Q1. The melting and boiling points in a newly devised thermometer are 0 °X and 100 °X which are equivalent to –45°C and 115°C respectively in Celsius scale. What is a temperature reading of 86 °X in °C in this thermometer?

A) 93°C
B) 54°C
C) 75°C
D) 86°C
E) 134°C

Sec# 1-4
Grade# 60

Q2. Which one of the following is an example of a *physical* change?

A) Lead becomes a liquid when heated to 601^{o}C.
B) Corrosiveness of sulfuric acid.
C) Burning wood in air.
D) Gasoline combustion in the car's engine.
E) Neutralization of stomach acid with an antacid

Sec# 1-1
Grade# 75

Q3. $^{40}_{20}Ca^{2+}$ and $^{31}_{15}P^{3-}$ species have the same,

A) number of electrons.
B) number of protons.
C) number of neutron.
D) net charge.
E) atomic mass.

Sec# 2-5
Grade# 75

Q4. The correct name for the compound HNO_2 is

A) Nitrous acid
B) Nitric acid
C) Hydronitronic acid
D) Hydrogen nitrite
E) Hydronitrous acid

Sec# 2-8

Grade# 75

Q5. A compound of only titanium(Ti) and oxygen(O) contains 59.9% of Ti by mass. What is the empirical formula of this compound?

A) TiO_2
B) TiO
C) Ti_2O_3
D) TiO_4
E) Ti_2O

Sec# 3-5
Grade# 70

Q6. How many atoms of carbon are present in 0.50 g of $C_{12}H_{22}O_{11}$?

A) 1.1×10^{22} atoms
B) 2.1×10^{22} atoms
C) 6 atoms
D) 6.0×10^{23} atoms
E) 8.8×10^{20} atoms

Sec# 3-3
Grade# 50

Q7. Maleic acid is an organic compound of 41.39 % C, 3.47 % H and the rest is oxygen. If 0.129 mol of maleic acid has a mass of 15.0 g, what is the molecular formula of maleic acid?

A) $C_4H_4O_4$
B) CHO
C) $C_2H_3O_2$
D) C_3H_6O
E) $C_3H_2O_2$

Sec# 3-5
Grade# 50

Q8. What volume of 0.0200 M calcium hydroxide, $Ca(OH)_2$, is required to neutralize 35.00 mL of 0.0500M nitric acid, HNO_3?

A) 43.8 mL
B) 32.5 mL
C) 175 mL
D) 125 mL
E) 75.3 mL

Sec# 4-8
Grade# 70

Q9. The spectator ions in the reaction between aqueous perchloric acid, $HClO_4$ and aqueous barium hydroxide, $Ba(OH)_2$, are _____. (Note: This is an acid-base reaction).

A) ClO_4^- and Ba^{2+}
B) OH^- and ClO_4^-
C) H^+, OH^-, ClO_4^-, and Ba^{2+}
D) H^+ and OH^-
E) H^+ and Ba^{2+}

Sec# 4-4
Grade# 70

Q10. What is the oxidation state of S in $MgSO_3$?

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

Sec# 4-9
Grade# 70

Q11. What volume is occupied by 2.0 g of He at 25°C and a pressure of 775 mm Hg?

A) 12 L
B) 24 L
C) 6.3 L
D) 54 L
E) 7.5 L

Sec# 5-3
Grade# 70

Q12.Which one of the following properties of a gas is not correct?

A) Density for the gaseous state is larger (or greater) than that of its liquid state.
B) Density varies with temperature.
C) It takes the shape and volume of its container.
D) It is compressible.
E) It forms homogeneous mixtures with one another.

Sec# 5-2
Grade# 75

Q13. The density of a gas measured at 751 mmHg and at 27°C, was found to be 1.05 g/L. What is the molar mass of the gas?

A) 26.2 g/mol
B) 0.0343 g/mol
C) 202 g/mol
D) 85.1 g/mol
E) 602 g/mol

Sec# 5-4
Grade# 75

Q14. Consider a mixture of air and gasoline vapor in a cylinder with a piston. The original volume is 40. cm^3. If the combustion of this mixture releases 950 J of energy, to what volume will the gases expand against a constant pressure of 650 torr if all the energy of combustion is converted into work to push the piston? (1L•atm = 101.3 J)

A) 11 L
B) 27 L
C) 8.3 L
D) 34 L
E) 1.8 L

Sec# 6-1
Grade# 60

Q15. The chemical reaction below is the oxidation of hydroquinione by hydrogen peroxide to produce quinone and water as follows:

$C_6H_4(OH)_2(aq) + H_2O_2(aq) \rightarrow C_6H_4O_2(aq) + 2H_2O(l)$

Calculate ΔH for this reaction from the following data:

