QUESTION BOOKLET NUMBER

QUESTION BOOKLET SERIES

ODISHA POLICE RECRUITMENT BOARD
(CPSE - 2019)

305(...)

A

Subject : Paper-III (Physics & Chemistry)
Duration of Exam : 180 minutes
No. of Questions : 200 (100 Physics & 100 Chemistry)

Roll Number of Candidate

						0			

READ THE INSTRUCTIONS CAREFULLY BEFORE WRITING ANYTHING ON THIS BOOKLET:

1. Please follow "Instructions to Candidates" already uploaded on the candidate portal.
2. **Please strictly follow the instructions given by the Invigilators and those given on the Question Booklet.**
3. Before commencing to write anything on this Booklet ensure that the Booklet has 200 (Two hundred) multiple choice questions (MCQs) divided in 2 sections (Section-A & Section-B), there is no misprint, overprinting and / or any other deficiency either in the Question Booklet or in the OMR Answer Sheet. If there is any deficiency, report the same to the invigilator forthwith and get the Booklet changed. Only on being fully satisfied, fill your details on the OMR Answer Sheet. Once the Roll No. has been written on the OMR Answer Sheet, it will normally not be replaced.
4. There are **23** pages in this Question Booklet and **1** additional page for **rough work** & out of which pa number **1** is "**General Instructions**" and page number **23** is **rough sheet**.
5. Candidate should mark his/her answer only on the OMR Answer Sheet, which is being provic separately.
6. Please use **blue/black** ball point pen ONLY for filling up the details & for marking your answers on the OMR Sheet.
7. Mark your answers with utmost care. You are not allowed to change the answer, once marked, by adopting any method (including correction fluid).
8. Mark only one answer for each question. If more than one answer is given by you for any question, that answer will be treated as wrong.
9. **One Mark (1)** will be awarded for each correct answer. There will be **negative marking of 0.25** in the test for every wrong answer. No marks will be awarded or deducted for un-answered question.
10. Rough work may be done in the blank space in the Question Booklet. No other paper will be provided. Please note that it will be your responsibility to carefully handover your OMR Answer Sheet, Admit Card and copy of identity proof to the invigilator at the end of the examination. If your OMR Answer Sheet is found missing, you will be disqualified.

DO NOT OPEN THE BOOKLET UNTIL ASKED TO DO SO

SECTION - A (Physics)

Q.1) Identify the correct option based on the given statements:

Statement (1): The inverse of the matrix is possible only for Non-singular matrix.

Statement (2): In singular matrix, the determinant of the square matrix is equal to zero.

a) Statement (1) is true but Statement (2) is false.
b) Statement (2) is true but Statement (1) is false.
c) Both Statement (1) and Statement (2) are true.
d) Both Statement (1) and Statement (2) are false.

Q.2) If matrix $A=\begin{bmatrix}1 & 0 & 1\\ 7 & 6 & 9\\ 8 & 3 & 13\end{bmatrix}$**, then trace of the matrix is _____.**

a) 20 b) 10 c) 2 d) 13

Q.3) Using Green's theorem, the value of the integral, $\int_C (x^2 y dx + xy dy)$**, where C is the rectangle with vertices (0, 0), (3, 0), (3, 1), (0, 1) oriented in the counter clockwise direction, will be _____.**

a) -15/2 b) 5/2 c) 3/2 d) -9/2

Q.4) The eigen values of the matrix $A=\begin{bmatrix}2 & 3\\ 5 & 4\end{bmatrix}$ **is _____.**

a) 7, 1 b) 1, -7 c) -7, -1 d) -1, 7

Q.5) The degree of the differential equation, $\frac{d^3y}{dx^3}+\left(\frac{d^2y}{dx^2}\right)^4+9\left(\frac{dy}{dx}\right)^5+y+3=0$ **is _____.**

a) 2 b) 1 c) 4 d) 5

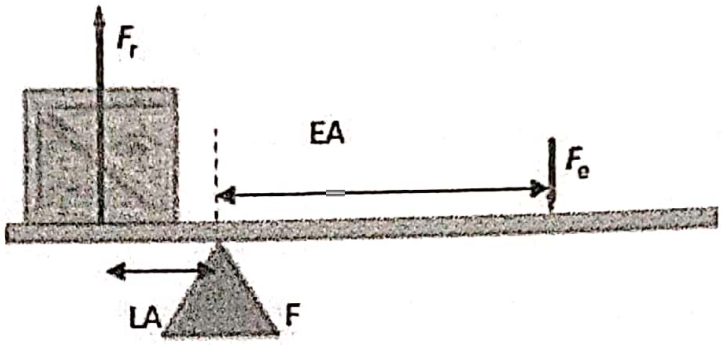
Q.6) The unit vector normal to the surface $x^2+y^2+z=1$ **at the point Q (1, 1, 1) is _____.**

a) $\frac{2\hat{i}+2\hat{j}-\hat{k}}{9}$ b) $\frac{\hat{i}+\hat{j}+\hat{k}}{3}$ c) $\frac{2\hat{i}+2\hat{j}+\hat{k}}{3}$ d) $\frac{\hat{i}+\hat{j}-\hat{k}}{3}$

Q.7) Which one of the following is not a fundamental dimension used in mechanics?

a) Time b) Mass c) Length d) Newton

Q.8) In a lever, fulcrum is at one end at a distance of 20 cm from the load (LA) and effort is at the other end at a distance of 60 cm from the load (EA) as shown in the figure given below. Calculate the mechanical advantage of the lever.



a) 3 b) 15 c) 0.33 d) 80

Q.9) Which of the following is/are correctly matched?

P. Recoiling of gun – Newton's third law of motion
Q. Kicking the ball – Newton's second law of motion
R. Passengers falling forward when brakes applied by a bus driver– Newton's first law of motion

a) P and Q b) P, R c) Only R d) P, Q, R

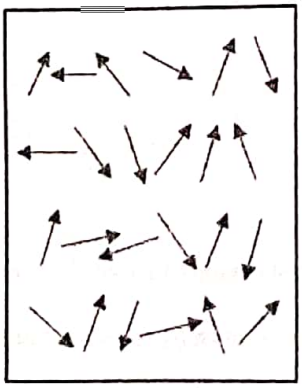
Q.10) A particle has an initial velocity of $2\hat{i}+3\hat{j}$ and an acceleration of $0.4\hat{i}+0.6\hat{j}$. Its speed after 15 seconds is

a) 28.84 units b) 14.42 units c) 7.21 units d) 0 units

Q.11) A solid cylinder of mass 12 kg and radius 0.4 m is rotating about its axis at 22 rad/s. The kinetic energy of the cylinder is _____ kJ.

a) 0.23 b) 0.46 c) 0.93 d) 0

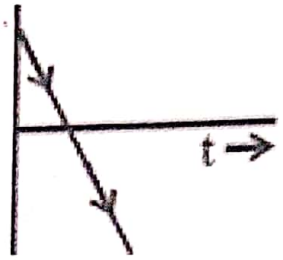
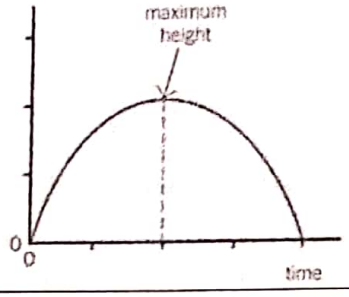
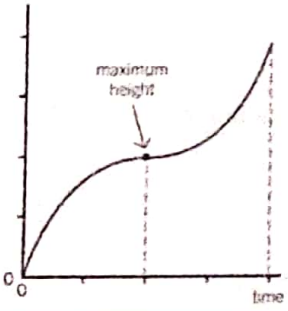
Q.12) As per the figure given below, the magnetic moment of neighbouring atoms in the absence of magnetic field belongs to which one of the following classifications of magnetic material?



a) Antiferromagnetic b) Ferrimagnetic c) Paramagnetic d) Ferromagnetic

SET A

Q.13) A ball has been thrown vertically upwards. Match the description given with their graphical representation.

