

1031_3rd Exam_1031217

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

- 1) The distance between adjacent crests in an electromagnetic wave is called
A) amplitude B) frequency C) area D) median E) wavelength

Answer: E

- 2) Which of the following colors of electromagnetic radiation has the shortest wavelength?
A) blue B) yellow C) green D) violet E) orange

Answer: D

- 3) Which kind of electromagnetic radiation contains the greatest energy per photon

- A) infrared radiation
- B) X-rays
- C) microwaves
- D) visible light
- E) gamma rays

Answer: E

- 4) Calculate the energy of the red light emitted by a neon atom with a wavelength of 703.2 nm. (Planck's Constant $h = 6.626 \times 10^{-34} \text{ J} \cdot \text{s}$)

- A) $2.83 \times 10^{-19} \text{ J}$
- B) $4.27 \times 10^{-19} \text{ J}$
- C) $6.45 \times 10^{-19} \text{ J}$
- D) $3.54 \times 10^{-19} \text{ J}$
- E) $2.34 \times 10^{-19} \text{ J}$

Answer: A

- 5) A nitrogen gas laser pulse with a wavelength of 337 nm contains 3.83 mJ of energy. How many photons does it contain?

- A) 3.83×10^9
- B) 5.90×10^3
- C) 7.44×10^{12}
- D) 9.25×10^{18}
- E) 6.49×10^{15}

Answer: E

- 6) Which of the following statements is TRUE?

- A) An orbital is the volume in which we are most likely to find an electron.
- B) The emission spectrum of a particular element is always the same and can be used to identify the element.
- C) Part of the Bohr model proposed that electrons in the hydrogen atom are located in "stationary states" or particular orbits around the nucleus.
- D) The uncertainty principle states that we can never know both the exact location and speed of an electron.
- E) All of the above are true.

Answer: E

7) Calculate the wavelength of a baseball ($m = 155 \text{ g}$) moving at 32.5 m/s . ($1 \text{ J} = 1 \text{ kg} \cdot \text{m}^2/\text{s}^2$)

- A) $2.68 \times 10^{-34} \text{ m}$
- B) $1.32 \times 10^{-34} \text{ m}$
- C) $3.57 \times 10^{-32} \text{ m}$
- D) $7.60 \times 10^{-36} \text{ m}$
- E) $2.15 \times 10^{-32} \text{ m}$

Answer: B

8) It is possible to determine the ionization energy for hydrogen using the Bohr equation. Calculate the ionization energy (in kJ) for a mole of hydrogen atoms, making the assumption that ionization is the transition from $n = 1$ to $n = \infty$. (Rydberg constant $R_H = 2.18 \times 10^{-18} \text{ J}$)

- A) $3.62 \times 10^3 \text{ kJ}$
- B) $5.33 \times 10^3 \text{ kJ}$
- C) $1.31 \times 10^3 \text{ kJ}$
- D) $2.76 \times 10^3 \text{ kJ}$
- E) $7.62 \times 10^3 \text{ kJ}$

Answer: C

9) Which of the following statements is TRUE?

- A) An orbital is the path that an electron follows during its movement in an atom.
- B) The magnetic quantum number (m_l) describes the orientation of the orbital.
- C) The principal quantum number (n) describes the shape of an orbital.
- D) The angular momentum quantum number (l) describes the the size and energy associated with an orbital.
- E) All of the above are true.

Answer: B

10) What value of l is represented by a d orbital?

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

Answer: B

11) Give the numbers for m_l for a d orbital.

- A) -1, 0, 1
- B) 0, 1, 2
- C) 1, 2, 3
- D) -2, -1, 0, 1, 2

Answer: D

12) Describe the shape of a s orbital.

- A) dumbbell shaped
- B) spherical
- C) eight balls
- D) four balls
- E) three balls

Answer: B

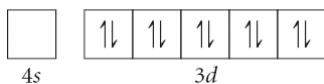
13) Which of the following set is an acceptable set of quantum numbers?

- A) $n = 2, \ell = 0, m_\ell = 0, m_s = 1$
- B) $n = 2, \ell = 1, m_\ell = 2, m_s = -\frac{1}{2}$
- C) $n = 1, \ell = 1, m_\ell = 0, m_s = -\frac{1}{2}$
- D) $n = 3, \ell = 1, m_\ell = -1, m_s = -\frac{1}{2}$
- E) $n = 0, \ell = 0, m_\ell = 0, m_s = +\frac{1}{2}$

Answer: D

14) Choose the valence orbital diagram that represents the ground state of Zn.

