

1021_3rd Exam_1021218

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

- 1) On the electromagnetic spectrum, visible light is immediately between two other wavelengths. Name them.
- A) infrared and ultraviolet
 - B) microwave and x-ray
 - C) infrared and x-ray
 - D) radio and microwave
 - E) gamma ray and ultraviolet

Answer: A

- 2) Which of the following occur as the energy of a photon increases?
- A) the frequency decreases.
 - B) the wavelength increases
 - C) the wavelength gets shorter.
 - D) the speed decreases.

Answer: C

- 3) Determine the longest wavelength of light required to remove an electron from a sample of potassium metal, if the binding energy for an electron in K is 1.76×10^3 kJ/mol. (Planck's constant $h = 6.626 \times 10^{-34}$ J·s)
- A) 113 nm
 - B) 387 nm
 - C) 68.0 nm
 - D) 147 nm
 - E) 885 nm

Answer: C

- 4) In an experiment searching for the photoelectric effect, an incident beam of green light produced no ejected electrons from a metal. In order to eject electrons, the experimenter should
- A) increase the brightness of the light.
 - B) decrease the brightness of the light.
 - C) try yellow light.
 - D) try blue light.

Answer: D

- 5) It is possible to determine the ionization energy for hydrogen using the Bohr equation. Calculate the ionization energy for an atom of hydrogen, making the assumption that ionization is the transition from $n = 1$ to $n = \infty$. (Rydberg constant $R_H = 2.18 \times 10^{-18}$ J)
- A) -2.18×10^{-18} J
 - B) -4.59×10^{-18} J
 - C) $+4.59 \times 10^{-18}$ J
 - D) $+4.36 \times 10^{-18}$ J
 - E) $+2.18 \times 10^{-18}$ J

Answer: E

- 6) Which of the following quantum numbers describes the shape of an orbital?
- A) spin quantum number
 - B) Schrödinger quantum number
 - C) magnetic quantum number
 - D) principal quantum number
 - E) angular momentum quantum number

Answer: E

- 7) What value of l is represented by a f orbital?
- A) 2
 - B) 0
 - C) 3
 - D) 1

Answer: C

8) What is the maximum number of p orbitals that are possible?

- A) 3 B) 9 C) 5 D) 7 E) 1

Answer: A

9) How many electrons are there in a filled $3p_x$ orbital?

- A) 2 B) 3 C) 4 D) 5 E) 6

Answer: A

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

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

Answer: D

11) Which set of quantum numbers *cannot* occur together to specify an orbital?

- A) $n = 2, l = 1, m_l = -1$ B) $n = 3, l = 2, m_l = -0$ C) $n = 3, l = 3, m_l = 2$ D) $n = 4, l = 3, m_l = 0$

Answer: C

12) Which electron transition produces light of the highest frequency in the hydrogen atom?

- A) $5p \rightarrow 1s$ B) $4p \rightarrow 1s$ C) $3p \rightarrow 1s$ D) $2p \rightarrow 1s$

Answer: A

13) A major league pitcher throws a 148.8 g baseball at a speed of 92.5 mph (41.4 m/s). What is the de Broglie wavelength of the baseball in meters? (Planck's constant $h = 6.626 \times 10^{-34}$ J·s and $1 \text{ J} = 1 \text{ kg} \cdot \text{m}^2/\text{s}^2$)

- A) 4.81×10^{-38} B) 4.81×10^{-41} C) 1.08×10^{-34} D) 1.08×10^{-37} E) 1.08×10^{-40}

Answer: C

14) Which orbital is a d orbital?



Answer: D

15) The quantum numbers of the last electron of nickel could be:

- A) $n = 4, l = 2, m_l = 0, m_s = 1/2$
B) $n = 3, l = 1, m_l = 0, m_s = 1/2$
C) $n = 3, l = 2, m_l = 0, m_s = 1/2$
D) $n = 3, l = 2, m_l = 0, m_s = 0$
E) $n = 3, l = 2, m_l = 1/2, m_s = 1/2$

Answer: C

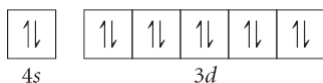
16) No two electrons can have the same four quantum numbers is known as the

- A) Heisenberg uncertainty principle B) Hund's rule
C) Aufbau principle D) Pauli exclusion principle

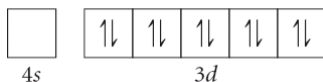
Answer: D

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

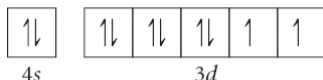
A)



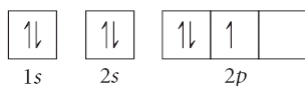
B)



C)



D)



E)



Answer: A

18) Identify the element that has a ground state electronic configuration of $[\text{Kr}]5s^24d^5$.

A) Tc

B) Nb

C) Ru

D) Mn

Answer: A

19) How many valence electrons do the halogens possess?

A) 6

B) 2

C) 7

D) 1

E) 5

Answer: C

20) Which of the following elements has the smallest atomic radius?

