Practice for Exam 3 (Answer key is found on last page)

Multiple Choice
Identify the letter of the choice that best completes the statement or answers the question.

____ 1. A green laser pointer emits 532 nm light. What is the frequency of this radiation?
   a. $1.77 \times 10^{-15} \text{ s}^{-1}$
   b. $1.77 \times 10^{-6} \text{ s}^{-1}$
   c. $1.59 \times 10^{2} \text{ s}^{-1}$
   d. $5.64 \times 10^{5} \text{ s}^{-1}$
   e. $5.64 \times 10^{14} \text{ s}^{-1}$

____ 2. Ham radio operators broadcast at 50 Hz. What is the wavelength of this radiation?
   a. 6 m
   b. 50 m
   c. 2×10^{2} nm
   d. 6×10^{6} m
   e. 3×10^{8} m

____ 3. If the frequency of infrared light is 2.00×10^{14} Hz, what is the energy of a single photon of this light?
   a. 4.15×10^{-21} J
   b. 1.33×10^{-19} J
   c. 8.23×10^{-17} J
   d. 1.50×10^{-16} J
   e. 9.93×10^{-14} J

____ 4. Calculate the wavelength of the line in the Lyman series that results from the transition $n = 5$ to $n = 1$. The Rydberg constant equals -2.18×10^{-18} J.
   a. 54.2 nm
   b. 95.0 nm
   c. 114 nm
   d. 126 nm
   e. 209 nm

____ 5. What type of orbital is designated $n = 4$, $\ell = 2$, $m_{\ell} = +1$?
   a. 4s
   b. 4p
   c. 4d
   d. 2f
   e. none

____ 6. What is the maximum number of orbitals in $n = 3$?
   a. 1
   b. 3
   c. 4
   d. 7
   e. 9

____ 7. What is the maximum number of electrons that can exist in the shell $n = 4$?
   a. 2
   b. 8
   c. 18
   d. 32
   e. 50

_____ 8. Which of the following atoms is paramagnetic?
   a. Ca
   b. Zn
   c. Kr
   d. He
   e. N

_____ 9. Which element has the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^2$?
   a. Mg
   b. Ga
   c. Si
   d. Ge
   e. S

_____ 10. Which +3 ion has the electron configuration $[Ar]3d^3$?
   a. Fe
   b. Nb
   c. Cr
   d. Mo
   e. Sc

_____ 11. What is the electron configuration for Pb^{2+}?
   a. $[Xe]5d^{10}6s^2$
   b. $[Xe]4f^{14}5d^{10}6s^2$
   c. $[Xe]6s^2$
   d. $[Xe]4f^{14}5d^{10}$
   e. $[Xe]4f^{14}6p^2$

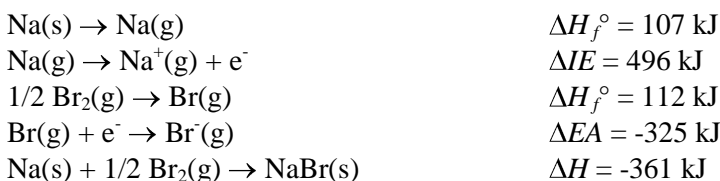_____ 12. What element has the following electron configuration?
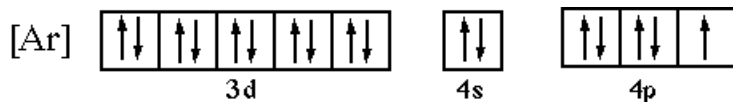
   a. Br
   b. Ag
   c. Ga
   d. Kr
   e. I

_____ 13. Place the following atoms in order of increasing atomic radii: S, F, K, Cl, and Na.
   a. $K < Na < S < F < Cl$
   b. $Na < K < F < S < Cl$
   c. $S < Cl < F < K < Na$
   d. $F < Na < S < Cl < K$
   e. $F < Cl < S < Na < K$

_____ 14. All of the following statements concerning ionization energy are true EXCEPT
   a. ionization energy is always a positive value.
   b. ionization energy is the energy required to remove an electron from a gaseous atom.
   c. ionization energies increase down a group of the periodic table.
   d. the second ionization energy is always larger than the first.
   e. ionization energies generally increase across a period.

