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JEE • NEET • MHT-CET

2023_JEE Actual Paper_1 Feb_1st Shift

FULL SYLLABUS

Date : 1-2-2023

Marks : 300

PHYSICS

1) **The mass of proton, neutron and helium nucleus are respectively 1.0073 u, 1,0087 u and 4,0015 u. The binding energy of helium nucleus is:**

a) 14.2MeV
b) 56.8MeV
c) 28.4MeV
d) 7.1MeV

2) $\left(P+\frac{a}{v^2}\right)$**(V – b) = RT represents the equation of state of some gases. Where P is the pressure, Vis the volume, Tis the temperature and a, b, R are the constants. The physical quantity, which has dimensional formula as that of** $\frac{b^2}{a}$**, will be:**

a) Bulk Modulus
b) Energy density
c) Compressibility
d) Modulus of rigidity

3) **A mercury drop of radius** 10^{-3} **m is broken into 125 equal size droplets.**

Surface tension of mercury is 0.45 Nm^{-1}**, The gain in surface energy is:**

a) 2.26×10^{-5}J
b) 5×10^{-5}J
c) 17.5×10^{-5}J
d) 28×10^{-5}J

4) **An object moves with speed** v_1**,** v_2 **and** v_3 **along a line segment AB, BC and CD respectively as shown in figure. Where AB=BC and AD = 3AB, then average speed of the object will be:**

a) $\frac{\nu_1\nu_2\nu_3}{3(\nu_1\nu_2+\nu_2\nu_3+\nu_3\nu_1)}$
b) $\frac{(\nu_1+\nu_2+\nu_3)}{3}$
c) $\frac{3\nu_1\nu_2\nu_3}{(\nu_1\nu_2+\nu_2\nu_3+\nu_3\nu_1)}$
d) $\frac{(\nu_1+\nu_2+\nu_3)}{3\nu_1\nu_2\nu_3}$

5) **If earth has a mass nine times and radius twice to that of a planet P. Then** $\frac{\nu_e}{3}\sqrt{x}ms^{-1}$ **will be the minimum velocity required by a rocket to pull out of 3 gravitational force of P, where** ν_e **is escape velocity on earth. The value of x is**

a) 18
b) 1
c) 2
d) 3

6) **Match List I with List II:**

	Column I		**Column II**
A.	Microwaves	I.	Radio active decay of the nucleus
B.	Gamma rays	II.	Rapid acceleration and deceleration of electron in aerials
C.	Radio waves	III.	Inner shell electrons
D.	X-rays	IV.	Klystron valve

Choose the correct answer from the options given below:

a) A-IV, B-III, C-II, D-I b) A-I, B-II, C-III, D-IV

c) A-I, B-III, C-IV, D-II d) A-IV, B-I, C-II, D-III

7) **A sample of gas at temperature T is adiabatically expanded to double its volume. The work done by the gas in the process is** $\left(given\ \gamma = \frac{3}{2}\right)$

a) $W = \frac{R}{T}\left[2 - \sqrt{2}\right]$ b) $W = \frac{T}{R}\left[\sqrt{2} - 2\right]$

c) $W = TR\left[\sqrt{2} - 2\right]$ d) $W = RT\left[2 - \sqrt{2}\right]$

8) **A proton moving with one tenth of velocity of light has a certain de Broglie wavelength of λ. An alpha particle having certain kinetic energy has the same de-Brogle wavelength λ. The ratio of kinetic energy of proton and that of alpha particle is:**

a) 1 : 2 b) 2 : 1

c) 4 : 1 d) 1 : 4

9) **Match List I with List II:**

	Column I		**Column II**
A.	Intrinsic semiconductor	I.	Fermi-level near the valence band
B.	n-type semiconductor	II.	Fermi-level in the middle of valence and conduction band.
C.	p-type semiconductor	III.	Fermi-level near the conduction band
D.	Metals	IV.	Fermi-level inside the conduction band

