CHEM 110 Second Midterm Test Bank

Solution:

1. Calculate the mass of KI in grams required to prepare 5.00×10^2 mL of a 2.80 *M* solution.
   A) 1.40 g
   B) 2.32 g
   C) 232 g
   D) 486 g

2. What mass of $NaNO_3$ would be required to prepare 250 mL of a 0.707 *M* solution?
   A) 0.177 g
   B) 15.0 g
   C) 23.2 g
   D) 1.50×10^4 g

3. How many moles of $MgCl_2$ are present in 60.0 mL of 0.100 *M* $MgCl_2$ solution?
   A) 60.0 moles
   B) 0.572 moles
   C) 6.00×10^{-3} moles
   D) 6.00 moles

4. How many grams of KOH are present in 35.0 mL of a 5.50 *M* solution?
   A) 10.8 g
   B) 0.193 g
   C) 1.96 g
   D) 308 g

5. Calculate the molarity of a solution of 29.0 g of ethanol (C_2H_5OH) in 545 mL of solution.
   A) 2.30 *M*
   B) 5.32×10^{-2} *M*
   C) 0.630 *M*
   D) 1.15 *M*

6. Calculate the molarity of a solution of 15.4 g of sucrose ($C_{12}H_{22}O_{11}$) in 74.0 mL of solution.
   A) 4.5×10^{-2} *M*
   B) 0.608 *M*
   C) 208 *M*
   D) 60.8 *M*

7. Calculate the molarity of a solution of 6.57 g of methanol (CH_3OH) in 1.50×10^2 mL of solution.
   A) 4.38×10^{-2} *M*
   B) 1.37 *M*
   C) 0.213 *M*
   D) 3.92 *M*

8. Calculate the molarity of a solution of 10.4 g of calcium chloride ($CaCl_2$) in 2.20×10^2 mL of solution.
   A) 0.426 *M*
   B) 4.73×10^{-2} *M*
   C) 0.963 *M*
   D) 0.505 *M*

9. Calculate the volume in mL required to provide 2.14 g of sodium chloride from a 0.270 *M* solution.
   A) 7.92 mL
   B) 2.14 mL
   C) 136 mL
   D) 15.2 mL

10. Calculate the volume in mL required to provide 4.30 g of ethanol from a 1.50 *M* solution.
    A) 2.87 mL
    B) 30.7 mL
    C) 22.3 mL
    D) 62.2 mL

11. How many grams of cesium iodide (CsI) would be needed to make 2.50×10^2 mL of a 0.100 *M* solution?
    A) 25 g
    B) 6.50 g
    C) 0.100 g
    D) 18.3 g

12. How many grams of sulfuric acid (H_2SO_4) would be needed to make 2.50×10^2 mL of a 0.100 M solution?
    A) 2.45 g
    B) 25 g
    C) 100 g
    D) 6.25 g

13. Water is added to 25.0 mL of a 0.866 *M* KNO_3 solution until the volume of the solution is exactly 500 mL. What is the concentration of the final solution?
    A) 0.0433 *M*
    B) 0.500 *M*
    C) 0.0866 *M*
    D) 0.0217 *M*

14. You have 505 mL of a 0.125 *M* HCl solution and you want to dilute it to exactly 0.100 *M*. How much water should you add?
    A) 25.0 mL
    B) 63.1 mL
    C) 50.5 mL
    D) 126 mL

15. A 35.2-mL, 1.66 *M* $KMnO_4$ solution is mixed with 16.7 mL of 0.892 *M* $KMnO_4$ solution. Calculate the concentration of the final solution.
    A) 2.55 *M*
    B) 0.638 *M*
    C) 1.41 *M*
    D) 1.28 *M*

16. A 46.2-mL, 0.568 *M* calcium nitrate [$Ca(NO_3)_2$] solution is mixed with 80.5 mL of 1.396 *M* calcium nitrate solution. Calculate the concentration of the final solution.
    A) 1.96 *M*
    B) 1.09 *M*
    C) 0.982 *M*
    D) 2.25 *M*

Answers:

1.	C	2.	B	3.	C	4.	A	5.	D	6.	B
7.	B	8.	A	9.	C	10.	D	11.	B	12.	A
13.	A	14.	D	15.	C	16.	B				

Gasses:

1. Give the common units for pressure.
    A) mmHg, atm, kPa
    B) mmH_2O, atm, Pa
    C) mmH_2O atm, kPa
    D) mmHg, atm, liters

2. Convert 562 mmHg to atm.
    A) 0.739 atm
    B) 4.27×10^5 atm
    C) 1.05 atm
    D) 0.562 atm

3. Convert 2.0 atm to mmHg.
   A) 150 mmHg
   B) 0.27 mmHg
   C) 150 mmHg
   D) 1500 mmHg

4. The atmospheric pressure at the summit of Mt. McKinley is 606 mmHg on a certain day. What is the pressure in atm and in kPa?
   A) 4.61×10^5 atm, 80.8 kPa
   B) 4.61×10^5 atm, 7.87×10^{-3} kPa
   C) 0.797 atm, 80.8 kPa
   D) 0.797 atm, 7.87×10^{-3} kPa

5. A gas occupying a volume of 725 mL at a pressure of 0.970 atm is allowed to expand at constant temperature until its pressure reaches 0.541 atm. What is its final volume?
   A) 380 mL
   B) 1.30×10^3 mL
   C) 130 mL
   D) 1.34×10^3 mL

6. At 46°C a sample of ammonia gas exerts a pressure of 5.3 atm. What is the pressure when the volume of the gas is reduced to one-tenth (0.10) of the original value at the same temperature?
   A) 53 atm
   B) 0.53 atm
   C) 530 atm
   D) 24.4 atm

7. The volume of a gas is 5.80 L, measured at 1.00 atm. What is the pressure of the gas in mmHg if the volume is changed to 9.65 L? (The temperature remains constant.)
   A) 457 mm Hg
   B) 0.074 mm Hg
   C) 4.25×10^4 mm Hg
   D) 0.601 mm Hg

8. A sample of air occupies 3.8 L when the pressure is 1.2 atm. What volume does it occupy at 6.6 atm? (The temperature is kept constant.)
   A) 30.1 L
   B) 0.58 L
   C) 0.69 L
   D) 20.9 L

9. A sample of air occupies 3.8 L when the pressure is 1.2 atm. What pressure is required in order to compress it to 0.075 L? (The temperature is kept constant.)
   A) 42 atm
   B) 0.24 atm
   C) 24 atm
   D) 61 atm

10. A 36.4-L volume of methane gas is heated from 25 °C to 88 °C at constant pressure. What is the final volume of the gas?
   A) 128.1 L
   B) 44.1 L
   C) 30.0 L
   D) 80.5 L

11. Under constant-pressure conditions a sample of hydrogen gas initially at 88 °C and 9.6 L is cooled until its final volume is 3.4 L. What is its final temperature?
   A) 31.2 °C
   B) 31.2 K
   C) 1.0×10^3 K
   D) 1.3×10^2 K

12. Ammonia burns in oxygen gas to form nitric oxide (NO) and water vapor. How many volumes of NO are obtained from one volume of ammonia at the same temperature and pressure?
   A) One
   B) Two
   C) Three
   D) Four

13. Molecular chlorine and molecular fluorine combine to form a gaseous product. Under the same conditions of temperature and pressure it is found that one volume of Cl_2 reacts with three volumes of F_2 to yield two volumes of the product. What is the formula of the product?
   A) Cl_2F_2
   B) Cl_2F_6
   C) ClF_2
   D) ClF_3

14. Write the ideal gas equation. Give the units for each term in the equation.
   A) $PV = nRT$; P in torr, V in L, n in mol, R in Latm/Kmol, T in °C.
   B) $PV = nRT$; P in torr, V in L, n in mol, R in Latm/Kmol, T in K.
   C) $PV = nRT$; P in atm, V in L, n in mol, R in Latm/Kmol, T in K.
   D) $PV = nRT$; P in atm, V in L, n in mol, R in Latm/Kmol, T in °C .

