \rightarrow 2Mn^{2+}(aq) + 3H_2O(l)$

B) 
$Fe(s) \rightarrow Fe^{3+}(aq) + 3e^-$

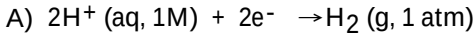
C) 
$MnO_4^-(aq) + 8H^+(aq) + 5e^- \rightarrow Mn^{2+}(aq) + 4H_2O(l)$

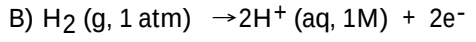
D) 
$Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$

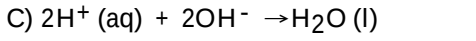
E) 
$Fe^{2+}(aq) \rightarrow Fe^{3+}(aq) + e^-$

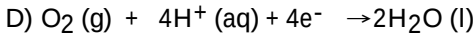
Answer: C

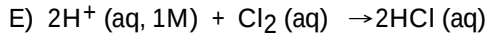
3) The reduction half reaction occurring in the standard hydrogen electrode is _____.

A) 
$2H^+(aq, 1M) + 2e^- \rightarrow H_2(g, 1\ atm)$

B) 
$H_2(g, 1\ atm) \rightarrow 2H^+(aq, 1M) + 2e^-$

C) 
$2H^+(aq) + 2OH^- \rightarrow H_2O(l)$

D) 
$O_2(g) + 4H^+(aq) + 4e^- \rightarrow 2H_2O(l)$

E) 
$2H^+(aq, 1M) + Cl_2(aq) \rightarrow 2HCl(aq)$

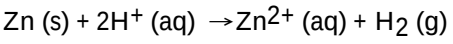
Answer: A

4) Corrosion of iron is retarded by _____.

A) high pH conditions
B) low pH conditions
C) the presence of salts
D) both the presence of salts and high pH conditions
E) both the presence of salts and low pH conditions

Answer: A

5) The standard cell potential (E°) of a voltaic cell constructed using the cell reaction below is 0.76 V:



$$Zn(s) + 2H^+(aq) \rightarrow Zn^{2+}(aq) + H_2(g)$$

With P_{H_2} = 1.0 atm and $[Zn^{2+}]$ = 1.0 M, the cell potential is 0.66 V. The concentration of H^+ in the cathode compartment is _____ M.

A) 1.0×10^{-12} B) 1.4×10^{-1} C) 4.9×10^{1} D) 4.2×10^{-4} E) 2.0×10^{-2}

Answer: E

6) How many kilowatt-hours of electricity are used to produce 3.00 kg of magnesium in the electrolysis of molten $MgCl_2$ with an applied emf of 4.50 V?

A) 7.4 B) 14.9 C) 0.0298 D) 0.0336 E) 29.8

Answer: E

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

A) $HAsO_2$ to As

B) $Cr_2O_7^{2-} \rightarrow Cr^{2+}$

C) F_2 to F^-

D) O_2 to H_2O

E) None of the above could take place at the anode.

Answer: E

Table 20.1

Half Reaction	E°(V)
$F_2(g) + 2e^- \rightarrow 2F^-(aq)$	+2.87
$Cl_2(g) + 2e^- \rightarrow 2Cl^-(aq)$	+1.359
$Br_2(l) + 2e^- \rightarrow 2Br^-(aq)$	+1.065
$O_2(g) + 4H^+(aq) + 4e^- \rightarrow 2H_2O(l)$	+1.23
$Ag^+ + e^- \rightarrow Ag(s)$	+0.799
$Fe^{3+}(aq) + e^- \rightarrow Fe^{2+}(aq)$	+0.771
$I_2(s) + 2e^- \rightarrow 2I^-(aq)$	+0.536
$Cu^{2+} + 2e^- \rightarrow Cu(s)$	+0.34
$2H^+ + 2e^- \rightarrow H_2(g)$	0
$Pb^{2+} + 2e^- \rightarrow Pb(s)$	-0.126
$Ni^{2+} + 2e^- \rightarrow Ni(s)$	-0.28
$Li^+ + e^- \rightarrow Li(s)$	-3.05

8) Which of the halogens in Table 20.1 is the strongest oxidizing agent?

A) Br_2

B) Cl_2

C) I_2

D) F_2

E) All of the halogens have equal strength as oxidizing agents.

Answer: D

9) Consider an electrochemical cell based on the reaction:

$$2H^+(aq) + Sn(s) \rightarrow Sn^{2+}(aq) + H_2(g)$$

Which of the following actions would <u>not</u> change the measured cell potential?

A) increasing the pressure of hydrogen gas in the cathode compartment

B) increasing the tin (II) ion concentration in the anode compartment

C) lowering the pH in the cathode compartment

D) addition of more tin metal to the anode compartment

E) Any of the above will change the measured cell potential.

Answer: D

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

Answer: B

11) Carbon-11 is used in medical imaging. The half-life of this radioisotope is 20.4 min. What percentage of a sample remains after 60.0 min?
A) 13.0 B) 34.0 C) 5.28 D) 71.2 E) 2.94

Answer: A

12) Carbon-11 decays by positron emission:

$$^{11}_{6}C \rightarrow {}^{11}_{5}B + {}^{0}_{1}e$$

The decay occurs with a release of 2.87×10^{11} J per mole of carbon-11. When 4.00 g of carbon-11 undergoes this radioactive decay, _____ g of mass is converted to energy.
A) 3.48×10^{5} B) 1.28×10^{-2} C) 1.16×10^{-3} D) 1.16×10^{-6} E) 8.62×10^{2}

Answer: C

13) In balancing the nuclear reaction $^{238}_{92}U \rightarrow {}^{234}_{90}E + {}^{4}_{2}He$, the identity of element E is _____.
A) Np B) U C) Th D) Pa E) Pu

