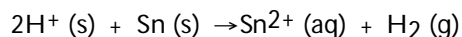


Exam

Name \_\_\_\_\_

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

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



- A)  $\text{Sn} + 2\text{e}^- \rightarrow \text{H}_2$
- B)  $\text{Sn} + 2\text{e}^- \rightarrow \text{Sn}^{2+}$
- C)  $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$
- D)  $\text{Sn} \rightarrow \text{Sn}^{2+} + 2\text{e}^-$
- E)  $2\text{H}^+ \rightarrow \text{H}_2 + 2\text{e}^-$

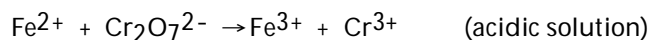
Answer: C

- 2) 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) 49.6
- B) 24.8
- C) 0.0496
- D) 12.4
- E) 0.0201

Answer: A

- 3) What is the coefficient of the dichromate ion when the following equation is balanced?



- A) 6
- B) 3
- C) 5
- D) 2
- E) 1

Answer: E

- 4) Which one of the following types of elements is most likely to be a good oxidizing agent?

- A) alkaline earth elements
- B) halogens
- C) lanthanides
- D) alkali metals
- E) transition elements

Answer: B

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

Answer: E

- 6) The product of the nuclear reaction in which  $^{40}\text{Ar}$  is subjected to neutron capture followed by alpha emission is \_\_\_\_\_.

- A)  $^{37}\text{S}$
- B)  $^{45}\text{Ca}$
- C)  $^{36}\text{S}$
- D)  $^{35}\text{Ar}$
- E)  $^{41}\text{Ar}$

Answer: A

- 7) 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)  $7.03 \times 10^{-22}$
  - B) 7.076
  - C) 1.435
  - D) 1.095
  - E) 0.565

Answer: E

- 8) If we start with 1.000 g of strontium-90, 0.805 g will remain after 9.00 yr. This means that the half-life of strontium-90 is \_\_\_\_\_ yr.
- A) 28.8
  - B) 7.25
  - C) 11.2
  - D) 7.74
  - E) 41.6

Answer: A

- 9) In balancing the nuclear reaction  ${}^{14}_6\text{C} \rightarrow \text{E} + {}^0_{-1}\text{e}$ , the identity of element E is \_\_\_\_\_.
- A) C
  - B) B
  - C) O
  - D) N
  - E) none of the above

Answer: D

- 10) The half-life of a radionuclide \_\_\_\_\_.
- A) gets shorter with passing time
  - B) gets longer with increased temperature
  - C) is constant
  - D) gets longer with passing time
  - E) gets shorter with increased temperature

Answer: C

- 11) What radioactive element is used to diagnose medical conditions of the heart and arteries?
- A) thallium-201
  - B) radium-226
  - C) thorium-234
  - D) radon-222
  - E) cobalt-60

Answer: A

- 12) Which ion shown below does not exist?
- A)  $\text{Y}^{4+}$
  - B)  $\text{Zr}^{4+}$
  - C)  $\text{Y}^{+}$
  - D)  $\text{Y}^{2+}$
  - E)  $\text{Nb}^{3+}$

Answer: A

- 13) The ligand with the name aqua when used in complexes with transition metals has the formula \_\_\_\_\_.
- A)  $\text{H}_2\text{O}_2$
  - B)  $\text{H}_3\text{O}^{+}$
  - C)  $\text{N}_3^{-}$
  - D)  $\text{HO}^{-}$
  - E)  $\text{H}_2\text{O}$

Answer: E

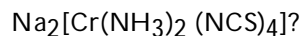
- 14) How many d electrons are associated with the metal ion in  $[\text{Cr}(\text{NH}_3)_6]^{3+}$ ?
- A) 3
  - B) 2
  - C) 0
  - D) 4
  - E) 1

Answer: A

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

Answer: D

16) What are the respective central-metal oxidation state, coordination number, and overall charge on the complex ion in



- A) +2; 4; -1      B) +1; 6; -2      C) +3; 6; +1      D) +3; 6; -1      E) +2; 6; -2

Answer: E

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

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

Answer: D

18) A complex that absorbs light at 700 nm will appear \_\_\_\_\_.

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

Answer: A

19) Which one of the following could be a cyclic alkane?

- A)  $\text{C}_{10}\text{H}_{22}$       B)  $\text{C}_3\text{H}_5$       C)  $\text{C}_2\text{H}_6$       D)  $\text{C}_6\text{H}_5$       E)  $\text{C}_5\text{H}_{10}$

Answer: E

20) How many chiral centers are there in  $\text{CH}_3\text{CHCHCH}_2\text{CHBr}_2$ ?

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

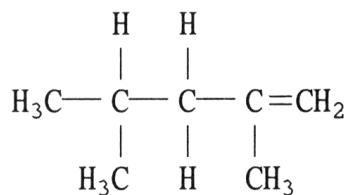
Answer: C

21) How many structural isomers (include all types except optical) can be drawn for  $\text{C}_5\text{H}_{10}$ ?

- A) 7      B) 10      C) 12      D) 6      E) 5

Answer: B

22) What is the name of the compound below?

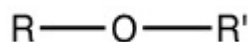


- A) 2,4-methylbutene  
B) 2,4-dimethyl-4-pentene  
C) 2,4-dimethyl-1-pentene  
D) 2,5-dimethylpentane  
E) 2,4-ethylbutene

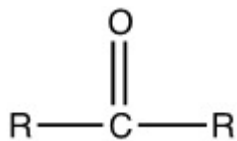
Answer: C

23) The general formula of a carboxylic acid is \_\_\_\_\_.

A)



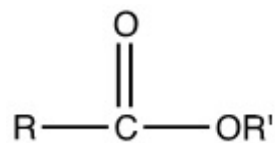
B)



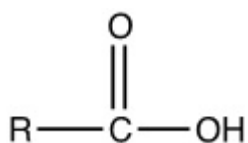
C)



D)



E)



Answer: E

24) The hybridization of the central carbon atom in an aldehyde is \_\_\_\_\_.

A)  $sp^3$

B)  $sp^2$

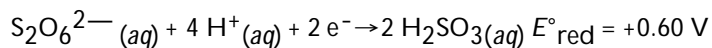
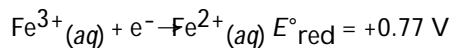
C)  $d^2sp^3$

D)  $sp^4$

E)  $sp$

Answer: B

25) Given the following reduction half-reactions:



Calculate  $G^\circ$  and equilibrium constant  $K$  for the oxidation of  $\text{Fe}^{2+}(\text{aq})$  by  $\text{S}_2\text{O}_6^{2-}(\text{aq})$  at 298 K, respectively.

A) 33000 KJ;  $1.78 \times 10^{-12}$

B) 33 KJ;  $1.78 \times 10^{-6}$

C) 63 KJ;  $3.42 \times 10^{-7}$

D) 33 J;  $2.78 \times 10^3$

E) 330 KJ;  $2.78 \times 10^2$

Answer: B