Column I	Column II
P. Displacement-time graph for a ball thrown upwards x-axis: displacement, y-axis: time	1. 
Q. Distance-time graph for a ball thrown upwards x-axis: distance, y-axis: time	2. 
R. Velocity-time graph for a ball thrown upwards x-axis: velocity, y-axis: time	3. 

a) P-1, Q-2, R-3 b) P-3, Q-2, R-1 c) P-2, Q-3, R-1 d) P-1, Q-3, R-2

Q.14) Which of the following statement is/are incorrect?

P. The device used for producing electric current is called electric generator.
Q. Electric motor uses electric current to do mechanical work.
R. Ammeter detects the presence of current in the circuit
S. Galvanometer is used to measure the current in the circuit.

a) P, Q b) Q, R c) R, S d) P, S

Q.15) Identify the correct statement(s):
Statement 1: The magnetic field lines of a long straight wire are comprised of concentric circles centered around the wire.
Statement 2: The direction of magnetic field lines of a long straight wire is given by the left-hand thumb rule.

a) Statement (1) is true but Statement (2) is false.
b) Statement (2) is true but Statement (1) is false.
c) Both Statement (1) and Statement (2) are true.
d) Both Statement (1) and Statement (2) are false.

Q.16) A solenoid has a core of a material with relative permeability 350. The windings of the solenoid are insulated from the core and carry a current of 3A. If the number of turns is 1200 per metre, find the magnetic field intensity.

a) 0.36 A/m b) 3.6×10^3 A/m c) 7.2×10^3 A/m d) 0.72 A/m

Q.17) Which of the following describes the relationship between magnetic susceptibility (φ) and relative permeability (μ_r) is

a) $\mu_r = \varphi - 1$ b) $\mu_r - 1 = \varphi$ c) $\mu_r = 1 - \varphi$ d) $\mu_r \varphi = 1$

Q.18) The phenomenon of perfect diamagnetism in superconductors is called the _____.

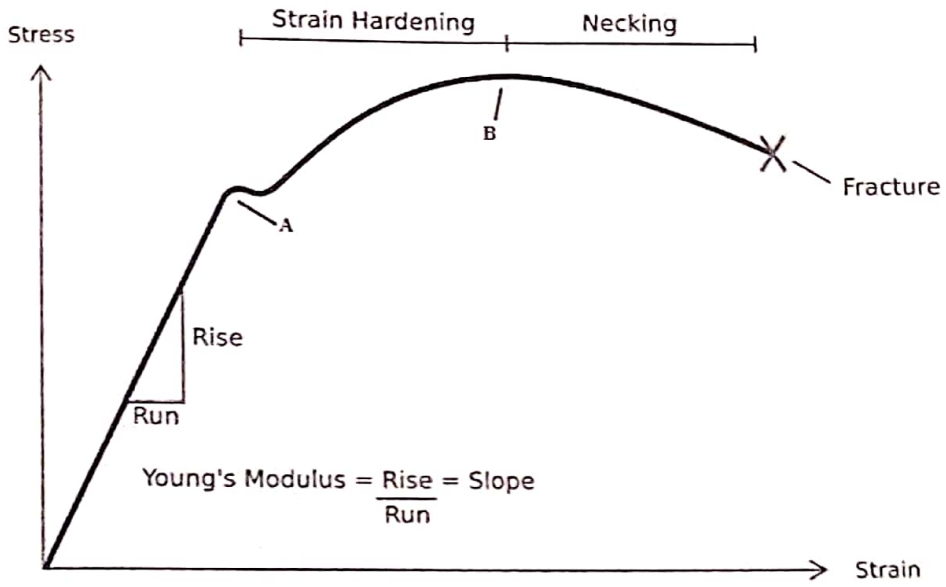
a) Meissner effect b) Curie effect c) Hysteresis d) Dynamo effect

Q.19) A metallic wire is stretched with a stress of 50 MPa at 20°C. If the length of the metallic wire is held constant, the temperature upto which the wire must be heated to reduce the stress to 15 MPa is ___

Given: Elastic modulus of metallic wire = 207 GPa
Coefficient of linear expansion of metallic wire = 12.0 x 10^{-6} °C^{-1}

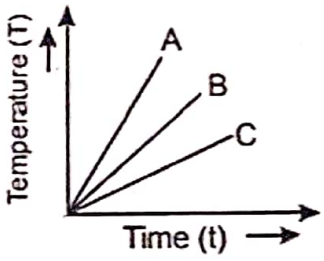
a) 307 K b) 273 K c) 1000 K d) None of the above

Q20) In the diagram below, what best defines A and B?



a) Ultimate Strength, Yield Strength
b) Yield Strength, Ultimate Strength
c) True Stress, Engineering Stress
d) Engineering Stress, True Stress

Q.21) As per the plot given below, the substance which has the highest heat capacity if heat is supplied to them at equal rates among A, B and C is _____.



a) A b) B c) C d) All have equal specific heat

Q.22) The correct relation between Fahrenheit temperature (t_F) and Celsius temperature (t_C) is given by _____

a) $\frac{t_F - 32}{180} = \frac{t_c}{100}$ b) $\frac{t_F + 32}{18} = \frac{t_c}{100}$ c) $\frac{t_F - 32}{1800} = \frac{t_c}{100}$ d) $\frac{t_F + 32}{180} = \frac{t_c}{100}$

Q.23) Determine the specific heat of the metal when 25000 J of energy is supplied to 3 kg block and the temperature of the block rises from 18 °C to 36 °C.

a) 463 J/kg.K b) 926 J/kg.K c) 232 J/kg.K d) 116 J/kg.K

Q.24) The relation between Kelvin absolute zero and zero degree Celsius is _____.

a) 0 K = -273.15 °C b) 0 K = 273.15 °C c) 0 K = 173 °C d) c) 0 K = 100 °C

Q.25) The NAND gate output will be low if the two inputs are _____.

a) 00 b) 01 c) 10 d) 11

Q.26) The binary equivalent of the decimal number 368 is _____.

a) 101110000 b) 110110000 c) 111010000 d) 111010000

Q.27) Which of the following digital circuit can store only a single bit?

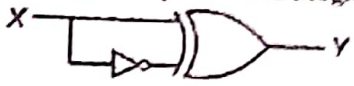
a) Flip-flop b) NOR gate c) XOR gate d) Register

Q.28) Identify the correct statement(s):

Statement 1: A half adder is an arithmetic circuit block that can be used to add two bits.
Statement 2: EX-OR gate and AND gates are required to build a half adder.

a) Statement (1) is true but Statement (2) is false.
b) Statement (2) is true but Statement (1) is false.
c) Both Statement (1) and Statement (2) are true.
d) Both Statement (1) and Statement (2) are false.

Q.29) The output Y of the logic circuit given below is _____.



a) 1 b) zero c) X d) $\bar{X}$

Q.30) Match the logic gates in Column A with their equivalents in Column B

Column A	Column B
P. 	1 
Q 	2. 
R 	3. 
S. 	4. 

a) P – 2, Q – 4, R – 1, S – 3
b) P – 4, Q – 2, R – 1, S – 3
c) P – 2, Q – 4, R – 3, S – 1
d) P – 4, Q – 2, R – 3, S – 1

Q.31) Identify the correct option:

Statement 1: The resonance of a series RLC circuit occurs when the inductive and capacitive reactance are equal in magnitude.
Statement 2: The power factor for a series RLC circuit at resonance is equal to zero.

a) Statement (1) is true but Statement (2) is false.
b) Statement (2) is true but Statement (1) is false.
c) Both Statement (1) and Statement (2) are true.
d) Both Statement (1) and Statement (2) are false.

SET A

Q.32) If three 6 mH inductors are connected in parallel without mutual inductance, then the total inductance is

a) 2 mH b) 6 mH c) 12 mH d) 18 mH

Q.33) Complete the statement

Thevenin's theorem states that "Any linear circuit containing several voltages and resistances can be replaced _____ voltage(s) in _____ with a single resistance connected across the load".

a) one, series b) one, parallel c) two, series d) two, parallel

Q.34) The energy stored in the capacitor is in the form of _____.

