DF-2986
Second Year B. Sc. (Sem. III) Examination
March / April - 2016
PHYSICS : Paper - III
(Mechanics & Thermodynamics)

Time : hours] [Total Marks : 

Suggestion / Instructions:

(1) Fill up strictly the details of signs on your answer book.
Name of the Examination: SECOND YEAR B. SC. (SEM. 3)
Name of the Subject: Physics : Paper - 3 (Mechanics & Thermodynamics)

(2) There are 28 questions in this question paper. All are compulsory.
(3) Questions 1 to 24 carry 0.25 marks each.
(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 भरता अनेको अपनी सूचनालाई आवेदित
O.M.R. Sheet-ली पार्श्व छापेको छ.

Important instructions to fill up O.M.R. Sheet
is given on back side of provided O.M.R. Sheet.
At constant pressure the change in enthalpy of a system is equal to:

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

S.I. unit of Tds is:

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

4. According to Maxwell's relation \( \left( \frac{\delta T}{\delta V} \right)_S = \ldots \)

\[ \left( \frac{\delta S}{\delta P} \right)_V \]

\[ -\left( \frac{\delta P}{\delta S} \right)_V \]

\[ -\left( \frac{\delta T}{\delta P} \right)_V \]

\[ \left( \frac{\delta P}{\delta S} \right)_V \]
5 \textbf{Joule-Kelvin coefficient} \( \mu = \quad \text{______} \)

The Joule-Kelvin coefficient \( \mu = \quad \text{______} \)

(A) \( \frac{\delta S}{\delta P} \)

(B) \( \frac{\delta T}{\delta P} \)

(C) \( \frac{\delta T}{\delta P} \)

(D) \( \frac{\delta V}{\delta T} \)

6 \textbf{Sustained thermodynamic process} during which the maximum work \( \text{______} \) has been done.

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

(A) \( G_1 - G_2 \)

(B) \( F_1 - F_2 \)

(C) \( U_1 - U_2 \)

(D) \( \text{Zero} \)
7. Which out of the following cannot be a unit of electric field intensity:

(A) Newton/coulomb
(B) Volt/meter
(C) Newton/Ampere
(D) Joule/coulomb-meter

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

(A) circular
(B) hyperbolic
(C) parabolic
(D) elliptic
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) \( y \propto x \)

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

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

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

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

(A) \( \frac{qE_0}{mw^2} \)

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

(C) \( \frac{mw}{qE_0} \)

(D) \( \frac{E_0w^2}{qm} \)
The value of Lorenz force acting on a charged particle in magnetic field is maximum when angle between velocity and magnetic field is:

(A) 0°

(B) 90°

(C) 180°

(D) 120°

The energy gained by an \( \alpha \) – particle passing once through Dees of a cyclotron having potential difference 'V' is:

(A) 1eV

(B) 2eV

(C) 3eV

(D) 4eV
13. Given the Gibbs function $G$ at $T$, \( \left( \frac{\partial G}{\partial P} \right)_T = \text{________} \)

For Gibbs' function $G$, \( \left( \frac{\partial G}{\partial P} \right)_T = \text{________} \)

(A) P  
(B) V  
(C) S  
(D) U

14. Which of the following represents the specific heat at constant volume $C_V = \text{________}$

Specific heat at constant volume $C_V = \text{________}$

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

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

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

(D) \( \left( \frac{\delta S}{\delta T} \right)_V \)
15 The expression \( a = \frac{1}{300} K^{-1} \) is used to evaluate the Joule-Kelvin coefficient \( \mu \). What is the value of this coefficient at 300 K?

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

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__________

16 For van-der-Waals ideal gas \( C_P = C_v \) is__________

For van-der-Waals ideal gas \( C_P - C_v = \)__________

(A) \( R \)
(B) \( R \left( 1 + \frac{2a}{RTV} \right) \)
(C) \( R \left( 1 - \frac{2a}{RTV} \right) \)
(D) Zero
In cyclotron magnetic field of intensity 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) $0.4 \times 10^8$ Hz

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

(C) $10^8$ Hz

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

An electron moves between two points having potential difference 100 voltls, what is change in its kinetic energy :

(A) $1.6 \times 10^{-19}$ Joule

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

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

(D) $6.1 \times 10^{18}$ 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) 200 V/m

(B) 0.5 V/m

(C) 100 V/m

(D) 50 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) \( \frac{X}{qv} \) Tesla

(B) \( \frac{2X}{qv} \) Tesla

(C) \( \frac{Xq}{v} \) Tesla

(D) \( \frac{3X}{qv} \) Tesla
A charged particle moving with velocity \( V = v_x + jv_y + kv_z \) in a region of magnetic field \( B = iB_z \) which component of velocity remains constant during entire motion:

(A) \( V_x \) only

(B) both \( V_x \) and \( V_y \)

(C) none

(D) \( V_z \) only

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

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

(B) \( H \neq 0 \) and \( h_i \neq h_f \)

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

(D) \( H \neq 0 \) and \( h_i = h_f \)
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) $-TS\beta (p_2 - p_1)$

(B) $-TV\beta (p_2 - p_1)$

(C) $-T\beta (p_2 - p_1)$

(D) $-S\beta (p_2 - p_1)$

For a gas having volume expansion coefficient $\alpha$ and bulk modulus $E$, the value of $C_p - C_v =$ ________

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

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

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

(D) $-PE\alpha^2 V$
Which of the following equation is true?

(A) \[ C_p = -T \left( \frac{\partial^2 G}{\partial T^2} \right)_p \]

(B) \[ C_v = -T \left( \frac{\partial^2 H}{\partial T^2} \right)_p \]

(C) \[ C_p = -P \left( \frac{\partial^2 G}{\partial T^2} \right)_p \]

(D) \[ C_p = -V \left( \frac{\partial^2 F}{\partial T^2} \right)_p \]

26. 0.02 क्वांटम वीजलार परियोजना अंक क्व. \( \vec{E} = (3i - 2j + 5k) \) वोल्ट/मी. ता विद्युतमाण अने \( \vec{B} = 4j \) तैलवाती समान वुडकोलीं कोणहँडी पसर वायर जो कणांत वेग \( 2i \) भिलेसे. कोण तो. तेसरे पर बागवता आणि मानतक केल्ह? 

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) 0.27 N

(B) 27 N

(C) 3.76 N

(D) 270 N
27 एक सांप्द्वोल्रनमां प्रोटॉने प्रवेशित करा माटे 2.8 वेबर/मी मुख्य क्षेत्र वाष्पांत आवे े. सांप्द्वोल्रनमां घरोंच आहे वाष्पांत आवेल वीज्येन डेट्वी उडःथियर भडःल्यां? (प्रोटॉने वीज्येन =1.6×10⁻¹⁹ कुंल्यं अने)

\[ E = 1.67 \times 10^{-27} \text{ J.}

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) 1.17×10⁻⁸ Sec
(B) 1.17×10⁻¹⁵ Sec
(C) 3.17×10⁻⁶ Sec
(D) 1.17×10⁸ Sec

28 एक सांप्द्वोल्रन 12MHz आंदोलक आवृत्ति अने 0.55 मी.१८ विघ्न घरावे े. ज्येष्ठरोनने प्रवेशित करा माटे जुडःी मुख्य क्षेत्र डेट्वी राखून घरावें ? (डेट्वोननुं द्रणमान 3.3436×10⁻²⁷ डिवोलर बो)

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 3.3436×10⁻²⁷ Kg.)

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