2023/12

SET A

B.Sc. PHYSICS
THIRD SEMESTER
THERMAL PHYSICS
BSP -302 OLD COURSE [REPEAT]
[USE OMR FOR OBJECTIVE PART]

Duration : 3 hrs. **Full Marks : 70**

Objective

Time : 30 min. **Marks : 20**

Choose the correct answer from the following: ***1X20=20***

1. Which of the following quantities determine thermal equilibrium?
   a. Pressure b. Volume
   c. Temperature d. Entropy

2. When temperature of a system is kept constant, which of the following does not change?
   a. Enthalpy b. Internal Energy
   c. Work d. Free energy

3. What is the ratio of specific heats for a monoatomic gas?
   a. 1.66 b. 1.4
   c. 1.33 d. 1.25

4. Which one of the following is the unit of mechanical equivalent of heat?
   a. Erg.calorie b. Joule.calorie
   c. Calorie per Joule d. Joule per calorie

5. Which one of the following is correct form of Clausius- Clapeyron equation?
   a. $\frac{dT}{dP} = \frac{L}{T(V_2 - V_1)}$ b. $\frac{dP}{dT} = \frac{T}{L(V_2 - V_1)}$
   c. $\frac{dT}{dP} = \frac{T}{L(V_2 - V_1)}$ d. $\frac{dP}{dT} = \frac{L}{T(V_2 - V_1)}$

6. Transport of energy gives rise to which phenomenon?
   a. Viscosity b. Thermal Conductivity
   c. Diffusion d. Brownian motion

7. How many Maxwell's thermodynamic relations are there?
   a. 4 b. 3
   c. 2 d. 1

8. Which of the following is correct?
   a. $Q_1T_1 = Q_2T_2$ b. $Q_1T_2 = Q_2T_1$
   c. $Q_1Q_2 = T_1T_2$ d. None

9. The correct relation between efficiency of heat engine and coefficient of performance is

a. $\beta = \dfrac{\eta}{1-\eta}$

b. $\eta = \dfrac{\beta}{1-\beta}$

c. $\beta = \dfrac{1-\eta}{\eta}$

d. $\eta = \dfrac{1-\beta}{\beta}$

10. The unit of entropy is

a. Joule/K
b. Joule
c. Joule.K
d. K

11. The net entropy change in a Carnot cycle is

a. Positive
b. zero
c. negative
d. More than 1

12. In a Carnot engine, when heat is taken by a perfect gas from the hot source, then temperature of the source

a. Decreases
b. Increases
c. Remains constant
d. is unpredictable

13. Which one of the following is the expression of internal energy?

a. U + TS
b. U - TS
c. T + US
d. T - US

14. What results in adiabatic demagnetization of a paramagnetic salt?

a. Constant temperature
b. Temperature increase
c. Temperature decrease
d. Does not affect temperature

15. Which is constant in Joule- Thomson expansion?

a. Internal energy
b. Enthalpy
c. Gibbs function
d. pressure

16. Which one of the following relations is correct?

a. $C_p + C_v = R$

b. $C_p + R = C_v$

c. $C_p + R + C_v = 0$

d. $C_p - C_v = R$

17. The quantity $\dfrac{RT_c}{P_c V_c}$ has a value of

a. 3/8
b. 5/8
c. 8/5
d. 8/3

18. Which one of the following, is correct? T_B is Boyle Temperature

a. $T_B = 3.38T_c$

b. $T_B = T_c$

c. $T_c = 3.5T_B$

d. $T_B = 3.83T_c$

19. The dimension of the constant *b* in Van der Waals equation is
    a. Pressure
    b. volume
    c. Volume/pressure
    d. Pressure/volume

20. Which quantity is involved in a first order phase transition?
    a. Constant Density
    b. Varying temperature
    c. Free energy
    d. Latent heat

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Descriptive

Time: 2 hrs. 30 min. **Marks: 50**

[Answer question no.1 & any four (4) from the rest]

1. Find an expression for root mean square speed of ideal gas molecules from Maxwell- Boltzmann law of velocity distribution. **10**

2. a.Explain zeroth law of thermodynamics with an appropriate figure. **5+5=10**
   b. Discuss concepts of work and heat.

3. a. Explain state functions with an example. **4+6=10**
   b. Explain the concept of internal energy. What is the internal energy of a perfect gas?

4. a. Find an expression for work done during isothermal process. **5+5=10**
   b. What is Brownian motion? Mention its significance.

5. a. What is a refrigerator? Find the expression for coefficient of performance of a refrigerator. **6+4=10**
   b. Discuss reversible and irreversible processes?

6. a. Derive an expression for entropy of a perfect gas in terms of pressure and temperature. **6+4=10**
   b. Define the four thermodynamic potentials.

7. a. Discuss adiabatic demagnetization. **5+5=10**
   b. How does a real gas deviate from an ideal gas conditions? Write Van Der Waals' equation of state.

8. a. Discuss Joule- Thomson experiment related to expansion of a real gas. **6+4=10**
   b. Write Maxwell's four thermodynamic relations.

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