$C_6H_4(OH)_2(aq) \rightarrow C_6H_4O_2(aq) + H_2(g)$	$\Delta H = +177.4$ kJ
$H_2(g) + O_2(g) \rightarrow H_2O_2(aq)$	$\Delta H = -191.2$ kJ
$H_2(g) + 1/2O_2(g) \rightarrow H_2O(g)$	$\Delta H = -241.8$ kJ

$H_2O(g) \rightarrow H_2O(l)$ $\Delta H = -43.8$ kJ

A) -202.6 kJ
B) +327.4 kJ
C) -1402.8 kJ
D) +1089.0 kJ
E) -2504.1 kJ

Sec# 6-3
Grade# 60

Q16. In the Periodic Table, the lightest atom having the ground state electron configuration $ns^2 (n-1)d^8$ would be found in:

A) Period 4
B) Group IIA
C) Period 8
D) Period 6
E) Lanthanide series

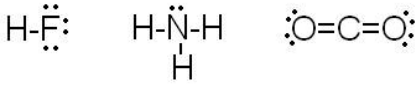
Sec# 7-11
Grade# 70

Q17. Which one of the following statements is **False**?

A) The exact location and momentum of an electron can be determined simultaneously.
B) All matter display both particle and wavelike characteristics.
C) Ni has two unpaired electrons in its 3d orbital.
D) No two electrons in an atom can have the same four quantum numbers.
E) The frequency and wavelength of electromagnetic radiation are inversely proportional to each other.

Sec# 7-2
Grade# 70

Q18. Consider the following molecular formulas:



Which one of the following statements is **true**?

A) The electrons in each molecule tend to orient themselves around the most electronegative element.
B) Only CO_2 molecules will form hydrogen bond with each other.
C) Both HF and CO_2 are linear molecules and therefore nonpolar.
D) The bond angles of NH_3 are exactly 109.5^o.
E) The hybridization of N atom in NH_3 molecule is sp^2.

Sec# 8-10
Grade# 70

Q19. Which one of the following compounds contains only **one** unshared pair of valence electrons on the central atom (as indicated by the underlined atom) in the Lewis structure?

A) $\underline{Se}O_2$
B) $H_2\underline{O}$
C) $\underline{C}H_4$
D) $\underline{S}O_3$
E) $\underline{O}Cl_2$

Sec# 8-9
Grade# 75

Q20. Consider the following ionic substances and arrange them in the order of decreasing lattice energy **NaI, KI, LiCl, LiI**

A) LiCl > LiI >NaI > KI
B) NaI > KI > LiCl > LiI
C) KI > NaI > LiCl > LiI
D) LiCl > KI > NaI > LiI
E) LiI >NaI > KI > LiCl

Sec# 8-5
Grade# 70

Q21. The hybridization of the tellurium atom in TeF_2 is

A) sp^3
B) dsp^3
C) d^2sp^3
D) sp^2
E) sp

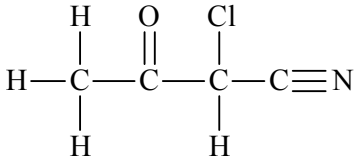
Sec# 9-1
Grade# 70

Q22. The angle formed by the carbon atoms labeled with stars (*) in $CH_2=CH-{}^{*}CH={}^{*}CH-{}^{*}CH=CH_2$ is nearly:

A) 120°
B) 180°
C) 90°
D) 109°
E) 104°

Sec# 9-1
Grade# 50

Q23. Consider the molecule



What is the hybridization of the oxygen atom?

A) sp^2
B) sp
C) sp^3
D) dsp^3
E) d^2sp^3

Sec# 9-2
Grade# 60

Q24. Which one of the following diatomic species would become more stable when one electron is removed from its orbitals?

A) F_2
B) CO^+
C) N_2
D) B_2^+
E) NO^+

Sec# 9-3

Grade# 50

Q25. Which one of the following statements about the molecule BN is False?

A) It is paramagnetic.
B) Its bond order is 2.
C) The total number of valence electrons are 8.
D) It has one sigma bond.
E) Its π_{2p} orbital has paired electrons.

Sec# 9-3
Grade# 80

Q26. Consider the benzene molecule. Which one of the following statements about the molecule is **False**?

A) The sigma (σ) bonds of carbon atoms are delocalized.
B) All six C - C bonds are known to be equivalent.
C) Each carbon atom is sp^2 hybridized.
D) The localized electron model must consider resonance to account for the six equal C - C bonds.
E) The pi (π) bonding in the molecule is delocalized.

Sec# 9-5
Grade# 75

Q27. Palladium crystallizes in a face-centered cubic unit cell. Its density is 12.0 g/cm^3 at 27°C. Calculate the atomic radius of Pd.