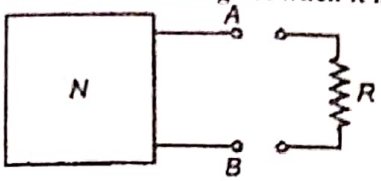
a) electrical kinetic energy
b) electrical potential energy
c) electromagnetic energy
d) thermal energy

Q.35) Identify the correct option:

Statement 1: The superposition theorem is applicable to current, voltage and power.
Statement 2: Superposition theorem can be applied only to circuits having Nonlinear elements.

a) Statement (1) is true but Statement (2) is false.
b) Statement (2) is true but Statement (1) is false.
c) Both Statement (1) and Statement (2) are true.
d) Both Statement (1) and Statement (2) are false.

Q.36) Norton equivalent to the network N to the left of AB is a current source $I_N = 4A$ from B to A, $R_N = 2\Omega$. The current through R when it is connected across AB = 2A. Calculate the value of resistance R.



a) 1Ω b) 2Ω c) 3Ω d) 4Ω

Q.37) The intensity of light does not depend on _____.

P. Frequency
Q. Wavelength
R. Amplitude
S. Velocity

a) Only R b) P, Q c) P, Q, R d) P, Q, S

Q.38) Identify the correct statement:

Statement 1: *Young's double-slit experiment* uses two coherent sources of light placed at a small distance apart
Statement 2: The fringe width can be increased in Young's double-slit experiment by decreasing the separation of slits.

a) Statement (1) is true but Statement (2) is false.
b) Statement (2) is true but Statement (1) is false.
c) Both Statement (1) and Statement (2) are true.
d) Both Statement (1) and Statement (2) are false.

Q.39) In a Young's double split experiment, 16 fringes are observed to be formed in a certain segment of the screen when light of wavelength 600 nm is used. If the wavelength of light is changed to 300 nm, number of fringes observed in the same segment of the screen is given by _____.

a) 16 b) 32 c) 48 d) 64

Q.40) Identify the incorrect statement(s) regarding Bose-Einstein statistics.

P. Bose-Einstein statistics is for the particles with half integral spin.
Q. Bose-Einstein statistics can be applied to photons.
R. In Bose-Einstein Statistics, the energy states are distinguishable.

a) P, R b) Q, R c) Only P d) P, Q, R

Q.41) The sum of all the microscopic forms of energy is called the _____ of the system.

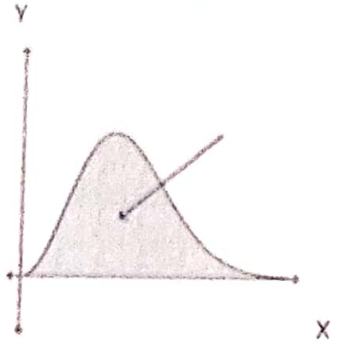
a) Kinetic energy b) Potential energy c) Internal energy d) Total energy

Q.42) Boltzmann's constant has a value of around _____ ($J.K^{-1}$).

a) 1.3807×10^{-23} b) 1.3807×10^{23} c) 1.3807×10^{27} d) 1.3807×10^{-27}

SE

Q.43) The y-axis of the Maxwell-Boltzmann distribution graph gives the number of molecules per unit speed and x- axis is the number of molecules. According to Maxwell-Boltzmann distribution, the area under the curve given below represents _____.



a) total number of molecules
b) rate of acceleration
c) half of the total number of molecules
d) speed of particles

Q.44) Identify the correct option:
Statement 1: The number of particles is unlimited in Fermi Dirac Statistics.
Statement 2: Fermi-Dirac statistics follow Pauli Exclusion principle.

a) Statement (1) is true but Statement (2) is false.
b) Statement (2) is true but Statement (1) is false.
c) Both Statement (1) and Statement (2) are true.
d) Both Statement (1) and Statement (2) are false.

Q.45) Which of the following equation represents the correct relation between entropy (S) and thermodynamic probability (Ω)? Where K_b = Boltzmann constant

a) $S = \frac{1}{2} K_b\Omega$
b) $S = K_b\log(\Omega)$
c) $S = K_b\Omega$
d) $S = 2\Omega$

Q.46) If an object explodes into two objects of mass 4 kg each moving with a speed 0.8c relative to the original body, what would be the mass of the object when it is at rest?

a) 8 kg
b) 26.67 kg
c) 53.34 kg
d) 4 kg

Q47) A rod 1m long moves with a velocity of 0.6c. Calculate it length as it appears to an observer on the earth?

a) 0.9 m
b) 1.2m
c) 0.8m
d) 0.64m

Q.48) The table given below represents 4 particles having a lifetime of 2 microseconds. The particle which will survive for the shortest duration will be:

Particle P	v = 0.5c
Particle Q	v = 0.2c
Particle R	v = 0.09c
Particle S	v = 0.85 c

a) P
b) Q
c) R
d) S

Q.49) In Lorentz Length transformation, there is no change in the dimensions of the objects in the direction which is _____ to the direction of motion.

a) parallel
b) perpendicular
c) 45 degrees
d) 120 degrees

Q.50) Identify the correct option:
Statement 1: According to Einstein's Special Theory of Relativity, the laws of physics are the same in all inertial frames of reference.
Statement 2: A frame of reference that has four coordinates, x, y, z, and time 't' is referred to as the Inertial frame of reference.

a) Statement (1) is true but Statement (2) is false.
b) Statement (2) is true but Statement (1) is false.
c) Both Statement (1) and Statement (2) are true.
d) Both Statement (1) and Statement (2) are false.

Q.51) According to Einstein's theory of relativity, the relation between energy of particle and momentum is given by _____, where E is total energy, m_0 is the invariant mass of the particle, constant c is speed of light and p is momentum of magnitude.

a) $E = \sqrt{p^2c^2 + m_0^2c^4}$
b) $E = \sqrt{p^2c^2 + m_0^2c^4}$
c) $E = p^2c^2 + m_0^2c^4$
d) $E = p^2c^2 + m_0^2c^2$

SET A

Q.52) The amplitude of oscillator at any time 't' is given by _____, where b = damping coefficient.

a) $A = A_0e^{-bt}$ b) $A = 2A_0e^{-bt}$ c) $A = A_0e^{bt}$ d) $A = 2A_0e^{bt}$

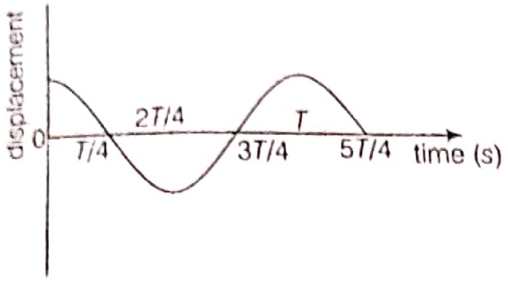
Q.53) If it is given that a simple pendulum has a time period of T and the mass of the bob is made one-sixth, then the time period of the pendulum will become _____.

a) 6T b) 1/6T c) T d) 1/3T

Q.54) Calculate the time period of the oscillation if a 5 kg block is attached to a spring (of spring constant 500 N/m).

a) $\pi/5$ b) 5π c) $\pi/10$ d) 0.5π

Q.55) Identify the correct statement(s) for the displacement-time graph of a particle given below undergoing Simple Harmonic motion (SHM).



P. At t = 3T/4, the acceleration of the particle is zero.
Q. At t = 4T/4, the acceleration is maximum.
R. The velocity is minimum at t = T/4.

a) P, Q b) Q, R c) Only R d) P, Q, R

Q.56) Identify the properties of crystalline solids:
P. Anisotropy
Q. Sharp melting point
R. Definite geometry
S. Isotropy

a) P, Q, R b) Q, R, S c) P, R d) Q, S

Q.57) Match the given elements in Column A with their corresponding crystal structures in Column B:

Column A	Column B
P. Chromium	1. Body centered cubic (BCC)
Q. Polonium	2. Face centered cubic (FCC)
R. Zinc	3. Simple cubic (SC)
S. Copper	4. Hexagonal closest packed (HCP)

a) P – 2, Q – 3, R – 4, S – 1 b) P – 2, Q – 1, R – 3, S – 4
c) P – 1, Q – 3, R – 4, S – 2 d) P – 1, Q – 3, R – 2, S – 4

Q.58) The density of the crystal remains unchanged in which defect?

a) Vacancy defect b) Interstitial defect c) Frankel defect d) Schottky defect

Q.59) The covalent compound which conducts electricity is _____.

a) Silica b) Methane c) Diamond d) Graphite

Q.60) Match the semiconductor material with its band gap energy (Approx).