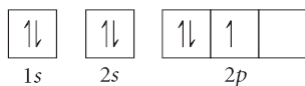
A)



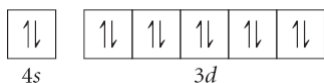
B)



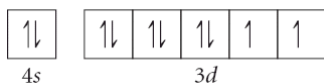
C)



D)



E)



Answer: D

15) Give the ground state electron configuration for Sr.

- A) $[\text{Kr}]5s^2 4d^{10} 5p^2$
- B) $[\text{Kr}]5s^2 4d^{10}$
- C) $[\text{Kr}]5s^2 4d^2$
- D) $[\text{Kr}]5s^2$
- E) $[\text{Kr}]5s^2 5d^{10} 5p^2$

Answer: D

16) Give the complete electronic configuration for Mn.

- A) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^6$
- B) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^5$
- C) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4p^5$
- D) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$

Answer: D

17) Give the ground state electron configuration for Rb^+ .

- A) $[\text{Ar}]4s^24p^6$
- B) $[\text{Ar}]4s^23d^{10}4p^6$
- C) $[\text{Kr}]5s^24d^2$
- D) $[\text{Kr}]5s^1$
- E) $[\text{Kr}]5s^2$

Answer: B

18) Name an element in the fourth period (row) of the periodic table with three 3 d electrons.

- A) As
- B) V
- C) Sc
- D) Sr
- E) Ni

Answer: B

19) How many valence electrons does an atom of Al possess?

- A) 8
- B) 2
- C) 1
- D) 3
- E) 5

Answer: D

20) Only two electrons, with opposing spins, are allowed in each orbital is known as the

- A) Pauli exclusion principle
- B) Heisenberg uncertainty principle
- C) Hund's rule
- D) Hess's Law
- E) Boyle's Law

Answer: A

21) Examining a group going down a column in the Periodic Table, which trend is not correct?

- A) atomic mass increases
- B) atomic radii increase
- C) electronegativities decrease
- D) metallic character decreases
- E) first ionization energy decrease

Answer: D

22) Which electrons experience the greatest effective nuclear charge?

- A) The valence electrons in S
- B) The valence electrons in Al
- C) The valence electrons in Si
- D) The valence electrons in Mg
- E) The valence electrons in P

Answer: A

23) Given the following successive ionization energies, predict which element they correspond to.

	IE ₁	IE ₂	IE ₃	IE ₄
(MJ/mol)	0.80	2.43	3.66	25.02

- A) C
- B) N
- C) Be
- D) Li
- E) B

Answer: E

24) Which reaction below represents the second ionization of Sr?

- A) $\text{Sr}^+(\text{g}) \rightarrow \text{Sr}^{2+}(\text{g}) + \text{e}^-$
- B) $\text{Sr}^+(\text{g}) + \text{e}^- \rightarrow \text{Sr}(\text{g})$
- C) $\text{Sr}(\text{g}) \rightarrow \text{Sr}^+(\text{g}) + \text{e}^-$
- D) $\text{Sr}^{2+}(\text{g}) + \text{e}^- \rightarrow \text{Sr}^+(\text{g})$
- E) $\text{Sr}^-(\text{g}) + \text{e}^- \rightarrow \text{Sr}^{2-}(\text{g})$

Answer: A

25) Place the following in order of increasing atomic radius.

As O Br

- A) $\text{O} < \text{Br} < \text{As}$
- B) $\text{O} < \text{As} < \text{Br}$
- C) $\text{As} < \text{O} < \text{Br}$
- D) $\text{Br} < \text{As} < \text{O}$
- E) $\text{As} < \text{Br} < \text{O}$

Answer: A

26) Place the following in order of decreasing radius.

Te^{2-} F^- O^{2-}

- A) $\text{F}^- > \text{O}^{2-} > \text{Te}^{2-}$
- B) $\text{Te}^{2-} > \text{O}^{2-} > \text{F}^-$
- C) $\text{Te}^{2-} > \text{F}^- > \text{O}^{2-}$
- D) $\text{F}^- > \text{Te}^{2-} > \text{O}^{2-}$
- E) $\text{O}^{2-} > \text{F}^- > \text{Te}^{2-}$

Answer: B

27) For which element would the atoms be expected to be diamagnetic?

- A) Na
- B) Sr
- C) Ge
- D) Co
- E) H

Answer: B

28) Which of the following species would have the greatest attraction to a magnetic field?

