

Final Review 15-16

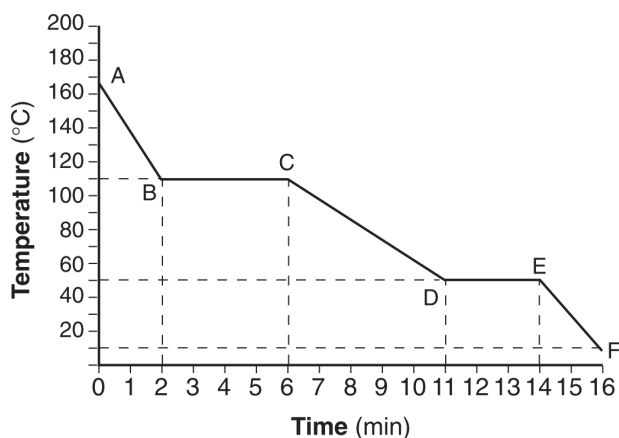
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Date: \_\_\_\_\_

- As the elements of Group 16 (VIA) are considered from top to bottom on the Periodic Table, the covalent radii
  - increase and the ionization energies decrease
  - increase and the ionization energies increase
  - decrease and the ionization energies increase
  - decrease and the ionization energies decrease
- The elements that have the most pronounced nonmetallic properties are located toward which corner of the Periodic Table?
  - upper right
  - upper left
  - lower right
  - lower left
- Which element within any given period of the Periodic Table would always have the *lowest* first ionization energy?
  - an alkali metal
  - a halogen
  - an alkaline earth metal
  - a noble gas
- Which is the correct equilibrium expression for the reaction  $4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \rightleftharpoons 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{g})$ ?
  - $K_{\text{eq}} = \frac{[\text{NO}]^4[\text{H}_2\text{O}]^6}{[\text{NH}_3]^4[\text{O}_2]^5}$
  - $K_{\text{eq}} = \frac{[\text{NO}]^4 + [\text{H}_2\text{O}]^6}{[\text{NH}_3]^4 + [\text{O}_2]^5}$
  - $K_{\text{eq}} = \frac{[4\text{NO}][6\text{H}_2\text{O}]}{[4\text{NH}_3][5\text{O}_2]}$
  - $K_{\text{eq}} = \frac{[4\text{NO}] + [6\text{H}_2\text{O}]}{[4\text{NH}_3] + [5\text{O}_2]}$
- If X represents an element of Group IA, the formula of its oxide would be
  - XO
  - X<sub>2</sub>O
  - XO<sub>2</sub>
  - X<sub>2</sub>O<sub>3</sub>
- Beryllium is classified as
  - an alkaline earth metal
  - an alkali metal
  - a transition metal
  - a noble gas
- More than two-thirds of the elements of the Periodic Table are
  - metalloids
  - metals
  - nonmetals
  - noble gases
- Which substance has a high melting point and conducts electricity in the liquid phase?
  - Ne
  - Hg
  - NaCl
  - SiC
- Which characteristic describes most nonmetals in the solid phase?
  - good conductors of electricity
  - good conductors of heat
  - malleable
  - brittle
- Two basic properties of the gas phase are
  - a definite shape and a definite volume
  - a definite shape but no definite volume
  - no definite shape but a definite volume
  - no definite shape and no definite volume

11. Which set of procedures and observations indicates a chemical change?
- Ethanol is added to an empty beaker and the ethanol eventually disappears.
  - A solid is gently heated in a crucible and the solid slowly turns to liquid.
  - Large crystals are crushed with a mortar and pestle and become powder.
  - A cool, shiny metal is added to water in a beaker and rapid bubbling occurs.

12. Base your answer(s) to the following question(s) on the graph below, which represents the cooling of a substance starting at a temperature above its boiling point.



What is the melting point of this substance?

13. Which process is a chemical change?
- melting of ice
  - boiling of water
  - subliming of ice
  - decomposing of water
14. Which part of a helium atom is positively charged?
- electron
  - neutron
  - nucleus
  - orbital

15. At STP, which element is solid, brittle, and a poor conductor of electricity?

A. Al      B. K      C. Ne      D. S

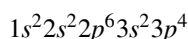
16. Which is the electron configuration of a neutral atom in the ground state with a total of six valence electrons?

