

## 1051-2nd Chem Exam\_1051207(A)

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

1) In which of the molecules below is the carbon-carbon distance the shortest?

- A)  $\text{H}_3\text{C}-\text{CH}_2-\text{CH}_3$
- B)  $\text{H}_2\text{C}=\text{C}=\text{CH}_2$
- C)  $\text{H}_2\text{C}=\text{CH}_2$
- D)  $\text{H}_3\text{C}-\text{CH}_3$
- E)  $\text{H}-\text{C}\equiv\text{C}-\text{H}$

Answer: E

2) The Lewis structure of  $\text{N}_2\text{H}_2$  shows \_\_\_\_\_.

- A) a nitrogen-nitrogen triple bond
- B) each nitrogen has one nonbonding electron pair
- C) each nitrogen has two nonbonding electron pairs
- D) a nitrogen-nitrogen single bond
- E) each hydrogen has one nonbonding electron pair

Answer: B

3) In the nitrite ion ( $\text{NO}_2^-$ ), \_\_\_\_\_.

- A) there are 20 valence electrons
- B) both bonds are single bonds
- C) one bond is a double bond and the other is a single bond
- D) both bonds are double bonds
- E) both bonds are the same

Answer: E

4) Resonance structures differ by \_\_\_\_\_.

- A) placement of electrons only
- B) number and placement of electrons
- C) number of electrons only
- D) placement of atoms only
- E) number of atoms only

Answer: A

For the questions that follow, consider the BEST Lewis structures of the following oxyanions:

- (i)  $\text{NO}_2^-$    (ii)  $\text{NO}_3^-$    (iii)  $\text{SO}_3^{2-}$    (iv)  $\text{SO}_4^{2-}$    (v)  $\text{BrO}_3^-$

5) There can be four equivalent best resonance structures of \_\_\_\_\_.

- A) (i)                      B) (ii)                      C) (iii)                      D) (iv)                      E) (v)

Answer: D

- 6) In which of the ions do all X-O bonds (X indicates the central atom) have the same length?
- A) none
  - B) all
  - C) (i) and (ii)
  - D) (iii) and (v)
  - E) (ii), (iv), and (v)

Answer: B

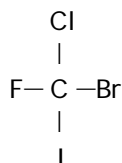
- 7) A valid Lewis structure of \_\_\_\_\_ cannot be drawn without violating the octet rule.
- A) PF<sub>3</sub>
  - B) SO<sub>4</sub><sup>2-</sup>
  - C) SbF<sub>3</sub>
  - D) IF<sub>3</sub>
  - E) NF<sub>3</sub>

Answer: B, D

- 8) Of the bonds C-C, C=C, and C≡C, the C-C bond is \_\_\_\_\_.
- A) strongest/shortest
  - B) strongest/longest
  - C) weakest/longest
  - D) weakest/shortest
  - E) intermediate in both strength and length

Answer: C

- 9) In the molecule below, which atom has the largest partial negative charge?



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

Answer: B

- 10) Given the electronegativities below, which covalent single bond is most polar?

Element:	H	C	N	O
Electronegativity:	2.1	2.5	3.0	3.5

- A) N-H
- B) O-C
- C) O-N
- D) O-H
- E) C-H

Answer: D

- 11) \_\_\_\_\_ have the lowest first ionization energies of the groups listed.

- A) Noble gases
- B) Halogens
- C) Alkaline earth metals
- D) Transition elements
- E) Alkali metals

Answer: E

- 12) Of the following species, \_\_\_\_\_ has the largest radius.

- A) Br<sup>-</sup>
- B) Sr<sup>2+</sup>
- C) Rb<sup>+</sup>
- D) Kr
- E) Ar

Answer: A

Consider the following electron configurations to answer the questions that follow:

- (i)  $1s^2 2s^2 2p^6 3s^1$
- (ii)  $1s^2 2s^2 2p^6 3s^2$
- (iii)  $1s^2 2s^2 2p^6 3s^2 3p^1$
- (iv)  $1s^2 2s^2 2p^6 3s^2 3p^4$
- (v)  $1s^2 2s^2 2p^6 3s^2 3p^5$

13) The electron configuration belonging to the atom with the highest second ionization energy is \_\_\_\_\_.

- A) (i)                      B) (ii)                      C) (iii)                      D) (iv)                      E) (v)

Answer: A

14) The electron configuration that belongs to the atom with the lowest second ionization energy is \_\_\_\_\_.

- A) (i)                      B) (ii)                      C) (iii)                      D) (iv)                      E) (v)

Answer: B

15) The electron configuration of the atom with the most negative electron affinity is \_\_\_\_\_.

- A) (i)                      B) (ii)                      C) (iii)                      D) (iv)                      E) (v)

Answer: E

16) The electron configuration of the atom that is expected to have a positive electron affinity is \_\_\_\_\_.

- A) (i)                      B) (ii)                      C) (iii)                      D) (iv)                      E) (v)

Answer: B

17) The reaction of alkali metals with oxygen produce \_\_\_\_\_.

