Multiple Choice

1) A 250.0 g plate of pure gold metal "Au" absorbs 903.0 J of heat energy as its temperature rises from 25°C to 53.0°C. The molar heat capacity (in J/mol °C) of pure gold is:

A) 25.4 B) 28.2 C) 27.5 D) 26.3

2) A piece of 0.865 g of magnesium metal "Mg" is completely combusted in a constant-volume bomb calorimeter containing 1000.0 g of water. The heat capacity of the calorimeter alone (excluding the water) is 1.5 kJ/°C and the specific heat of water is 4.184 J/g °C. Knowing that the molar heat of combustion of magnesium metal is –602.0 kJ/mol, the temperature rise (in °C) of the calorimeter and its water is:

A) 2.33 B) 4.25 C) 3.77 D) 2.88

3) Given the following thermal equation for the complete combustion of acetone "C_3H_6O":

$C_3H_6O(l) + 4O_2(g) \rightarrow 3CO_2(g) + 3H_2O(l)$ $\Delta H^o_{comb} = -1789.9$ kJ

And knowing that:

$\Delta H^o_f[(CO_2)_g] = -393.5$ kJ/mol

and $\Delta H^o_f[(H_2O)_l] = -285.8$ kJ/mol

the heat of formation (in kJ) of acetone, $\Delta H^o_f[(C_3H_6O)_l]$ is:

A) –328 B) –226 C) +226 D) –248

4) From the enthalpies of the following reactions:

$H_2(g) + F_2(g) \longrightarrow 2HF(g)$ $\Delta H = -537$ kJ

$C(gr.) + 2F_2(g) \longrightarrow CF_4(g)$ $\Delta H = -680$ kJ

$2C(gr.) + 2H_2(g) \longrightarrow C_2H_4(g)$ $\Delta H = +52$ kJ

The magnitude of ΔH (in kJ) for the reaction of ethylene with fluorine is:

$C_2H_4(g) + 6F_2(g) \longrightarrow 2CF_4(g) + 4HF(g)$

A) –2538 B) –2486 C) –2382 D) –2330

5) The enthalpy change for the complete combustion of sucrose (table sugar) "$C_{12}H_{22}O_{11}$" is represented as:

$C_{12}H_{22}O_{11}(s) + 12O_2(g) \longrightarrow 12CO_2(g) + 11H_2O(l)$ $\Delta H^o_{comb} = -5650.0$ kJ

the mass (in g) of sucrose which should be combusted in order to obtain 198.0 kJ of heat energy is:

A) 10 B) 16 C) 14 D) 12

6) A certain gas absorbs 1555.9 J of heat energy as it expands in volume from 2.0 L to 10.0 L against a pressure of 1.5 atm. The change in the internal energy ΔE "ΔU" (in J) of this gas system is:

A) +340 B) –275 C) –36 D) +36

7) At 17°C, the solubility of acetylene gas in acetone liquid is 6.75 g/L when the partial pressure of acetylene is 190 mmHg. The solubility (in g/L), at 17°C, of acetylene in acetone when the partial pressure of acetylene becomes 4.0 atm is:

A) 96 B) 114 C) 108 D) 102

8) The vapor pressure of pure water at 20°C is 17.5 mmHg. At the same 20°C temperature, the vapor pressure (in mmHg) of water over a solution prepared from 90.1 g of urea "$(NH_2)_2CO$" (a nonvotatile and nonelectrolyte solute) in 180.2 g of water is:

A) 15.2 B) 16.8 C) 16.2 D) 15.7

9) An aqueous solution prepared from 7.5 g of a compound dissolved in 100.0 g of water, whereby the solution has a freezing point of –1.5°C. Knowing that for water $K_f = 1.86$ °C/m, the molar mass (in g/mol) of the solute compound is:

A) 82 B) 93 C) 96 D) 87

10) An aqueous solution prepared from 22.0 g sodium chloride "NaCl" (an electrolyte) and enough water to make 750.0 mL of solution at 25°C. Knowing that the vant' Hoff factor for NaCl in this solution is 1.55, the osmotic pressure (in atm) of this solution is:

A) 17 B) 11 C) 14 D) 19

11) When heated above 500°C, potassium nitrate "KNO_3" decomposes according to:

$$4KNO_3(s) \longrightarrow 2K_2O(s) + 2N_2(g) + 5O_2(g)$$

If at a certain period of time, the rate of disappearance of KNO_3 is 0.24 $mol.L^{-1}.s^{-1}$, the rate of appearance (in $mol.L^{-1}.s^{-1}$) of O_2 at the same period of time should be:

A) 0.096 B) 0.48 C) 0.3 D) 0.12

12) Nitric oxide "NO" reacts with hydrogen "H_2" according to:

$$2NO(g) + H_2(g) \rightarrow N_2O(g) + H_2O(l)$$

The following initial rates of reaction (in $mol.L^{-1}.min^{-1}$) have been measured for the given reagent concentrations (in $mol.L^{-1}$)

Exp.	$[NO]_o$	$[H_2]_o$	Initial rate
1	0.021	0.065	1.46
2	0.021	0.260	1.46
3	0.042	0.065	5.84

The initial rate (in $mol.L^{-1}.min^{-1}$) for this reaction when $[NO]_o = 0.084$ $mol.L^{-1}$ and $[H_2]_o = 0.13$ $mol.L^{-1}$ is:

A) 23.36 B) 3.04 C) 55.96 D) 36.16

13) A certain first order reaction A → B is 25% complete in 42 min at 25°C. The half life period "$t_{1/2}$" (in min) of A at 25°C is:

A) 101.2 B) 131.4 C) 121.5 D) 111.3

14) At 770 K, the rate constant for the isomerization reaction of cyclopropane to propane which follows a first order kinetics is 2.4×10^{-2} min^{-1}. The time (in min) required for this isomerization reaction to be 80% complete at 770 K is:

A) 88 B) 67 C) 74 D) 82

15) A certain exothermic reaction has $\Delta H^{o} = -95$ kJ/mol and its activation energy is 25 kJ/mol. The activation energy (in kJ/mol) for its reverse reaction is:

A) 120 B) 25 C) 70 D) 95