A.  $1s^22s^22p^2$       B.  $1s^22s^22p^4$   
 C.  $1s^22s^22p^6$       D.  $1s^22s^22p^63s^23p^6$

17. The correct electron configuration of the  $O^{2-}$  ion is

A.  $1s^22s^22p^2$       B.  $1s^22s^22p^3$   
 C.  $1s^22s^22p^5$       D.  $1s^22s^22p^6$

18. Given the electron configuration of an atom in the ground state:



This element is found in the Periodic Table in

- Period 4 and Group 16
- Period 4 and Group 14
- Period 3 and Group 16
- Period 3 and Group 14

19. What is the total number of valence electrons in an atom of boron in the ground state?

A. 1      B. 7      C. 3      D. 5

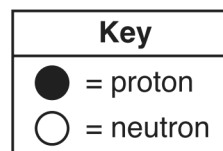
20. Which pair of elements form an ionic bond with each other?

A. KCl      B. ICl      C. PCl      D. HCl

21. A characteristic of ionic solids is that they
- have high melting points
  - have low boiling points
  - conduct electricity
  - are noncrystalline
22. Which type of bond is formed by the transfer of electrons from one atom to another?
- a covalent bond
  - a coordinate covalent bond
  - a hydrogen bond
  - an ionic bond
23. Which compound contains both covalent bonds and ionic bonds?
- NaCl(s)
  - HCl(g)
  - NaNO<sub>3</sub>(s)
  - N<sub>2</sub>O<sub>5</sub>(g)
24. Which kind of bond is formed when two atoms share electrons to form a molecule?
- ionic
  - metallic
  - electrovalent
  - covalent
25. The bonds present in silicon carbide (SiC) are
- covalent
  - ionic
  - metallic
  - van der Waals
26. Which element is composed of atoms that can form more than one covalent bond with each other?
- hydrogen
  - helium
  - carbon
  - calcium
27. The ability to conduct electricity in the solid state is a characteristic of metallic bonding. This characteristic is best explained by the presence of
- high ionization energies
  - high electronegativities
  - mobile electrons
  - mobile protons
28. Metallic bonding occurs between atoms of
- sulfur
  - copper
  - fluorine
  - carbon
29. Which substance contains metallic bonds?
- Hg(*ℓ*)
  - H<sub>2</sub>O(*ℓ*)
  - NaCl(s)
  - C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>(s)
30. Hydrogen bonding is a type of
- strong covalent bond
  - weak ionic bond
  - strong intermolecular force
  - weak intermolecular force
31. Which pair of formulas represents the empirical formula and the molecular formula of a compound?
- CH<sub>2</sub>O, C<sub>4</sub>H<sub>6</sub>O<sub>4</sub>
  - CHO, C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>
  - CH<sub>4</sub>, C<sub>5</sub>H<sub>12</sub>
  - CH<sub>2</sub>, C<sub>3</sub>H<sub>6</sub>
32. A compound contains 40% calcium, 12% carbon, and 48% oxygen by mass. What is the empirical formula of this compound?
- CaCO<sub>3</sub>
  - CaC<sub>2</sub>O<sub>4</sub>
  - CaC<sub>3</sub>O<sub>6</sub>
  - CaCO<sub>2</sub>

33. Which is an empirical formula?
- A. CH      B. C<sub>2</sub>H<sub>2</sub>      C. C<sub>2</sub>H<sub>4</sub>      D. C<sub>4</sub>H<sub>8</sub>
34. What is the molecular formula of a compound that has a molecular mass of 42 and an empirical formula of CH<sub>2</sub>?
- A. CH<sub>2</sub>      B. C<sub>2</sub>H<sub>4</sub>      C. C<sub>3</sub>H<sub>6</sub>      D. C<sub>4</sub>H<sub>12</sub>
35. The percentage by mass of nitrogen in NH<sub>3</sub> is
- A. 14      B. 17      C. 25      D. 82
36. Which formula correctly represents iron (III) oxide?
- A. Fe<sub>2</sub>O<sub>3</sub>      B. Fe<sub>3</sub>O<sub>2</sub>      C. FeO<sub>3</sub>      D. Fe<sub>3</sub>O
37. What is the correct name for the compound with the formula CrPO<sub>4</sub>?
- A. chromium (II) phosphate  
 B. chromium (III) phosphate  
 C. chromium (II) phosphide  
 D. chromium (III) phosphide
38. A particle of matter contains 6 protons, 7 neutrons, and 6 electrons. This particle must be a
- A. neutral carbon atom  
 B. neutral nitrogen atom  
 C. positively charged carbon ion  
 D. positively charged nitrogen ion

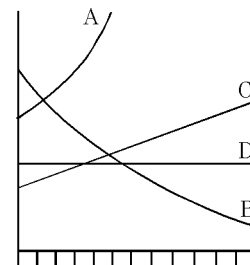
39. The diagram below represents the nucleus of an atom.