15. What are standard temperature and pressure (STP)?
    A) 0 °C, 1 torr
    B) 25 °C, 1 torr
    C) 0 °C, 1 atm
    D) 25 °C, 1 atm

16. What is the volume of one mole of an ideal gas at STP?
    A) 24.5 L
    B) 22.4 L
    C) 1.0 L
    D) 10.0 L

17. What units are normally used to express the density of gases?
    A) g/mL
    B) kg/L
    C) mg/L
    D) g/L

18. A sample of nitrogen gas kept in a container of volume 2.3 L and at a temperature of 32 °C exerts a pressure of 4.7 atm. Calculate the number of moles of gas present.
    A) 4.1 mol
    B) 0.43 mol
    C) 0.24 mol
    D) 0.043 mol

19. Given that 6.9 moles of carbon monoxide gas are present in a container of volume 30.4 L, what is the pressure of the gas (in atm) if the temperature is 62 °C?
    A) 6.2 atm
    B) 1.2 atm
    C) 1,100 atm
    D) 62 atm

20. What volume will 5.6 moles of sulfur hexafluoride (SF_6) gas occupy if the temperature and pressure of the gas are 128 °C and 9.4 atm?
    A) 2.0×10^1 L
    B) 6.3 L
    C) 2.0×10^2 L
    D) 63 L

21. A certain amount of gas at 25 °C and at a pressure of 0.800 atm is contained in a glass vessel. Suppose that the vessel can withstand a pressure of 2.00 atm. How high can you raise the temperature of the gas without bursting the vessel?
    A) 62.5 °C
    B) 336 °C
    C) 472 °C
    D) 745 °C

22. The temperature of 2.5 L of a gas initially at STP is raised to 250 °C at constant volume. Calculate the final pressure of the gas in atm.
    A) 1.8 atm
    B) 10 atm
    C) 1.9 atm
    D) 12.5 atm

23. The pressure of 6.0 L of an ideal gas in a flexible container is decreased to one-third of its original value, and its absolute temperature is decreased by one-half. What is the final volume of the gas?
    A) 9.0 L
    B) 6.0 L
    C) 4.0 L
    D) 1.0 L

24. An ideal gas originally at 0.85 atm and 66 °C was allowed to expand until its final volume, pressure, and temperature were 94 mL, 0.60 atm, and 45°C, respectively. What was its initial volume?
    A) 97 mL
    B) 0.071 mL
    C) 7.1 mL
    D) 71 mL

25. Calculate the volume (in liters) of 88.4 g of CO_2 at STP.
    A) 53.9 L
    B) 45.0 L
    C) 26.6 L
    D) 0.245 L

26. A gas at 772 mmHg and 35.0 °C occupies a volume of 6.85 L. Calculate its volume at STP.
    A) 4,690 L
    B) 4.97 L
    C) 6.17 L
    D) 6.73 L

27. Dry ice is solid carbon dioxide. A 0.050-g sample of dry ice is placed in an evacuated 4.6-L vessel at 30 °C. Calculate the pressure inside the vessel after all the dry ice has been converted to CO_2 gas.
    A) 6.1×10^{-3} atm
    B) 12 atm
    C) 6.1×10^{-4} atm
    D) 1.2 atm

28. At STP, 0.280 L of a gas weighs 0.400 g. Calculate the molar mass of the gas.
    A) 27.8 g/mol
    B) 32.0 g/mol
    C) 10.9 g/mol
    D) 2.93 g/mol

29. At 741 torr and 44 °C, 7.10 g of a gas occupy a volume of 5.40 L. What is the molar mass of the gas?
    A) 35.0 g/mol
    B) 20.3 g/mol
    C) 4.85 g/mol
    D) 46.0 g/mol

30. Consider the formation of nitrogen dioxide from nitric oxide and oxygen:
    $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$
    If 9.0 L of NO are reacted with excess O_2 at STP, what is the volume in liters of the NO_2 produced?
    A) 9.0
    B) 4.5 L
    C) 18 L
    D) 6.2 L

31. Methane, the principal component of natural gas, is used for heating and cooking. The combustion process is:
    $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$
    If 15.0 moles of CH_4 are reacted, what is the volume of CO_2 (in liters) produced at 23.0 degrees C and 0.985 atm?
    A) 450 L
    B) 370 L
    C) 189 L
    D) 12.6 L

32. When coal is burned, the sulfur present in coal is converted to sulfur dioxide (SO_2), which is responsible for the acid rain phenomenon,
    $S(s) + O_2(g) \rightarrow SO_2(g)$
    If 2.54 kg of S are reacted with oxygen, calculate the volume of SO_2 gas (in liters) formed at 30.5 degrees C and 1.12 atm.
    A) 56.6 L
    B) 694 L
    C) 981 L
    D) 1.76×10^3 L

33. In alcohol fermentation, yeast converts glucose to ethanol and carbon dioxide:
$C_6H_{12}O_6(s) \rightarrow 2C_2H_5OH(l) + 2CO_2(g)$
If 5.97 g of glucose are reacted and 1.44 L of CO_2 gas are collected at 293 K and 0.984 atm, what is the percent yield of the reaction?
A) 50.6%
B) 77.2%
C) 88.9%
D) 100.%

34. A sample of air contains only nitrogen and oxygen gases whose partial pressures are 0.80 atm and 0.20 atm, respectively. Calculate the total pressure and the mole fractions of the gases.
A) 2 atm; X of N_2 = 0.40 mol, X of O_2 = 0.10 mol
B) 1 atm; X of N_2 = 0.80 mol, X of O_2 = 0.20 mol
C) 2 atm; X of N_2 = 0.40 , X of O_2 = 0.10
D) 1 atm; X of N_2 = 0.80, X of O_2 = 0.20

35. A mixture of gases contains 0.31 mol CH_4, 0.25 mol C_2H_6, and 0.29 mol C_3H_8. The total pressure is 1.50 atm. Calculate the partial pressures of the gases.
A) Partial pressures: CH_4 = 0.24 atm, C_2H_6 = 0.19 atm, C_3H_8 = 0.23 atm
B) Partial pressures: CH_4 = 0.54 atm, C_2H_6 = 0.44 atm, C_3H_8 = 0.51 atm
C) Partial pressures: CH_4 = 0.46 atm, C_2H_6 = 0.38 atm, C_3H_8 = 0.44 atm
D) Partial pressures: CH_4 = 0.21 atm, C_2H_6 = 0.17 atm, C_3H_8 = 0.19 atm

Use the following to answer questions 72-73:

A 2.5-L flask at 15 °C contains a mixture of N_2, He, and Ne at partial pressures of 0.32 atm for N_2, 0.15 atm for He, and 0.42 atm for Ne.