Semi-conductor	Band Gap
P. Germanium	1) 5.5
Q. Diamond	2) 1.1
R. Silicon	3) 0.67

a) P-1, Q-2, R-3 b) P-3, Q-2, R-1 c) P-2, Q-3, R-1 d) P-3, Q-1, R-2

SET

Q.61) In the closest packing of atoms _____ (TV = Tetrahedral voids and OV = Octahedral voids)

a) The size of TV is greater than that of OV
b) The size of TV is smaller than that of OV
c) The size of TV is equal to that of OV
d) Can't say

Q.62) The ratio of Young's modulus to the modulus of rigidity of a material having Poisson's ratio 0.30 is___

a) 5.2 b) 2.6 c) 1.3 d) 8.4

Q.63) It is given that two wires P and Q are of the same length. Their diameters are in the ratio of 1:3 and the Young's modulus are in the ratio of 3:1. If the wires are pulled by the same force, then the elongation produced of one wire will be _____ of the other.

a) 1/3 b) 1/9 c) 1/27 d) 1/81

Q.64) Dimensionally, the modulus of elasticity is similar to _____.

a) Stress b) Strain c) Poisson's ratio d) Both stress and strain

Q.65) Identify the correct option:
Statement 1: Changing the dimension does not affect the elasticity of the substance.
Statement 2: If the shape of the body is changed on applying force, then the corresponding force is known as shearing force.

a) Statement (1) is true but Statement (2) is false.
b) Statement (2) is true but Statement (1) is false.
c) Both Statement (1) and Statement (2) are true.
d) Both Statement (1) and Statement (2) are false.

Q.66) Which of the following is/are not dimensionless quantity/quantities?
P. Stress
Q. Strain
R. Bulk modulus
S. Modulus of Elasticity

a) Only Q b) R, S c) P, Q, R d) P, R, S

Q.67) If it is given that a block of mass 5 kg is suspended from the roof with the help of a metallic wire of radius 2.5 mm. Determine the stress produced in the wire. (Note: Consider mass of wire to be negligible and $g = \pi^2$)

a) 2.5×10^6 N/m^2 b) 5.0×10^6 N/m^2 c) 1.25×10^6 N/m^2 d) 6.25×10^6 N/m^2

Q.68) The voltage gain of an amplifier without feedback is 2500. The voltage gain of the amplifier if the negative feedback is introduced in the circuit is _____. (Assume feedback fraction is 0.01)

a) 96.15 b) 46 c) 100 d) 25

Q.69) In a BJT, the current gain of a common emitter is 99. Then the current gain for the common collector is

a) 100 b) 99 c) 0.01 d) 0.99

Q.70) What does the arrow direction in diode symbol indicates?

a) direction of electron flow
b) direction of holes flow
c) opposite to direction of hole flow
d) none of these

Q.71) Identify the correct option:
Statement 1: Avalanche breakdown is a phenomenon that can occur in both insulating and semiconducting materials.
Statement 2: Avalanche breakdown results due to impact ionization.

a) Statement (1) is true but Statement (2) is false.
b) Statement (2) is true but Statement (1) is false.
c) Both Statement (1) and Statement (2) are true.
d) Both Statement (1) and Statement (2) are false.

Q.72) A transistor has a β_{DC} of 300 and a base current, IB of 30 μA. The collector current, I_C is equal to _____

a) 900 μA b) 9 mA c) 90 mA d) 9 A

Q.73) Which of the following is/are method(s) of Amplifier coupling?
P. Susceptance coupling
Q. Transformer coupling
R. Impedance coupling
S. Direct coupling

a) Q, R, S b) P, Q c) Only P d) P, Q, R

SET A

Q.74) For chemical reaction to be spontaneous, the corresponding values of entropy change of system and Gibbs free energy change of the system should be?

a) $\Delta G > 0, \Delta S > 0$ b) $\Delta G < 0, \Delta S < 0$ c) $\Delta G > 0, \Delta S < 0$ d) $\Delta G < 0, \Delta S > 0$

Q.75) If 25J of heat is supplied and the work done by the system is +15 J, then the change in internal energy of the system is given by:

a) 0 Joules b) -10 Joules c) +10 Joules d) None

Q.76) Identify the correct option:
Statement (1): Heat transfer takes place according to Second law of thermodynamics.
Statement (2): Second law of thermodynamics states that there is no practical device which can transfer heat from low temperature to high temperature without any external work.

a) Statement (1) is true but Statement (2) is false. b) Statement (2) is true but Statement (1) is false.
c) Both Statement (1) and Statement (2) are true. d) Both Statement (1) and Statement (2) are false.

Q.77) Which of the following is/are path function(s)?
P. Work
Q. Heat
R. Volume
S. Temperature

a) P, Q, S b) P, Q, R c) P, Q d) R, S

Q.78) Match Column I with Column II and select the correct answer using the codes given below the lists: (P_1, P_2 denote pressure, T_1, T_2 denote temperature and V_1, V_2 denotes volume)

Column I	Column II
P. $P_1V_1 = P_2V_2$	1. Isochoric Process
Q. $P_1V_1^{\gamma} = P_2V_2^{\gamma}$.	2. Isobaric Process
R. $\frac{V_1}{T_1} = \frac{V_2}{T_2}$	3. Isothermal Process
S. $\frac{P_1}{T_1} = \frac{P_2}{T_2}$	4. Adiabatic Process

a) P-2, Q-4, R-1, S-3 b) P-2, Q-3, R-4, S-2 c) P-3, Q-4, R-2, S-1 d) P-4, Q-2, R-3, S-1

Q.79) Two moles of mono-atomic ideal gas is reversibly and isothermally expanded at 800 K to twice its original volume. The work done by the gas in Joule is _____kJ

a) 9.2 b) 18.4 c) 13.30 d) 20.5

Q.80) Identify the property/properties of a photon:
P. The rest mass of photon is zero
Q. They have zero electric charge
R. Photons do not decay on their own
S. Photons are stable particles.

a) P, Q, R, S b) Q, R, S c) P, Q d) P, R

Q.81) Which of the following equation is for the wave function of a box?

a) Atan(kx) b) Acos(kx) c) Asin(kx) + Bcos(kx) d) None of the above

Q.82) It is given that a spherical body having diameter of 20 cm radiates 400 watt power at 600 K. If the radius is halved and the temperature is doubled, then what would be the power radiated?

a) 800 Watt b) 1600 Watt c) 400 Watt d) 2400 Watt

Q.83) Identify the correct option:
Statement 1: A body that absorbs all the radiations falling on it is called a black body.
Statement 2: A white body is one with a "rough surface that reflects all incident rays completely and uniformly in all directions."

a) Statement (1) is true but Statement (2) is false. b) Statement (2) is true but Statement (1) is false.
c) Both Statement (1) and Statement (2) are true. d) Both Statement (1) and Statement (2) are false.

Q.84) Who is the founder of theory of relativity?

a) Albert Einstein b) Antoine Lavoisier c) Charles Babbage d) None of the above

Q.85) Calculate the wavelength of light if the frequency of light is $4.8 \times 10^{12}\ s^{-1}$. Given: speed of light = 3.0×10^{8} m/s

a) 6.25×10^{-5} m b) 5.2×10^{-7} m c) 6.25×10^{-6} m d) 9.6×10^{-5} m

Q.86) Three resistors of 4Ω, 5Ω and 10Ω are connected in parallel in a 25V circuit. The current that will flow through the 5Ω resistor is ____.

a) 5A b) 10A c) 25A d) 125A

Q.87) Calculate the maximum resistance which can be made using 4 resistors of ¼ Ω each?

a) 1Ω b) 2Ω c) 4Ω d) 0.4Ω

Q.88) Identify the correct option:
Statement (1): The resistivity of the substance depends on the nature of the material.
Statement (2): The resistivity of the substance is the characteristic property.

a) Statement (1) is true but Statement (2) is false. b) Statement (2) is true but Statement (1) is false.
c) Both Statement (1) and Statement (2) are true. d) Both Statement (1) and Statement (2) are false.

