1071-2nd Chem Exam-1071128(A)

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

1) The halogens, alkali metals, and alkaline earth metals have _____ valence electrons, respectively.
A) 7, 4, and 6 B) 2, 7, and 4 C) 8, 2, and 3 D) 7, 1, and 2 E) 1, 5, and 7

Answer: D

2) The only noble gas without eight valence electrons is _____.
A) He
B) Ar
C) Kr
D) Ne
E) All noble gases have eight valence electrons.

Answer: A

3) For a given arrangement of ions, the lattice energy increases as ionic radius _____ and as ionic charge _____.
A) decreases, decreases
B) increases, increases
C) decreases, increases
D) increases, decreases
E) This cannot be predicted.

Answer: C

4) What is the maximum number of double bonds that a hydrogen atom can form?
A) 0 B) 1 C) 2 D) 3 E) 4

Answer: A

5) 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

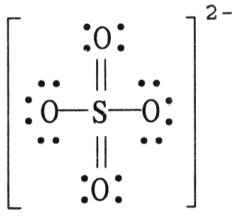
A) O—N B) C—H C) N—H D) O—C E) O—H

Answer: E

6) The ion PO_4^{3-} has _____ valence electrons.
A) 24 B) 32 C) 27 D) 14 E) 29

Answer: B

7) The formal charge on sulfur in SO_4^{2-} is _____, where the Lewis structure of the ion is:



A) -4 B) -2 C) 0 D) +4 E) +2

Answer: C

8) How many equivalent resonance forms can be drawn for SO_2 without expanding octet on the sulfur atom (sulfur is the central atom)?

A) 2 B) 1 C) 4 D) 3 E) 0

Answer: A

9) Using the table of average bond energies below, the ΔH for the reaction is _____ kJ.

$$H\text{-}C{\equiv}C\text{-}H\ (g) + H\text{-}I\ (g) \rightarrow H_2C{=}CHI\ (g)$$

Bond:	C≡C	C=C	H-I	C-I	C-H
D (kJ/mol):	839	614	299	240	413

A) +129 B) -931 C) -506 D) -129 E) +506

Answer: D

10) Which of the following has eight valence electrons?

A) Cl^-
B) Ti^{4+}
C) Na^+
D) Kr
E) all of the above

Answer: E

11) An electron in a(n) _____ subshell experiences the greatest effective nuclear charge in a many-electron atom.

A) 3d B) 3p C) 3f D) 3s E) 4s

Answer: D

12) A tin atom has 50 electrons. Electrons in the _____ subshell experience the lowest effective nuclear charge.

A) 1s B) 3p C) 5s D) 3d E) 5p

Answer: E

13) Oxides of the active metals combine with water to form _____.

A) hydrogen gas
B) oxygen gas
C) metal hydroxides
D) water and a salt
E) metal hydrides

Answer: C

14) The substance _____ is always produced when an active metal reacts with water.

A) NaOH B) H_2O C) H_2 D) CO_2 E) O_2

Answer: C

15) The most common and stable allotrope of sulfur is _____.

A) S_2

B) S

C) S_4

D) S_8

E) Sulfur does not form allotropes.

Answer: D

16) The element phosphorus exists in two forms in nature called white phosphorus and red phosphorus. These two forms are examples of _____.

A) noble gases B) isotopes C) oxidation D) metalloids E) allotropes

Answer: E

17) Of the halogens, which are gases at room temperature and atmospheric pressure?

A) fluorine, chlorine, and bromine

B) fluorine, bromine, and iodine

C) fluorine and chlorine

D) fluorine, chlorine, bromine, and iodine

E) fluorine, chlorine, and iodine

Answer: C

18) $2\ F_2\ (g) + 2\ H_2O\ (l) \rightarrow$ _____

A) $2\ F^-\ (aq) + 2\ H^+\ (aq) + H_2O_2\ (aq)$

B) $2\ HF_2\ (aq) + 2\ OH^-\ (aq)$

C) $4\ HF\ (aq) + O_2\ (g)$

D) 2 HF (aq) + 2 HFO (aq)

E) $4\ HF\ (aq) + 2\ O^{2-}\ (aq)$

Answer: C

19) In which set of elements would all members be expected to have very similar chemical properties?

A) S, Se, Si B) Na, Mg, K C) O, S, Se D) N, O, F E) Ne, Na, Mg

Answer: C

20) Screening of the nuclear charge by core electrons in atoms is _____.

