

B.SC. PHYSICS
THIRD SEMESTER
THERMAL PHYSICS
BSP – 302

**SET
A**

[USE OMR FOR OBJECTIVE PART]

Duration : 3 hrs.

Full Marks : 70

(Objective)

Time : 30 min.

Marks : 20

Choose the correct answer from the following:

1×20=20

1. The quantity $\frac{RT_C}{P_C V_C}$ has a value of
 - a. 3/8
 - b. 8/3
 - c. 5/8
 - d. 8/5
2. Which of the following is correct?
 - a. $Q_1 T_1 = Q_2 T_2$
 - b. $Q_1 Q_2 = T_1 T_2$
 - c. $Q_1 T_2 = Q_2 T_1$
 - d. None
3. What is the ratio of specific heats for a triatomic gas?
 - a. 1.25
 - b. 1.66
 - c. 1.33
 - d. 1.4
4. The entropy of an isolated system always ____ and becomes a ____ at the state of equilibrium.
 - a. decreases, maximum
 - b. decreases, minimum
 - c. increases, minimum
 - d. increases, maximum
5. Which of the following is the net entropy change in Carnot's cycle?
 - a. Zero
 - b. Negative
 - c. Positive
 - d. Anything between 0 and 1
6. Which of the following quantities is included in Clausius- Clapeyron equation?
 - a. Entropy
 - b. Latent heat
 - c. Internal energy
 - d. Enthalpy
7. Which of the following is the correct mathematical expression of Gibb's function, G? Symbols have usual meaning.
 - a. $G=T-HS$
 - b. $G=H+TS$
 - c. $G = S-TH$
 - d. $G = H-TS$
8. Which of the following quantities determine thermal equilibrium?
 - a. Entropy
 - b. Volume
 - c. Temperature
 - d. Pressure
9. Adiabatic demagnetization in a paramagnetic salt result in
 - a. Temperature increase
 - b. Temperature decrease

- c. Constant temperature
- d. Decrease, then rise
10. The correct relation between efficiency of heat engine and coefficient of performance is
- a. $\beta = \frac{1-\eta}{\eta}$
- b. $\eta = \frac{\beta}{1-\beta}$
- c. $\eta = \frac{1-\beta}{\beta}$
- d. $\beta = \frac{\eta}{1-\eta}$
11. Joule per calorie is the unit of which of the following quantities?
- a. Enthalpy
- b. Entropy
- c. Gibbs free energy
- d. Mechanical equivalent of heat
12. Transport of energy gives rise to which phenomenon?
- a. Brownian motion
- b. Viscosity
- c. Thermal Conductivity
- d. Diffusion
13. Boyle's temperature is related to critical temperature as
- a. $T_C = 3.5T_B$
- b. $T_B = 3.38T_C$
- c. $T_B = T_C$
- d. $T_B = 3.83T_C$
14. In a first order phase transition,
- a. Volume changes
- b. Volume remains constant
- c. Entropy remains constant
- d. Both volume and entropy are constants
15. In a second order phase transition
- a. Volume changes
- b. Entropy changes
- c. Both volume and entropy change
- d. Specific heat changes
16. With increase in pressure, melting point of ice
- a. Remains same
- b. Increases
- c. Decreases
- d. Can both increase or decrease
17. Specific heats are related as
- a. $C_p + R + C_v = 0$
- b. $C_p - C_v = R$
- c. $C_p + C_v = R$
- d. $C_p + R = C_v$
18. Which one of the following is an extensive thermodynamic variable?
- a. Volume
- b. Pressure
- c. Temperature
- d. Density
19. The work done is when it is done by a perfect gas
- a. unchanged
- b. negative
- c. positive
- d. none of above
20. In an isobaric process
- a. Temperature is constant
- b. Volume is constant
- c. Entropy is constant
- d. Pressure is constant

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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 the most probable speed of ideal gas molecules using Maxwell- Boltzmann law of velocity distribution. 10

2. a. What are reversible and irreversible thermodynamic processes? Give examples. 4+2+4
=10
b. What is a heat engine? Explain zeroth and first laws of thermodynamics.

3. a. What are extensive and intensive thermodynamic variables? Give examples. 4+2+4
=10
b. Define work and heat.
c. Establish the general relationship between the specific heats.

4. a. Derive Clausius-Clapeyron equation from Maxwell's thermodynamic relations. 3+7=10
b. With transport phenomenon consideration, obtain an expression for coefficient of viscosity.

5. a. Write Maxwell's four thermodynamic relations. 4+6=10
b. Derive an expression for entropy of a perfect gas in terms of volume and temperature.

6. a. What is a refrigerator? Establish an expression for coefficient of performance of a refrigerator. 2+3+5
=10
b. A motor in a refrigerator has a power output of 200 watt. If the freezing compartment is at 270 K and outside air is at 300 K, assuming ideal efficiency, what is the maximum amount of heat that can be extracted from the freezing compartment?

7. a. Show that Joule-Thomson's porous plug experiment is an isenthalpic process. 4+6=10
b. Obtain values of different critical constants.

8. a. How are real gases different from ideal gases? 3+7=10
b. Establish Van der Waals equation of state for a real gas.

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