Q.89) The filament of the bulb is made up of _____.

a) Aluminum b) Iron c) Tungsten d) Platinum

Q.90) Identify the correct statement:
Statement (1): To prevent electric shocks, the metallic electrical wires are covered with plastic.
Statement (2): Plastic is an insulator of electricity.

a) Statement (1) is true but Statement (2) is false. b) Statement (2) is true but Statement (1) is false.
c) Both Statement (1) and Statement (2) are true. d) Both Statement (1) and Statement (2) are false.

Q.91) Calculate the heat developed in 40s in an electric iron of resistance 24Ω and takes a current of 6A.

a) 34.5 kJ b) 3.45 kJ c) 15 kJ d) 69 kJ

Q.92) A piece of wire of resistance R_1 is cut into 10 equal parts. These parts are then connected in parallel. If the equivalent resistance of this combination is R_2, then the ratio R_2/R_1 is :

a) 0.01 b) 0.1 c) 10 d) 100

Q.93) A nanometer is a _____ of a meter.

a) billionth b) millionth c) thousandth d) trillionth

Q.94) Which of the following are true?
(1) Nanowires generally have a diameter and thickness of less than 100 nanometres or even lesser.
(2) Nickel, Platinum and Gold nanowires are metallic nanowires.

a) Both (1) and (2) are true b) Both (1) and (2) are false
c) Only (1) is true d) Only (2) is true

Q.95) State true or false.
(1) The absorption and scattering of light are examples for thermal properties of nanostructure.
(2) Transmission and light remission are optical properties of nanomaterial.

a) Both (1) and (2) are true b) Both (1) and (2) are false
c) Only (1) is true d) Only (2) is true

Q.96) Which one of the following is an example for electrical properties of nanostructure?

a) Melting temperature b) Tunnelling current
c) Both Melting temperature and Tunnelling current d) None of the above

Q.97) Which of the following are correct?
(1) Melting-point depression is the phenomenon of reduction of the melting point of a material with reduction of its size.
(2) Melting-point depression phenomenon is very prominent in nanoscale materials, which melt at temperatures hundreds of degrees lower than bulk materials.

a) Both (1) and (2) are correct b) Both (1) and (2) are incorrect
c) Only (1) is correct d) Only (2) is correct

SET A

Q.98) Time complexity of 0/1 knapsack problem (in backtracking algorithm) ___

a) $O(n)$ b) $O(n^2)$ c) $O(n^3)$ d) $O(2^n)$

Q.99) At which layer of OSI model, the router configuration problem resides?

a) Transport b) Network c) Logical link d) Physical

Q.100) Advanced Encryption standard is based on ___

a) Asymmetric key algorithm
b) Symmetric key algorithm
c) Public key algorithm
d) Key exchange

SECTION - B (Chemistry)

Q.101) Which of the following statements are true?
(i) Ce(IV) salts are good oxidizing agents.
(ii) Ceric salts hydrolyse even at acid pH values.

a) Both are true b) Both are false c) Only (i) is true d) Only (ii) is true

Q.102) $TiCl_4$ on hydrolysis may give.....

a) Sodium Chloride b) Titanium dioxide c) Sulphuric Acid d) Titanium Ethoxide

Q.103) Among transition elements, the element having lowest melting point is ___

a) Iron b) Cobalt c) Titanium d) Mercury

Q.104) _____ is also knows as Fools Gold

a) Pyrite b) Citrine c) Tourmaline d) Magnetite

Q.105) State true or false.
(i) ferric iodide is very unstable
(ii) ferric chloride is stable

a) True, True b) True, False c) False, False d) False, True

Q.106) The electrical configuration of D block elements is _____

a) $(n-1)d^{1-10}\ ns^{1-2}$ b) ns^{1-2} c) ns^2np^{1-6} d) $(n-2)f^{0-1}(n-1)d^{0-1}ns^2$

Q.107) The acid anhydride of permanganic acid is

a) Mn_2O_7 b) MnO_3 c) MnO_2 d) MnO

Q.108) In the preparation of Borazine using the Stock and Pohland method, Diborane and Ammonia (B_2H_6 and NH_3) are taken in the ratio ___

a) 1 : 2 b) 2 : 3 c) 3 : 4 d) 3 : 2

Q.109) Which of the following statements are true?
(i) Two polymers may have the same average MW (molecular weight) values but completely different MWDs (molecular weight distribution).
(ii) Size Exclusion Chromatography (SEC) is a popular method to determine average MW and MWD of a polymer.

a) Both are true b) Both are false c) only (i) is true d) only (ii) is true

Q.110) Which of the following give rise to NMR signals?
(i) C^{12}
(ii) O^{16}
(iii) S^{32}

a) (i) and (ii) b) (iii) and (ii) c) (i), (ii) and (iii) d) None of (i), (ii) or (iii)

Q.111) Mass spectroscopy can be used for
(i) Analysis of aerosol particles
(ii) identify drug abuse
(iii) Finding out volatile organic species pollutants in water bodies.

a) (i) and (ii) b) (iii) and (ii) c) (i), (ii) and (iii) d) None of (i), (ii) or (iii)

Q.112) The order for filling up orbitals for same n is

a) s, p, d, f b) f, d, p, s c) s, f, p, d d) f, s, d, p

Q.113) Which of the following statements are true?
(i) Aufbau's principle states that electrons enter the highest possible energy state available.
(ii) According to Hunds rule, electrons avoid entering the same orbital in a given sub-shell as far as possible.

a) Both are true b) Both are false c) only (i) is true d) only (ii) is true

Q.114) Amongst the following, which has the highest ionization energy?

a) Mg b) N c) P d) He

Q115) The steady _____ in atomic and ionic radii of lanthanide elements with _____ atomic number is called lanthanide contraction.

a) increase, decreasing b) increase, increasing c) decrease, decreasing d) decrease, increasing

Q116) Which of the following are true for lanthanides?
(i) All the f states, except f^0 and f^{14}, contain unpaired electrons and are therefore paramagnetic.
(ii) The lanthanide ions show absorptions in the visible or near-ultra violet regions of the spectrums, except for La^{3+} and Lu^{3+} ions.

a) Both are true b) Both are false c) only (i) is true d) only (ii) is true

Q.117) What is the IUPAC name of the complex [Rh(PPh3)3Cl]

a) Chlorotris (triphenylphosphine)Rhodium(I) b) Chlorotris (triphenylphosphine)Rhodium(III)
c) Dichlorotris(triphenylphosphine)Osmium(I) d) ichlorotris(triphenylphosphine)Ruthenium(ii)

Q.118) α decay converts one element into another (e.g. Uranium into Thorium). This process is known as ___

a) decantation b) transmutation c) subjugation d) transmogrification

Q.119) Which of the following are true about noble gases?
(i) All noble gases have 8 electrons in the outer shell.
(ii) The atoms of noble gases do not form bonds in nature, not even with atoms of their own kind.

a) Both are true b) Both are false c) Only (i) is true d) Only (ii) is true

Q.120) When a current of electricity is passed through a glass tube containing krypton at_____, a ____ light is emitted.

a) low pressure, bluish white b) high pressure, bluish white
c) low pressure, bright yellow d) high pressure, fluorescent pink

Q.121) Which of the following is an element of group 18 of the periodic table?

a) radium b) samarium c) radon d) uranium

Q.122) Which of the following are true?
(i) Sigma bonds form when p orbitals overlap sideways.
(ii) Pi bond form by the direct overlap of electron orbitals.
(iii) The formation of hybrid orbitals (when s and p orbitals merge) is called hybridisation.

a) i and iii b) ii and iii c) iii only d) i, ii and iii.