A) S

B) Si

C) F

D) P

E) O

Answer: C

21) Place the following in order of decreasing radius: Te^{2-} F^- O^{2-}

A) $\text{F}^- > \text{Te}^{2-} > \text{O}^{2-}$

B) $\text{O}^{2-} > \text{F}^- > \text{Te}^{2-}$

C) $\text{F}^- > \text{O}^{2-} > \text{Te}^{2-}$

D) $\text{Te}^{2-} > \text{O}^{2-} > \text{F}^-$

E) $\text{Te}^{2-} > \text{F}^- > \text{O}^{2-}$

Answer: D

22) Choose the statement that is TRUE.

A) Outer electrons efficiently shield one another from nuclear charge.

B) Core electrons are the easiest of all electrons to remove.

C) Valence electrons are most difficult of all electrons to remove.

D) Core electrons effectively shield outer electrons from nuclear charge.

Answer: D

23) Which reaction below represents the first ionization of O?

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

Answer: D

24) Place the following in order of increasing IE_1 : K Ca Rb

- A) $\text{Ca} < \text{K} < \text{Rb}$
- B) $\text{Rb} < \text{K} < \text{Ca}$
- C) $\text{Rb} < \text{Ca} < \text{K}$
- D) $\text{K} < \text{Ca} < \text{Rb}$
- E) $\text{Ca} < \text{Rb} < \text{K}$

Answer: B

25) Identify the number of valence electrons in Cl^- .

- A) 5
- B) 6
- C) 8
- D) 4
- E) 7

Answer: C

26) Give the ground state electron configuration for Mg^{2+} .

- A) $1s^2 2s^2 2p^6 3s^2 3p^2$
- B) $1s^2 2s^2 2p^6 3s^2$
- C) $1s^2 2s^2 2p^6 3s^2 3p^6$
- D) $1s^2 2s^2 2p^6 3s^1$
- E) $1s^2 2s^2 2p^6$

Answer: E

27) Place the following in order of increasing metallic character: Rb Cs K Na

- A) $\text{Na} < \text{Rb} < \text{Cs} < \text{K}$
- B) $\text{Na} < \text{K} < \text{Rb} < \text{Cs}$
- C) $\text{K} < \text{Cs} < \text{Rb} < \text{Na}$
- D) $\text{K} < \text{Cs} < \text{Na} < \text{Rb}$
- E) $\text{Cs} < \text{Rb} < \text{K} < \text{Na}$

Answer: B

28) According to Coulomb's law, if the separation between two particles of the same charge is doubled, the potential energy of the two particles:

- A) becomes twice as high as it was before the distance separation.
- B) becomes one-half as high as it was before the separation.
- C) does not change.
- D) becomes one-fourth as high as it was before the separation.

Answer: B

29) In which atom do the outermost electrons experience the weakest effective nuclear charge?

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

Answer: B

30) The following ionization energies were determined by experiment for an unknown element:
($I_1 = 801 \text{ kJ/mol}$, $I_2 = 2427 \text{ kJ/mol}$, $I_3 = 3660 \text{ kJ/mol}$, $I_4 = 25,029 \text{ kJ/mol}$).

Which of the following elements is most likely responsible for the given ionization energies?

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

Answer: D

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

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

Answer: B

32) Which of the following species is most likely to be diamagnetic?

- A) Fe B) Zn^{2+} C) Mn^+ D) W^{3+} E) I

Answer: B

33) Why is the electron affinity so positive for the group 12 (2B) elements?

- A) The added electron would have to be added into the half-filled p subshell.
B) The groups 12 elements are diatomic elements.
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

34) Which of the following represent the Lewis structure for Br^- ?

- A) $\text{:}\ddot{\text{Br}}\text{:}^-$ B) $\cdot\ddot{\text{Br}}\text{:}^-$ C) $\text{:}\ddot{\text{Br}}\text{:}^-$ D) $\text{:}\ddot{\text{Br}}\text{:}^-$ E) $\text{Br}\cdot^-$

Answer: C

35) Give the complete electronic configuration for Br^- .

- A) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$
B) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$
C) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^{10} 4p^6$
D) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$
E) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4p^6$

Answer: B

36) Use Lewis theory to determine the chemical formula for the compound formed between Al and O.

- A) AlO_2 B) AlO C) Al_2O_3 D) Al_3O_2 E) Al_2O

Answer: C

37) Which of the following reactions is associated with the lattice energy of Li_2O ($\Delta H^\circ_{\text{latt}}$)?

