Q1. In which one of the following processes is $\Delta E = \Delta H$?

A) Two moles of hydrogen iodide gas react to form hydrogen gas and iodine gas in a 40-L closed container.
B) Two moles of ammonia gas are cooled from 325°C to -50°C at 1.2 atm.
C) One gram of liquid water is vaporized at 100°C and 1 atm.
D) Solid calcium carbonate is heated to form solid calcium oxide and carbon dioxide gas in an open container.
E) One mole of solid carbon dioxide sublimes to the gas phase.

Sec# 6-1
Grade# 50

Q2. A system gives out 125 kJ of heat while 104 kJ of work is done on it. Calculate ΔE.

A) -21 kJ
B) 21 kJ
C) 229 kJ
D) -229 kJ
E) -300 kJ

Sec# 6-3
Grade# 65

Q3. Which is the correct order of increasing atomic radii?

A) F< Cl < S < As
B) As< S < Cl < F
C) S< As < Cl < F
D) As< S < F <Cl
E) As< Cl < S < F

Sec# 7-12
Grade# 65

Q4. When 2.55 g of sodium hydroxide is dissolved in 81.0 g of water in a coffee cup calorimeter, the temperature of the water rises from 21.02 ^{o}C to 29.44 ^{o}C. Calculate the *q* for the dissolution of one mole of solute. (Assume that the specific heat capacity of the solution is 4.18 J/g ^{o}C)

A) 46.1 kJ/mol
B) 1.12 kJ/mol
C) 2.85 kJ/mol
D) 156 kJ/mol
E) 21.5 kJ/mol

Sec# 6-4
Grade# 65

Q5. The heat of formation of Fe_2O_3 (s) is -826.0 kJ/mol. Calculate the heat of the reaction,

$$4\ Fe(s) + 3O_2\ (g) \rightarrow 2\ Fe_2O_3\ (s)$$

when 57.48 g of iron is reacted with excess oxygen.

A) -425.1 kJ
B) -212.5 kJ
C) -850.1 kJ
D) -1700. kJ
E) -2.374×10^4 kJ

Sec# 6-5
Grade# 60

Q6. Consider the following two reactions at 298 K and 1 atm.

$N_2(g) + O_2\ (g) \rightarrow 2\ NO\ (g)$ $\quad \Delta H_1$
$NO(g) + \frac{1}{2}\ O_2\ (g) \rightarrow NO_2\ (g)$ $\quad \Delta H_2$

Which statement is TRUE?

A) ΔH^o_f for NO_2 (g) = $\Delta H_2 + \frac{1}{2}\ \Delta H_1$
B) ΔH^o_f for NO_2 (g) = $2\Delta H_2$
C) ΔH^o_f for NO_2 (g) = ΔH_1
D) ΔH^o_f for NO_2 (g) = $\Delta H_2 + \Delta H_1$
E) ΔH^o_f for NO_2 (g) = ΔH_2

Sec# 6-5
Grade# 65

Q7. Which one of the following sets of quantum numbers can correctly represent a 3*p* orbital?

a.	b.	c.	d.	e.
$n = 3$	$n = 1$	$n = 3$	$n = 3$	$n = 3$
$l = 1$	$l = 3$	$l = 2$	$l = 1$	$l = 0$
$m_l = 2$	$m_l = 3$	$m_l = 1$	$m_l = -1$	$m_l = 1$

A) d
B) b
C) c
D) a
E) e

Sec# 7-6
Grade# 75

Q8. How many electrons are there in all the *p* orbitals of selenium (Se) in its ground state?

A) 16
B) 4
C) 6
D) 10
E) 8

Sec# 7-11
Grade# 65

Q9. What is the energy of a photon having a wavelength of 25 nm?

A) 7.9×10^{-18} J
B) 1.3×10^{17} J
C) 4.8×10^{6} J
D) 1.3×10^{-17} J
E) 4.0×10^{-20} J

Sec# 7-1
Grade# 75

Q10. Which one of the following atoms would have the largest second ionization energy?

A) Cs
B) Ba
C) Tl
D) Pb

E) Bi

Sec# 7-12
Grade# 65

Q11. Calculate the velocity of a neutron with a de Broglie wavelength of 75 pm. (The mass of neutron = 1.675×10^{-27} kg)

A) 5.3×10^{3} m/s
B) 3.0×10^{-17} m/s
C) 1.9×10^{-4} m/s
D) 1.5×10^{23} m/s
E) 2.9×10^{1} m/s

Sec# 7-1
Grade# 75

Q12. An excited hydrogen atom with an electron in the n = 6 during an electronic transition emits light having a frequency of 2.74×10^{14} s^{-1}. Determine the principal quantum number for the final state in this electronic transition.

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

Sec# 7-2
Grade# 60

Q13. Atomic orbitals developed using quantum mechanics

A) describe the 90 % probability of finding an electron in the space around the nucleus.
B) describe exact paths for electron motion.
C) suggest that Bohr model can be correctly applied to all atoms.
D) show that the electron has only mass property.
E) determine that the two electrons can have same four quantum numbers in the same orbital.

Sec# 7-4
Grade# 65

Q14. Consider the following reaction:

$A_2 + B_2 \rightarrow 2AB \qquad \Delta H = -285$ kJ

The bond energy of A_2 is one-half the amount of the AB bond energy. The bond energy of B_2 is 432 kJ/ mol. What is the bond energy of A_2?

A) +239 kJ/ mol
B) –239 kJ/ mol
C) +73.5 kJ/ mol
D) –73.5 kJ/ mol
E) + 143 kJ/ mol

Sec# 8-8
Grade# 65

Q15. Which one of the following ionic compounds has the least exothermic lattice energy?

A) CsI
B) LiF
C) NaCl
D) BaO
E) MgO

Sec# 8-5
Grade# 60

Q16. In the Lewis structure for PCl_2^-, which obeys the octet rule, how many lone pairs of electrons are around the central atom?

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

Sec# 8-10
Grade# 70

Q17. What is the formal charge on the central atom of ClO_3^-, which obeys octet rule?

A) +2
B) –2
C) –1
D) +4
E) +3

Sec# 8-11
Grade# 60

Q18. Predict the molecular structure for XeO_2F_2 (where Xe is the central atom).

A) See-saw
B) Tetrahedral
C) Square planar
D) Trigonal planar
E) Square pyramid

Sec# 8-13
Grade# 65

Q19. Which one of the following molecules is polar?

A) ICl_3
B) CH_4
C) SeF_6
D) SO_3
E) PCl_5

Sec# 8-3
Grade# 70

Q20. Which one of the following molecules is expected to exhibit resonance?

A) NO_2^-
B) CH_2Cl_2
C) HCN
D) NH_4^+
E) PF_5

Sec# 8-12
Grade# 70