- A) oxides
- B) superoxides
- C) peroxides
- D) all of the above
- E) none of the above

Answer: D

18) Of the hydrogen halides, only \_\_\_\_\_ is a weak acid.

- A) HBr (aq)
- B) HF (aq)
- C) HI (aq)
- D) HCl (aq)
- E) They are all weak acids.

Answer: B

19) Of the following transitions in the Bohr hydrogen atom, the \_\_\_\_\_ transition results in the emission of the lowest-energy photon.

- A)  $n = 3 \rightarrow n = 6$
- B)  $n = 6 \rightarrow n = 1$
- C)  $n = 6 \rightarrow n = 3$
- D)  $n = 1 \rightarrow n = 4$
- E)  $n = 1 \rightarrow n = 6$

Answer: C

- 20) Which of the subshells below do not exist due to the constraints upon the angular momentum quantum number?
- A) 2s
  - B) 2d
  - C) 2p
  - D) all of the above
  - E) none of the above

Answer: B

- 21) An electron cannot have the quantum numbers  $n = \underline{\hspace{2cm}}$ ,  $l = \underline{\hspace{2cm}}$ ,  $m_l = \underline{\hspace{2cm}}$ .
- A) 3, 2, 1
  - B) 2, 1, -1
  - C) 2, 0, 0
  - D) 3, 1, -1
  - E) 1, 1, 1

Answer: E

- 22) Which quantum number determines the energy of an electron in a hydrogen atom?
- A)  $n$
  - B)  $m_l$
  - C)  $l$
  - D)  $E$
  - E)  $n$  and  $l$

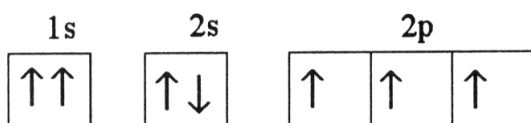
Answer: A

- 23) Which one of the following orbitals can hold two electrons?
- A) 3s
  - B)  $2p_x$
  - C)  $4d_{xy}$
  - D) all of the above
  - E) none of the above

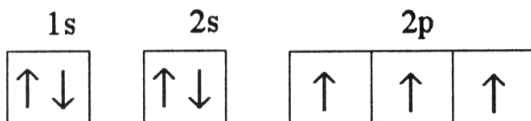
Answer: D

- 24) Which one of the following is the correct electron configuration for a ground-state nitrogen atom?

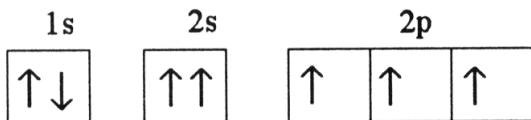
A)



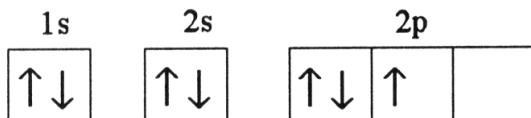
B)



C)



D)



E) None of the above is correct.

Answer: B

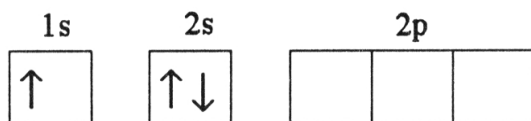
25) Which one of the following configurations depicts an excited oxygen atom?

- A)  $[\text{He}]2s^22p^4$
- B)  $1s^22s^22p^1$
- C)  $1s^22s^22p^4$
- D)  $1s^22s^22p^23s^2$
- E)  $1s^22s^22p^2$

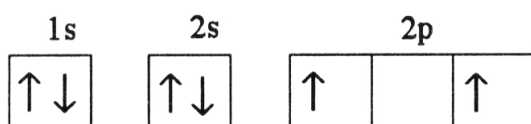
Answer: D

26) Which electron configuration represents a violation of Hund's rule for an atom in its ground state?

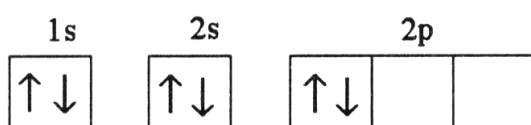
A)



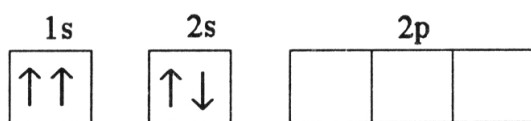
B)



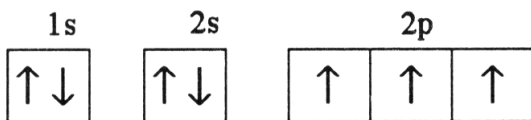
C)



D)



E)



Answer: C

27) The  $n = 8$  to  $n = 4$  transition in the Bohr hydrogen atom occurs in the \_\_\_\_\_ region of the electromagnetic spectrum.

- A) microwave
- B) ultraviolet
- C) infrared
- D) visible
- E) X-ray

Answer: C

28) The  $n = 1$  shell contains \_\_\_\_\_ p orbitals. All the other shells contain \_\_\_\_\_ p orbitals.