Choose the correct answer from the options given below:

a) A-II, B-I, C-III, D-IV b) A-I, B-II, C-III, D-IV

c) A-II, B-III, C-I, D-IV d) A-III, B-I, C-II, D-IV

10) **Which of the following frequencies does not belong to FM broadcast.**

a) 106MHz b) 89MHz

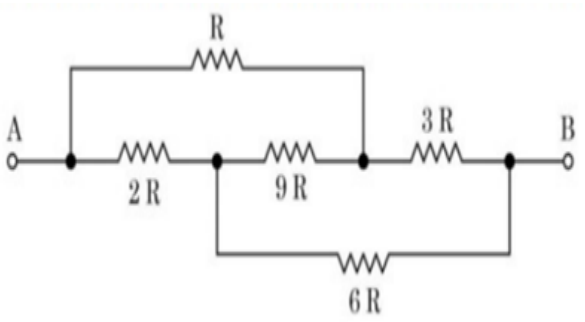
c) 93MHz d) 64MHz

11) **The average kinetic energy of a molecule of the gas is**

a) dependent on the nature of the gas b) proportional to pressure

c) proportional to absolute temperature d) proportional to volume

12) **The equivalent resistance between A and B of the network shown in figure:**



a) $11\frac{2}{3}R$
b) 14R
c) $\frac{8}{3}R$
d) 21R

13) **A child stands on the edge of the cliff 10 m above the ground and throws a stone horizontally with an initial speed of 5 ms^{-1}. Neglecting the air resistance, the speed with which the stone hits the ground will be _____ ms^{-1} (given, g = 10 ms^{-2}).**

a) 15
b) 30
c) 20
d) 25

14) **A steel wire with mass per unit length 7.0 × 10^{-3} kgm^{-1} is under tension of 70 N. The speed at transverse waves in the wire will be:**

a) 10 m/s
b) 100m/s
c) 50m/s
d) 200π m/s

15) **Match List I with List II:**

	Column I		**Column II**
A.	AC generator	I.	Presence of both L and C
B.	Transformer	II.	Electromagnetic Induction
C.	Resonance phenomenon to occur	III.	Quality factor
D.	Sharpness of resonance	IV.	Mutual Induction

Choose the correct answer from the options given below:

a) A-II, B-IV, C-I, D-III
b) A-IV, B-II, C-I, D-III
c) A-IV, B-III, C-I, D-II
d) A-II, B-I, C-III, D-IV

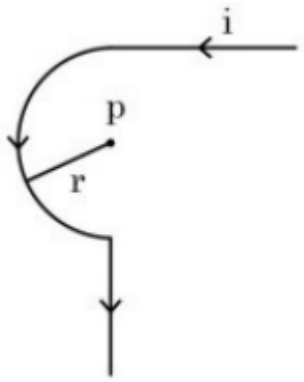
16) **'n' polarizing sheets are arranged such that each makes an angle 45° with the preceeding sheet. An unpolarized light of intensity I is incident into this arrangement. The output intensity is found to beI/64. The value of n will be:**

a) 3
b) 5
c) 4
d) 6

17) **A block of mass 5 kg is placed at rest on a table of rough surface. Now, if a force of 30N is applied in the direction parallel to surface of the table, the block slides through a distance of 50 m in an interval of time 10s. Coefficient of kinetic friction is (given, g = 10 ms^{-2}):**

a) 0.75
b) 0.60
c) 0.50
d) 0.25

18) **Find the magnetic field at the point P in figure. The curved portion is a semicircle connected to two long straight wires.**



