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| 1. Transition metals display great similarities   |  |  |  | | --- | --- | --- | |  | a. | within a given period | |  | b. | within a given vertical group | |  | c. | with the semimetals | |  | d. | all of these | |  | e. | A and B only |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 2. Which of the transition metals is the best conductor of heat and electric current?   |  |  |  | | --- | --- | --- | |  | a. | copper | |  | b. | silver | |  | c. | gold | |  | d. | tungsten | |  | e. | titanium |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 3. Why do transition metals show a lot of chemical similarities within a given period?   |  |  |  | | --- | --- | --- | |  | a. | The valence *s* and *p* electrons affect their chemistry more so than the inner *d* and *f* electrons, which do not participate in bonding as easily. | |  | b. | The number of electrons within a given period varies only slightly and is sometimes identical because these metals have more than one ionic form. | |  | c. | All elements in a given period, including the representative elements, have a lot of chemical similarities due to the gradual increase in atomic number. | |  | d. | The transition metals always fill their *s* and *p* orbitals first before filling their *d* orbitals, which affects their chemistry. | |  | e. | None of the above is correct. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 4. Which of the following is incorrect concerning the 3*d*, 4*d*, and 5*d* transition series?   |  |  |  | | --- | --- | --- | |  | a. | There is a significant increase in radius in going from the 3*d* to the 4*d* metals, but the 4*d* and 5*d* metals are similar in size. | |  | b. | There is a general decrease in size going from left to right for each of these series due to the increasing nuclear charge. | |  | c. | The separation of hafnium and zirconium found together in nature is difficult due to their similarities in chemistry, which is attributed to their virtually identical sizes. | |  | d. | Cerium through lutetium exhibits what is referred to as the lanthanide contraction. | |  | e. | All of the above are correct. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 5. The reducing abilities of the first-row transition metals generally \_\_\_\_\_\_\_\_\_\_ going from left to right across the period.   |  |  |  | | --- | --- | --- | |  | a. | decrease | |  | b. | increase | |  | c. | stay the same | |  | d. | none of these | |  | e. | remain at 1.0 V |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 6. Which metal ion has a *d5* electron configuration?   |  |  |  | | --- | --- | --- | |  | a. | Pd2+ | |  | b. | Ag+ | |  | c. | Fe3+ | |  | d. | V2+ | |  | e. | Co2+ |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | electron configuration | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 7. Which of the following is a *d7* ion?   |  |  |  | | --- | --- | --- | |  | a. | Co(II) | |  | b. | Cu(II) | |  | c. | Mn(II) | |  | d. | Mn(IV) | |  | e. | At least two of the above (a-d) are *d7* ions. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | electron configuration | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 8. What is the maximum oxidation state expected for vanadium?   |  |  |  | | --- | --- | --- | |  | a. | +8 | |  | b. | +6 | |  | c. | +4 | |  | d. | +3 | |  | e. | +5 |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | oxidation state | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 9. What is the electron configuration of the Sc(I) ion?   |  |  |  | | --- | --- | --- | |  | a. | [Ar] 4*s*14*d*1 | |  | b. | [Ar] 4*s*13*d*1 | |  | c. | [Ar] 3*s*13*d*1 | |  | d. | [Ar] 4*s*2 | |  | e. | [Ar] 3*d*2 |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | electron configuration | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 10. What is the electron configuration of the Ni(II) ion?   |  |  |  | | --- | --- | --- | |  | a. | [Ar] 4*s*23*d*6 | |  | b. | [Ar] 4*s*13*d*7 | |  | c. | [Ar] 4*s*23*d*8 | |  | d. | [Ar] 3*d*8 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | electron configuration | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 11. What is the electron configuration of the Mn(II) ion?   |  |  |  | | --- | --- | --- | |  | a. | [Ar] 4*s*23*d*5 | |  | b. | [Ar] 4*s*13*d*5 | |  | c. | [Ar] 4*s*23*d*3 | |  | d. | [Ar] 3*d*5 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | electron configuration | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 12. The electron configuration of Cr3+ is   |  |  |  | | --- | --- | --- | |  | a. | [Ar] 4*s*23*d*1 | |  | b. | [Ar] 4*s*13*d*2 | |  | c. | [Ar] 3*d*3 | |  | d. | [Ar] 4*s*23*d*4 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | electron configuration | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 13. The electron configuration for Cr2+ is   |  |  |  | | --- | --- | --- | |  | a. | [Ar] 4*s*23*d*4 | |  | b. | [Ar] 4*s*13*d*5 | |  | c. | [Ar] 3*d*4 | |  | d. | [Ar] 4*s*23*d*2 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | electron configuration | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 14. The electron configuration of Ti2+ is   |  |  |  | | --- | --- | --- | |  | a. | [Ar] 4*s*2 | |  | b. | [Ar] 4*s*13*d*1 | |  | c. | [Ar] 3*d*2 | |  | d. | [Ar] 4*s*23*d*2 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | electron configuration | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 15. A complex ion is a charged species consisting of a metal ion surrounded by   |  |  |  | | --- | --- | --- | |  | a. | other transition metals | |  | b. | hydrogen ions | |  | c. | ligands | |  | d. | ligands and counter ions | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | basic definitions | Chemistry | complex ions and coordination compounds | general chemistry | structure and isomerism in coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 16. How many ligands are in this representative drawing of a complex ion?   |  |  |  | | --- | --- | --- | |  | a. | 1 | |  | b. | 3 | |  | c. | 6 | |  | d. | 7 | |  | e. | 8 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | basic definitions | Chemistry | complex ions and coordination compounds | general chemistry | structure of complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 17. Which of the following transition metals is most likely to form an oxide?   |  |  |  | | --- | --- | --- | |  | a. | gold | |  | b. | silver | |  | c. | platinum | |  | d. | palladium | |  | e. | copper |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | oxidation state | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 18. The phenomenon called \_\_\_\_\_\_\_\_\_\_ contraction is responsible for the great similarity in atomic size and chemistry of 4*d* and 5*d* elements.   |  |  |  | | --- | --- | --- | |  | a. | transition | |  | b. | coordination | |  | c. | lanthanide | |  | d. | isomeric | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | atomic radii | Chemistry | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 19. Which of the following is true?   |  |  |  | | --- | --- | --- | |  | a. | The first ionization energy for Zn is significantly higher than that of Sc. | |  | b. | The first ionization energy for Zn is significantly lower than that of Sc. | |  | c. | The third ionization energy for Zn is significantly higher than that of Sc. | |  | d. | The third ionization energy for Zn is significantly lower than that of Sc. | |  | e. | Two of these are correct. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | ionization energy | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 20. Which of the following transition metals are important to the U.S. economy and defense?   |  |  |  | | --- | --- | --- | |  | a. | chromium and cobalt | |  | b. | manganese | |  | c. | platinum and palladium | |  | d. | all of these | |  | e. | A and B only |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 21. Which metal is most widely used in the electrical systems of homes and factories?   |  |  |  | | --- | --- | --- | |  | a. | copper | |  | b. | silver | |  | c. | gold | |  | d. | tungsten | |  | e. | titanium |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 22. What transition metal is used in stainless steel?   |  |  |  | | --- | --- | --- | |  | a. | nickel | |  | b. | titanium | |  | c. | chromium | |  | d. | iridium | |  | e. | niobium |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 23. What transition metal is used in magnets, catalysts, and drill bits?   |  |  |  | | --- | --- | --- | |  | a. | nickel | |  | b. | copper | |  | c. | platinum | |  | d. | cobalt | |  | e. | titanium |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 24. True or false: Transition metals show great similarities both within a given period and within a given vertical group.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 25. The metals with the highest ionization energies are most likely to be found in nature in the elemental state.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | ionization energy | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 26. Metals usually have higher melting points than nonmetals.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | melting point and boiling point | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 27. Co2+ in water is blue.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 28. The expected electron configuration of Cu+ is [Ar] 3*s*13*d*9.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | electron configuration | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 29. The electron configuration of Mn2+ is [Ar] 4*s*23*d*3.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | electron configuration | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 30. What transition metal has the combination of toughness, stretchability, and resilience that makes it ideal for use in bicycle frames?   |  |  |  | | --- | --- | --- | |  | a. | titanium | |  | b. | platinum | |  | c. | tungsten | |  | d. | nickel | |  | e. | aluminum |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 31. This transition metal is used in the production of a hard steel used for rock crushers and bank vaults, and can be found in nodules on the ocean floor.   |  |  |  | | --- | --- | --- | |  | a. | iron | |  | b. | manganese | |  | c. | magnesium | |  | d. | cobalt | |  | e. | nickel |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 32. What heavy metal is the most abundant and most important to our civilization?   |  |  |  | | --- | --- | --- | |  | a. | iron | |  | b. | gold | |  | c. | magnesium | |  | d. | cobalt | |  | e. | copper |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 33. An element that is a significant component of both brass and bronze is:   |  |  |  | | --- | --- | --- | |  | a. | nickel | |  | b. | tin | |  | c. | copper | |  | d. | iron | |  | e. | zinc |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 34. Which 3*d* transition metal is mixed with concentrated sulfuric acid to give a powerful cleaning solution for removing organic materials from analytical glassware?   |  |  |  | | --- | --- | --- | |  | a. | chromium | |  | b. | iron | |  | c. | cobalt | |  | d. | scandium | |  | e. | manganese |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 35. Which transition metal is valued for its high electrical conductivity and resistance to corrosion, and is widely used for plumbing?   |  |  |  | | --- | --- | --- | |  | a. | iron | |  | b. | manganese | |  | c. | magnesium | |  | d. | cobalt | |  | e. | copper |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 36. What transition metal is mainly used for galvanizing steel?   |  |  |  | | --- | --- | --- | |  | a. | iron | |  | b. | zinc | |  | c. | copper | |  | d. | cobalt | |  | e. | nickel |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 37. How many *d* electrons are present on the metal ion in the complex ion FeCl64–?   |  |  |  | | --- | --- | --- | |  | a. | 8 | |  | b. | 6 | |  | c. | 4 | |  | d. | 3 | |  | e. | 2 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | electron configuration | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 38. Which of the metal ions in the following complex ions has a *d*5 electron configuration?   |  |  |  | | --- | --- | --- | |  | a. | V(H2O)62+ | |  | b. | Mo(NH3)63+ | |  | c. | Co(CN)4– | |  | d. | Fe(CN)63– | |  | e. | RhCl64– |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | electron configuration | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 39. What are the oxidation numbers of each central metal atom in the following coordination compounds? K3[Fe(CN)6], [Cr(NH3)4Br2]Br, [Ni(H2O)6]Cl2, Na2[TaF7]   |  |  |  | | --- | --- | --- | |  | a. | 3, 3, 3, 5 | |  | b. | 3, 3, 2, 7 | |  | c. | –3, 3, 2, 5 | |  | d. | –3, 1, 2, 5 | |  | e. | 3, 3, 2, 5 |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | oxidation state | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 40. The coordination theory was proposed by:   |  |  |  | | --- | --- | --- | |  | a. | Bailar | |  | b. | Jorgensen | |  | c. | Blomstrand | |  | d. | Werner | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 41. Ethylenediamine (en) is a bidentate ligand. What is the coordination number of cobalt in [Co(en)2Cl2]Cl?   |  |  |  | | --- | --- | --- | |  | a. | four | |  | b. | five | |  | c. | seven | |  | d. | eight | |  | e. | six |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | structure of complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 42. Which of the following coordination compounds will form a precipitate when treated with an aqueous solution of AgNO3?   |  |  |  | | --- | --- | --- | |  | a. | [Cr(NH3)3Cl3] | |  | b. | [Cr(NH3)6]Cl3 | |  | c. | [Cr(NH3)Cl]NO3 | |  | d. | Na3[Cr(CN)6] | |  | e. | Na3[CrCl6] |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | structure of complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 43. When 4.7 moles of [Co(NH3)5Cl]Cl2 is dissolved in water, how many moles of ions are in solution?   |  |  |  | | --- | --- | --- | |  | a. | 1.7 | |  | b. | 2.7 | |  | c. | 1.6 | |  | d. | 14 | |  | e. | 42 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | structure of complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 44. A coordination compound of Cu2+ can be described as Cu(NH3)*x*SO4 and is known to contain 29.92% NH3 by mass. The value of *x* is:   |  |  |  | | --- | --- | --- | |  | a. | 2 | |  | b. | 3 | |  | c. | 4 | |  | d. | 6 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *RATIONALE:* | Alert to Publisher: All answer choices remain the same regardless of x value when rounded to 0 decimal places. | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | formula of a complex | general chemistry | structure of complex | transition elements | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 45. The empirical formula of a compound with a mass percent composition of 6.78% H, 31.43% N, 39.76% Cl, and 22.03% Co is consistent with which of the following complexes?   |  |  |  | | --- | --- | --- | |  | a. | [Co(NH3)3Cl3] | |  | b. | [Co(NH3)4Cl2]Cl | |  | c. | [Co(NH3)5Cl]Cl2 | |  | d. | [Co(NH3)6]Cl3 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | formula of a complex | general chemistry | structure of complex | transition elements | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| Suppose you are studying coordination compounds of Co(II) with the ligand pyridine (py, C5H5N, molar mass = 79.10). You isolate a crystalline compound, and since the only available anions are Cl– and NO3–, you hypothesize the empirical formula of the coordination compound must be Co*w*(py)*x*(Cl)*y*(NO3)*z*. |

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| 46. You discover that the complex decomposes in water. You dissolve 0.1000 g of the complex in H2O and add excess NaHg(SCN)4, which precipitates Co(II) as CoHg(SCN)4(*s*). After the precipitate is washed and dried, its mass is 0.1102 g. How many grams of cobalt are contained in 0.1000 g of the complex?   |  |  |  | | --- | --- | --- | |  | a. | 0.1102 | |  | b. | 0.0396 | |  | c. | 0.0132 | |  | d. | 0.437 | |  | e. | 0.0548 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-1 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | formula of a complex | general chemistry | structure of complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 47. You analyze for pyridine (*K*b is approximately 10–9) by dissolving 0.1000 g of complex in 10 mL of H2O and titrating with a 0.01 *M* HCl solution. Which of the following indicators should be used to detect the endpoint? (Assume that the initial concentration of pyridine is approximately 0.01 *M*.)   |  |  |  | | --- | --- | --- | |  | a. | bromophenol blue, pH range of color change = 3.0–4.6 | |  | b. | methyl red, pH range of color change = 4.8–6.0 | |  | c. | bromothymol blue, pH range of color change = 6.0–7.6 | |  | d. | thymol blue, pH range of color change = 8.0 –9.6 | |  | e. | alizarin yellow, pH range of color change = 10.1–12.0 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-1 | | *KEYWORDS:* | acid-base titration curve | acids and bases | Chemistry | general chemistry | solutions of a weak acid or base with another solute | titration of a weak base by a strong acid | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 48. Addition of AgNO3 to aqueous solutions of the complex results in a cloudy white precipitate, presumably AgCl. You dissolve 0.1000 g of the complex in H2O and perform a precipitation titration with 0.0500 *M* AgNO3 as the titrant. Using an electrode that is sensitive to [Ag+], you reach the endpoint after 9.00 mL of titrant are added. How many grams of chloride ion were present in the 0.1000-g sample?   |  |  |  | | --- | --- | --- | |  | a. | 4.50 × 10–4 | |  | b. | 5.00 × 10–3 | |  | c. | 1.77 × 10–3 | |  | d. | 6.38 × 10–2 | |  | e. | 1.60 × 10–2 |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-1 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | formula of a complex | general chemistry | structure of complex | transition elements | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 49. Analysis of the data from a titration indicates that a 0.1600-g sample of the complex contains 0.1134 g of py. Further analysis shows that 0.1600 g of the complex contains a 0.0211 g of cobalt and 0.0254 g of chloride. What is the empirical formula of the complex?   |  |  |  | | --- | --- | --- | |  | a. | Co(py)6(Cl)(NO3) | |  | b. | Co(py)4Cl2 | |  | c. | Co2(py)5(Cl)2(NO3)2 | |  | d. | Co3(py)8(Cl)2(NO3)4 | |  | e. | Co(py)4(NO3)2 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *PREFACE NAME:* | Ref 21-1 | | *KEYWORDS:* | Chemistry | complex ion equilibria | formula of a complex | general chemistry | structure of complex | transition elements | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 50. In which of the following complexes does the transition metal have a *d8* configuration?   |  |  |  | | --- | --- | --- | |  | a. | PtCl42– | |  | b. | Cu(H2O)62+ | |  | c. | Ni(CO)4 | |  | d. | Zn(NH3)42+ | |  | e. | Fe(CN)63– |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | electron configuration | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 51. What is the correct formula for sodium tetrachloronickelate(II)?   |  |  |  | | --- | --- | --- | |  | a. | Na2(NiCl6) | |  | b. | Na4(NiCl4) | |  | c. | Na(NiCl4) | |  | d. | Na2(NiCl4) | |  | e. | Na3(NiCl4) |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | naming coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 52. What is the correct IUPAC name for [FeCl4(H2O)2]–?   |  |  |  | | --- | --- | --- | |  | a. | diaquatetrachloroferrate(0) ion | |  | b. | diaquatetrachloroferrate(III) ion | |  | c. | diaquatetrachloroferrate(I) ion | |  | d. | diaquatetrachloroiron(III) ion | |  | e. | diaquatetrachloroiron(I) ion |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | naming coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 53. What is the formula for the hexaaquachromium(II) ion?   |  |  |  | | --- | --- | --- | |  | a. | [Cr(H2O)6]2+ | |  | b. | [Cr2(H2O)6]4+ | |  | c. | [Cr(H2O)4]2+ | |  | d. | [Cr2(H2O)6]2+ | |  | e. | [Cr(H2O)6]4– |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | naming coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 54. What is the formula for the pentaamminehydroxoiron(II) ion?   |  |  |  | | --- | --- | --- | |  | a. | [Fe(NH3)(OH)5]3– | |  | b. | [Fe(NH3)5(OH)5]2+ | |  | c. | [Fe(NH3)5(OH)]2+ | |  | d. | [Fe(NH3)5(OH)5]3– | |  | e. | [Fe(NH3)5(OH)]+ |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | naming coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 55. The coordination theory was proposed by Alfred Packer.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | basic definitions | Chemistry | complex ions and coordination compounds | general chemistry | structure of complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 56. Consider the following complexes:   |  |  |  |  | | --- | --- | --- | --- | |  | I. | Pt(NH3)2Cl2 | (square planar) | |  | II. | Rh(en)32+ | (en = H2N–CH2–CH2–NH2 and is bidentate) | |  | III. | CoCl42– | (tetrahedral) |   Which can exhibit *cis-trans* isomerism?   |  |  |  | | --- | --- | --- | |  | a. | I | |  | b. | II | |  | c. | III | |  | d. | I, II | |  | e. | I, II, III |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | structure and isomerism in coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 57. Which of the following complexes can exhibit optical isomerism? (en = H2N–CH2–CH2–NH2 and is bidentate)   |  |  |  | | --- | --- | --- | |  | a. | *cis*–Co(NH3)4Cl2 | |  | b. | *trans*–Co(en)2Br2 | |  | c. | *cis*–Co(en)2Cl2 | |  | d. | Co(NH3)3Cl3 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.4 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | stereoisomerism | structure and isomerism in coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 58. Because they have the same atoms, bonds, and formulas, geometrical isomers have the same color.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.4 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | stereoisomerism | structure and isomerism in coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 59. Which of the following complexes shows geometrical isomerism?   |  |  |  | | --- | --- | --- | |  | a. | [Co(NH3)5Cl]SO4 | |  | b. | [Co(NH3)6]Cl3 | |  | c. | [Co(NH3)5Cl]Cl2 | |  | d. | K[Co(NH3)2Cl4] | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.4 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | stereoisomerism | structure and isomerism in coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 60. What is the sum of all isomers (geometrical and optical) that the complex ion Co(en)2Cl2+ exhibits?   |  |  |  | | --- | --- | --- | |  | a. | 0 | |  | b. | 1 | |  | c. | 2 | |  | d. | 3 | |  | e. | 4 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | stereoisomerism | structure and isomerism in coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 61. Which complex ion shape is not capable of showing *cis*–*trans* isomerism?   |  |  |  | | --- | --- | --- | |  | a. | octahedral | |  | b. | square planar | |  | c. | tetrahedral | |  | d. | two of these | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.4 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | stereoisomerism | structure and isomerism in coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 62. Give the number of geometrical isomers for the octahedral compound [MA2B2C2], where A, B, and C represent ligands.   |  |  |  | | --- | --- | --- | |  | a. | 1 | |  | b. | 2 | |  | c. | 3 | |  | d. | 5 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 21.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | stereoisomerism | structure and isomerism in coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 63. For the process Co(NH3)5Cl2+ + Cl– → Co(NH3)4Cl2+ + NH3 what would be the ratio of *cis* to *trans* isomer in the product?   |  |  |  | | --- | --- | --- | |  | a. | 1 : 1 | |  | b. | 1 : 2 | |  | c. | 1 : 4 | |  | d. | 4 : 1 | |  | e. | 2 : 1 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | stereoisomerism | structure and isomerism in coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 64. The \_\_\_\_ isomer of the complex Ni(en)2Cl2 exhibits optical isomers, but the \_\_\_\_\_ isomer does not.   |  |  |  | | --- | --- | --- | |  | a. | *cis*, *trans* | |  | b. | *trans*, *cis* | |  | c. | Both isomers exhibit optical isomers. | |  | d. | Neither isomers exhibit optical isomers. | |  | e. | Depends on the wavelength of plane-polarized light used. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | stereoisomerism | structure and isomerism in coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 65. How many of the following compounds exhibit geometric isomers?   |  |  |  | | --- | --- | --- | |  | I. | Pt(NH3)2Cl2 (square planar) | |  | II. | [Co(H2O)2]Cl3 | |  | III. | Ni(NH3)4(NO2)2 | |  | IV. | K2[CoCl4] |   ​   |  |  |  | | --- | --- | --- | |  | a. | 0 | |  | b. | 1 | |  | c. | 2 | |  | d. | 3 | |  | e. | 4 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | stereoisomerism | structure and isomerism in coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/6/2017 6:44 AM | |

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| 66. Which of the following ligands might give linkage isomers?   |  |  |  | | --- | --- | --- | |  | a. | NO2– | |  | b. | SCN– | |  | c. | H2NHC2CH2NH2 | |  | d. | A and B | |  | e. | A, B, and C |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.4 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | constitutional isomerism | general chemistry | structure and isomerism in coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 67. Which of the following are structural isomers?   |  |  |  | | --- | --- | --- | |  | I. | coordination isomers | |  | II. | linkage isomers | |  | III. | geometrical isomers | |  | IV. | optical isomers |   ​   |  |  |  | | --- | --- | --- | |  | a. | I, III | |  | b. | II, IV | |  | c. | I, III, IV | |  | d. | II, III | |  | e. | I, II |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | constitutional isomerism | general chemistry | structure and isomerism in coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/6/2017 6:45 AM | |

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| 68. Which of the following statements concerning the complex ion Co(en)2Cl2+ is true? (en = ethylenediamine, NH2CH2CH2NH2)?   |  |  |  | | --- | --- | --- | |  | a. | The complex ion contains Co(I). | |  | b. | The complex ion exhibits *cis* and *trans* geometrical isomers, but no optical isomers. | |  | c. | The complex ion exhibits two geometrical isomers (*cis* and *trans*) and two optical isomers. | |  | d. | Since en is a strong field ligand (large Δ), the complex ion is paramagnetic. | |  | e. | The geometric isomers of the complex ion have identical chemical properties. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 69. Which of the following is true about coordination complexes?   |  |  |  | | --- | --- | --- | |  | a. | The metal is a Lewis base and the ligands are Lewis acids. | |  | b. | Only complexes with coordination number six are found in nature. | |  | c. | When the ligands approach a transition metal ion in an octahedral field, the *dxz*, *dyz*, and *dxy* atomic orbitals are affected the least by the ligands. | |  | d. | None of the above is true. | |  | e. | All of the above are true. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 70. Which of the following is paramagnetic?   |  |  |  | | --- | --- | --- | |  | a. | Zn(H2O)62+ | |  | b. | Co(NH3)63+ (strong field) | |  | c. | Cu(CN)32– | |  | d. | Mn(CN)62– (strong field) | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 71. The complex ions of Zn2+ are all colorless. The most likely explanation for this is:   |  |  |  | | --- | --- | --- | |  | a. | Zn2+ is paramagnetic. | |  | b. | Zn2+ exhibits “*d* orbital” splittings in its complexes such that they absorb all wavelengths in the visible region. | |  | c. | Since Zn2+ is a *d*10 ion, it does not absorb visible light even though the “*d* orbital” splittings are correct for absorbing visible wavelengths. | |  | d. | Zn2+ is not a transition metal ion. | |  | e. | None of these is correct. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 72. Copper(I) complexes would be expected to be colorless.