A) less efficient than that by valence electrons

B) responsible for a general decrease in atomic radius going down a group

C) more efficient than that by valence electrons

D) essentially identical to that by valence electrons

E) <u>both</u> essentially identical to that by valence electrons <u>and</u> responsible for a general decrease in atomic radius going down a group

Answer: C

21) What is the wavelength of light (nm) that has a frequency $4.62 \times 10^{14}\ s^{-1}$?

A) 1.39×10^{23} B) 1.07×10^{6} C) 649 D) 932 E) 1.54×10^{-3}

Answer: C

22) The uncertainty principle states that _____.
A) it is impossible to know how many electrons there are in an atom
B) matter and energy are really the same thing
C) it is impossible to know the exact position and momentum of an electron
D) there can only be one uncertain digit in a reported number
E) it is impossible to know anything with certainty
Answer: C

23) The de Broglie wavelength of a car (1.0×10^3 kg) traveling at 75 km/hr is _____ m.
A) 1.4×10^{35} B) 8.8×10^{-39} C) 3.2×10^{-38} D) 1.4×10^{-35} E) 3.2×10^{-35}
Answer: C

24) 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) $n = 1 \rightarrow n = 4$
C) $n = 6 \rightarrow n = 3$
D) $n = 6 \rightarrow n = 1$
E) $n = 1 \rightarrow n = 6$
Answer: C

25) The angular momentum quantum number is 3 in _____ orbitals.
A) a B) s C) d D) f E) p
Answer: D

26) Which of the following is a valid set of four quantum numbers? (n, l, m_l, m_s)
A) 2, 2, 1, -1/2 B) 1, 1, 0, -1/2 C) 2, 1, 0, +1/2 D) 1, 0, 1, +1/2 E) 2, 1, +2, +1/2
Answer: C

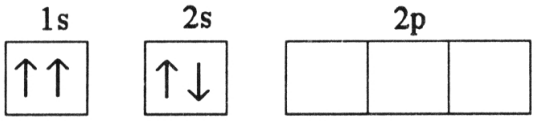
27) The ground state electron configuration of Fe is _____.
A) $1s^2 2s^2 3s^2 3p^6 3d^6$
B) $1s^2 2s^2 3s^2 3p^{10}$
C) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^6$
D) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
E) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$
Answer: E

28) The ground-state electron configuration of _____ is $[Ar]4s^1 3d^5$.
A) Cr B) V C) K D) Fe E) Mn
Answer: A

29) The electron configuration of a ground-state Ag atom is _____.
A) $[Ar]4s^1 4d^{10}$ B) $[Kr]5s^2 4d^{10}$ C) $[Ar]4s^2 4d^9$ D) $[Kr]5s^1 4d^{10}$ E) $[Kr]5s^2 3d^9$
Answer: D

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

A)



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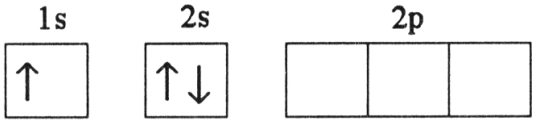

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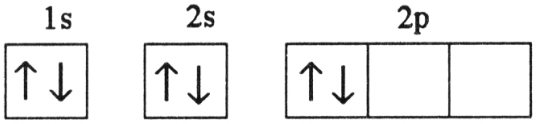
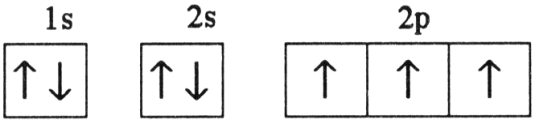
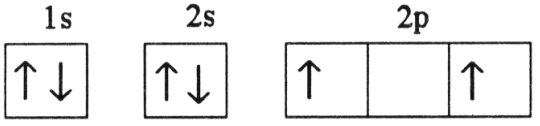


D)



E)



Answer: C

31) Which one of the following statements is true?

A) Enthalpy is a state function.
B) Enthalpy is an intensive property.
C) H is the value of q measured under conditions of constant volume.
D) The enthalpy change of a reaction is the reciprocal of the ΔH of the reverse reaction.
E) The enthalpy change for a reaction is independent of the state of the reactants and products.