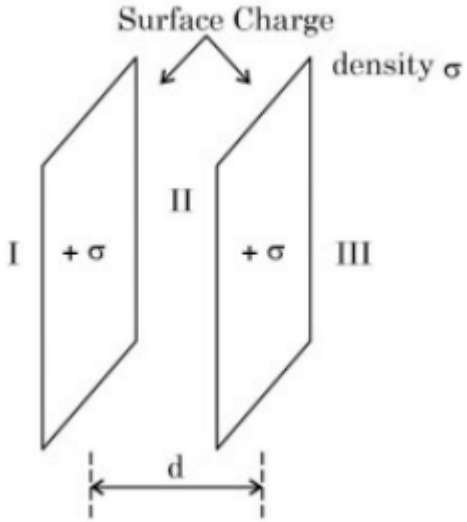
a) $\frac{\mu_0 i}{2r}\left(\frac{1}{2}+\frac{1}{2\pi}\right)$

b) $\frac{\mu_0 i}{2r}\left(1+\frac{1}{\pi}\right)$

c) $\frac{\mu_0 i}{2r}\left(\frac{1}{2}+\frac{1}{\pi}\right)$

d) $\frac{\mu_0 i}{2r}\left(1+\frac{2}{\pi}\right)$

19) **Let σ be the uniform surface charge density of two infinite thin plane sheets shown in figure. Then the electric fields in three different region E_I,E_{II} and E_{III} are:**



a) $\vec{E}_I = \frac{2\sigma}{\epsilon_0}\hat{n}, \vec{E}_{II} = 0, \vec{E}_{III} = \frac{2\sigma}{\epsilon_0}\hat{n}$

b) $\vec{E}_I = \frac{\sigma}{2\epsilon_0}\hat{n}, \vec{E}_{II} = 0, \vec{E}_{III} = \frac{\sigma}{2\epsilon_0}\hat{n}$

c) $\vec{E}_I = 0, \vec{E}_{II} = \frac{2\sigma}{\epsilon_0}\hat{n}, \vec{E}_{III} = 0$

d) $\vec{E}_I = -\frac{\sigma}{\epsilon_0}\hat{n}, \vec{E}_{II} = 0, \vec{E}_{III} = \frac{\sigma}{\epsilon_0}\hat{n}$

20) Given below are two statements:

Statement I: Acceleration due to gravity is different at different places on the surface of earth.

Statement II: Acceleration due to gravity increases as we go down below the earth's surface.

In the light of the above statements, choose the correct answer from the options given below

a) Statement I is false but Statement II is true

b) Both Statement I and Statement II are false

c) Both Statement I and Statement II are true

d) Statement I is true but Statement II is false

21) A charge particle of 2 μC accelerated by a potential difference of 100V enters a region of uniform magnetic field of magnitude 4 mT at right angle to the direction of field. The charge particle completes semicircle of radius 3 cm inside magnetic field. The mass of the charge particle is _____ $\times 10^{-18}$ kg.

)

22) A light of energy 12.75 eV is incident on a hydrogen atom in its ground state. The atom absorbs the radiation and reaches to one of its excited states. The angular momentum of the atom in the excited state is $\frac{x}{\pi} \times 10^{-17}$eVs. The value of x is _____ (use h = 4.14×10^{-15}eVs, c = 3×10^8 ms^{-1}).

)

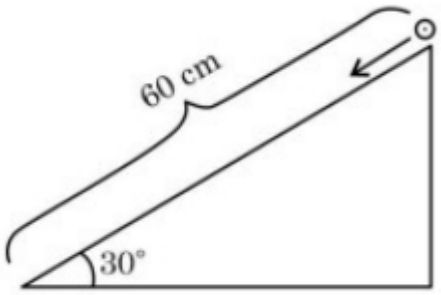
23) A thin cylindrical rod of length 10 cm is placed horizontally on the principle axis of a concave mirror of focal length 20 cm. The rod is placed in a such a way that mid point of the rod is at 40 cm from the pole of mirror. The length of the image formed by the mirror will be $\frac{x}{3}$cm. The value of x is _____

)

24) A small particle moves to position $5\hat{i}-2\hat{j}+\hat{k}$ from its initial position $2\hat{i}+3\hat{j}-4\hat{k}$ under the action of force $5\hat{i}+2\hat{j}+7\hat{k}N$. The value of work done will be _____ J.