36. Calculate the total pressure of the mixture.
A) 2.2 atm
B) 1.8 atm
C) 0.36 atm
D) 0.89 atm

37. Calculate the volume in liters at STP occupied by He and Ne if the N_2 is removed selectively.
A) 2.2 L
B) 2.4 L
C) 1.4 L
D) 1.6 L

Use the following to answer questions 74-75:

Dry air near sea level has the following composition by volume: N_2, 78.08 percent; O_2, 20.94 percent; Ar, 0.93 percent; CO_2, 0.05 percent. The atmospheric pressure is 1.00 atm.

38. Calculate the partial pressure of each gas in atm.
    A) Partial pressures: N_2 =0.781 atm; O_2 = 0.209 atm; Ar = 9.3×10^{-3} atm; $CO_2 = 5 \times 10^{-4}$ atm
    B) Partial pressures: N_2 =78.1 atm; O_2 = 20.9 atm; Ar = 0.93 atm; CO_2 = 0.05 atm
    C) Partial pressures: N_2 =78.1 atm; O_2 = 20.9 atm; Ar = 9.3×10^{-3} atm; $CO_2 = 5 \times 10^{-4}$ atm
    D) Partial pressures: N_2 =0.0781 atm; O_2 = 0.0209 atm; Ar = 9.3×10^{-4} atm; $CO_2 = 5 \times 10^{-5}$ atm

39. Calculate the concentration of each gas in moles per liter at 0 °C. (*Hint:* Because volume is proportional to the number of moles present, mole fractions of gases can be expressed as ratios of volumes at the same temperature and pressure.)
    A) N_2: 4.46×10^{-2} M; O_2: 1.67×10^{-2} M; Ar: 7.4×10^{-3} M; CO_2: 4×10^{-4} M
    B) N_2: 3.48×10^{-2} M; O_2: 9.34×10^{-3} M; Ar: 4.1×10^{-4} M; CO_2: 2×10^{-5} M
    C) N_2: 17.5 M; O_2: 4.68 M; Ar: 0.21 M; CO_2: 0.01 M
    D) N_2: 28.7 M; O_2: 107 M; Ar: 2.4×10^{3} M; CO_2: 5×10^{4} M

40. A mixture of helium and neon gases is collected over water at 28.0 °C and 745 mmHg. If the partial pressure of helium is 368 mmHg, what is the partial pressure of neon? (Vapor pressure of water at 28 °C = 28.3 mmHg.)
    A) 385 mmHg
    B) 349 mmHg
    C) 317 mmHg
    D) 364 mmHg

Answer Key

1.	A	2.	A	3.	D	4.	C	5.	B	6.	A
7.	A	8.	C	9.	D	10.	B	11.	D	12.	A
13.	D	14.	C	15.	C	16.	B	17.	D	18.	B
19.	A	20.	A	21.	C	22.	C	23.	A	24.	D
25.	B	26.	C	27.	A	28.	B	29.	A	30.	A
31.	B	32.	D	33.	C	34.	D	35.	B	36.	D
37.	C	38.	A	39.	B	40.	B				

1. What is the wavelength (in nanometers) of light having a frequency of 8.6×10^{13} Hz?
   A) 3.5 nm
   B) 3.5×10^{3} nm
   C) 3.5×10^{6} nm
   D) 2.9×10^{5} nm

2. What is the frequency (in Hz) of light having a wavelength of 566 nm.
   A) 1.89 Hz
   B) 5.30 Hz
   C) 1.89×10^{6} Hz
   D) 5.30×10^{14} Hz

3. What is the frequency of light having a wavelength of 456 nm?
   A) 1.37×10^{2} Hz
   B) 6.58×10^{5} Hz
   C) 6.58×10^{14} Hz
   D) 1.37×10^{14} Hz

4. What is the wavelength (in nanometers) of radiation having a frequency of 2.45×10^{9} Hz? (This is the type of radiation used in microwave ovens.)
   A) 1.22×10^{8} nm
   B) 8.20×10^{9} nm
   C) 1.22×10^{11} nm
   D) 8.20×10^{12} nm

5. The average distance between Mars and Earth is about 1.3×10^{8} miles. How long would it take TV pictures transmitted from the *Viking* space vehicle on Mars' surface to reach Earth? (1 mile = 1.61 km.)
   A) 0.70 s
   B) 7.0×10^{2} s
   C) 2.7×10^{3} s
   D) 1.0×10^{5} s

6. How many seconds would it take a radio wave to travel from the planet Venus to Earth? (Average distance from Venus to Earth = 28 million miles.)
   A) 1.5×10^{2} s
   B) 9.3×10^{1} s
   C) 9.3 s
   D) 0.15 s

7. The SI unit of time is the second, which is defined as 9,192,631,770 cycles of radiation associated with a certain emission process in the cesium atom. Calculate the wavelength of this radiation (to three significant figures). In which region of the electromagnetic spectrum is this wavelength found?
   A) 3.06×10^{7} nm, microwave
   B) 3.06×10^{10} nm, radio wave
   C) 3.26×10^{7} nm, microwave
   D) 3.26×10^{10} nm, radio wave

8. The SI unit of length is the meter, which is defined as the length equal to 1,650,763.73 wavelengths of the light emitted by a particular energy transition in krypton atoms. Calculate the frequency of the light to three significant figures.
   A) 182 s^{-1}
   B) 1.82×10^{14} s^{-1}
   C) 4.95 s^{-1}
   D) 4.95×10^{14} s^{-1}

9. A photon has a wavelength of 624 nm. Calculate the energy of the photon in joules.
   A) 3.19×10^{-16} J
   B) 3.19×10^{-19} J
   C) 1.24×10^{-22} J
   D) 3.19×10^{-28} J

10. The blue color of the sky results from the scattering of sunlight by air molecules. The blue light has a frequency of about 7.5×10^{14} Hz. Calculate the wavelength, in nm, associated with this radiation.
    A) 2.5×10^{-3} nm
    B) 4.0×10^{2} nm
    C) 4.5×10^{2} nm
    D) 4.8×10^{2} nm

11. The blue color of the sky results from the scattering of sunlight by air molecules. The blue light has a frequency of about 7.5×10^{14} Hz. Calculate the energy, in joules, of a single photon associated with this frequency.
    A) 2.6×10^{-31} J
    B) 2.6×10^{-22} J
    C) 5.0×10^{-19} J
    D) 5.0×10^{-16} J

12. A photon has a frequency of 6.0×10^{4} Hz. (a) Convert this frequency into wavelength (nm). Does this frequency fall in the visible region?
    A) 5.0×10^{12} nm; no, radiowave
    B) 5.0×10^{9} nm; no, radiowave
    C) 2.0×10^{5} nm; no, microwave
    D) 5.0×10^{3} nm; no, infrared

