Chapter-2 Thermodynamics (Answer key)

1. Basic Concepts of Thermodynamics

1	2	3	4	5	6	7	8	9	10
d	d	c	c	c	b	d	b	a	b
11	12	13	14	15	16	17	18	19	20
b	c	d	b	d	b	b	c	d	b
21	22	23	24	25	26	27	28	29	30
*	a	d	c	b	d	b	b	d	a
31	32	33	34	35	36	37	38	39	40
a	b	c	c	d	b	d	c	b	d
41	42	43	44	45	46	47	48	49	
c	d	c	a	a	a	c	c	d	

2. Forms of Energy and Energy Interactions

1	2	3	4	5	6	7	8	9	10
b	a	d	a	d	a	c	b	c	b
11	12	13	14	15	16	17	18	19	20
a	b	a	a	a	d	c	a	d	b
21	22	23	24	25	26	27	28	29	
a	a	a	c	a	b	c	d	d	

3. First Law of Thermodynamics

1	2	3	4	5	6	7	8	9	10
d	b	c	b	b	b	b	c	c	d
11	12	13	14	15	16	17	18	19	20
b	c	c	d	c	b	c	c	c	c
21	22	23	24	25	26				
d	d	a	b	c	a				

4. Control Volume Analysis

1	2	3	4	5	6	7	8	9
c	b	b	a	b	d	c	b	d

5. Second Law of Thermodynamics

1	2	3	4	5	6	7	8	9	10
a	a	b	b	d	c	b	a	c	c
11	12	13	14	15	16	17	18	19	20
d	c	c	a	a	c	b	d	c	b
21	22	23							
b	c	d							

6. Entropy Analysis

1	2	3	4	5	6	7	8	9	10
d	d	a	a	d	d	c	b	a	c
11	12	13	14	15	16				
a	b	a	d	*	b				

7. Material Science

1	2	3	4	5	6	7	8	9	10
c	d	c	b	a	a	b	c	c	b
11	12	13	14	15	16	17	18	19	20
a	b	a	b	b	c	d	b	d	b
21	22	23	24	25	26				
b	d	d	a	d	b				

Chapter-2 Thermodynamics (SOLUTIONS)

1. Basic Concepts of Thermodynamics

1. (d)

According to Charles's law, all perfect gases, change in volume by $\frac{1}{273}$ of their original volume at 0ºC for every 1ºC change in temperature when pressure remains constant.

when P remains constant $\boxed{V \propto T}$

2. (d)

Efficiency of Carnot engine depends on temperature of source and sink.

$$\boxed{\eta_c = 1 - \frac{T_2}{T_1}}$$

3. (c)

Zeroth law defines the temperature as a property of the system.

4. (c)

NTP stands for – normal temperature and pressure.

5. (c)

Mixture of ice and water considered as isolated system because there is no energy and mass transfer take place from the boundary.

6. (b)

Open system: When mass and energy both can cross the boundary.

Closed system: When energy can cross the boundary but mass cannot cross the boundary.

Isolated system: Neither mass nor energy can cross the boundary of the system.

7. (d)

Kinetic energy of gas molecules, $K.E. = \frac{3}{2}RT$

$\boxed{K.E. \propto T}$

8. (b)

According to Boyle's law, $P \propto \frac{1}{V}$

Given data: $P_2 = 1.01P_1$ let $P_1 = P$ and $V_1 = V$

$\therefore \quad V_2 = \frac{P_1}{P_2} \times V_1 = \frac{P}{1.01P} \times V$

$V_2 = \frac{1}{1.01}V$

Now % decrement of volume $= \frac{V_1 - V_2}{V_1} \times 100$

$$= \frac{V - \frac{V}{1.01}}{V} \times 100 = \frac{1.01 - 1}{1.01} \times 100 \ \frac{0.01 \times 100}{1.01}$$

$\boxed{\%\,\text{reduction} = \frac{100}{101}\%}$

9. (a)

All specific properties are called as intensive properties because these are calculated as per unit mass.

10. (b)

Properties of system which is dependent on mass called as extensive properties.
Ex- volume, enthalpy, internal energy etc.

11. (b)

First law of thermodynamic is valid for every concept of energy in which heat and mass transfer take place.

$\boxed{\delta Q = dU + \delta W}$

12. (c)

According to gas law

$PV = mRT$

If ,$T = \text{constant}$

$\boxed{PV = \text{constant} \Rightarrow P_1V_1 = P_2V_2}$

13. (d)

Given: $(m)_{gas} = 60kg,\ A = 0.04m^2,\ T = 70^oC,\ g = 9.81m/sec^2$