Q.123) According to _____, any non-linear molecule in an electronically degenerate state is unstable and the molecule become distorted in such a way to remove degeneracy, lower its symmetry and lower the energy.

a) Crystal Field Theory b) Ligand Filed Theory
c) Valence Bond Theory d) Jahn Teller Theorem

Q.124) According to _____, paramagnetic susceptibility is inversely proportional to absolute temperature.

a) Curie Law b) Jahn Teller Distortion c) Tanabe-Sugano parameters d) Franck Condon Principle

Q.125) For ammonia, the value of bond angle is _____

a) 107° b) 104° c) 109.5° d) 104.5°

Q.126) Which of the following is true regarding bond angles?
(i) Bond angle for hydrides increases as we move down the group.
(ii) Order of bond angle is $H_2O > H_2S > H_2Se > H_2Te$

a) i only b) ii only c) both i and ii d) neither i nor ii

Q.127) Which of the following has trigonal bipyramidal geometry?

a) Phosphorus Trichloride
b) Phosphorous Pentasulfide
c) Phosphorus Pentachloride
d) Phosphine

Q.128) Angle between two neighbouring tetrahedral bonds in Si having a diamond cubic structure is

a) 120° b) 109.5° c) 135.5° d) 102.5°

Q.129) How is the dislocation energy defined?

a) Jm^{-1} b) Jm^{-2} c) m^{-2} d) Nm^{-1}

Q.130) A complex having square planar geometry having all four ligands same (ML_4) will have the following symmetry:

a) D_4h b) D_3h c) D_2h d) C_2v

Q.131) The sensitivity of NMR depends on

a) the abundance of the isotope
b) the size of the atom
c) spin magnetic moment of the isotopes
d) the bond length of the analyte molecule

Q.132) In Bailar twist mechanism, the intermediate has a

a) trigonal prismatic structure
b) trigonal bipyramidal structure
c) square pyramidal structure
d) tetrahedral structure

Q.133) What is the relationship between becquerel and curie unit?

a) 1 curie = 0.8 Bq
b) 1 curie = 3.7 Bq
c) 1 milicurie = 3.7×10^{10} Bq
d) 1 curie = 3.7×10^{10} Bq

Q.134) A Geiger-Muller tube is a _____ .

a) cloud chamber b) fluorescence detector c) spectrophotometer d) gas ionization detector

Q.135) What do the letters NPK stand for in NPK fertilizers?

a) Nitrogen, Phosphorous and Potassium
b) Nitrogen, Phosphorous and Krypton
c) Nitrogen, Palladium and Potassium
d) Niobium, Palladium and Krypton

Q.136) The stability of benzyl carbonium is due to ____

a) inductive effect
b) resonance effect
c) both inductive and resonance effect
d) neither inductive nor resonance effect

Q.137) Which of the following are correctly matched?
(i) Hydronium ion – nucleophiles
(ii) Nitronium ion – electrophiles
(iii) Hydrides – electrophiles
(iv) Alcohols – nucleophiles

a) ii and iii b) i and iv c) ii and iv d) i and iii

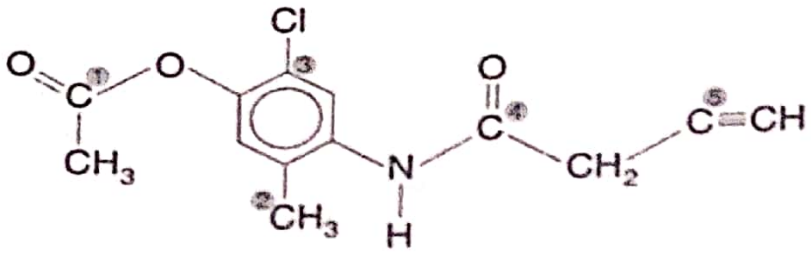
Q.138) The g_e factor for organic radicals is close to _____

a) 0 b) 1 c) 2 d) π

Q.139) State True or False
(i) Mesomeric effect is a common phenomenon occurring in aromatic compounds.
(ii) Nitro items of groups show -M effect.

a) True, True b) True, False c) False, True d) False, False

Q.140) Type of hybridization of the carbon atom is marked from 1 to 5 in the figure below. The geometry about the labels 1 and 2 ____ and _____ respectively.



a) trigonal planar, tetrahedral
b) linear, trigonal planar
c) trigonal planar, trigonal planar
d) tetrahedral, tetrahedral

Q.141) How many of the definitions below are correct?
(i) Molecular ion: An ion formed by removing one electron from the parent molecule.
(ii) Pi (π) Bond: A covalent bond formed by the overlap of parallel *2p* orbitals.
(iii) Molecular Dipole Moment (μ): The vector sum of individual bond dipoles.

a) zero
b) One
c) Two
d) All three

Q.142) Fischer projection is changed to _____ in eclipsed form.

a) Sawhorse Projection
b) Newmann's Projection
c) Sawhorse Projection and Newmann's Projection
d) None of the above

Q.143) All elimination reactions involve _____ from the starting material to form _____ in the product.

a) loss of elements, many new pi bonds
b) loss of elements, a new pi bond
c) loss of pi bonds, new elements
d) increase of pi bonds, a new element

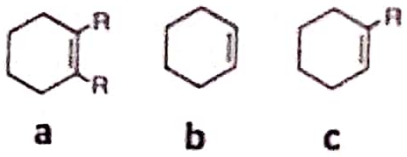
Q.144) A _____ molecule is non-superimposable with its mirror image.

a) chiral
b) achiral
c) both chiral and achiral
d) neither chiral nor achiral

Q.145) What is the solubility factor (K_{sp}) for Barium Sulfate $BaSO_4$?

a) $1.9 \times 10^{-12}\ M^2$
b) $1.9 \times 10^{-7}\ M^2$
c) $1.1 \times 10^{-10}\ M^2$
d) $1.0 \times 10^{-4}\ M^2$

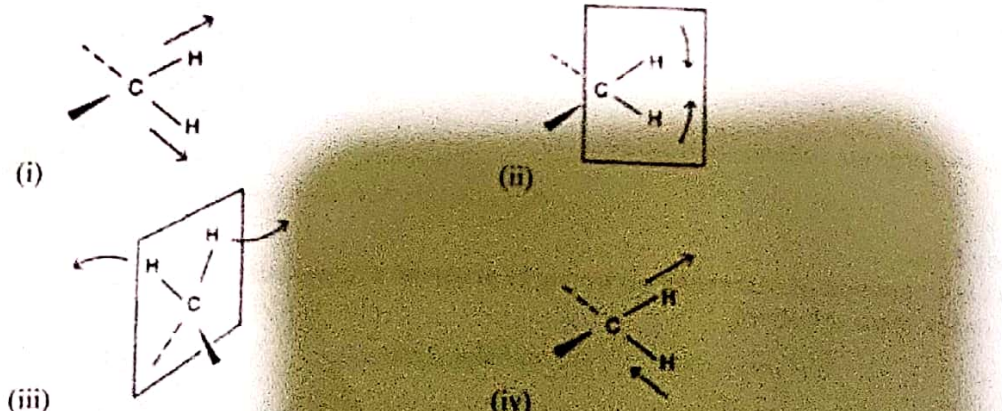
Q.146) Consider the compounds shown below:



The frequency of absorption of double bond follows the order ___

a) a > b > c
b) b > c > a
c) a > c > b
d) a = c > b

Q.147) Which of the following vibrations can be identified as bending vibration?



SET A

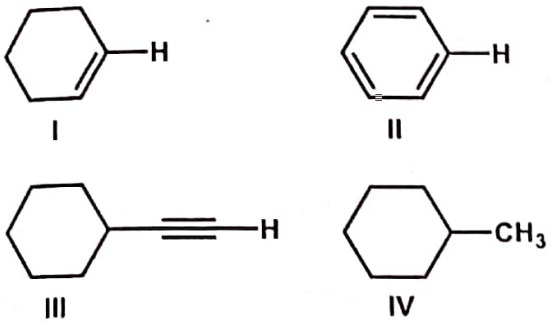
a) ii and iv b) i and iii c) ii and iii d) iii and iv

Q.148) Match the bonds with their corresponding frequency of vibration.