- A) $\text{Li}_2\text{O}_{(\text{s})} \rightarrow 2 \text{Li}^+_{(\text{aq})} + \text{O}^{2-}_{(\text{aq})}$
B) $2 \text{Li}_{(\text{s})} + \frac{1}{2} \text{O}_{2(\text{g})} \rightarrow \text{Li}_2\text{O}_{(\text{s})}$
C) $\text{Li}_2\text{O}_{(\text{s})} \rightarrow 2 \text{Li}^+_{(\text{g})} + \text{O}^{2-}_{(\text{g})}$
D) $2 \text{Li}^+_{(\text{g})} + \text{O}^{2-}_{(\text{g})} \rightarrow \text{Li}_2\text{O}_{(\text{s})}$
E) $2 \text{Li}^+_{(\text{aq})} + \text{O}^{2-}_{(\text{aq})} \rightarrow \text{Li}_2\text{O}_{(\text{s})}$

Answer: D

38) Place the following in order of *decreasing* magnitude of lattice energy: K_2O Rb_2S Li_2O

- A) $Rb_2S > K_2O > Li_2O$
- B) $Rb_2S > Li_2O > K_2O$
- C) $K_2O > Li_2O > Rb_2S$
- D) $Li_2O > Rb_2S > K_2O$
- E) $Li_2O > K_2O > Rb_2S$

Answer: E

39) Use the data given below to construct a Born-Haber cycle to determine the heat of formation of KCl.

	$\Delta H^\circ(\text{kJ})$
$K(s) \rightarrow K(g)$	89
$K(g) \rightarrow K^+(g) + e^-$	418
$Cl_2(g) \rightarrow 2 Cl(g)$	244
$Cl(g) + e^- \rightarrow Cl^-(g)$	-349
$KCl(s) \rightarrow K^+(g) + Cl^-(g)$	717

- A) -1119 kJ
- B) +158 kJ
- C) +631 kJ
- D) -997 kJ
- E) -437 kJ

Answer: E

40) A double covalent bond contains _____ of electrons.

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

Answer: A

41) Identify the compound with the highest percent ionic character.

- A) HCl
- B) LiF
- C) IBr
- D) HF

Answer: B

42) The phosphorus atom in PCl_3 would be expected to have a

- A) partial positive (δ^+) charge.
- B) partial negative (δ^-) charge.
- C) 3+ charge.
- D) 3- charge.

Answer: A

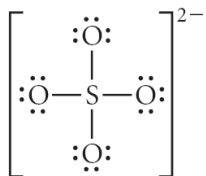
43) Give the number of valence electrons for SO_4^{2-} .

- A) 32
- B) 30
- C) 36
- D) 34
- E) 28

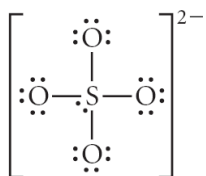
Answer: A

44) Choose the best Lewis structure for SO_4^{2-} .

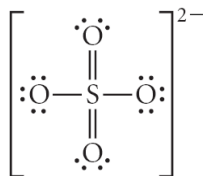
A)



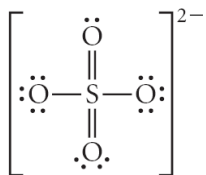
B)



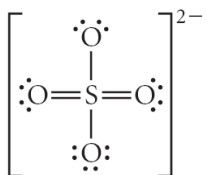
C)



D)



E)



Answer: C

45) Draw the best Lewis structure for the free radical, NO_2 . What is the formal charge on the N?

A) +2

B) 0

C) -2

D) +1

E) -1

Answer: D

46) Which compound has the longest carbon-carbon bond length?

A) HCCH

B) CH_3CH_3

C) CH_2CH_2

D) all bond lengths are the same

Answer: B

47) Use the bond energies provided to estimate $\Delta H^\circ_{\text{rxn}}$ 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 $\equiv$ C	837	
H-H	436	

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

Answer: A

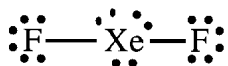
48) Draw the Lewis structure for NO_2^- including any valid resonance structures. Which of the following statements is TRUE?

- A) The nitrite ion contains one N—O single bond and one N=O double bond.
 B) The nitrite ion contains two N --- O bonds that are equivalent to $1\frac{1}{2}$ bonds.
 C) The nitrite ion contains two N=O double bonds.
 D) The nitrite ion contains two N—O single bonds.
 E) None of the above are true.

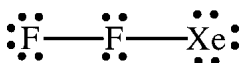
Answer: B

49) Which of the following structures is the best Lewis structure for XeF_2 ?

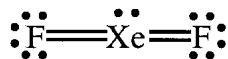
A)



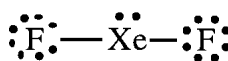
B)



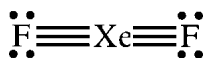
C)



D)



E)



Answer: A

50) Which one of the following processes would be expected to be exothermic?

- A) $\text{K}_{(\text{g})} \rightarrow \text{K}^+_{(\text{g})} + \text{e}^-$
 B) $\text{Br}_{2(\text{l})} \rightarrow \text{Br}_{2(\text{g})}$
 C) $\text{K}_{(\text{s})} \rightarrow \text{K}_{(\text{g})}$
 D) $\text{Br}_{(\text{g})} + \text{e}^- \rightarrow \text{Br}^-_{(\text{g})}$
 E) $\text{Br}_{2(\text{g})} \rightarrow 2 \text{Br}_{(\text{g})}$

Answer: D