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | transition elements | visible spectra of transition-metal complexes | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 73. Calculate the total number of unpaired electrons in the following complex ions: Zn(OH2)62+, Ni(CN)42– (square planar), Co(NH3)63+ (strong field).   |  |  |  | | --- | --- | --- | |  | a. | 0 | |  | b. | 1 | |  | c. | 2 | |  | d. | 3 | |  | e. | 4 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 74. The complex FeL62+, where L is a neutral ligand, is known to be diamagnetic. The number of *d* electrons in this complex ion is:   |  |  |  | | --- | --- | --- | |  | a. | 4 | |  | b. | 5 | |  | c. | 6 | |  | d. | 7 | |  | e. | 8 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | octahedral complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 75. The geometry of a coordination compound with a coordination number of 4 is   |  |  |  | | --- | --- | --- | |  | a. | tetrahedral, in order to minimize repulsions between the ligands | |  | b. | octahedral, since there are two different positions possible for each ligand | |  | c. | square planar, to allow room for the counterion because the ligands take up so much space | |  | d. | linear, since there are two ligands on each side of the transition metal | |  | e. | tetrahedral or square planar, but too difficult to predict based on the information given |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | structure of complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 76. Which of the following statements is true about the octahedral complexes of Ni2+?   |  |  |  | | --- | --- | --- | |  | a. | Both strong- and weak-field complexes are diamagnetic. | |  | b. | The strong-field complex is diamagnetic and the weak-field complex is paramagnetic. | |  | c. | The strong-field complex is paramagnetic and the weak-field complex is diamagnetic. | |  | d. | Both strong- and weak-field complexes are paramagnetic. | |  | e. | There are no octahedral complexes of Ni. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | octahedral complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| Specify the number of unpaired electrons. |

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| 77. CuCl2– (linear)   |  |  |  | | --- | --- | --- | |  | a. | 0 | |  | b. | 1 | |  | c. | 2 | |  | d. | 4 | |  | e. | 5 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-2 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 78. Ni(NH3) 62+   |  |  |  | | --- | --- | --- | |  | a. | 0 | |  | b. | 1 | |  | c. | 2 | |  | d. | 4 | |  | e. | 5 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-2 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 79. NiCl42–  (tetrahedral)   |  |  |  | | --- | --- | --- | |  | a. | 0 | |  | b. | 1 | |  | c. | 2 | |  | d. | 4 | |  | e. | 5 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-2 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 80. CoF63–  (weak field)   |  |  |  | | --- | --- | --- | |  | a. | 0 | |  | b. | 1 | |  | c. | 2 | |  | d. | 4 | |  | e. | 5 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-2 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 81. Co(en)33+  (strong field)   |  |  |  | | --- | --- | --- | |  | a. | 0 | |  | b. | 1 | |  | c. | 2 | |  | d. | 4 | |  | e. | 5 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-2 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 82. Mn(H2O)43+  (tetrahedral)   |  |  |  | | --- | --- | --- | |  | a. | 0 | |  | b. | 1 | |  | c. | 2 | |  | d. | 4 | |  | e. | 5 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-2 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 83. Fluoride ion ranks low in the spectrochemical series and produces a weak crystal field in complex ions. Based on this information, predict the number of unpaired electrons in CoF64–.   |  |  |  | | --- | --- | --- | |  | a. | 0 | |  | b. | 1 | |  | c. | 2 | |  | d. | 3 | |  | e. | 4 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 84. According to crystal field theory, how many unpaired electrons are present in the complex ion [Fe(H2O)6]2+? The water molecules are weak field ligands.   |  |  |  | | --- | --- | --- | |  | a. | 1 | |  | b. | 2 | |  | c. | 3 | |  | d. | 4 | |  | e. | 5 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 85. How many unpaired electrons are present in the tetrahedral complex [CoCl4]–?   |  |  |  | | --- | --- | --- | |  | a. | 1 | |  | b. | 2 | |  | c. | 3 | |  | d. | 4 | |  | e. | 5 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 86. Which has the greatest number of unpaired electrons?   |  |  |  | | --- | --- | --- | |  | a. | The square planar complex Ni(CN)42–. | |  | b. | The tetrahedral complex FeCl4–. | |  | c. | Neither of the above have any unpaired electrons. | |  | d. | Both (A and B) have the same number (non-zero) of unpaired electrons. | |  | e. | More information is needed. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 87. A *d*6 ion (Fe2+) is complexed with six strong-field ligands (for example, SCN–). What is the number of unpaired electrons in this complex?   |  |  |  | | --- | --- | --- | |  | a. | 0 | |  | b. | 1 | |  | c. | 2 | |  | d. | 3 | |  | e. | 4 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 88. How many unpaired electrons are there in Ir(Br)64–?  (Br– is a weak-field ligand.)   |  |  |  | | --- | --- | --- | |  | a. | 4 | |  | b. | 3 | |  | c. | 2 | |  | d. | 1 | |  | e. | 0 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 89. The complex ion NiCl42– is tetrahedral. The number of unpaired electrons in the complex is:   |  |  |  | | --- | --- | --- | |  | a. | 0 | |  | b. | 1 | |  | c. | 2 | |  | d. | 3 | |  | e. | 4 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 90. How many unpaired electrons are there in the tetrahedral complex ion [FeCl4]–?   |  |  |  | | --- | --- | --- | |  | a. | 1 | |  | b. | 2 | |  | c. | 3 | |  | d. | 4 | |  | e. | 5 |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | tetrahedral and square planar complexes | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 91. A metal ion in a high-spin octahedral complex has two more unpaired electrons than the same ion does in a low-spin octahedral complex. The metal ion could be:   |  |  |  | | --- | --- | --- | |  | a. | V2+ | |  | b. | Cu2+ | |  | c. | Mn2+ | |  | d. | Cr3+ | |  | e. | Co2+ |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 92. For which of the following metal ions would there be no low-spin versus high-spin distinction in octahedral complexes?   |  |  |  | | --- | --- | --- | |  | a. | Cr2+ | |  | b. | V2+ | |  | c. | Fe3+ | |  | d. | Mn2+ | |  | e. | Co3+ |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 93. How many unpaired electrons are there in a complex ion having a *d*5 electron configuration and an octahedral geometry in the weak field case?   |  |  |  | | --- | --- | --- | |  | a. | 1 | |  | b. | 2 | |  | c. | 3 | |  | d. | 4 | |  | e. | 5 |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 94. The spectrochemical series is  I– < Br– < Cl– < F– < OH– < H2O < NH3 < en < NO2– < CN– Which of the following complexes will absorb visible radiation of the highest energy (shortest wavelength)?   |  |  |  | | --- | --- | --- | |  | a. | [Co(H2O)6]3+ | |  | b. | [Co(I)6]3– | |  | c. | [Co(OH)6]3– | |  | d. | [Co(en)3]3+ | |  | e. | [Co(NH3)6]3+ |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | transition elements | visible spectra of transition-metal complexes | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| Here are some crystal field representations of *d* electrons in an octahedral complex:   |  |  | | --- | --- | | I) |  | | II) |  | | III) |  | | IV) |  | | V) |  |   Choose the representation that fits the transition metal atom in the following species: |