13. A photon has a frequency of 6.0×10^4 Hz. Calculate the energy (in joules) of this photon.
    A) 4.0×10^{39} J
    B) 9.0×10^{37} J
    C) 4.0×10^{-29} J
    D) 1.1×10^{-38} J

14. A photon has a frequency of 6.0×10^4 Hz. Calculate the energy (in joules) of 1 mole of photons all with this frequency.
    A) 2.4×10^{-5} J/mol
    B) 4.0×10^{-10} J/mol
    C) 6.6×10^{-15} J/mol
    D) 4.0×10^{-20} J/mol

15. When copper is bombarded with high-energy electrons, X-rays are emitted. Calculate the energy (in joules) associated with the photons if the wavelength of the X rays is 0.154 nm.
    A) 3.06×10^{-14} J
    B) 1.29×10^{-15} J
    C) 1.29×10^{-24} J
    D) 3.06×10^{-26} J

16. A particular form of electromagnetic radiation has a frequency of 8.11×10^{14} Hz. What is its wavelength in nanometers? To what region of the electromagnetic spectrum would you assign it?
    A) 2.43×10^{11} nm, radio
    B) 2.43×10^{8} nm, microwave
    C) 3.70×10^{5} nm, microwave
    D) 3.70×10^{2} nm, ultraviolet

17. A particular form of electromagnetic radiation has a frequency of 8.11×10^{14} Hz. What is the energy (in joules) of one quantum of this radiation?
    A) 5.38×10^{-10} J
    B) 5.38×10^{-19} J
    C) 2.45×10^{-22} J
    D) 2.45×10^{-31} J

18. The first line of the Balmer series occurs at a wavelength of 656.3 nm. What is the energy difference between the two energy levels involved in the emission that results in this spectral line?
    A) 3.367×10^{-36} J
    B) 3.027×10^{-28} J
    C) 1.299×10^{-22} J
    D) 3.027×10^{-19} J

19. Calculate the wavelength (in nanometers) of a photon emitted by a hydrogen atom when its electron drops from the $n = 5$ state to the $n = 3$ state.
    A) 1.28×10^{-6} nm
    B) 1.46×10^{-6} nm
    C) 1.46×10^{3} nm
    D) 1.28×10^{3} nm

20. Calculate the frequency (Hz) of the emitted photon when an electron drops from the $n = 4$ to the $n = 2$ level in a hydrogen atom.
    A) 2.74×10^{14} Hz
    B) 6.17×10^{14} Hz
    C) 1.62×10^{15} Hz
    D) 3.65×10^{15} Hz

21. Calculate the wavelength (nm) of the emitted photon when an electron drops from the $n = 4$ to the $n = 2$ level in a hydrogen atom.
    A) 4.86×10^{2} nm
    B) 1.85×10^{2} nm
    C) 8.22×10^{1} nm
    D) 1.09×10^{3} nm

22. An electron in the hydrogen atom makes a transition from an energy state of principal quantum numbers n_i to the $n = 2$ state. If the photon emitted has a wavelength of 434 nm, what is the value of n_i?
    A) 3
    B) 4
    C) 5
    D) 6

23. What is the de Broglie wavelength, in cm, of a 12.4-g hummingbird flying at 1.20×10^{2} mph? (1 mile = 1.61km.)
    A) 9.96×10^{-29} cm
    B) 1.66×10^{-30} cm
    C) 9.96×10^{-32} cm
    D) 1.66×10^{-33} cm

24. What is the de Broglie wavelength (in nm) associated with a 2.5-g Ping-Pong ball traveling 35mph?
    A) 1.7×10^{-23} nm
    B) 2.8×10^{-25} nm
    C) 1.7×10^{-26} nm
    D) 2.8×10^{-28} nm

25. An electron in a certain atom is in the $n = 2$ quantum level. List the possible values of l, and m_l, that it can have.
    A) $l = 0$, $m_l = 0$; $l = 1$, $m_l = -1, 0, 1$; $l = 2$; $m_l = -2, -1, 0, 1, 2$
    B) $l = 0$, $m_l = 0$; $l = 1$, $m_l = -1, 0, 1$
    C) $l = 0$, $m_l = -1, 0, 1$
    D) $l = 1$, $m_l = -1, 0, 1$

26. An electron in an atom is in the $n = 3$ quantum level. List the possible values of l and m_l, that it can have.
    A) $l = 1$, $m_l = -1, 0, 1$; $l = 2$, $m_l = -2, -1, 0, 1, 2$
    B) $l = 0$, $m_l = 0$; $l = 1$, $m_l = 0, 1$; $l = 2$, $m_l = 0, 1, 2$
    C) $l = 0$, $m_l = 0$; $l = 1$, $m_l = -1, 0, 1$; $l = 2$, $m_l = -2, -1, 0, 1, 2$
    D) $l = 0$, $m_l = 0$; $l = 1$, $m_l = -1, 0, 1$; $l = 2$, $m_l = -2, -1, 0, 1, 2$; $l = 3$, $m_l = -3, -2, -1, 0, 1, 2, 3$

27. Give the values of the quantum numbers associated with the 2*p* subshell.
    A) $n = 2$, $l = 2$, $m_l = -2, -1, 0, 1, 2$
    B) $n = 2$, $l = 1$, $m_l = 0$
    C) $n = 2$, $l = 1$, $m_l = 1$
    D) $n = 2$, $l = 1$, $m_l = -1, 0, 1$

28. Give the values of the quantum numbers associated with the 3*s* subshell.
    A) $n = 3$, $l = 0$, $m_l = 0$
    B) $n = 3$, $l = 1$, $m_l = -1, 0, 1$
    C) $n = 3$, $l = 2$, $m_l = -2, -1, 0, 1, 2$
    D) $n = 3$, $l = 3$, $m_l = -3, -2, -1, 0, 1, 2, 3$

29. Give the values of the quantum numbers associated with the 5*d* subshell.
    A) $n = 5$, $l = 0$, $m_l = 0$
    B) $n = 5$, $l = 1$, $m_l = -1, 0, 1$
    C) $n = 5$, $l = 2$, $m_l = -2, -1, 0, 1, 2$
    D) $n = 5$, $l = 3$, $m_l = -3, -2, -1, 0, 1, 2, 3$

30. Calculate the total number of electrons that can occupy: (A) one *s* orbital, (B) three *p* orbitals, (C) five *d* orbitals, (D) seven *f* orbitals.
    A) (A)2; (B)9; (C)10, (D)14
    B) (A)2; (B)6; (C)8, (D)14
    C) (A)2; (B)6; (C)10, (D)14
    D) (A)2; (B)6; (C)10, (D)16

31. What is the total number of electrons that can be held in all orbitals having the same principal quantum number *n*?
    A) $4n^2$
    B) $2n^2$
    C) $2n$
    D) 2