Bonds	Frequency of Vibration
a. C-H (stretching)	i. 3000 cm^{-1}
b. =C-H	ii. 1340 cm^{-1}
c. C-O (stretching)	iii. 1100 cm^{-1}
d. C-H (bending)	iv. 3100 cm^{-1}

a) a – i, b – iii, c – iv, d – ii
b) a – iii, b – iv, c – I, d –ii
c) a – i, b – iv, c. – iii, d – ii
d) a – i, b – iii, c – iv, d –ii

Q.149). The correct order of ^1H NMR shift values for the indicated hydrogen in the following compound is

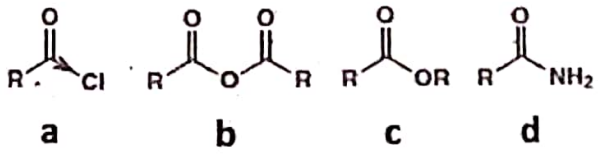


a) I > II > III > IV b) II > I > III > IV c) III > II > I > IV d) II > III > IV > I

Q.150) The ^1H NMR spectrum of a mixture of acetone and chloroform shows a 1: 1 intensity by integration, the molar ratio of these solvents (acetone: chloroform) in the solution would be ___

a) 1:1 b) 1:3 c) 1:6 d) 6:1

Q.151) Consider the compounds shown below:



The correct order of C=O stretching frequency would be

a) a > b > c > d b) b > a > c > d c) b > d > a > c d) a > c > b > d

Q.152) The normal modes of vibration of naphthalene is _____

a) 55 b) 54 c) 48 d) 49

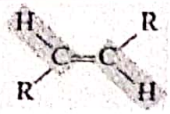
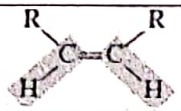
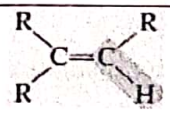
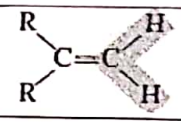
Q.153) A solution of a compound in ethanol shows an absorbance of 0.52 at 236 nm in a cell with a 1 cm light path. Its molar absorptivity in ethanol at the wavelength is 12600 M^{-1} cm^{-1}. The concentration of the compound is approx. _____ × 10^{-5} M.

a) 4.1 b) 3.7 c) 3.3 d) 2.8

Q.154) The number of peaks or signals in ^1H-NMR of nitrobenzene at 25°C is _____

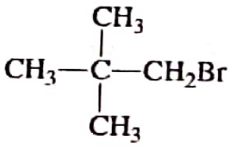
a) 2 b) 3 c) 4 d) 6

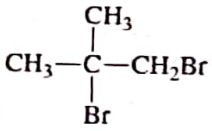
Q.155) Match the bonds with their corresponding C-H bending vibration

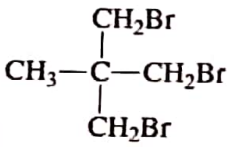
Bonds	C-H bending vibration
a. 	i. 840 cm^{-1}
b. 	ii. 890 cm^{-1}
c. 	iii. 730 cm^{-1}
d.  terminal alkene (disubstituted)	iv. 980 cm^{-1}

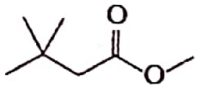
a) a – iii, b – iv, c – i, d – ii
b) a – iv, b – iii, c – i, d – ii
c) a – ii, b – i, c – iv, d – iii
d) a – i, b – iv, c – ii, d – iii

Q.156) Which of the following compounds with different kinds of proton would give an integral ratio of 6: 4: 18.4 in going from left to right across the compound?

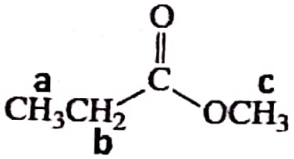
(a) 

(b) 

(c) 

(d) 

Q.157) Consider the compound shown below with protons marked as a, b and c



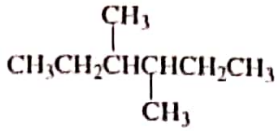
Which of the following proton is least shielded?

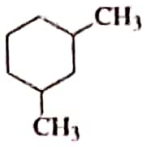
(a) a b) b c) c d) a, b, c are equally shielded

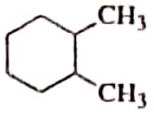
Q.158) A solution prepared by mixing 10 mL of a 0.10 M solution of the *R* enantiomer of a compound and 30 mL of a 0.10 M solution of the *S* enantiomer was found to have an observed specific rotation of +4.8. The specific rotation of each of the enantiomers would be _____.

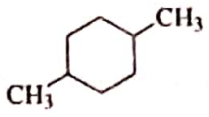
a) 6.5 b) 7.6 c) 8.4 d) 9.6

Q.159) Which of the following compounds do not have a stereoisomer which is a meso compound?

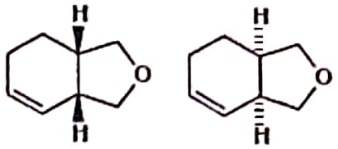
(a) 

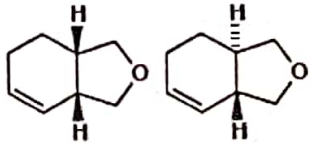
(b) 

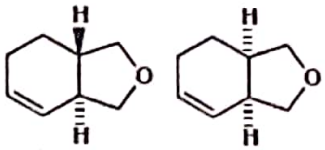
(c) 

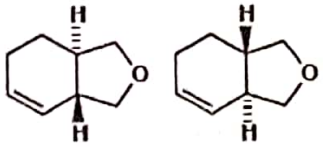
(d) 

Q.160) Which of the following pairs are enantiomeric in nature?

(a) 

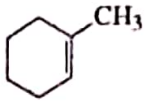
(b) 

(c) 

(d) 

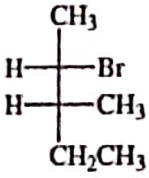
a) a and b b) a and d c) b and c d) b and d

Q.161) The number of carbons in the planar double bond system is

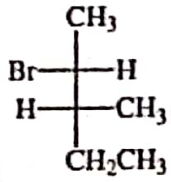


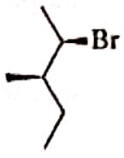
a) 2 b) 3 c) 4 d) 5

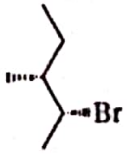
Q.162) Consider the compound shown below:

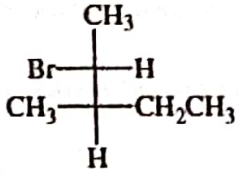


Which of the following are the diastereomers to the compound shown above?

(a) 

(b) 

(c) 

(d) 

a) a and b b) b and c c) a, b and d d) a, b, c and d

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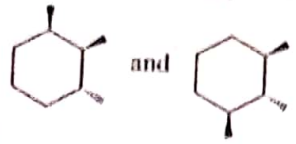
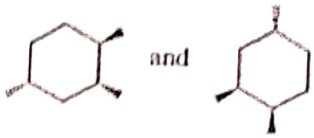
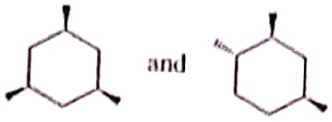
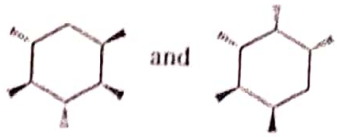
Q.163) Which of the following pair of compounds are constitutional isomers to each other?

(a)  and

(b)  and

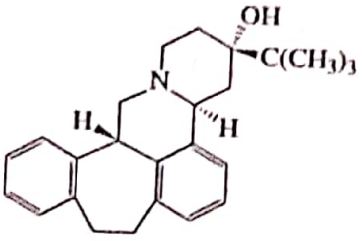
(c)  and

(d)  and

Q.164) The increasing order of energy of various conformations of cyclohexane molecule is ____

a) Twist boat < boat <chair < half chair
b) Boat < twist boat < half chair < chair
c) Chair < half chair < twist boat < boat
d) Chair < twist boat < boat < half chair

Q.165) Consider the compound shown below:



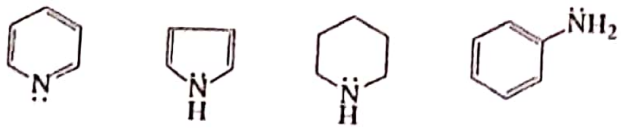
The number of asymmetric centres in the compound is

a) 1 b) 3 c) 4 d) 5

Q.166) The stereochemical outcome of the SN^2 reaction on an optically active substrate will be

a) Inversion in configuration
b) Retention in configuration
c) Partial racemization
d) Complete racemization

Q.167) Consider the compounds shown below:



1 2 3 4

The correct order of the compounds from least basic to most basic would be

a) (3) < (2) < (1) < (4)
b) (2) < (4) < (1) < (3)
c) (3) < (4) < (2) < (1)
d) (4) < (3) < (1) < (2)

Q.168) As per the laws of Thermodynamics, the maximum work that can be derived from a chemical reaction is equal to _____ for the reaction.

a) ΔH b) ΔG c) ΔT d) ΔE

Q.169) Real gases obey the ideal gas equation most closely at ____ temperature and ____ pressure.

a) low, low b) low, high c) high, high d) high, low

Q.170) One mole of any gas at 0°C, 1 ATM pressure occupies a volume of approximately ____ litres.

a) 0.53 b) 20.8 c) 22.4 d) 2.24

Q.171) Which of the following are examples of ionic crystals?