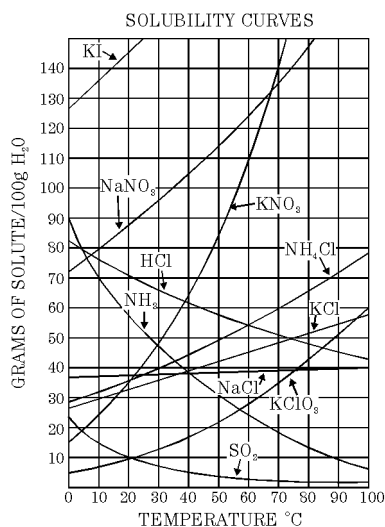
What are the atomic number and mass number of this atom?

- A. The atomic number is 9 and the mass number is 19.  
 B. The atomic number is 9 and the mass number is 20.  
 C. The atomic number is 11 and the mass number is 19.  
 D. The atomic number is 11 and the mass number is 20.
40. An atom of  $^{226}_{88}\text{Ra}$  contains
- A. 88 protons and 138 neutrons  
 B. 88 protons and 138 electrons  
 C. 88 electrons and 226 neutrons  
 D. 88 electrons and 226 protons
41. The graph shown represents four solubility curves. Which curve best represents the solubility of a gas in water?

- A. A      B. B  
 C. C      D. D

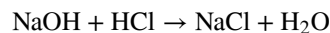


42. A solution of  $\text{NaNO}_3$  contains 1 gram of solute dissolved in 100 grams of water. According to Reference Table D, at  $50^\circ\text{C}$  this solution is considered



- A. unsaturated and concentrated  
 B. unsaturated and dilute  
 C. saturated and concentrated  
 D. saturated and dilute
43. According to Reference Table D, how many grams of  $\text{NH}_4\text{Cl}$  must be dissolved in 100 grams of  $\text{H}_2\text{O}$  at  $70^\circ\text{C}$  to reach solution equilibrium?
- A. 52 g    B. 56 g    C. 61 g    D. 86 g
44. Given the reaction:  ${}^{234}_{91}\text{Pa} \rightarrow \text{X} + {}^0_{-1}\text{e}$ . When the equation is correctly balanced, the nucleus represented by X is
- A.  ${}^{234}_{92}\text{U}$     B.  ${}^{235}_{92}\text{U}$     C.  ${}^{230}_{90}\text{Th}$     D.  ${}^{232}_{90}\text{Th}$
45. When the equation  $\text{NH}_3 + \text{O}_2 \rightarrow \text{N}_2 + \text{H}_2\text{O}$  is completely balanced using the smallest whole numbers, the coefficient of the  $\text{O}_2$  will be
- A. 1    B. 2    C. 3    D. 4

46. Given the balanced equation:



What is the total number of grams of  $\text{H}_2\text{O}$  produced when 116 grams of the product,  $\text{NaCl}$ , is formed?

- A. 9.0 g    B. 18 g    C. 36 g    D. 54 g
47. Given the reaction:  $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$
- What is the total number of moles of aluminum oxide that can be formed when 54 grams of aluminum reacts completely with oxygen?
- A. 1.0 moles    B. 2.0 moles  
 C. 3.0 moles    D. 4.0 moles
48. Given the reaction:
- $$2\text{C}_2\text{H}_6(\text{g}) + 7\text{O}_2(\text{g}) \rightarrow 4\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$$
- At STP, what is the total volume of  $\text{CO}_2(\text{g})$  formed when 6.0 liters (L) of  $\text{C}_2\text{H}_6(\text{g})$  are completely oxidized?
- A. 24 L    B. 12 L    C. 6.0 L    D. 4.0 L
49. Given the reaction at equilibrium:
- $$\text{A}(\text{g}) + \text{B}(\text{g}) + \text{heat} \rightleftharpoons \text{C}(\text{g}) + \text{D}(\text{g})$$
- The equilibrium will shift to the right when the
- A. pressure is decreased  
 B. temperature is increased  
 C. concentration of  $\text{A}(\text{g})$  is decreased  
 D. concentration of  $\text{C}(\text{g})$  is increased
50. Which metal will react spontaneously with  $\text{HCl}(\text{aq})$ ?
- A. Au    B. Ag    C. Cu    D. Mg
51. Which metal will react with  $\text{HCl}(\text{aq})$  to produce hydrogen gas?
- A. Au    B. Hg    C. Cu    D. Zn