32. Determine the maximum number of electrons that can be found in each of the following subshells: 3*s*, 3*d*, 4*p*, 4*f*, 5*f*.
    A) 3*s*(2); 3*d*(8); 4*p*(6); 4*f*(14); 5*f*(14)
    B) 3*s*(2); 3*d*(10); 4*p*(6); 4*f*(14); 5*f*(16)
    C) 3*s*(2); 3*d*(8); 4*p*(6); 4*f*(14); 5*f*(14)
    D) 3*s*(2); 3*d*(10); 4*p*(6); 4*f*(14); 5*f*(14)

33. State the total number of: *p* electrons in N ($Z = 7$); *s* electrons in Si ($Z = 14$); and 3*d* electrons in S ($Z = 16$).
    A) N, 3*p* electrons; Si, 6*s* electrons; S, 5*d* electrons
    B) N, 2*p* electrons; Si, 6*s* electrons; S, 5*d* electrons
    C) N, 3*p* electrons; Si, 6*s* electrons; S, 0*d* electrons
    D) N, 6*p* electrons; Si, 6*s* electrons; S, 0*d* electrons

34. Indicate which of the following sets of quantum numbers in an atom are unacceptable: (A) (1, 0, ½, ½); (B) (3, 0, 0, +½); (C) (2, 2, 1, +½); (D) (4, 3, –2, +½); (E) (3, 2, 1, 1).
    A) (A) and (E) are unacceptable.
    B) (B), (C) and (E) are unacceptable.
    C) (A), (B), (C) and (E) are unacceptable.
    D) (A), (C) and (E) are unacceptable.

35. The ground-state electron configuration listed here is incorrect: Al: $1s^2 2s^2 2p^4 3s^2 3p^3$. Write the correct electron configuration.
    A) Al: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$
    B) Al: $1s^2\ 2s^2\ 2p^6\ 3s^2$
    C) Al: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$

36. The ground-state electron configuration listed is incorrect: B: $1s^2 2s^2 2p^5$. Write the correct electron configuration.
    A) B: $1s^2\ 2s^2\ 2p^1$
    B) B: $1s^2\ 2s^2\ 2p^2$
    C) B: $1s^2\ 2s^2\ 2p^3$

37. The ground-state electron configuration listed is incorrect: F: $1s^2 2s^2 2p^6$. Write the correct electron configuration.
    A) F: $1s^2\ 2s^2\ 2p^3$
    B) F: $1s^2\ 2s^2\ 2p^4$
    C) F: $1s^2\ 2s^2\ 2p^5$

38. The atomic number of an element is 73. Is this element diamagnetic or paramagnetic?
    A) Diamagnetic
    B) Paramagnetic

39. Indicate the number of unpaired electrons present in each of the following atoms: B, Ne, P, Sc, Mn, Se.
    A) B(1); Ne(0); P(3); Sc(1); Mn(5); Se(2)
    B) B(0); Ne(0); P(3); Sc(1); Mn(5); Se(2)
    C) B(1); Ne(0); P(2); Sc(2); Mn(5); Se(2)
    D) B(1); Ne(0); P(3); Sc(2); Mn(4); Se(2)

40. Indicate the number of unpaired electrons present in each of the following atoms: Kr, Fe, Cd, I, Pb.
    A) Kr(0); Fe(4); Cd(0); I(1); Pb(1)
    B) Kr(0); Fe(4); Cd(1); I(1); Pb(2)
    C) Kr(0); Fe(3); Cd(0); I(1); Pb(2)
    D) Kr(0); Fe(4); Cd(0); I(1); Pb(2)

41. The electron configuration of a neutral atom is $1s^2 2s^2 2p^6 3s^2$. Name the element.
    A) Si
    B) Na
    C) Mg
    D) Al

42. Which of the following species has the most unpaired electrons? S^+, S, or S^-?
    A) S^+
    B) S
    C) S^-
    D) They all have the same number of unpaired electrons.

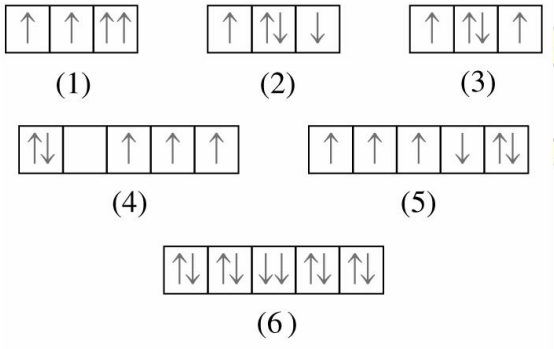
43. Use the Aufbau principle to obtain the ground-state electron configuration of selenium.
    A) Se: [Ar]$4s^2 3d^{10} 4p^3$
    B) Se: [Ar]$4s^2 3d^{10} 4p^4$
    C) Se: [Ar]$4s^2 3d^{10} 4p^5$
    D) Se: [Ar]$4s^2 3d^{10} 4p^6$

44. Use the Aufbau principle to obtain the ground-state electron configuration of technetium.
    A) Tc: [Kr] $4d^6$
    B) Tc: [Kr] $4d^7$
    C) Tc: [Kr] $5s^2 4d^5$
    D) Tc: [Kr] $5s^2 4d^6$

45. What is the maximum number of electrons in an atom that can have the following quantum numbers: (1) $n = 2$, $m_s = +½$; (2) $n = 4$, $m_l = +1$; (3) $n = 3$, $l = 2$; (4) $n = 2$, $l = 0$, $m_s = –½$; (5) $n = 4$, $l = 3$, $m_l = –2$.
    A) (1)4; (2)5; (3)8; (4)2; (5)2
    B) (1)4; (2)6; (3)8; (4)1; (5)2
    C) (1)4; (2)6; (3)10; (4)1; (5)2
    D) (1)4; (2)6; (3)10; (4)2; (5)2

Use the following to answer questions 46-47:

Examine the following portions of orbital diagrams representing the ground-state electron configurations of certain elements.



46. Which of the orbital diagrams violate the Pauli exclusion principle?
    A) (1) and (6)
    B) (1), (3) and (6)
    C) (2) and (5)
    D) (4) and (5)

47. Which of the orbital diagrams violate Hund's rule?
    A) (2) and (3)
    B) (2), (4) and (5)
    C) (1), (4) and (5)
    D) (1) and (4)

Answer Key

1.	B	2.	D	3.	C	4.	A	5.	B	6.	A
7.	C	8.	D	9.	B	10.	B	11.	C	12.	A
13.	C	14.	A	15.	B	16.	D	17.	B	18.	D
19.	D	20.	B	21.	A	22.	C	23.	C	24.	A
25.	B	26.	C	27.	D	28.	A	29.	C	30.	C
31.	B	32.	D	33.	C	34.	D	35.	C	36.	A
37.	C	38.	B	39.	A	40.	D	41.	C	42.	A
43.	B	44.	C	45.	C	46.	A	47.	B		

Periodic Table

1. A non-metal of the following is _____.
   A) Ba
   B) Fe
   C) P
   D) Cu

2. An example of a metal is _____.
   A) I_2
   B) Br_2
   C) Hg
   D) S

3. Which of the following is a metalloid?
   A) Bi
   B) Pb
   C) Ca
   D) As

4. Representative elements are also called _____.
   A) sub-group elements
   B) main group elements
   C) non-metals
   D) metals