Answer: C

14) The missing product from this reaction is _____.

$$^{10}_{5}B + \_\_\_\_ \rightarrow {}^{13}_{7}N + {}^{1}_{0}n$$

A) $^{4}_{2}He$ B) $^{0}_{1}e$ C) $^{1}_{0}n$ D) $^{0}_{-1}e$ E) $^{0}_{0}\gamma$

Answer: A

15) This reaction is an example of _____.

$$^{41}_{20}Ca \rightarrow {}^{41}_{19}K + \_\_\_\_$$

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

Answer: D

16) What is the largest number of protons that can exist in a nucleus and still be stable?
A) 206 B) 92 C) 84 D) 50 E) 83

Answer: E

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

Answer: B

18) What drives the turbine in a nuclear power plant?
A) the primary coolant
B) the moderator
C) UF_6 gas
D) steam
E) the control rods

Answer: D

19) In the nuclear transmutation represented by ${}^{16}_{8}O(p, \alpha) {}^{13}_{7}N$, the emitted particle is _____.

A) a positron.
B) a neutron.
C) an alpha particle.
D) a beta particle.
E) a proton.

Answer: C

20) Atoms containing radioactive nuclei are called _____.
A) radionuclides
B) radioisophores
C) nuclides
D) radioisotopes
E) nucleons

Answer: D

21) 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

22) The lanthanide contraction is responsible for the fact that
A) Zr and Zn have similar oxidation states.
B) Zr and Y have about the same radius.
C) Zr and Hf have the same oxidation states.
D) Zr and Nb have similar oxidation states.
E) Zr and Hf have about the same radius.

Answer: E

23) Which one of the following species is paramagnetic?
A) Cr^{3+} B) Ca C) Cu^{+} D) Ag^{+} E) Zn

Answer: A

24) The coordination number of cobalt in $CoCl_3 \cdot 6NH_3$ is _____.
A) 2 B) 8 C) 4 D) 6 E) 3

Answer: D

25) Changes in the coordination sphere of a complex compound may lead to changes in _____.
A) physical properties
B) chemical properties
C) stability
D) color
E) all of the above

Answer: E

26) Does either or both cis- or trans-$[Mn(en)_2Br_2]$ have optical isomers?
A) cis only
B) trans only
C) both cis and trans
D) neither cis nor trans
E) $[Mn(en)_2Br_2]$ does not exhibit cis-trans isomerism.

Answer: A

27) Which of the following will display optical isomerism?
A) octahedral $[Co(NH_3)_6]^{3+}$
B) square-planar $[Pt(H_2NC_2H_4NH_2)_2]^{2+}$
C) octahedral $[Co(NH_3)_5Cl]^{2+}$
D) square-planar $[Rh(CO)_2Cl_2]^{-}$
E) octahedral $[Co(H_2NC_2H_4NH_2)_3]^{3+}$

Answer: E

28) A complex that absorbs light at 700 nm will appear _____.
A) violet B) yellow C) green D) orange E) red

Answer: C

29) Which one of the following complex ions will be paramagnetic?
A) $[Fe(H_2O)_6]^{3+}$ (low spin)
B) $[Fe(H_2O)_6]^{2+}$ (low spin)
C) $[Co(H_2O)_6]^{3+}$ (low spin)
D) $[Zn(NH_3)_4]^{2+}$
E) $[Zn(H_2O)_4]^{2+}$

Answer: A

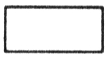
30) Which one of the following ions <u>cannot</u> form both a high spin and a low spin octahedral complex ion?
A) Cr^{3+} B) Cr^{2+} C) Co^{2+} D) Fe^{3+} E) Mn^{3+}

Answer: A

31) 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: A

32) Benzene behaves differently from a hydrocarbon which simply contains three C=C bonds in that the latter would be expected to react much more readily with _____.

A) Br_2
B) HCl
C) Cl_2
D) H_2
E) all of the above

Answer: E

33) The oxidation of ethanol produces _____.

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

Answer: A

34) The melting and boiling points of hydrocarbons are determined by _____.

A) ionic bonding
B) dipole-dipole attraction
C) hydrogen bonding
D) ion-dipole attraction
E) London forces

Answer: E

35) _____ acts as a kind of energy bank in the body, and is found concentrated in muscles and liver.

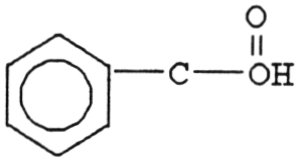
A) Cellulose B) Lactose C) Sucrose D) Starch E) Glycogen

Answer: E

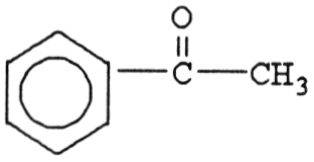
36) Which structure below represents an amine?

A)

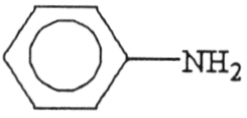
B)



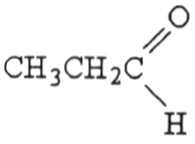
C)



D)



E)



Answer: D

37) How many chiral carbon atoms does the neopentane (2, 2 - dimethylpropane) have?

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

Answer: E

38) Hybridization of the carbon atom indicated by (*) in CH_3-$^*CH_2$-CH_3, $^*CH_2$=CH_2, and CH_3-$^*C$≡CH is _____, _____, and _____, respectively.

A) sp^3, sp^2, sp B) sp^2, sp^3, sp C) sp, sp^3, sp^2 D) sp^3, sp, sp^2 E) sp, sp^2, sp^3

Answer: A

39) The addition of HBr to 2-butene produces _____.

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

Answer: D

40) How many chiral atoms does the open-chain form of glucose have?

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

Answer: A