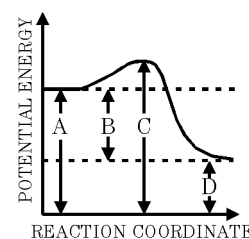
52. Which factors must be equal in a reversible chemical reaction at equilibrium?
- the concentration of the reactants and products
  - the potential energies of the reactants and products
  - the activation energies of the forward and reverse reactions
  - the rates of reaction of the forward and reverse reactions
53. Which solution will change red litmus to blue?
- HCl(aq)
  - NaCl(aq)
  - CH<sub>3</sub>OH(aq)
  - NaOH(aq)
54. The gram molecular mass of Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> is
- 246 g
  - 279 g
  - 310 g
  - 342 g
55. Which sample of O<sub>2</sub> contains a total of  $3.01 \times 10^{23}$  molecules at STP?
- 1.00 moles
  - 2.00 moles
  - 16.0 grams
  - 32.0 grams
56. What is the molarity of a solution of KNO<sub>3</sub> (molecular mass = 101) that contains 404 grams of KNO<sub>3</sub> in 2.00 liters of solution?
- 1.00
  - 2.00
  - 0.500
  - 4.00
57. How many milliliters of 5.0 M NaOH are needed to exactly neutralize 40 milliliters of 2.0 M HCl?
- 8.0
  - 10
  - 16
  - 40

58.

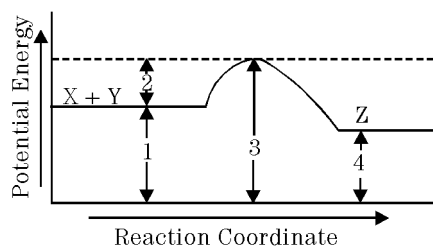
Indicator	Change	pH range at which change occurs
Bromthymol Blue	yellow → blue	6.2 – 7.6
Thymol Blue	red → yellow	1.2 – 2.8
Methyl Orange	red → yellow	3.1 – 4.4

The table shown was compiled from experimental laboratory data. At what pH would all three indicators appear as yellow?

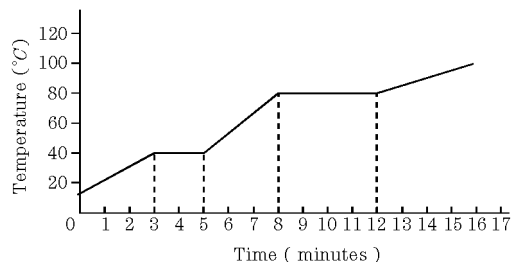
- 1.9
  - 2.9
  - 4.7
  - 8.7
59. What is the OH<sup>-</sup> ion concentration of an aqueous solution with a pH of 5?
- $1 \times 10^{-5}$  M
  - $1 \times 10^{-7}$  M
  - $1 \times 10^{-9}$  M
  - $1 \times 10^{-14}$  M
60. Which diagram represents the potential energy of an exothermic reaction?
- - 
  - 
  -
61. The graph shown represents the potential energy changes that occur in a chemical reaction. Which interval represents the  $\Delta H$  of the reaction?
- A
  - B
  - C
  - D



62. The potential energy diagram pictured shows the reaction  $X + Y \rightleftharpoons Z$ . When a catalyst is added to the reaction, it will change the value of



- A. 1 and 2                      B. 1 and 3  
C. 2 and 3                      D. 3 and 4
63. The temperature of a sample of water changes from  $10^{\circ}\text{C}$  to  $20^{\circ}\text{C}$  when the sample absorbs 418 joules of heat. What is the mass of the sample?
- A. 1 g      B. 10 g      C. 100 g      D. 1000 g
64. The graph shows the relationship between temperature and time as heat is added to one mole of a substance at a rate of 100 calories per minute. The substance is in the solid phase at Time = 0 minutes.



- The temperature at which the substance begins to boil is
- A.  $10^{\circ}\text{C}$       B.  $40^{\circ}\text{C}$       C.  $80^{\circ}\text{C}$       D.  $110^{\circ}\text{C}$
65. A 220.0-mL sample of helium gas is in a cylinder with a movable piston at 105 kPa and 275 K. The piston is pushed in until the sample has a volume of 95.0 mL. The new temperature of the gas is 310. K. What is the new pressure of the sample?

- A. 51.1 kPa                      B. 216 kPa  
C. 243 kPa                      D. 274 kPa

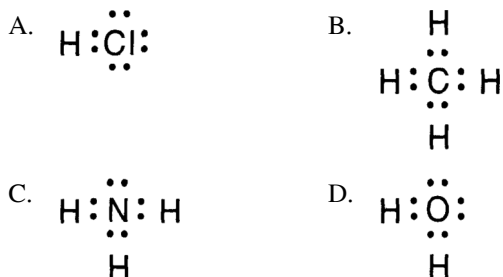
66. A gas occupies a volume of 30 milliliters at 273 K. If the temperature is increased to 364 K while the pressure remains constant, what will be the volume of the gas?

