(2) There are 28 questions in this question paper. All are compulsory.
(3) Symbols used in the paper have their usual meaning.
(4) Non-programmable scientific calculator can be used,
(5) For each wrong answer 0.25 per mark will be deducted
(6) Students can use non-programmable calculators wherever necessary.

Q. 1 to 12 Multiple Choice Questions Each carries : 1 Mark
Q. 13 to 22 Multiple Choice Questions Each carries : 2 Marks
Q. 23 to 28 Multiple Choice Questions Each carries : 3 Marks

O.M.R. Sheet भरवा अंगेनी आगत्य-ती सूचनाओ आपेक्ष
O.M.R. Sheet-ल कारण छापेकृत हो।

Important instructions to fillup O.M.R. Sheet
is given on back side of provided O.M.R. Sheet.
1. The value of Lorentz force acting on a charged particle in magnetic field is maximum when angle between velocity and magnetic field is:

(A) 90°

(B) 180°

(C) 120°

(D) 0°

2. The energy gained by an $\alpha$-particle passing once through Dees of a cyclotron having potential difference 'V' is:

(A) 2eV

(B) 3eV

(C) 4eV

(D) 1eV
At constant pressure the change in enthalpy of a system is equal to:

(A) Work
(B) Heat
(C) Internal energy
(D) Gibbs' energy

S.I. unit of Tds is:

(A) Joule
(B) Newton
(C) Kelvin-sec
(D) Calorie
5 Which out of the following are intensive thermodynamic variables:
(A) Volume and Pressure
(B) Internal energy & Entropy
(C) Volume and Entropy
(D) Temperature & Pressure

6 According to Maxwell'S relation \( \left( \frac{\delta T}{\delta V} \right)_S = \) ______ 

(A) \( -\left( \frac{\delta P}{\delta S} \right)_V \)
(B) \( -\left( \frac{\delta T}{\delta P} \right)_V \)
(C) \( \left( \frac{\delta P}{\delta S} \right)_V \)
(D) \( \left( \frac{\delta S}{\delta P} \right)_V \)

DF-2986_D ] 4 [ Contd...
7. The Joule-Kelvin coefficient $\mu = \quad$ 

(A) $\left( \frac{\delta T}{\delta P} \right)_V$

(B) $\left( \frac{\delta T}{\delta P} \right)_h$

(C) $\left( \frac{\delta V}{\delta T} \right)_P$

(D) $\left( \frac{\delta S}{\delta P} \right)_V$

8. The maximum work done by a system during an isothermal thermodynamic process is:

(A) $F_1 - F_2$

(B) $U_1 - U_2$

(C) Zero

(D) $G_1 - G_2$
Which out of the following cannot be a unit of electric field intensity:

(A) Volt/meter

(B) Newton/Ampere

(C) Joule/colm²/meter

(D) Newton/coulmb

The path of electron entering normally into a uniform magnetic field with constant speed is:

(A) hyperbolic

(B) parabolic

(C) elliptic

(D) circular
A charged particle moving in positive X-direction enters a region of uniform electric field in positive Y-direction, the relation between X and Y components of displacement of the particle is:

(A) \( y \propto \sqrt{x} \)

(B) \( y \propto x^2 \)

(C) \( y \propto x^3 \)

(D) \( y \propto x \)

The drift velocity of a particle having charge ‘q’ in an alternating electric field \( E_0 \sin \omega t \) is:

(A) \( \frac{qE_0}{mn} \)

(B) \( \frac{m}{qE_0} \)

(C) \( \frac{E_0 \omega^2}{qm} \)

(D) \( \frac{qE_0}{mn^2} \)
13. The coefficient \( a = \frac{1}{300} K^{-1} \) is given for the temperature 300 K. Which of the following statements about \( a \) is correct?

(A) 0
(B) \( \infty \)
(C) Negative
(D) Positive

Value of Joule-Kelvin coefficient \( \mu \) at 300 K temperature of a gas having volume coefficient of expansion \( a = \frac{1}{300} K^{-1} \) is________

(A) Positive
(B) Negative
(C) Infinite
(D) Zero

14. For van der Waals' ideal gas, \( C_p - C_v = \)________

For van der Waals' ideal gas, \( C_p - C_v = \)________

(A) \( \mathcal{R}\left(1 + \frac{2a}{RTV}\right) \)
(B) \( \mathcal{R}\left(1 - \frac{2a}{RTV}\right) \)
(C) Zero
(D) \( \mathcal{R} \)
3.14 Tesla is applied. What is the resonance frequency to accelerate proton. (Take $e/m$ as $10^8$ Coulomb/kg approximately for proton)

(A) $0.5 \times 10^8$ Hz

(B) $10^8$ Hz

(C) $2.0 \times 10^{-8}$ Hz

(D) $0.4 \times 10^8$ Hz

100 potential difference between two points having potential difference 100 volts, what is change in its kinetic energy:

