Assignment for the course on Chemical and Biological thermodynamics: Principles to applications

Assignment Week-1

[AW-1]. Correct combinations of (i) open system, (ii) closed system, and (iii) isolated system are

(A) **Open system:** cup containing hot tea, swimming pool, pressure cooker

(B) **Closed system:** thermometer, tightly capped water bottle, tightly capped cuvette containing buffer

(C) **Isolated system:** thermos flask, thermometer, pressure cooker

(D) **Global, Isolated system:** Reaction vessel placed in a thermostatic bath, only thermostatic bath, gas contained in cylinder with a weightless and frictionless piston

[AW-2]. Under what conditions a path function becomes equal to change in the property of a state function?

(A) Isothermal expansion of a perfect gas

(B) Adiabatic expansion of a perfect gas

(C) Isothermal compression of a perfect gas

(D) Free expansion of a perfect gas

[AW-3]. The CORRECT statement about extensive and intensive properties are:

(A) Intensive properties do not depend upon the mass of the system

(B) Extensive properties do not depend upon the mass of the system

(C) Intensive properties depend upon mass of the system

(D) Extensive properties depend upon mass of the system

[AW-4]. What do you understand by "Standard State"? Will the standard state of a substance be different at different temperatures? What is practical utility of choosing a Standard State?

Answer options:

(A) Standard state means substance should be pure, pressure should be 1 bar, temperature can be any

(B) Standard state means substance should be pure, pressure should be 1 atm, temperature can be any

(C) Standard state means substance should be pure, pressure should be 1 bar, temperature should be 25^{o}C

(D) Standard state means substance should be pure, pressure and temperature can be any

[AW-5]. The pressure-volume work for a gas is defined by $w = -p_{ex}\Delta V$. The correct statement about the validity of the negative sign is

(A) The negative sign is used when gas undergoes expansion, whereas positive sign is used when gas undergoes compression

(B) The negative sign is used irrespective of expansion or compression because the internal energy of the system always decreases

(C) The negative sign is used because work is always done against an external force irrespective of compression or expansion

(D) The negative sign is used because work is a path function.

[AW-6].

One mole of a monatomic gas undergoes a reversible cycle.

Fill in the blanks in the table below:

State	p/atm	V/litres	T/K
1	1	-	298
2	-	24.4	596
3	-	12.2	298

Step	Nature of process	q, Joules	w, Joules	ΔU,Joules	ΔH, Joules
1---->	isochoric	_____	_____	_____	_____
2---->	isobaric	_____	_____	_____	_____
e---->	isothermal	_____	_____	_____	_____

Total cycle _____ _____ _____ _____

[AW-7]. Calculate the work done in Joules when 2 moles of hydrogen gas expand (i) isothermally from 15 L to 50 L against a constant external pressure of 1atm at 25° C, and (ii) isothermally and reversibly from 15 L to 50 L at 25° C.

Answer options;

(A) (i) -3846 J; (ii) -4200 J

(B) (i) -3546 J, (ii) -5969 J

(C) (i) -6000 J, (ii) – 2008 J

(D) (i) -2546 J, (ii) -4829 J

[AW-8]

Calculate $\Delta H°$ and $\Delta U°$ at 298^o K for the reaction :

OF_2 (g) + H_2 0(g) = O_2 (g) + 2HF (g)

The standard enthalpies of formation are :

OF_2 (g)	23.01 kJ/mol
H_2O(g)	-241.83 kJ/mol
HF (g)	-268.61 kJ/mol

Answer options:

(A) ΔH^o = -318 kJ mol^{-1}; ΔS^o = - 321 kJ mol^{-1}

(B) ΔH^o = -218 kJ mol^{-1}; ΔS^o = - 221 kJ mol^{-1}

(C) ΔH^o = -418 kJ mol^{-1}; ΔS^o = - 220 kJ mol^{-1}

(D) ΔH^o = +408 kJ mol^{-1}; ΔS^o = + 120 kJ mol^{-1}

[AW-9]. Maximum work is done by the gas when it expands

(A) under reversible adiabatic conditions

(B) under irreversible isothermal conditions

(C) under reversible isothermal conditions

(D) under irreversible adiabatic conditions

[AW-10]. The statement in which all the properties are state function are

(A) Temperature, pressure, heat

(B) Internal Energy, volume, work

(C) Enthalpy, Gibbs energy, Helmholtz function

(D) Heat, work, temperature