5. Representative elements are in groups _____.
   A) 1 and 2
   B) 13 to 17
   C) 1,2 and 13 to 17
   D) 3 to 12

6. An example of a representative element is _____.
   A) Cr
   B) Ca
   C) Cu
   D) Fe

7. Which of the following is not a representative element?
   A) Cs
   B) Al
   C) S
   D) Ni

8. An example of an element in group IA is _____.
   A) Sr
   B) Ru
   C) Rb
   D) Ra

9. Which of the following is an alkaline earth metal?
   A) K
   B) Ca
   C) La
   D) Pb

10. An element in group-13 (3A) of the following is _____.
    A) P
    B) Ge
    C) Al
    D) As

11. The element Sn is in group _____.
    A) 4A
    B) 6A
    C) 5A
    D) 7A

12. An example of an element in group-5A is ____.
    A) Ge
    B) S
    C) Pb
    D) P

13. Which of the following elements is not in group –7A?
    A) F
    B) At
    C) I
    D) Hf

14. An example of a transition metal is _____.
    A) Fr
    B) Pb
    C) Pd
    D) Po

15. An element existing in the monoatomic state is _____.
    A) cesium
    B) iodine
    C) sulfur
    D) oxygen

16. Which of the following is diatomic?
    A) neon
    B) phosphorus
    C) oxygen
    D) sodium

17. The element having three valence electrons is _____.
    A) N
    B) Ge
    C) Al
    D) Ca

18. Six valence electrons are present in _____.
    A) Si
    B) B
    C) I
    D) S

19. The number of valence electrons in phosphorus is _____.
    A) 3
    B) 5
    C) 2
    D) 4

20. The elements having ns^1 configuration in their outermost shell are _____.
    A) transition metals
    B) halogens
    C) alkali metals
    D) alkaline earth metals

21. Halogens have _____ electrons in their outermost shell.
    A) four
    B) six
    C) seven
    D) three

22. Elements having eight electrons in their valence shell are _____.
    A) noble gases
    B) halogens
    C) alkali metals
    D) metals

23. The subshell which is gradually filled in the transition metal is _____.
    A) s
    B) d
    C) f
    D) p

24. Sc to Zn are called _____ row transition metals.
    A) second
    B) third
    C) fourth
    D) first

25. Isoelectronic ions have _____ electronic configuration.
    A) similar
    B) the same
    C) different
    D) unequal

26. O^{2-} is isoelectronic with _____.
    A) F^-
    B) K^+
    C) Cl^-
    D) Ar

27. Which of the following is isoelectronic with Na^+?
    A) Ar
    B) Al^{3+}
    C) Cl^-
    D) Ca^{2+}

28. Which of the following is not isoelectronic with Na^+?
    A) O^{2-}
    B) Ne
    C) F^-
    D) K^+

29. Mg^{2+} is isoelectronic with _____.
    A) K^+
    B) Cl^-
    C) F^-
    D) S^{2-}

30. Ti^{4+} is isoelectronic with _____.
    A) Ar
    B) Kr
    C) Br^-
    D) Mg^{2+}

31. The transition metal ion which is isoelectronic with Ar is _____.
    A) V^{3+}
    B) Cr^{3+}
    C) Ti^{3+}
    D) Sc^{3+}

32. An atom has 17 electrons. The element is a/an _____.
    A) alkali metal
    B) halogen
    C) noble gas
    D) transition metal

33. The element with atomic number 17 is placed in the _____ group of the IUPAC periodic table.
    A) 7^{th}
    B) 11^{th}
    C) 17^{th}
    D) 16^{th}

34. The element with atomic number 17 is _____.
    A) diatomic
    B) halogen
    C) non metal
    D) all the above

Use the following to answer questions 35-40:

Consider the following elements:
A: $1s^2 2s^2 2p^6 3s^2$
B: $1s^2 2s^2 2p^3$
C: $[Ar]4s^2 3d^{10} 4p^6$
D: $1s^2 2s^2$
E: $1s^2 2s^2 2p^6$
F: $1s^2 2s^2 2p^6 3s^2 3p^3$

35. The alkaline earth metals are _____.
    A) C, E
    B) B, F
    C) A, D
    D) E, F

36. The element 'D' will be similar in properties to _____.
    A) B
    B) E
    C) F
    D) A

37. Element E is a _____.
    A) noble gas
    B) Halogen
    C) 15^{th} group element
    D) Lanthanide

38. A noble gas of is _____.
    A) C
    B) D
    C) B
    D) F

39. Element F belongs to the _____ group.
    A) carbon
    B) nitrogen
    C) boron
    D) oxygen

40. Element B will be similar in properties to element _____.
    A) C
    B) D
    C) A
    D) F

Use the following to answer questions 41-45:

Consider the following electron configurations:
A. $1s^2 2s^2 2p^5$
B. $1s^2 2s^1$
C. $1s^2 2s^2 2p^6$
D. $1s^2 2s^2 2p^6 3s^2 3p^5$
E. [Ar] $4s^1$
F. [Ar]$4s^2 3d^{10} 4p^6$

41. Which is a halogen?
    A) B
    B) C
    C) A
    D) E

42. Element E is a/an _____.
    A) alkali metal
    B) halogen
    C) alkaline earth metal
    D) transition metal

43. Which is a noble gas?
    A) F
    B) D
    C) E
    D) A

44. Element A will be similar in properties to ____.
    A) F
    B) E
    C) D
    D) C

45. Which is not a gas?
    A) A
    B) C
    C) D
    D) E

46. An element with atomic number-20 is _____.
    A) alkali metal
    B) transition metal
    C) halogen
    D) alkaline earth metal

47. Which of the following atomic numbers represents halogen?
    A) 34
    B) 55
    C) 9
    D) 16

48. An element with atomic number-26 is _____.
    A) Ca
    B) Fe
    C) Co
    D) Ni

49. The element $[Ne]3s^1$ is in the _____ group.
    A) 1^{st}
    B) 2^{nd}
    C) 13^{th}
    D) 17^{th}

50. The element $[Ne]3s^23p^3$ is in the _____ group.
    A) 13^{th}
    B) 2^{nd}
    C) 15^{th}
    D) 17^{th}

51. The element $[Ar]4s^23d^8$ is a/an _____.
    A) alkali metal
    B) transition metal
    C) lanthanide
    D) halogen

52. $1s^22s^22p^6$ is the electronic configuration of _____.
    A) Cl^-
    B) Al^{3+}
    C) Ar
    D) K^+

53. Which of the following will not have the configuration $1s^2$?
    A) Li^+
    B) H^-
    C) Be^{2+}
    D) Mg^{2+}

54. The ion having d^{10} configuration in the outermost shell is _____.
    A) K^+
    B) Zn^{2+}
    C) Al^{3+}
    D) Mg^{2+}

55. Which of the following does not form a monovalent cation?
    A) Au
    B) Tl
    C) Zn
    D) Cu

56. The metal which does not form a trivalent cation is _____.
    A) Fe
    B) Cr
    C) Ti
    D) Cd

57. The metal with the electronic configuration $[Ar]3d^3$ is _____.
    A) Cr^{3+}
    B) Fe^{3+}
    C) Ni^{2+}
    D) Co^{2+}