- A. 60 mL      B. 40 mL      C. 30 mL      D. 20 mL

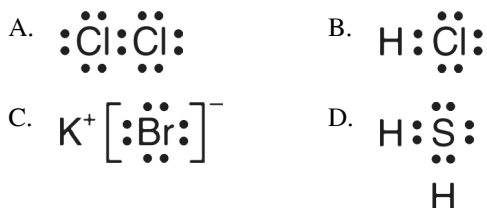
67. Oxygen, nitrogen, and fluorine bond with hydrogen to form molecules. These molecules are attracted to each other by

- A. ionic bonds  
B. hydrogen bonds  
C. electrovalent bonds  
D. coordinate covalent bonds

68. Which electron-dot structure represents a nonpolar molecule?



69. Which Lewis electron-dot diagram represents a molecule having a nonpolar covalent bond?



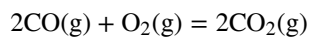
70. What is the name of the compound whose formula is  $\text{H}_2\text{SO}_4$ ?

- A. hydrosulfuric acid                      B. hydrosulfurous acid  
C. sulfuric acid                      D. sulfurous acid

71. The nucleus of an atom of  $^{127}_{53}\text{I}$  contains

- A. 53 neutrons and 127 protons
- B. 53 protons and 127 neutrons
- C. 53 protons and 74 neutrons
- D. 53 protons and 74 electrons

72. Given the reaction at equilibrium:



The correct equilibrium expression for this reaction is

- A.  $K_{eq} = \frac{[2\text{CO}][\text{O}_2]}{[2\text{CO}_2]}$
- B.  $K_{eq} = \frac{[\text{CO}]^2[\text{O}_2]}{[\text{CO}_2]^2}$
- C.  $K_{eq} = \frac{[2\text{CO}_2]}{[2\text{CO}][\text{O}_2]}$
- D.  $K_{eq} = \frac{[\text{CO}_2]^2}{[\text{CO}]^2[\text{O}_2]}$

73. The total quantity of moles contained in 5.6 liters of a gas at STP is

- A. 1.0 mole
- B. 0.75 mole
- C. 0.50 mole
- D. 0.25 mole

74. The pressure on 200 milliliters of a gas at constant temperature is changed from 380 torr to 760 torr. The new volume of the gas is

- A. 100 mL
- B. 200 mL
- C. 400 mL
- D. 800 mL



1.  
Answer:      A
2.  
Answer:      A
3.  
Answer:      A
4.  
Answer:      A
5.  
Answer:      B
6.  
Answer:      A
7.  
Answer:      B
8.  
Answer:      C
9.  
Answer:      D
10.  
Answer:      D
11.  
Answer:      D
12.  
Answer:      50° C
13.  
Answer:      D
14.  
Answer:      C
15.  
Answer:      D
16.  
Answer:      B
17.  
Answer:      D
18.  
Answer:      C
19.  
Answer:      C
20.  
Answer:      A

21.  
Answer:      A
22.  
Answer:      D
23.  
Answer:      C
24.  
Answer:      D
25.  
Answer:      A
26.  
Answer:      C
27.  
Answer:      C
28.  
Answer:      B
29.  
Answer:      A
30.  
Answer:      C
31.  
Answer:      D
32.  
Answer:      A
33.  
Answer:      A
34.  
Answer:      C
35.  
Answer:      D
36.  
Answer:      A
37.  
Answer:      B
38.  
Answer:      A
39.  
Answer:      B
40.  
Answer:      A

41.  
Answer: B

42.  
Answer: B

43.  
Answer: C

44.  
Answer: A

45.  
Answer: C

46.  
Answer: C

47.  
Answer: A

48.  
Answer: B

49.  
Answer: B

50.  
Answer: D

51.  
Answer: D

52.  
Answer: D

53.  
Answer: D

54.  
Answer: C

55.  
Answer: C

56.  
Answer: B

57.  
Answer: C

58.  
Answer: C

59.  
Answer: C

60.  
Answer: D

61.  
Answer: B

62.  
Answer: C

63.  
Answer: B

64.  
Answer: C

65.  
Answer: D

66.  
Answer: B

67.  
Answer: B

68.  
Answer: B

69.  
Answer: A

70.  
Answer: C

71.  
Answer: C

72.  
Answer: D

73.  
Answer: D

74.  
Answer: A