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| 95. Fe(OH2)63+ (assume weak field)   |  |  |  | | --- | --- | --- | |  | a. | representation I | |  | b. | representation II | |  | c. | representation III | |  | d. | representation IV | |  | e. | representation V |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-3 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | octahedral complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 96. [Co(NH3)4Br2]+   |  |  |  | | --- | --- | --- | |  | a. | representation I | |  | b. | representation II | |  | c. | representation III | |  | d. | representation IV | |  | e. | representation V |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-3 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | octahedral complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 97. K4Mn(CN)6 (assume strong field)   |  |  |  | | --- | --- | --- | |  | a. | representation I | |  | b. | representation II | |  | c. | representation III | |  | d. | representation IV | |  | e. | representation V |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-3 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | octahedral complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 98. K4Fe(CN)6   |  |  |  | | --- | --- | --- | |  | a. | representation I | |  | b. | representation II | |  | c. | representation III | |  | d. | representation IV | |  | e. | representation V |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-3 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | octahedral complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 99. [Cr(NH3)5Cl]SO4   |  |  |  | | --- | --- | --- | |  | a. | representation I | |  | b. | representation II | |  | c. | representation III | |  | d. | representation IV | |  | e. | representation V |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-3 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | octahedral complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 100. A complex ion is a square planar complex. It has a *d*8 electron configuration. What is the most reasonable *d* orbital scheme for this complex?   |  |  |  | | --- | --- | --- | |  | a. |  | |  | b. |  | |  | c. |  | |  | d. |  | |  | e. |  |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | tetrahedral and square planar complexes | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 101. Which of the following crystal field diagrams is correct for Co(CN)64– where CN– is a strong field ligand?   |  |  |  | | --- | --- | --- | |  | a. |  | |  | b. |  | |  | c. |  | |  | d. |  | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 102. Which of the following crystal field diagrams is correct for Mn(CN)63– (CN– is a strong field ligand)?   |  |  |  | | --- | --- | --- | |  | a. |  | |  | b. |  | |  | c. |  | |  | d. |  | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 103. Choose the most likely pattern for the crystal field diagram for the complex *trans*–[Ni(NH3)2(CN)4]2– where CN– produces a much stronger crystal field than does NH3.   |  |  |  | | --- | --- | --- | |  | a. |  | |  | b. |  | |  | c. |  | |  | d. |  | |  | e. |  |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 104. Which of the following is true in describing the crystal field model?   |  |  |  | | --- | --- | --- | |  | a. | The metal ion and ligand interaction is treated as a Lewis acid–base interaction. | |  | b. | The ligands are treated as negative point charges. | |  | c. | The metal ion–ligand bonds are considered to be completely ionic. | |  | d. | The electrons are assumed to be localized. | |  | e. | None of the above is true. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 105. Which model(s) accounts for the magnetism and color of coordination compounds?   |  |  |  | | --- | --- | --- | |  | I. | Lewis model | |  | II. | localized electron model | |  | III. | crystal field model |   ​   |  |  |  | | --- | --- | --- | |  | a. | I | |  | b. | II | |  | c. | III | |  | d. | I, II | |  | e. | none accounts for both phenomena |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/6/2017 7:26 AM | |

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| 106. Which of the following complexes would be diamagnetic (all electrons paired)? Assume the strong-field case for all complexes.   |  |  |  | | --- | --- | --- | |  | a. | [Ni(CN)6]4– | |  | b. | [Ti(CN)6]3– | |  | c. | [Co(CN)6]3– | |  | d. | [Cr(CN)6]3– | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 107. How many unpaired electrons are there in the complex ion [Co(NO3)6]4–? For this ion the nitrate ligands produce a very strong crystal field.   |  |  |  | | --- | --- | --- | |  | a. | 1 | |  | b. | 2 | |  | c. | 3 | |  | d. | 4 | |  | e. | 5 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 108. A certain complex ion has a distorted octahedral structure in which the ligands along the plus and minus *z* axes are compressed (pushed in closer to the central metal ion). The *d* orbital splitting diagram for this complex ion would be:   |  |  |  | | --- | --- | --- | |  | a. | \_\_\_\_\_\_\_\_                                             \_\_\_\_\_\_\_\_                           \_\_\_\_\_\_\_\_                         \_\_\_\_\_\_\_\_                                                               \_\_\_\_\_\_\_\_ | |  | b. | \_\_\_\_\_\_\_\_                         \_\_\_\_\_\_\_\_                                                            \_\_\_\_\_\_\_\_                         \_\_\_\_\_\_\_\_                        \_\_\_\_\_\_\_\_ | |  | c. | \_\_\_\_\_\_\_\_                                           \_\_\_\_\_\_\_\_                                           \_\_\_\_\_\_\_\_                           \_\_\_\_\_\_\_\_                         \_\_\_\_\_\_\_\_ | |  | d. | \_\_\_\_\_\_\_\_                         \_\_\_\_\_\_\_\_                        \_\_\_\_\_\_\_\_                                                                                                   \_\_\_\_\_\_\_\_                         \_\_\_\_\_\_\_\_ | |  | e. | \_\_\_\_\_\_\_\_                         \_\_\_\_\_\_\_\_                                                               \_\_\_\_\_\_\_\_                                           \_\_\_\_\_\_\_\_                                           \_\_\_\_\_\_\_\_ |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | octahedral complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 109. The color of a transition metal complex results from:   |  |  |  | | --- | --- | --- | |  | a. | bending vibrations | |  | b. | stretching vibrations | |  | c. | transition of an electron between *d* orbitals | |  | d. | transition of an electron between an *s* and a *p* orbital | |  | e. | nuclear magnetic resonance |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | transition elements | visible spectra of transition-metal complexes | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 110. The complex ion Fe(CN)64– (no unpaired electrons) is classified as:   |  |  |  | | --- | --- | --- | |  | a. | weak field | |  | b. | strong field | |  | c. | no way to tell |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 111. The complex ion Co(NH3)62+ (three unpaired electrons) is classified as:   |  |  |  | | --- | --- | --- | |  | a. | weak field | |  | b. | strong field | |  | c. | no way to tell |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 112. The complex ion Ni(NH3)62+ (two unpaired electrons) is classified as:   |  |  |  | | --- | --- | --- | |  | a. | weak field | |  | b. | strong field | |  | c. | no way to tell |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 113. All tetrahedral complex ions are high spin.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | tetrahedral and square planar complexes | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 114. The complex ions containing Zn2+ are intensely colored.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | transition elements | visible spectra of transition-metal complexes | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 115. The complexes of Zn2+ are all diamagnetic.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 116. In the crystal field model, ligands are treated as negative point charges.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 117. Cytochromes consist of two main parts:   |  |  |  | | --- | --- | --- | |  | a. | myoglobin and heme | |  | b. | heme and porphyrin | |  | c. | heme and a protein | |  | d. | myoglobin and porphyrin | |  | e. | an iron ion and porphyrin |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 118. Hemoglobin is a complex of   |  |  |  | | --- | --- | --- | |  | a. | Co3+ | |  | b. | Mg2+ | |  | c. | Fe2+ | |  | d. | Sc3+ | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 119. The iron in hemoglobin is \_\_\_\_\_\_ when carrying oxygen to cells, and \_\_\_\_\_\_\_ after releasing the oxygen.   |  |  |  | | --- | --- | --- | |  | a. | diamagnetic Fe2+, paramagnetic Fe3+ | |  | b. | diamagnetic Fe2+, paramagnetic Fe2+ | |  | c. | paramagnetic Fe2+, diamagnetic Fe3+ | |  | d. | paramagnetic Fe3+, diamagnetic Fe3+ | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 120. Oxygen is stored in mammalian tissue in which type of molecule?   |  |  |  | | --- | --- | --- | |  | a. | hemoglobin | |  | b. | myoglobin | |  | c. | chlorophyll | |  | d. | cytochrome | |  | e. | prophyrin |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 121. The transition metal \_\_\_\_\_\_\_\_\_\_ assists insulin in the control of blood sugar and may also be involved in the control of cholesterol.   |  |  |  | | --- | --- | --- | |  | a. | scandium | |  | b. | titanium | |  | c. | iron | |  | d. | nickel | |  | e. | chromium |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 122. The transition metal \_\_\_\_\_\_\_\_\_\_ is present in vitamin B12.   |  |  |  | | --- | --- | --- | |  | a. | nickel | |  | b. | titanium | |  | c. | cobalt | |  | d. | zinc | |  | e. | chromium |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 123. This molecule is toxic because it has about 200 times the affinity for the Fe2+ in hemoglobin as oxygen does, causing asphyxiation if enough of it is present in the air.   |  |  |  | | --- | --- | --- | |  | a. | CN– | |  | b. | CO | |  | c. | CO2 | |  | d. | NH3 | |  | e. | CH4 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 124. Carboxyhemoglobin is formed when \_\_\_\_\_\_\_\_\_\_ prevents the normal uptake of oxygen in the blood.   |  |  |  | | --- | --- | --- | |  | a. | CN– | |  | b. | CO | |  | c. | CO2 | |  | d. | NH3 | |  | e. | CH4 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 125. When the body adapts to high altitudes, it makes more \_\_\_\_\_\_\_\_\_\_ to adapt to lower oxygen concentrations in the blood.   |  |  |  | | --- | --- | --- | |  | a. | myoglobin | |  | b. | iron | |  | c. | protein | |  | d. | hemoglobin | |  | e. | fatty tissue |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 126. Which of the following materials is added to the blast furnace to produce slag?   |  |  |  | | --- | --- | --- | |  | a. | sulfur | |  | b. | carbon | |  | c. | silicon | |  | d. | limestone | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | materials chemistry | metal | metallurgy | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 127. Name the careful heat treatment of metals that provides the proper combination of strength without too much brittleness.   |  |  |  | | --- | --- | --- | |  | a. | tempering | |  | b. | core hardening | |  | c. | fire polishing | |  | d. | blast furnace | |  | e. | direct reduction |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | materials chemistry | metal | metallurgy | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 128. Which of the following is not a typical step in metallurgy?   |  |  |  | | --- | --- | --- | |  | a. | reduction | |  | b. | refining | |  | c. | alloying | |  | d. | roasting | |  | e. | transmutation |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | materials chemistry | metal | metallurgy | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 129. Pig iron usually contains about 5%:   |  |  |  | | --- | --- | --- | |  | a. | aluminum | |  | b. | oxygen | |  | c. | sodium | |  | d. | sulfur | |  | e. | carbon |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | alloy | Chemistry | general chemistry | materials chemistry | metal | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 130. The strength of steel is due to the effect of what substance with the iron?   |  |  |  | | --- | --- | --- | |  | a. | copper | |  | b. | carbon monoxide | |  | c. | sulfur | |  | d. | carbon | |  | e. | zinc |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | alloy | Chemistry | general chemistry | materials chemistry | metal | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 131. Which of the following ligands are capable of linkage isomerism?   |  | | --- | | N– | | NO2– | | NH3 | | NH2CH2CH2NH2 | | OCN– | | Cl– | | H2O | | SCN– |  |  |  | | --- | --- | | *ANSWER:* | SCN–, NO2–, and OCN– | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.4 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | constitutional isomerism | general chemistry | structure and isomerism in coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 132. Define stereoisomerism.   |  |  | | --- | --- | | *ANSWER:* | Stereoisomers have the same bonds, but different spatial arrangements of the atoms. Types of stereoisomers include geometrical (*cis-trans*) and optical isomers.  