_____ 15. Which of the following elements would have the greatest difference between the first and the second ionization energies?

a. Na
b. Sr
c. Cu
d. Cl
e. Sc

_____ 16. Place the following ions in order from smallest to largest radii: N^{3-}, F^-, Cl^-, Mg^{2+}, and Li^+.
a. $Mg^{2+} < Li^+ < Cl^- < N^{3-} < F^-$
b. $Li^+ < Mg^{2+} < F^- < N^{3-} < Cl^-$
c. $Li^+ < Mg^{2+} < N^{3-} < F^- < Cl^-$
d. $F^- < N^{3-} < Li^+ < Mg^{2+} < Cl^-$
e. $F^- < N^{3-} < Mg^{2+} < Li^+ < Cl^-$

_____ 17. What is the expected number of valence electrons for a group 3A element?
a. 0
b. 3
c. 5
d. 6
e. 10

_____ 18. Which of the following combinations is most likely to produce ionic bonds?
a. O and H
b. Al and S
c. C and N
d. N and O
e. S and Cl

_____ 19. What is the total number of valence electrons in a dinitrogen tetraoxide molecule?
a. 18
b. 24
c. 26
d. 32
e. 34

_____ 20. Calculate the lattice energy, $\Delta E_{Lattice}$, of NaBr(s),

$Na^+(g) + Br^-(g) \rightarrow NaBr(s)$ $\Delta E_{Lattice} = ?$

given the following thermochemical equations.

$Na(s) \rightarrow Na(g)$	$\Delta H_f^\circ = 107$ kJ
$Na(g) \rightarrow Na^+(g) + e^-$	$\Delta IE = 496$ kJ
$1/2\ Br_2(g) \rightarrow Br(g)$	$\Delta H_f^\circ = 112$ kJ
$Br(g) + e^- \rightarrow Br^-(g)$	$\Delta EA = -325$ kJ
$Na(s) + 1/2\ Br_2(g) \rightarrow NaBr(s)$	$\Delta H = -361$ kJ

a. -751 kJ
b. -455 kJ
c. -290 kJ
d. +290 kJ
e. +1403 kJ

_____ 21. Which of the following compounds would be expected to have the strongest ionic bonds?
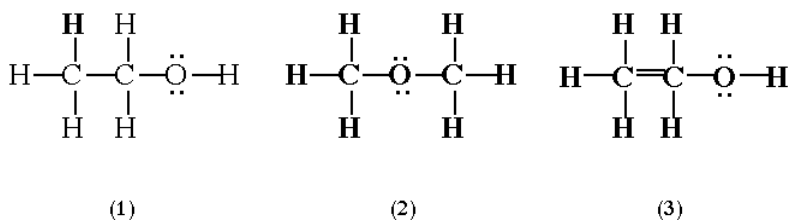a. SrO
b. RbI

c. NaBr
d. MgO
e. BaS

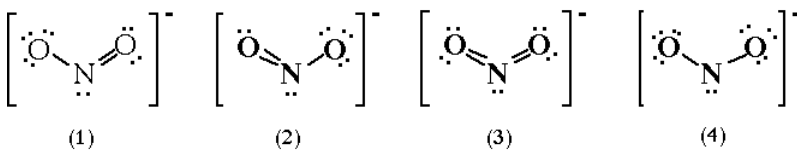22. Which of the following is a correct Lewis structure for SO_2?

