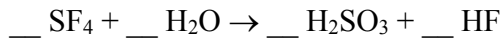Q1. Balance the following equation using the smallest set of whole numbers. The sum of the total coefficients is:

__ SF_4 + __ H_2O → __ H_2SO_3 + __ HF

A) 9
B) 6
C) 7
D) 4
E) 5

Sec# 3-6
Grade# 60

Q2. After carrying out the mathematical operations below, how many significant figures are appropriate to show in the result? $(13.7 + 0.027) \div 8.221$

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

Sec# 1-5
Grade# 70

Q3. Acetic acid boils at 244.2°F. What is its boiling point in degrees Celsius?

A) 117.9°C
B) 167.7°C
C) 153.4°C
D) 382.0°C
E) 103.7°C

Sec# 1-3
Grade# 70

Q4. Manganese makes up 1.3×10^{-4} percent by mass of the elements found in a normal healthy body. How many grams of manganese would be found in the body of a person weighing 183 lb? (2.2 lb = 1.0 kg)

A) 0.11 g

B) 1100 g
C) 11 g
D) 0.24 g
E) 32 g

Sec# 1-6
Grade# 60

Q5. Experiments with the cathode ray tube have shown that:

   A) all forms of matter contain electrons.
   B) all nuclei contain protons.
   C) all positive rays are actually protons.
   D) alpha particles are heavier than protons.
   E) most of the mass of the atom is in the nucleus.

Sec# 2-2
Grade# 65

Q6. Naturally occurring rubidium (Rb) consists of two isotopes. One of the isotopes consists of atoms having a mass of 84.91 amu; the other of 86.90 amu. What is the percent natural abundance of the heavier isotope?

A) 28%
B) 15%
C) 37%
D) 72 %
E) 85%

Sec# 2-5
Grade# 75

Q7. What is the correct formula for chromium (III) sulfite?

A) $Cr_2(SO_3)_3$
B) $CrSO_4$
C) $CrSO_3$
D) Cr_2S_3
E) $Cr_3(SO_4)_2$

Sec# 2-7
Grade# 75
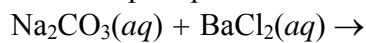
Q8. What is the correct name of the compound NH_4NO_2?

A) Ammonium nitrite
B) Dinitrogen tetrahydrogn dioxide
C) Ammonium nitride
D) Ammonia nitrate
E) Amine mononitrite

Sec# 2-6
Grade# 75

Q9. Select the precipitate that forms when the following reactants are mixed.
    $Na_2CO_3(aq) + BaCl_2(aq) \rightarrow$

A) $BaCO_3$
B) Ba_2CO_3
C) $NaCl$
D) $NaCl_2$
E) BaO

Sec# 4-1
Grade# 70

Q10. Arrange the following species in order of increasing oxidation number of sulfur atom.

S_8, H_2S, SO_3

A) $H_2S < S_8 < SO_3$
B) $S_8 < H_2S < SO_3$
C) $SO_3 < S_8 < H_2S$
D) $SO_3 < H_2S < S_8$
E) $H_2S < SO_3 < S_8$

Sec# 4-4
Grade# 60

Q11. Calculate the concentration of the acid or base remaining in solution when 10.7 mL of 0.211M HNO_3 is added to 16.3 mL of 0.258 M NaOH.

A) 7.21 x10^{-2} M NaOH
B) 2.26 x 10^{-3} M HNO_3
C) 4.21 x10^{-3} M HNO_3
D) 3.22 x 10^{-4} M NaOH

E) 1.95 x10⁻³ M NaOH

Sec# 4-6
Grade# 60

Q12. How many grams of sodium sulfate Na_2SO_4 are required to prepare a 250. mL
   solution whose concentration is 0.683 M Na_2SO_4?
      [Molar Mass of Na_2SO_4 = 142.07 g/mol]

A) 24.3 g
B) 12.2 g
C) 18.6 g
D) 22.1 g
E) 11.8 g

Sec# 4-5
Grade# 60

Q13. Nylon is 63.68% carbon, 12.38% nitrogen, 9.80% hydrogen, and 14.14% oxygen.
The correct empirical formula for nylon is:

A) $C_6H_{11}NO$
B) CHNO
C) $C_{13}H_2N_3O_3$
D) $C_3H_5N_2O_2$
E) $C_9H_{20}N_3O_4$

Sec# 3-2
Grade# 75

Q14. How many Fe atoms are present in 500. g of iron?

A) 5.39×10²⁴ atoms
B) 1.68×10²⁸ atoms
C) 500. atoms
D) 4.64×10²⁰ atoms
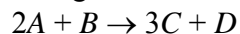E) 3.01×10²⁶ atoms

Sec# 3-4
Grade# 60

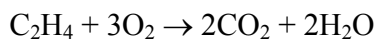Q15. Consider the following reaction:
$$2A + B \rightarrow 3C + D$$

3.0 mol *A* and 2.0 mol *B* react to form 4.0 mol *C*. What is the percent yield of this reaction?

A) 89%
B) 50%
C) 67%
D) 75%
E) 100%

Sec# 3-7
Grade# 60

Q16. When 125.0 g of ethylene (C_2H_4) burns in oxygen, it gives carbon dioxide and water. How many grams of CO_2 are formed according to the following balanced reaction?

$C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$

A) 392.9 g
B) 250.0 g
C) 57.50 g
D) 425.6 g
E) 327.0 g

Sec# 3-6
Grade# 60

Q17. Calculate w, and determine whether work is done by the system or on the system when 67 J of heat is released and $\Delta U = 510$ J.

A) +577 J, work is done on the system
B) +577 J, work is done by the system
C) +443 J, work is done on the system
D) -577 J, work is done on the system
E) -577 J, work is done by the system

Sec# 5-2
Grade# 70

Q18. Consider the reaction,
$N_2(g) + 3 H_2(g) \rightarrow 2 NH_3(g)$ $\Delta H = - 46.3$ kJ

When one mole of N_2 reacts with 3 mole of H_2 to form 2 moles of NH_3 at 1 atm and a certain temperature, there is a decrease in volume equal to 49.5 L. Calculate ΔU for this reaction. (1 L•atm = 101.3 J)

A) -41.3 kJ
B) -51.3 kJ
C) -46.8 kJ
D) +46.8 kJ
E) -41.5 kJ

Sec# 5-3
Grade# 60

Q19. Which one of the following statements is **false**?

A) Heat change in a bomb calorimeter is equal to ΔH.
B) The change in ΔU for a process is equal to the amount of heat absorbed at constant volume.
C) Natural gas burned in a burner is an exothermic reaction.
D) When solid KBr is dissolved in water the solution gets colder; this is an endothermic process.
E) q and w are not state functions.

Sec# 5-3
Grade# 65

Q20. When 2.55 g of solid NaOH is dissolved in 81.0 g of water, the temperature of water rises from $21.02^{o}C$ to $29.44^{o}C$. Calculate the q for the dissolution of one mole of NaOH. (specific heat of solution = 4.18 J/(g•^{o}C)

A) 46.1 kJ/mole
B) 156 kJ/mole
C) 2.94 kJ/mole
D) 1.12 kJ/mole
E) 35.2 kJ/mol

Sec# 5-4
Grade# 60