)

25) A solid cylinder is released from rest from the top of an inclined plane of inclination 30° and length 60 cm. If the cylinder rolls without slipping, its speed upon reaching the bottom of the inclined plane is _____ ms^{-1}. (Given $g = 10\ ms^{-2}$)



)

26) In an experiment to find emf of a cell using potentiometer, the length of null point for a cell of emf 1.5 V is found to be 60 cm. If this cell is replaced by another cell of emf E, the length-of null point increases by 40 cm. The value of E is $\frac{x}{10}$ V . The value of x is _____

)

27) A series LCR circuit is connected to an ac source of 220V, 50Hz. The circuit contain a resistance R = 100Ω and an inductor of inductive reactance X_L = 79.6Ω. The capacitance of the capacitor needed to maximize the average rate at which energy is supplied will be _____μF.

)

28) A certain pressure 'P' is applied to 1 litre of water and 2 litre of a liquid separately. Water gets compressed to 0.01% whereas the liquid gets compressed to 0.03%. The ratio of Bulk modulus of water to that of the liquid is 3/x. The value of x is _____ .

)

29) The amplitude of a particle executing SHM is 3 cm. The displacement at which its kinetic energy will be 25% more than the potential energy is; _____ cm.

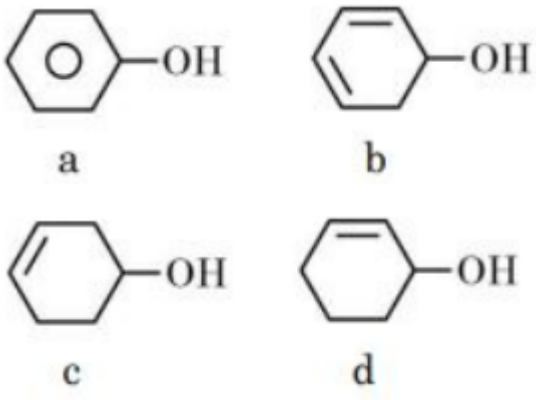
)

30) Two equal positive point charges are separated by a distance 2α. The distance of a point from the centre of the line joining two charges on the equatorial line (perpendicular bisector) at. which force experienced by a test charge q_0 becomes maximum is $\frac{a}{\sqrt{x}}$. The value of x is _____ .

)

CHEMISTRY

31) **Decreasing order of dehydration of the following alcohols is**



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

32) **Choose the correct statement(s):**

A, Beryllium oxide is purely acidic in nature.

B. Beryllium carbonate is kept in the atmosphere of CO_2.

C. Beryllium sulphate is readily soluble in water.

D. Beryllium shows anomalous behavior.

Choose the correct answer from the options given below

a) B, C and D
b) A only
c) A, B and C only
d) A and B only

33) **Which of the following complex will show largest splitting of d-orbitals?**

a) $[Fe(C_2O_4)_3]^{3-}$
b) $[Fe(CN)_6]^{3-}$
c) $[Fe(NH_3)_6]^{3}$
d) $[FeF_6]^{3-}$

34) **Match List I with List II**

	List I		**List II**
	Test		Functional group / Class of Compound
A.	Molisch's Test	I.	Peptide
B.	Biuret Test	II.	Carbohydrate
C.	Carbylamine Test	III.	Primary amine
D.	Schiff s Test	IV.	Aldehyde

Choose the correct answer from the options given below:

a) A-I, B-II, C-III, D-IV
b) A-III, B-IV, C-II, D-I
c) A-II, B-I, C-III, D-IV
d) A-III, B-IV, C-I, D-II

35) Given below are two statements:

Statement I: Chlorine can easily combine with oxygen to form oxides; and the product has a tendency to explode.

Statement II: Chemical reactivity of an element can be determined by its reaction with oxygen and halogens.