(1)　　　　(2)　　　　(3)　　　　(4)　　　　(5)
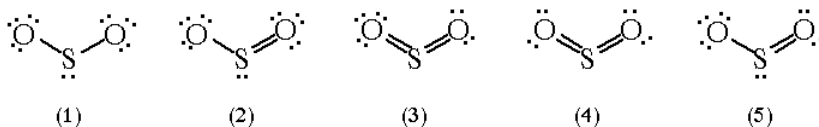
a. 1
b. 2
c. 3
d. 4
e. 5

23. Which of the following is a possible Lewis structures for C_2H_6O?

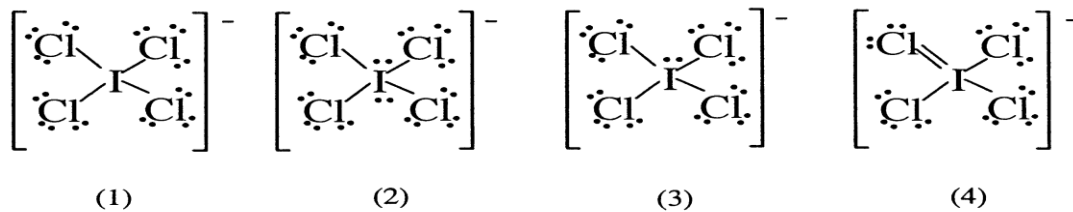(1)　　　　　　　(2)　　　　　　　(3)

a. 1
b. 2
c. 3
d. 1 and 2
e. 1 and 3

24. Which of the following are resonance structures for nitrite ion, NO_2^-?

(1)　　　　(2)　　　　(3)　　　　(4)

a. 1 and 2
b. 2 and 4
c. 1,2 and 3
d. 2 and 3
e. 1, 2 and 4

25. What is the correct Lewis structure for ICl_4^-?

(1)　　　　(2)　　　　(3)　　　　(4)

a. 1
b. 2
c. 3
d. 4
e. 2 and 4

26. The central atom in SF_4 is surrounded by
   a. 4 single bonds, no double bonds, and no lone pairs of electrons.
   b. 4 single bonds, no double bonds, and 1 lone pairs of electrons.
   c. 3 single bonds, 1 double bond, and 1 lone pair of electrons.
   d. 2 single bonds, 2 double bonds, and no lone pairs of electrons.
   e. no single bonds, 4 double bonds, and 2 lone pairs of electrons.

27. What is the formal charge on each atom in the hypochlorite ion, OCl^-?
   a. $O = +1$, $Cl = -2$
   b. $O = 0$, $Cl = -1$
   c. $O = -1$, $Cl = 0$
   d. $O = -1$, $Cl = +1$
   e. $O = -2$, $Cl = +1$

28. The standard molar enthalpy of formation of ClF_3 is -405 kJ.

$1/2\ Cl_2(g) + 3/2\ F_2(g) \rightarrow ClF_3(g)$
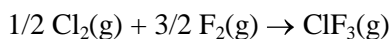
The bond energies of Cl_2 and F_2 are 243 kJ and 159 kJ/mol, respectively. Calculate the energy of a Cl-F bond.
   a. 188 kJ/mol
   b. 255 kJ/mol
   c. 375 kJ/mol
   d. 563 kJ/mol
   e. 807 kJ/mol

29. When heated, azomethane decomposes into nitrogen gas and methane gas.

$CH_3N=NCH_3(g) \rightarrow N_2(g) + C_2H_6(g)$
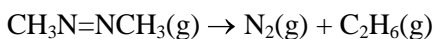
Bond	Bond Enthalpy (kJ/mol)	Bond	Bond Enthalpy (kJ/mol)
C-H	413	N-N	163
C-N	305	N=N	418
C-C	346	N≡N	945

Using average bond enthalpies, calculate the enthalpy of reaction.
   a. -609 kJ/mol
   b. -583 kJ/mol
   c. -462 kJ/mol
   d. -263 kJ/mol
   e. -197 kJ/mol

practice
Answer Section

MULTIPLE CHOICE

1. ANS: E
2. ANS: D
3. ANS: B
4. ANS: B
5. ANS: C
6. ANS: E
7. ANS: D
8. ANS: E
9. ANS: C
10. ANS: C
11. ANS: B
12. ANS: A
13. ANS: E
14. ANS: C
15. ANS: A
16. ANS: B
17. ANS: B
18. ANS: B
19. ANS: E
20. ANS: A
21. ANS: D
22. ANS: E
23. ANS: D
24. ANS: A
25. ANS: B
26. ANS: B
27. ANS: C
28. ANS: B
29. ANS: D