Answer: A

32) The change in the internal energy of a system that releases 2,500 J of heat and that does 7,655 J of work on the surroundings is _____ J.

A) -10,155 B) 5,155 C) -1.91×10^7 D) 10,155 E) -5,155

Answer: A

33) A 22.44 g sample of iron absorbs 180.8 J of heat, upon which the temperature of the sample increases from 21.1 °C to 39.0 °C. What is the specific heat of iron?

A) 0.840 B) 0.450 C) 0.820 D) 0.140 E) 0.900

Answer: B

34) The temperature of a 12.58 g sample of calcium carbonate [$CaCO_3$ (s)] increases from 23.6 °C to 38.2 °C. If the specific heat of calcium carbonate is 0.82 J/g-K, how many joules of heat are absorbed?

A) 5.0 B) 151 C) 410 D) 0.82 E) 7.5

Answer: B

35) The value of $\Delta H°$ for the reaction below is -126 kJ. _____ kJare released when 2.00 mol of NaOH is formed the reaction?

$$2Na_2O_2\ (s) + 2H_2O\ (l) \rightarrow 4NaOH\ (s) + O_2\ (g)$$

A) -126 B) 3.9 C) 252 D) 63 E) 7.8

Answer: D

36) Given the following reactions

$$Fe_2O_3\ (s) + 3CO\ (s) \rightarrow 2Fe\ (s) + 3CO_2\ (g) \qquad \Delta H = -28.0\ kJ$$

$$3Fe\ (s) + 4CO_2\ (s) \rightarrow 4CO\ (g) + Fe_3O_4\ (s) \qquad \Delta H = +12.5\ kJ$$

the enthalpy of the reaction of Fe_2O_3 with CO

$$3Fe_2O_3\ (s) + CO\ (g) \rightarrow CO_2\ (g) + 2Fe_3O_4\ (s)$$

is _____ kJ.

A) -59.0 B) 40.5 C) +109 D) -15.5 E) -109

Answer: A

37) Given the following reactions

$$H_2O\ (l) \rightarrow H_2O\ (g) \qquad \Delta H = 44.01\ kJ$$

$$2H_2\ (g) + O_2\ (g) \rightarrow 2H_2O\ (g) \qquad \Delta H = -483.64\ kJ$$

the enthalpy for the decomposition of liquid water into gaseous hydrogen and oxygen

$$2H_2O\ (l) \rightarrow 2H_2\ (g) + O_2\ (g)$$

is _____ kJ.

A) -395.62 B) 527.65 C) -527.65 D) 439.63 E) 571.66

Answer: E

38) For which one of the following equations is $\Delta H°_{rxn}$ equal to $\Delta H_f°$ for the product?

A) $2CO\ (g) + O_2\ (g) \rightarrow 2CO_2\ (g)$

B) $N_2\ (g) + O_3\ (g) \rightarrow N_2O_3\ (g)$

C) $CH_4\ (g) + 2Cl_2\ (g) \rightarrow CH_2Cl_2\ (l) + 2HCl\ (g)$

D) $Xe\ (g) + 2F_2\ (g) \rightarrow XeF_4\ (g)$

E) $C\ (diamond) + O_2\ (g) \rightarrow CO_2\ (g)$

Answer: D

39) Given the data in the table below, $\Delta H°_{rxn}$ for the reaction

$$4NH_3\,(g) + 5O_2\,(g) \rightarrow 4NO\,(g) + 6H_2O\,(l)$$

is _____ kJ.

Substance	$\Delta H_f°$ (kJ/mol)
H_2O (l)	-286
NO (g)	90
NO_2 (g)	34
HNO_3 (aq)	-207
NH_3 (g)	-46

A) -150
B) -1172
C) -1540
D) -1892
E) The $\Delta H_f°$ of O_2 (g) is needed for the calculation.

Answer: B

40) Given the data in the table below, $\Delta H°_{rxn}$ for the reaction

$$PCl_3\,(g) + 3\,HCl\,(g) \rightarrow 3\,Cl_2\,(g) + PH_3\,(g)$$

is _____ kJ.

Compound	$\Delta H_f°$ (kJ/mol)
PCl_3 (g)	-288.07
HCl (g)	-92.30
PH_3 (g)	5.40

A) -570.37
B) -385.77
C) 570.37
D) 385.77
E) The $\Delta H°_f$ of Cl_2 (g) is needed for the calculation.

Answer: C