In the light of the above statements, choose the correct answer from the options given below.

a) Statement I is false hut Statement II is true
b) Both the Statements I and II are false
c) Statement I is true but Statement II is false
d) Both the Statements I and II are true

36) Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R

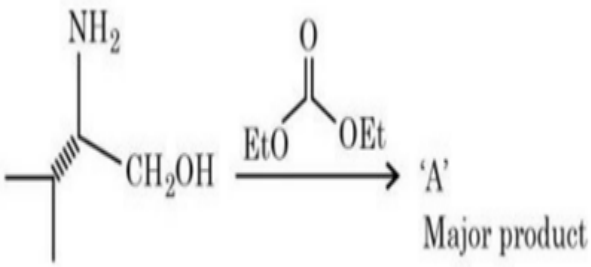
Assertion A: In an Ellingham diagram, the oxidation of carbon to carbon monoxide shows a negative slope with respect to temperature.

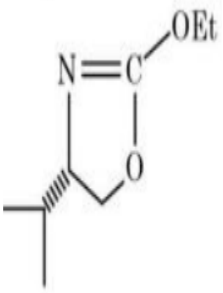
Reason R: CO tends to get decomposed at higher temperature.

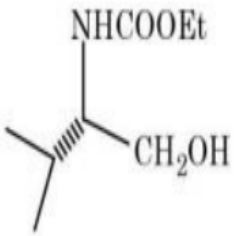
In the light of the above statements, choose the correct answer from the options given below

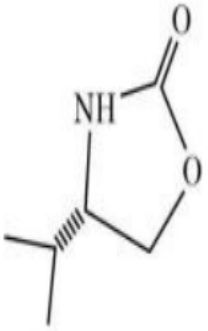
a) A is correct but R is not correct
b) Both A and R are correct hut R is NOT the correct explanation of A
c) A is not correct but R is correct
d) Both A and R are correct and R is the correct explanation of A

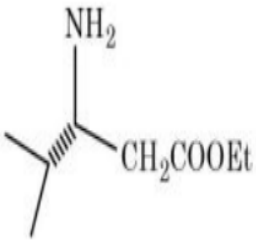
37) **In the following reaction, 'A' is**



a) 

b) 

c) 

d) 

38) **Which of the following are the example of double salt? .**

A. $FeSO_4.(NH_4)_2SO_4.6H_2O$

B. $CuSO_4.4NH_3.H_2O$

C. $K_2SO_4.Al_2(SO_4)_3.24H_2O$

D. $Fe(CN)_2.4KCN$

Choose the correct answer

a) A, B and D only
b) B and D only
c) A and C only
d) A and B only

39) **But-2-yne is reacted separately with one mole of Hydrogen as shown below:**

$$\underline{B} \xleftarrow[liq\ NH_3]{Na} CH_3 - \underset{+H_2}{C \equiv C} - CH_3 \xrightarrow[\Delta]{Pd/C} \underline{A}$$

A. A is more soluble than B.

B. The boiling point & melting point of A are higher and lower than B respectively.

C. A is more polar than B because dipole moment of A is zero.

D. Br_2 adds easily to B than A.

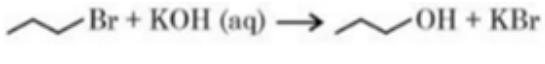
Identify the correct statements from the options given below:

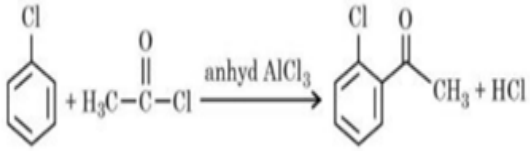
a) A and B only
b) B and C only
c) A, C & D only
d) B, C & D only

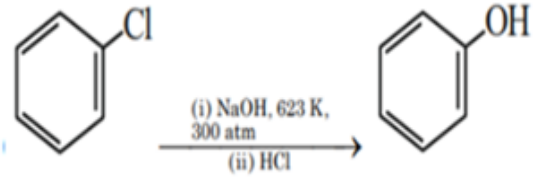
40) **How can photochemical smog be controlled**

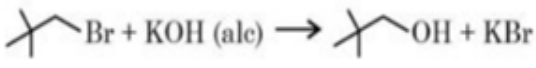
a) By using tall chimneys
b) By using catalytic converters in the automobiles/industry
c) By complete combustion of fuel
d) By using catalyst