A) 138 pm
B) 1.95×10^{-8} nm
C) 1.95×10^{-8} cm
D) 154 pm
E) 0.109 nm

Sec# 10-3
Grade# 75

Q28. Osmium tetraoxide, OsO_4, is a soft crystal that melts at 40°C. The liquid does not conduct electricity. What kind of crystal is this?

A) Molecular crystal
B) Atomic crystal
C) Ionic crystal
D) Metallic crystal
E) Solid crystal

Sec# 10-5
Grade# 75

Q29. A crystal was analyzed by X-Ray of wavelength 2.47 Angstroms (Å) and the angle of diffraction was 16.32 degrees. The crystal edge (d) for the first order (n = 1) diffractions in Angstroms is:

A) 4.40
B) 16.32
C) 2.42
D) 1
E) 2.47

Sec# 10-3
Grade# 75

Q30. The heat of vaporization of carbon disulfide is 26.74 kJ/mol, and its normal boiling point is 46.0 ^{o}C. What is the vapor pressure of CS_2 at 0.0 ^{o}C?

A) 139 torr
B) 447 torr
C) 313 torr
D) 5.47 torr
E) 4160 torr

Sec# 10-8
Grade# 75

Q31. At which one of the following conditions CO_2 will be a gas? Given that the triple point of carbon dioxide occurs at -56.6 ^{o}C and 5.1 atm.

A) 0.5 atm and –20 ^{o}C
B) 7 atm and –40 ^{o}C
C) 5 atm and –60 ^{o}C
D) 10 atm and –100 ^{o}C
E) 15 atm and -40 ^{o}C

Sec# 10-9
Grade# 70

Q32**.** Which one of the following substances will have both dispersion forces and dipole-dipole forces between molecules?

A) HCl
B) BCl_3

C) Br_2
D) H_2
E) CO_2

Sec# 10-1
Grade# 75

Q33. Which one of the following liquids would have the highest viscosity at 25°C?

A) $HOCH_2CH_2OH$
B) CH_2Cl_2
C) C_2H_5OH
D) CH_3Br
E) CH_3OCH_3

Sec# 10-2
Grade# 75

Q34. An aqueous solution is 16.0 % HNO_3 by mass. What is the molality (m) of this solution?

A) 3.02 m
B) 7.23 m
C) 2.05 m
D) 1.22 m
E) 1.03 m

Sec# 11-1
Grade# 75

Q35. Which one of the following solvents is most appropriate to dissolve HF gas?

A) CH_3OH
B) CCl_4
C) C_6H_6
D) CBr_4
E) CS_2

Sec# 11-2
Grade# 70

Q36. The partial pressure of O_2 in air at sea level is 0.21 atm. Determine the concentration of O_2 in the surface of water of a lake at 20 ^oC. The Henry's law constant of O_2 under these conditions is 1.38×10^{-3} mol/(L•atm).

A) 2.9×10^{-4} M

B) 3.5×10^{-4} M
C) 7.1×10^{-3} M
D) 4.6×10^{-4} M
E) 6.5×10^{-6} M

Sec# 11-3
Grade# 70

Q37. Calculate the vapor pressure at 25 ^{o}C of a solution containing 99.5 g of a substance (molar mass = 342.30 g/mol) and 300 mL of water. The vapor pressure of pure water at 25 ^{o}C is 23.8 torr. Assume the density of water to be 1.00 g/mL.

A) 23.4 torr
B) 23.6 torr
C) 23.2 torr
D) 24.2 torr
E) 24.6 torr

Sec# 11-4
Grade# 65

Q38. How much ethylene glycol (molar mass = 62.07 g/mol), must be added to 1.0 kg of water to produce a solution that boils at 105.0 ^{o}C? (K_b for water = 0.512 ^{o}C/m)

A) 6.1×10^{2} g
B) 9.8×10^{2} g
C) 45 g
D) 72 g
E) 3.2×10^{2} g

Sec# 11-4
Grade# 65

Q39. The osmotic pressure of a solution of 0.050 g of hemoglobin in 10.0 mL of aqueous solution is 1.8×10^{-3} atm at 25^{o}C. What is the molar mass of hemoglobin?

A) 6.8×10^{4} g/mol
B) 6.8×10^{3} g/mol
C) 4.2×10^{3} g/mol
D) 8.6×10^{4} g/mol
E) 4.2×10^{4} g/mol

Sec# 11-6
Grade# 70

Q40. A solution of 3.81 g of $MgCl_2$ in 400.0 g of water freezes at -0.497°C. The K_f of water is 1.86 °C/m. What is the van't Hoff factor, *i*, for this solution?

A) 2.67
B) 2.78
C) 2.35
D) 3.00
E) 2.49

Sec# 11-7
Grade# 70