(i) LiF
(ii) NaCl
(iii) KCl
(iv) KBr

a) (i) and (ii) b) (iii) and (ii) c) (i), (ii) and (iii) d) (i), (ii), (iii) and (iv)

Q.172) In a zero-order reaction, the rate of reaction is

a) independent of the reactant concentrations
b) proportional to the concentration of one reactant
c) proportional to the concentration of two reactants
d) proportional to the second power of a single reactant

Q.173) What is the molarity of a solution made by dissolving 9.8g of Sulphuric Acid in enough water to make 0.4 litres of solution?

a) 0.1 b) 0.2 c) 0.25 d) 0.4

Q.174) Normality is defined as

a) Equivalents of substance / volume of solution in litres
b) Moles of substance × volume of solution in litres
c) Mass of substance in grams / equivalent mass of substance
d) Mass of substance in grams / Molecular Mass

Q.175) In volumetric analysis, the strength of the standard solution is ____

a) always 1 unit b) known c) unknown d) always 0.1 unit

Q.176) Which of the following are correctly matched with their explanations.

(i) Percentage composition by weight – Number of grams of solute per 100gms of solution
(ii) Percentage composition by volume – 30% ethanol solution contains 30 ml ethanol and 70 ml water.
(iii) Percentage strength – a 10% solution of sodium hydroxide means 10gms of sodium hydroxide in 100 ml solution.

a) (i) and (ii) b) (iii) and (ii) c) (i) only d) (i), (ii) and (iii)

Q.177) Which of the following statements are true?

(i) Faraday was able to liquify gases like Hydrogen, Oxygen and Nitrogen.
(ii) Faraday was unable to liquify gases like SO_2, Cl_2 and CO_2.

a) true, true b) true, false c) false, true d) false, false

Q.178) For an idea gas, compressibility factor z = 1 indicates it is

a) independent of pressure
b) independent of temperature
c) independent of temperature and pressure
d) none of the above

Q.179) Which names of the system along with characteristics required for membership are correctly matched?

(i) Triclinic – a single 3-fold axis (rotation or inverse)
(ii) Tetragonal – a single 4-fold axis (rotation or inverse)
(iii) Monoclinic - a single 2-fold axis (rotation or inverse)

a) i only b) i and ii c) i, ii and iii d) ii and iii

Q.180) NaCl crystal has ___ elements of symmetry.

a) 1 b) 9 c) 13 d) 23

Q.181) The moment of inertia *I of a* diatomic molecule of bond length *R* composed of atoms of masses m_A and m_B is__

a) $I = \frac{m_A m_B}{m_A - m_B} R^2$ b) $I = \frac{m_A m_B}{m_A + m_B} R^2$ c) $I = \frac{m_A m_B}{m_A + m_B} R$ d) $I = \frac{m_A + m_B}{m_A m_B} R^2$

Q.182) Which of the following are correct in the content of calorific value?

(i) The heat energy released by the complete combustion of unit quantity of fuel is called the calorific value of the fuel.
(ii) A bomb calorimeter is used to measure calorific value of a substances like solid and liquid fuels.

a) incorrect, incorrect b) incorrect, correct c) correct, incorrect d) correct, correct

Q.183) The collision cross section for two molecules can be regarded as the area within which the molecule A hits molecule B for collision to occur. d_A and d_B are the respective diameters of reactant molecules A and B. The radius of the contact area of molecules A and B respectively is given by the expression:

$d_{AB} = \frac{d_A + d_B}{2}$, **Then the area of cross section is given by the expression ____**

a) $\sigma = d_{AB}^2$ b) $\sigma = \frac{\pi d_{AB}^2}{2}$ c) $\sigma = \frac{\pi d_{AB}^2}{4}$ d) $\sigma = \pi d_{AB}^2$

Q.184) If volume at critical point of a real gas = 0.15 units, then its van der Waal coefficient will be ____

a) 0.05 b) 0.5 c) 0.45 d) 0.3

Q.185) Which law states "under constant pressure, the volume of a fixed mass of gas varies directly with its absolute temperature."

a) Faraday's law b) Hess's law c) Charle's law d) Combined gas law

Q.186) An electrochemical cell consists of two half-cells. Which of the following are correct about half-cells?

(1) Each half cell consists of an electrode and an electrolyte.

(2) The two half-cells may use the same electrolyte or may use different electrolytes.

a)Both (1) and (2) are correct b)Both (1) and (2) are incorrect

c)Only (1) is correct d)Only (2) is correct

Q.187) Find the incorrect statement.

a) Most of the elements in the Periodic Table have different isotopes.

b) While every isotope of a given element has a different number of neutrons in their nuclei, they have the same number of protons.

c) Hydrogen has one proton in its nucleus.

d) All versions of hydrogen have neutrons, except the hydrogen isotope known as deuterium, which has no neutron.

Q.188) Which of the following is not true?

a) Fusion occurs when two atoms slam together to form a heavier atom.

b) An example of fusion is when two hydrogen atoms fuse to form one helium atom.

c) Fusion is the process that powers the sun and creates huge amounts of energy.

d) Fission creates energy several times greater than fusion.

Q.189) The overall order of the Hydrogen Bromine reaction, $H_2 + Br_2 \rightarrow 2HBr$ is ____

a) 1 b) 2 c) 3 d) 3/2

Q.190) For intermediate range of temperature, in Freundlich Adsorption Isotherm, the value of 1/n is _____

a) 1 in the case of physical adsorption b) 1 in the case of chemisorption

c) between 0 and 1 in all cases d) between 1 and 2 in all cases

Q.191) Number of nodes in a 3p orbital is ____

a) 1 b) 2 c) 0 d) 3

Q.192) The mathematical statement of Gibbs phase rule is ____

a) $F = C - P + 2$ b) $C = F - P + 2$ c) $C = F - P + 1$ d) $P = C + F + 2$

Q.193) The vibrational degree of freedom for CO_2, H_2O and HCl is ____

a) 3, 4, 1 b) 2, 3, 9 c) 4, 3, 1 d) 4, 2, 6

Q.194) In reference to Raman spectroscopy, the first stoke's and antistokes' line will be at a separation of _____ from the Rayleigh line.

a) 2B b) 3B c) 4B d) 6B

Q.195) The value of $\left(\frac{\partial H}{\partial P}\right)_T$ for solids and liquids is _____ (where H, P, T have their usual meanings)

a) V b) V μ J T c) V / μ J T d) μ J T

Q.196) For an ideal gas undergoing isothermal reversible expansion, which of the following relations stands true? (where G is Gibbs free energy and A is Helmholtz free energy)

a) $\Delta G = \Delta A$ b) $\Delta G > \Delta A$ c) $\Delta G < \Delta A$ d) $\Delta G \geq \Delta A$

Q.197) The final volumes for adiabatic expansion and isothermal expansions are related as ____

a) $V_{adiabatic} = V_{isothermal}$ b) $V_{adiabatic} > V_{isothermal}$

c) $V_{adiabatic} < V_{isothermal}$ d) Data Insufficient

Q.198) The correct order of observed molar ionic conductivities should be ____

a) $Li^+ > Na^+ > K^+ > Rb^+$ b) $Li^+ < Na^+ < K^+ < Rb^+$

c) $Li^+ = Na^+ < K^+ < Rb^+$ d) $Li^+ < Na^+ < K^+ = Rb^+$

Q.199) Partial molar quantities are ____

a) Extensive property b) Intensive property c) both extensive and intensive property d) data insufficient

Q.200) A thermodynamics equation that relates chemical potential to the composition of mixture is known as

a) Gibbs - Helmholtz equation b) Gibbs - Duhem Equation

c) Joule - Thomson Equation d) Debye - Huckel Equation

SET A