- A) O^{2-}
- B) Fe^{3+}
- C) Fe^{2+}
- D) Fe^{-2}
- E) Fe

Answer: B

29) The similar chemical behavior of the elements in a given group in the periodic table is best accounted for by the fact that atoms of these elements have:

- A) the same number of electrons in the outermost (valence) shell
- B) the same number of protons
- C) the same number of electrons
- D) the same number of isotopes
- E) similar nuclear structures

Answer: A

30) Identify a characteristic of halogens.

- A) powerful reducing agents
- B) absorbs water in reactions
- C) powerful oxidizing agents
- D) forms water in reactions
- E) inert

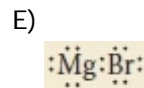
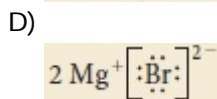
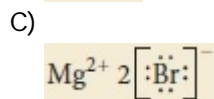
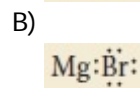
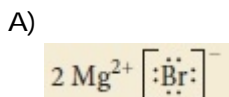
Answer: C

31) Which of the following represent the Lewis structure for Ca^{2+} ?

- A) Ca^{2+}
- B) $\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{Ca}}}^{2+}$
- C) $\text{Ca}:$
- D) $:\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{Ca}}}:^{2+}$
- E) Ca^{2+}

Answer: E

32) Which is the correct Lewis structure for magnesium bromide?



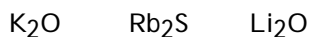
Answer: C

33) Which of the following reactions is associated with the lattice energy of CaS ($\Delta H^\circ_{\text{latt}}$)?

- A) $\text{CaS}(s) \rightarrow \text{Ca}^{2+}(\text{aq}) + \text{S}^{2-}(\text{aq})$
- B) $\text{Ca}^{2+}(\text{aq}) + \text{S}^{2-}(\text{aq}) \rightarrow \text{CaS}(s)$
- C) $\text{CaS}(s) \rightarrow \text{Ca}(s) + \text{S}(s)$
- D) $\text{Ca}^{2+}(\text{g}) + \text{S}^{2-}(\text{g}) \rightarrow \text{CaS}(s)$
- E) $\text{Ca}(s) + \text{S}(s) \rightarrow \text{CaS}(s)$

Answer: D

34) Place the following in order of decreasing magnitude of lattice energy.



- A) $\text{Li}_2\text{O} > \text{Rb}_2\text{S} > \text{K}_2\text{O}$
- B) $\text{Li}_2\text{O} > \text{K}_2\text{O} > \text{Rb}_2\text{S}$
- C) $\text{Rb}_2\text{S} > \text{K}_2\text{O} > \text{Li}_2\text{O}$
- D) $\text{K}_2\text{O} > \text{Li}_2\text{O} > \text{Rb}_2\text{S}$
- E) $\text{Rb}_2\text{S} > \text{Li}_2\text{O} > \text{K}_2\text{O}$

Answer: B

35) Use the data given below to construct a Born-Haber cycle to determine the bond energy of O₂.

	ΔH° (kJ)
Na(s) \rightarrow Na(g)	107
Na(g) \rightarrow Na ⁺ (g) + e ⁻	496
O(g) + e ⁻ \rightarrow O ⁻ (g)	-141
O ⁻ (g) + e ⁻ \rightarrow O ²⁻ (g)	878
2 Na(s) + $\frac{1}{2}$ O ₂ (g) \rightarrow Na ₂ O(s)	-416
2 Na ⁺ (g) + O ²⁻ (g) \rightarrow Na ₂ O(s)	-2608

- A) 852 kJ B) 356 kJ C) 249 kJ D) 426 kJ E) 498 kJ

Answer: E

36) A triple covalent bond contains _____ of electrons.

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

Answer: A

37) Identify the number of bonding pairs and lone pairs of electrons in water.

- A) 2 bonding pairs and 2 lone pairs
B) 2 bonding pairs and 1 lone pair
C) 3 bonding pairs and 2 lone pairs
D) 1 bonding pair and 2 lone pairs
E) 1 bonding pair and 1 lone pair

Answer: A

38) Which of the following has the most negative electron affinity: Li, Be, N, O, F?

- A) F B) N C) O D) Li E) Be

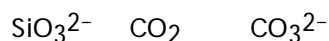
Answer: A

39) Choose the bond below that is most polar.

- A) H-I B) C-H C) H-Cl D) H-Br E) H-F

Answer: E

40) Place the following in order of decreasing XO bond length, where "X" represents the central atom in each of the following compounds or ions.