- A) 6, 2
- B) 0, 3
- C) 3, 6
- D) 0, 6
- E) 3, 3

Answer: B

29) How many quantum numbers are necessary to designate a particular electron in an atom?

- A) 4
- B) 1
- C) 3
- D) 2
- E) 5

Answer: A

30) Which one of the following represents an impossible set of quantum numbers for an electron in an atom?  
(arranged as  $n$ ,  $l$ ,  $m_l$ , and  $m_s$ )

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

Answer: B

31) Of the following, which one is a state function?

- A) H  
B)  $q$   
C)  $w$   
D) heat  
E) none of the above

Answer: A

32) Which of the following is a statement of the first law of thermodynamics?

- A) A negative  $\Delta H$  corresponds to an exothermic process.  
B) Energy lost by the system must be gained by the surroundings.  
C)  $E_k = \frac{1}{2}mv^2$   
D) 1 cal = 4.184 J (exactly)  
E)  $\Delta E = E_{\text{final}} - E_{\text{initial}}$

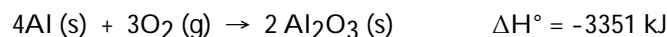
Answer: B

33) When a system \_\_\_\_\_,  $\Delta E$  is always negative.

- A) absorbs heat and has work done on it  
B) gives off heat and has work done on it  
C) gives off heat and does work  
D) absorbs heat and does work  
E) None of the above is always negative.

Answer: C

34) The reaction



is \_\_\_\_\_, and therefore heat is \_\_\_\_\_ by the reaction.

- A) endothermic, released  
B) endothermic, absorbed  
C) exothermic, absorbed  
D) exothermic, released  
E) thermoneutral, neither released nor absorbed

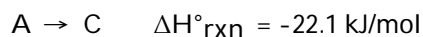
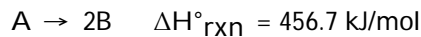
Answer: D

35) For which one of the following reactions is  $\Delta H^\circ_{\text{rxn}}$  equal to the heat of formation of the product?

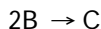
- A)  $\text{N}_2\text{ (g)} + 3\text{H}_2\text{ (g)} \rightarrow 2\text{NH}_3\text{ (g)}$   
B)  $\text{P (g)} + 4\text{H (g)} + \text{Br (g)} \rightarrow \text{PH}_4\text{Br (l)}$   
C)  $12\text{C (g)} + 11\text{H}_2\text{ (g)} + 11\text{O (g)} \rightarrow \text{C}_6\text{H}_{22}\text{O}_{11}\text{ (g)}$   
D)  $6\text{C (s)} + 6\text{H (g)} \rightarrow \text{C}_6\text{H}_6\text{ (l)}$   
E)  $(1/2)\text{N}_2\text{ (g)} + \text{O}_2\text{ (g)} \rightarrow \text{NO}_2\text{ (g)}$

Answer: E

36) Consider the following two reactions:



Determine the enthalpy change for the process:



A) -478.8 kJ/mol

B) -434.6 kJ/mol

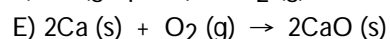
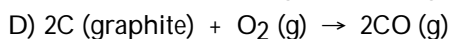
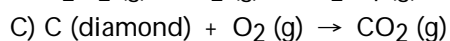
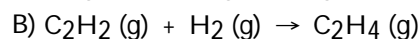
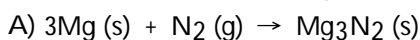
C) 434.6 kJ/mol

D) 478.8 kJ/mol

E) More information is needed to solve the problem.

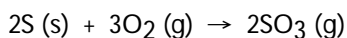
Answer: A

37) For which one of the following reactions is the value of  $\Delta H^\circ_{\text{rxn}}$  equal to  $\Delta H^\circ_f$  for the product?



Answer: A

38) The value of  $\Delta H^\circ$  for the reaction below is -790 kJ. The enthalpy change accompanying the reaction of 0.95 g of S is \_\_\_\_\_ kJ.



A) -790

B) -12

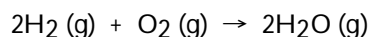
C) 23

D) 12

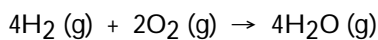
E) -23

Answer: B

39) The enthalpy change for the following reaction is -483.6 kJ:



Therefore, the enthalpy change for the following reaction is \_\_\_\_\_ kJ.



A) -967.2

B) 483.6

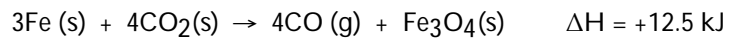
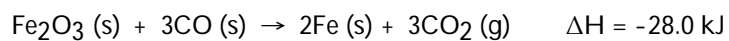
C)  $2.34 \times 10^5$

D) -483.6

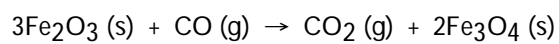
E) 967.2

Answer: A

40) Given the following reactions



the enthalpy of the reaction of  $\text{Fe}_2\text{O}_3$  with CO



is \_\_\_\_\_ kJ.

A) +109

B) -59.0

C) -109

D) 40.5

E) -15.5

Answer: B