58. Mn^{2+} will be isoelectronic with _____.
    A) Ni^{2+}
    B) Fe^{3+}
    C) Cr^{3+}
    D) V^{2+}

59. Cl^- will be isoelectronic with _____.
    A) Al^{3+}
    B) Ne
    C) O^{2-}
    D) Ar

60. Be^{2+} will be isoelectronic with _____.
    A) Na^+
    B) He
    C) H^+
    D) Al^{3+}

61. S^{2-} will be isoelectronic with _____.
    A) O^{2-}
    B) Na^+
    C) Ne
    D) Cl^-

62. N^{3-} will be isoelectronic with _____.
    A) Cl^-
    B) Ar
    C) F^-
    D) P^{3-}

63. The correct order of radius of an atom, A, to its ion is _____.
    A) $A^- < A$
    B) $A^{2+} < A^+$
    C) $A^{2+} > A$
    D) $A^+ > A^-$

64. The atom with the largest atomic radius of the following is _____.
    A) Na
    B) Br
    C) Cs
    D) Ca

65. The largest halogen atom of the following is _____.
    A) F
    B) I
    C) Cl
    D) Br

66. The correct order of atomic radius of the following is _____.
    A) Na > Al > Cl > Mg
    B) Na < Al < Cl < Mg
    C) Na < Mg < Al < Cl
    D) Na > Mg > Al > Cl

67. The largest atom in group 4A is _____.
    A) Si
    B) Ge
    C) Pb
    D) C

68. The smallest atom in group 7A is _____.
    A) F
    B) I
    C) Br
    D) Cl

69. The correct order of the size of the atom or ion of the following is _____.
    A) $Cl^- < Cl$
    B) $O^{2-} < S^{2-}$
    C) $Na^+ > Na$
    D) $Mg^{2+} < Al^{3+}$

70. The correct order of radius of the following is _____.
    A) $O^{2-} < F^{-} < Na^{+} < Mg^{2+}$
    B) $F^{-} < O^{2-} < Mg^{2+} < Na^{+}$
    C) $Mg^{2+} < Na^{+} < F^{-} < O^{2-}$
    D) $Mg^{2+} > Na^{+} > F^{-} > O^{2-}$

71. The element having higher ionization energy than magnesium is _____.
    A) Na
    B) Al
    C) K
    D) Si

72. Electron affinity is highest for _____.
    A) Cl
    B) I
    C) S
    D) Br

73. Which of the following shows greater tendency towards the formation of an anion?
    A) Ba
    B) Br
    C) Sb
    D) As

74. The correct order of ionization energy of the following is _____.
    A) $Na^{+} < Mg^{2+} < F^{-} < O^{2-}$
    B) $O^{2-} < F^{-} < Na^{+} < Mg^{2+}$
    C) $O^{2-} > F^{-} > Na^{+} > Mg^{2+}$
    D) $F^{-} < O^{2-} < Na^{+} < Mg^{2+}$

75. The correct order of ionic radii of the following is _____.
    A) $Mg^{2+} > Na^{+} > F^{-} > O^{2-}$
    B) $Mg^{2+} < O^{2-} < Na^{+} < F^{-}$
    C) $O^{2-} < F^{-} < Na^{+} < Mg^{2+}$
    D) $Mg^{2+} < Na^{+} < F^{-} < O^{2-}$

76. The correct order of radius of the following is _____.
    A) $O^{2-} > Mg^{2+}$
    B) $F^{-} > O^{2-}$
    C) $Tl^{2+} > Tl^{+}$
    D) Be > Mg

77. Which of the following is the biggest in size?
    A) H^+
    B) H
    C) H^-
    D) proton

Answer Key

1.	C	2.	C	3.	D	4.	B	5.	C	6.	B
7.	D	8.	C	9.	B	10.	C	11.	A	12.	D
13.	D	14.	C	15.	A	16.	C	17.	C	18.	D
19.	B	20.	C	21.	C	22.	A	23.	B	24.	D
25.	B	26.	A	27.	B	28.	D	29.	C	30.	A
31.	D	32.	B	33.	C	34.	D	35.	C	36.	D
37.	A	38.	A	39.	B	40.	D	41.	C	42.	A
43.	A	44.	C	45.	D	46.	D	47.	C	48.	B
49.	A	50.	C	51.	B	52.	B	53.	D	54.	B
55.	C	56.	D	57.	A	58.	B	59.	D	60.	B
61.	D	62.	C	63.	B	64.	C	65.	B	66.	D
67.	C	68.	A	69.	B	70.	C	71.	D	72.	A
73.	B	74.	B	75.	D	76.	A	77.	C	78.	

Bonding

1. The number of valence electrons in an atom is equal to its _____.
    A) number of orbits
    B) period number
    C) group number
    D) number of orbitals

2. According to the Lewis dot symbol, the number of electrons in the outermost shell of gallium is _____.
    A) 2
    B) 4
    C) 5
    D) 3

3. The element having five electrons in the valence shell is _____.
    A) Al
    B) N
    C) S
    D) Se

4. The element not having seven electrons in the outermost shell is _____.
   A) Cl
   B) At
   C) F
   D) Tl

5. The most stable ion of the following is _____.
   A) Br^{+}
   B) Mg^{+}
   C) Na^{+}
   D) Sn^{3+}

6. The ion not having Octet configuration in the outermost shell is _____.
   A) Sr^{2+}
   B) Fe^{2+}
   C) Mg^{2+}
   D) S^{2-}

7. Al^{3+} is not isoelectronic with _____.
   A) Mg^{2+}
   B) F^{-}
   C) Na^{+}
   D) Ca^{2+}

8. The most stable ion of the following is _____.
   A) O^{-}
   B) Bi^{3+}
   C) Si^{3+}
   D) Hg^{3+}

9. An ionic compound of the following is _____.
   A) MgO
   B) Cl_2O_7
   C) NO
   D) SiO_2

10. The formula of strontium nitride is _____.
    A) SrN
    B) $Sr(NO_3)_2$
    C) Sr_3N_2
    D) $Sr(NO_2)_2$

11. The formula of aluminum sulfide is _____.
    A) Al_2S_3
    B) AlS
    C) Al_3S_2
    D) AlS_3

12. Cesium sulfate is _____.
    A) $Cs(SO_4)_2$
    B) $Ce(SO_4)_2$
    C) Cs_2SO_4
    D) $CsSO_4$

13. Lithium nitride is _____.
    A) LiN
    B) Li_3N_2
    C) LiN_2
    D) Li_3N

14. In an ionic compound, _____.
    A) the cation is a metal and the anion is the non-metal
    B) the anion is the metal and the cation is the non-metal
    C) the negative ion is a metal and the positive ion is the non-metal
    D) both elements can be metals.