(A) $1.6 \times 10^{-21}$ Joule

(B) $1.6 \times 10^{-17}$ Joule

(C) $6.1 \times 10^{18}$ Joule

(D) $1.6 \times 10^{-19}$ Joule
A particle of charge 0.05 coulomb experiences a force of 10 Newton in a uniform electric field 'E'. The value of 'E' is _________

(A) 0.5 V/m
(B) 100 V/m
(C) 50 V/m
(D) 200 V/m

A particle of charge 'q' coulomb moving with velocity 'v' m/s experiences a force 'X' Newton entering a magnetic field B at angle 30°. The value of B is:

(A) \( \frac{2X}{qv} \) Tesla (Tesla)
(B) \( \frac{Xq}{v} \) Tesla (Tesla)
(C) \( \frac{3X}{qv} \) Tesla (Tesla)
(D) \( \frac{X}{av} \) Tesla (Tesla)
19 एक वीजात्मकता $V = iv_x + jv_y + kv_z$ वेग साथे $B = iB_z$ संबंधीय श्रेणी परंपरागत गति करे छ. संपूर्ण गति दरमाण वेगानुसार कितना घट अनुभूत रहे छ?

A charged particle moving with velocity $V = iv_x + jv_y + kv_z$ in a region of magnetic field $B = iB_z$ which component of velocity remains constant during entire motion:

(A) both $V_x$ and $V_y$

(B) none

(C) $V_z$ only

(D) $V_x$ only

20 शोटकिंग प्रक्रिया दरमाण थर्मोडायनामिक तंत्र अवस्था 'i' थी 'f' में बदले हेतु. उच्च H अने अन्य अवस्थियंहि h माने कितने विपरीत सांपूर्ण छ?

A thermodynamic system changes from state 'i' to 'f' during a throttling process. For heat H and enthalpy h which statement is true?

(A) $H \neq 0$ and $h_i \neq h_f$

(B) $H = 0$ and $h_i = h_f$

(C) $H \neq 0$ and $h_i = h_f$

(D) $H = 0$ and $h_i \neq h_f$
21. For Gibbs' function $G$, \( \left( \frac{\partial G}{\partial P} \right)_T = \) ________

22. Specific heat at constant volume $C_V = -$ ________

(A) \( \left( \frac{\delta U}{\delta T} \right)_V \)

(B) \( \left( \frac{\delta G}{\delta T} \right)_V \)

(C) \( \left( \frac{\delta S}{\delta T} \right)_V \)

(D) \( \left( \frac{\delta F}{\delta T} \right)_V \)
23 For a gas having volume expansion coefficient $\alpha$ and bulk modulus $E$, the value of $C_p - C_v =$

(A) $-PE\alpha V^2$

(B) $-E\alpha^2 V / T$

(C) $-PE\alpha^2 V$

(D) $-T\alpha^2 V$

24 Which of the following equation is true?

(A) $C_v = -T \left( \frac{\partial^2 H}{\partial T^2} \right)_p$

(B) $C_p = -P \left( \frac{\partial^2 G}{\partial T^2} \right)_p$

(C) $C_p = -V \left( \frac{\partial^2 F}{\partial T^2} \right)_p$

(D) $C_p = -T \left( \frac{\partial^2 G}{\partial T^2} \right)_p$
A particle having 0.02 coulomb charge is passing through region of electric field \( \vec{E} = (3i - 2j + 5k) \) volt/m and a magnetic field \( \vec{B} = 4j \) Tesla with velocity \((2i)\) m/s. What will be the magnitude of force acting on it?

(A) 27 N
(B) 3.76 N
(C) 270 N
(D) 0.27 N

To accelerate proton in a cyclotron a magnetic field of 2.8 Wb/m² is applied. At what rate the electric field applied to Dees of cyclotron will change. (Take charge of proton = 1.6 × 10⁻¹⁹ Coulomb and mass = 1.67 × 10⁻²⁷ Kg.

(A) 1.17 × 10⁻¹⁵ Sec
(B) 3.17 × 10⁻⁶ Sec
(C) 1.17 × 10⁸ Sec
(D) 1.17 × 10⁻⁸ Sec
A cyclotron has 12MHz oscillating frequency and 0.55 m radius of its Dee. What magnetic field must be kept to accelerate deuteron? (Take mass of deuteron to be $3.3436 \times 10^{-27}$ Kg.)

(A) 1.576 Tesla (Tesla)
(B) 0.576 Tesla (Tesla)
(C) 31.2 Tesla (Tesla)
(D) 15.76 Tesla (Tesla)

The pressure on a solid substance is increased isothermally from original pressure $p_1$ to $p_2$. What amount of heat need to be taken away from the substance. ($\beta$ is coefficient of volume expansion of the substance.)

(A) $-TV\beta(p_2 - p_1)$
(B) $-T\beta(p_2 - p_1)$
(C) $-S\beta(p_2 - p_1)$
(D) $-TS\beta(p_2 - p_1)$