See Sec. 21.4 of Zumdahl, *Chemistry*. | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.4 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | stereoisomerism | structure and isomerism in coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 133. Define optical isomerism.   |  |  | | --- | --- | | *ANSWER:* | Optical isomerism occurs when stereoisomers have opposite effects on plane-polarized light. Such steroisomers are nonsuperimposable mirror images.  See Sec. 21.4 of Zumdahl, *Chemistry*. | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.4 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | stereoisomerism | structure and isomerism in coordination compounds | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 134. Consider the pseudo-octahedral complex of Cr3+ shown below, where A and B represent Lewis bases and where A produces a stronger crystal field than B. Draw an appropriate crystal field diagram for this complex (include the electrons).   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | *ANSWER:* | |  |  |  | | --- | --- | --- | |  | **\_\_\_\_\_\_\_\_** |  | |  |  |  | |  | **\_\_\_\_\_\_\_\_** |  | |  |  |  | | **\_\_\_\_\_\_\_\_** |  | **\_\_\_\_\_\_\_\_** | |  |  |  | |  | **\_\_\_\_\_\_\_\_** |  | |  |  |  |   The orbitals with lobes pointed in the *z*-direction will be affected. Strong field interactions result in higher energy of the affected *d*-orbitals. Thus, the normal octahedral crystal field diagram will be distorted, with , , and at raised energy levels. See Sec. 21.6 of Zumdahl, *Chemistry*. | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | octahedral complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 135. The 3*d* electrons in Co(NH3)63+ are all paired but Fe(H2O)63+ has unpaired electrons (is paramagnetic). Explain.   |  |  | | --- | --- | | *ANSWER:* | Both complex ions have six 3*d* electrons. Co(NH3)63+ is low spin because NH3 produces a strong field when it coordinates with CO3+. Fe(H2O)62+ is high spin because H2O produces a weak field when it coordinates with Fe2+. See Sec. 21.6 of Zumdahl, *Chemistry*. | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| How many unpaired electrons are found in each of the following complex ions? |

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| 136. CoBr4–  (tetrahedral)   |  |  | | --- | --- | | *ANSWER:* | 4 | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-4 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 137. Fe(CN)64–   |  |  | | --- | --- | | *ANSWER:* | 0 | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-4 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 138. [Zn(CN)6]4–   |  |  | | --- | --- | | *ANSWER:* | 0 | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-4 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 139. NiCl42–   |  |  | | --- | --- | | *ANSWER:* | 0 | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-4 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 140. FeCl42–   |  |  | | --- | --- | | *ANSWER:* | 4 | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-4 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 141. [Ni(CN)6]4–   |  |  | | --- | --- | | *ANSWER:* | 2 | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-4 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 142. [Cr(CN)4]2–   |  |  | | --- | --- | | *ANSWER:* | 4 | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-4 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 143. [Co(NH3) 4]2+   |  |  | | --- | --- | | *ANSWER:* | 3 | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 21.6 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 21-4 | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | crystal field theory | general chemistry | high-spin and low-spin complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 144. Which of the following atoms has the smallest radius?   |  |  |  | | --- | --- | --- | |  | a. | Sc | |  | b. | Ti | |  | c. | V | |  | d. | Cr | |  | e. | Fe |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | atomic radii | Chemistry | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 145. Which of the following elements has the highest density?   |  |  |  | | --- | --- | --- | |  | a. | Hg | |  | b. | W | |  | c. | Ta | |  | d. | Au | |  | e. | Ir |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 146. Which of the following manganese species is likely to be the best oxidizing agent?   |  |  |  | | --- | --- | --- | |  | a. | MnO42-(aq) | |  | b. | MnO4-(aq) | |  | c. | MnO2(s) | |  | d. | Mn2+(aq) | |  | e. | Mn(s) |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | periodic trends | reduction potential | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 147. Which of the following metals (M) is mostly likely to form a chloride of the formula MCl4?   |  |  |  | | --- | --- | --- | |  | a. | Sc | |  | b. | Ti | |  | c. | Cr | |  | d. | Fe | |  | e. | Ni |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | oxidation state | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 148. Which of the following metals (M) is mostly likely to form a chloride of the formula MCl5?   |  |  |  | | --- | --- | --- | |  | a. | Sc | |  | b. | Ti | |  | c. | Cr | |  | d. | V | |  | e. | Mn |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | oxidation state | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 149. Which of the following metals (M) is mostly likely to form an oxide of the formula MO3?   |  |  |  | | --- | --- | --- | |  | a. | Sc | |  | b. | Ti | |  | c. | Cr | |  | d. | V | |  | e. | Mn |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | oxidation state | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 150. Which 1st row transition metal demonstrates the most oxidation states?   |  |  |  | | --- | --- | --- | |  | a. | Fe | |  | b. | Ti | |  | c. | Cr | |  | d. | V | |  | e. | Mn |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | oxidation state | periodic trends | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 151. How many oxygen atoms are present in the formula for triamminetriaquairon(II)sulfate?   |  |  |  | | --- | --- | --- | |  | a. | 2 | |  | b. | 3 | |  | c. | 4 | |  | d. | 6 | |  | e. | 7 |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | structure of complex | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 152. How many places on the ligand EDTA can simultaneously bind to a single metal atom?   |  |  |  | | --- | --- | --- | |  | a. | 1 | |  | b. | 2 | |  | c. | 3 | |  | d. | 4 | |  | e. | 6 |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | polydentate ligand | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |

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| 153. How many places on the ligand ethylene diamine can simultaneously bind to a single metal atom?   |  |  |  | | --- | --- | --- | |  | a. | 1 | |  | b. | 2 | |  | c. | 3 | |  | d. | 4 | |  | e. | 6 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 21.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | complex ions and coordination compounds | general chemistry | polydentate ligand | transition elements | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:32 PM | | *DATE MODIFIED:* | 3/4/2016 4:32 PM | |