15. Which of the following will form an ionic compound?
    A) Mg and F
    B) Si and O
    C) C and O
    D) Cl and O

16. Which of the following will form a covalent compound?
    A) Mg and I
    B) B and F
    C) Cs and F
    D) Ba and Cl

17. According to Lewis's theory, a covalent bond is formed by the _____.
    A) transfer of electrons
    B) sharing of electrons
    C) overlap of electrons
    D) donation of electrons

18. Which of the following compounds contains a lone pair of electrons?
    A) BH_3
    B) NH_3
    C) CH_4
    D) AlH_3

19. The least electronegative element of the following is _____.
    A) Cs
    B) Ca
    C) F
    D) C

20. An example of a polar covalent molecule is _____.
    A) CH_4
    B) HCl
    C) Br_2
    D) N_2

21. The molecule, which is non-polar of the following, is _____.
    A) HCl
    B) H_2
    C) CO
    D) NO_2

22. The ionic bond of the following is _____.
    A) Cs–F
    B) N–H
    C) Si–Cl
    D) N–B

23. The ionic compound of the following is _____.
    A) KF
    B) F_2O
    C) ICl
    D) CO_2

24. The covalent compound of the following is _____.
    A) KH
    B) Na_2O
    C) CCl_4
    D) RbCl

25. Which of the following bonds is not possible?
    A) C = C
    B) C = H
    C) C ≡ C
    D) C = O

26. Which of the following compounds does not exhibit resonance?
    A) C_6H_5OH
    B) CO_2
    C) H_2O
    D) NO_2

27. The species that will exhibit resonance of the following is _____.
    A) CH_4
    B) NO_3^-
    C) CCl_4
    D) C_6H_{12}

28. In the Lewis structure of XeO_2F_2, how many lone pairs surround the xenon?
    A) 0
    B) 1
    C) 2
    D) 3

29. The molecule not obeying the octet rule of the following is _____.
    A) $SbCl_5$
    B) PCl_3
    C) SiH_4
    D) Cl_2

30. A triple bond is present in _____.
    A) NO_2
    B) N_2
    C) N_2H_4
    D) N_2O_4
31. A triple bond is present in _____.
    A) CN^-
    B) CO_3^{2-}
    C) SO_3^{2-}
    D) NO

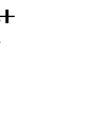
32. The Lewis dot symbol for the calcium ion is

A.
B.
C.
D.
E. Ca

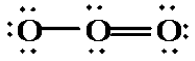
33. The Lewis structure for CS_2 is:

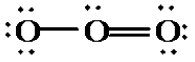
A.
B.
C.
D. 

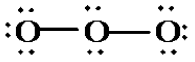
34. Which of these Lewis structures is incorrect?

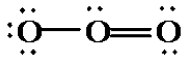
A.
B.
C.
D. 
E.

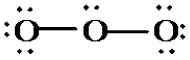
35. Which of these choices is a correct Lewis structure for ozone, O_3?

A. 

B. 

C. 

D. 

E. 

36. The number of resonance structures for the sulfur dioxide molecule that satisfy the octet rule is
A. 1.
B. 2.
C. 3.
D. 4.
E. none of these.

37. The number of resonance structures for the nitrate ion that satisfies the octet rule is
A. 1.
B. 2.
C. 3.
D. 4.
E. none of these.

38. What is the formal charge on the oxygen atom in N_2O (the atomic order is N-N-O)?
A. 0
B. +1
C. -1
D. -2
E. +2

39. The formal charge on the bromine atom in BrO_3^- drawn with three single bonds is
A. -2.
B. -1.
C. 0.
D. +1.
E. +2.

40. The formal charge on the sulfur atom in the resonance structure of sulfur dioxide which has one single bond and one double bond is
A. 0.
B. +1.
C. -1.
D. +2.
E. -2.

41. What is the formal charge on sulfur in the best Lewis structure for the SCN^- (thiocyanate) ion?
A. +2
B. -2
C. +1
D. -1
E. 0

42. What is the formal charge on the singly bonded oxygens in the Lewis structure for the carbonate ion?
A. -2
B. -1
C. 0
D. +1
E. +2

43. What is the formal charge on phosphorus in a Lewis structure for the phosphate ion that satisfies the octet rule?
A. -2
B. -1
C. 0
D. +1
E. +2

44. Nitrous oxide, N_2O, is sometimes called "laughing gas". What is the formal charge on the central nitrogen atom in the best Lewis structure for nitrous oxide? (The atom connectivity is N-N-O.)
A. -2
B. -1
C. 0
D. +1
E. +2

45. In the best Lewis structure for the fulminate ion, CNO^-, what is the formal charge on the central nitrogen atom?
A. +2
B. +1
C. 0
D. -1
E. -2

46. In the Lewis structure of the iodate ion, IO_3^-, that satisfies the octet rule, the formal charge on the central iodine atom is
A. +2.
B. +1.
C. 0.
D. -1.
E. -2.

47. BeF_4^{2-} is called the tetrafluoroberyllate ion. The formal charge on the beryllium atom in this ion is
A. +2.
B. +1.
C. 0.
D. -1.
E. -2.

48. Each of the three resonance structures of NO_3^- has how many lone pairs of electrons?
A. 7
B. 8
C. 9
D. 10
E. 13

49. The total number of lone pairs in the best Lewis structure for the SOF_4 molecule is
A. 0.
B. 2.
C. 14.
D. 16.
E. 18.

50. Which of these substances will display an incomplete octet in its Lewis structure?
A. CO_2
B. Cl_2
C. ICl
D. NO
E. SO_2

51. Which of these elements is most likely to exhibit an expanded octet in its compounds?
A. O
B. S
C. Na
D. C
E. N

52. Which of these compounds does not follow the octet rule?
A. NF_3
B. CF_4
C. PF_5
D. AsH_3
E. HCl

53. Which of these compounds does not follow the octet rule?
A. NF_3
B. CO_2
C. CF_4
D. Br_2
E. NO

54. Which response includes all the molecules below that do not follow the octet rule?
(1) H_2S (2) BCl_3 (3) PH_3 (4) SF_4
A. (2) and (4)
B. (2) and (3)
C. (1) and (2)
D. (3) and (4)
E. (1) and (4)

55. Which of these molecules has an atom with an incomplete octet?
A. NF_3
B. H_2O
C. $AsCl_3$
D. GeH_4
E. BF_3

56. Which of these molecules has an atom with an expanded octet?
A. HCl
B. $AsCl_5$
C. ICl
D. NCl_3
E. Cl_2

57. Which molecule has a Lewis structure that does not obey the octet rule?
A. N_2O
B. CS_2
C. PH_3
D. CCl_4
E. NO_2

Answer Key

1.	C	2.	D	3.	B	4.	D	5.	C	6.	B
7.	D	8.	B	9.	A	10.	C	11.	A	12.	C
13.	D	14.	A	15.	A	16.	B	17.	B	18.	B
19.	A	20.	B	21.	B	22.	A	23.	A	24.	C
25.	B	26.	C	27.	B	28.	B	29.	A	30.	B
31.	A	32.	D	33.	C	34.	E	35.	D	36.	B
37.	C	38.	C	39.	E	40.	B	41.	E	42.	B
43.	D	44.	D	45.	B	46.	A	47.	E	48.	B
49.	C	50.	D	51.	B	52.	C	53.	E	54.	A
55.	E	56.	B	57.	E	58.		59.		60.	