- A) CO₃²⁻ > SiO₃²⁻ > CO₂
B) SiO₃²⁻ > CO₃²⁻ > CO₂
C) CO₂ > CO₃²⁻ > SiO₃²⁻
D) CO₃²⁻ > CO₂ > SiO₃²⁻
E) CO₂ > SiO₃²⁻ > CO₃²⁻

Answer: B

41) Which order is correct for decreasing polarity (most polar first)?

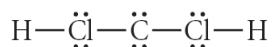
F-O F-F F-Cl F-C
A B C D

- A) $D > C > A > B$
- B) $B > A > C > D$
- C) $D > B > A > C$
- D) $D > A > C > B$
- E) $B > D > B > A$

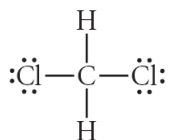
Answer: A

42) Choose the best Lewis structure for CH_2Cl_2 .

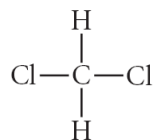
A)



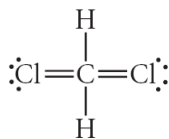
B)



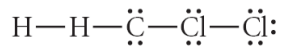
C)



D)



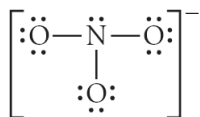
E)



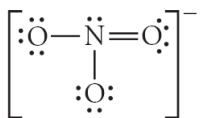
Answer: B

43) Choose the best Lewis structure for NO_3^- .

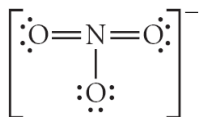
A)



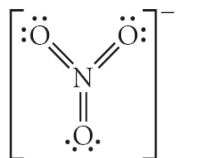
B)



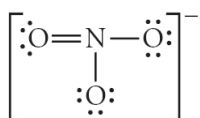
C)



D)



E)



Answer: E

44) Which molecule could have an expanded octet?

A) BF_3

B) H_2CO_3

C) HNO_2

D) H_3PO_4

E) NaCl

Answer: D

45) Draw the best Lewis structure for BrO_4^- and determine the formal charge on bromine.

A) 0

B) -1

C) +3

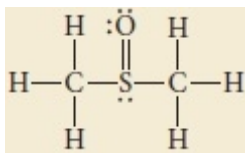
D) +1

E) +2

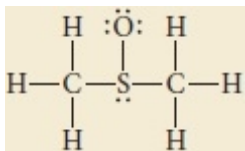
Answer: A

46) Use formal charge to choose the best Lewis structure for CH₃SOCH₃.

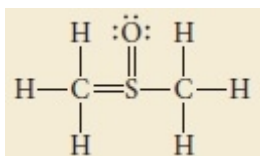
A)



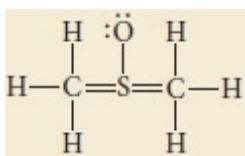
B)



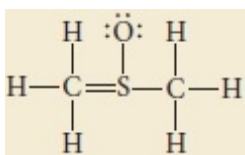
C)



D)



E)



Answer: A

47) Which of the following processes are exothermic?

- A) Li(s) → Li(g)
- B) Br(g) + e⁻ → Br⁻(g)
- C) Cl₂(g) → 2Cl(g)
- D) NaF(s) → Na⁺(g) + F⁻(g)
- E) None of the above are exothermic.

Answer: B

48) Use the bond energies provided to estimate ΔH[°]_{rxn} for the reaction below.

	$\text{C}_2\text{H}_4(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{C}_2\text{H}_6(\text{g})$	$\Delta H^\circ_{\text{rxn}} = ?$
<u>Bond</u>	<u>Bond Energy (kJ/mol)</u>	
C-C	347	
C-H	414	
C=C	611	
C≡C	837	
H-H	436	

- A) +98 kJ B) -102 kJ C) -166 kJ D) -128 kJ E) +700 kJ

Answer: D

49) Which compound would be expected to have the shortest nitrogen-nitrogen bond?

- A) N_2
- B) H_2NNH_2
- C) $(\text{CH}_3)_2\text{NNH}_2$
- D) HNNH
- E) O_2NNO_2

Answer: A

50) Why is the electron affinity so positive for the group 2 elements?

- A) The groups 2 elements are diatomic elements.
- B) The added electron would have to be added into the half-filled p subshell.
- C) The added electron would have to go into a new shell.
- D) Electrons can't be added to gases.
- E) The added electron would have to be added into the p subshell.

Answer: E