41) **Identify the incorrect option from the following**

a) 

b) 

c) 

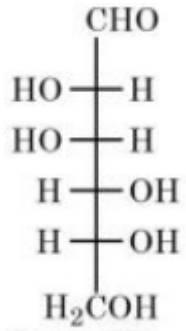
d) 

42) **A solution of $FeCl_3$ when treated with $K_4[Fe(CN)_6]$ gives a prussiun blue precipitate due to the formation of**

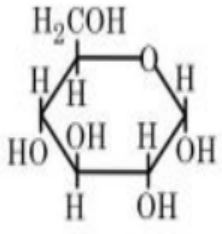
a) $K[Fe_2(CN)_6]$ b) $Fe_3[Fe(CN)_6]_2$

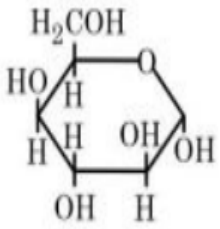
c) $Fe_4[Fe(CN)_6]_3$ d) $Fe[Fe(CN)_6]$

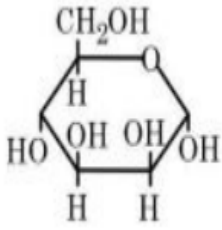
43) **The correct representation in six membered pyranose form for the following sugar [X] is**

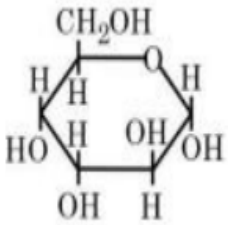


Sugar [X]

a) 

b) 

c) 

d) 

44) Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R

Assertion A: Hydrogen is an environment friendly fuel.

Reason R: Atomic number of hydrogen is 1 and it is a very light element.

In the light of the above statements, choose the correct answer from the options given below

a) A is true but R is false

b) Both A and R are true and R is the correct explanation of A

c) Both A and R are true but R is NOT the correct explanation of A

d) A is false but R is true

45) **Match List I with List II**

	List I		**List II**
A.	Slaked lime	I.	NaOH
B.	Dead burnt piaster	II.	$Ca(OH)_2$
C.	Caustic soda	III.	$Na_2CO_3.10H_2O$
D.	Washing soda	IV.	$CaSO_4$

Choose the correct answer from the options given below:

a) A-III, B-IV, C-II, D-I b) A-II, B-IV, C-I, D-III

c) A-I, B-IV, C-II, D-III d) A-III, B-II, C-IV, D-I

46) **Assertion A:** Amongst He, Ne, Ar and Kr; 1g of activated charcoal adsorbs more of Kr.

Reason R: The critical volume V_c (cm^3 mol^{-1}) and critical pressure P_c (atm) is highest for Krypton but the compressibility factor at critical point Z_c is lowest for Krypton.

In the light of the above statements, choose the correct answer from the options given below

a) Both A and R are true and R is the correct explanation of A

b) A is false but R is true

c) A is true but R is false

d) Both A and R are true but R is NOT the correct explanation of A

47) **Highest oxidation state of Mn is exhibited in Mn_2O_7. The correct statements about Mn_2O_7 are**

A. **Mn is tetrahedrally surrounded by oxygen atoms.**

B. **Mn is octahedrally surrounded by oxygen atoms.**

C. **Contains Mn-O-Mn bridge.**

D. **Contains Mn-Mn bond.**

Choose the correct answer from the options given below:

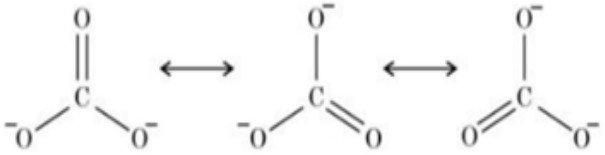
a) A and C only

b) B and C only

c) B and D only

d) A and D only

48) **Resonance in carbonate ion (CO_3^{2-}) is**



Which of the following is true?

a) All these structures are in dynamic equilibrium with each other.

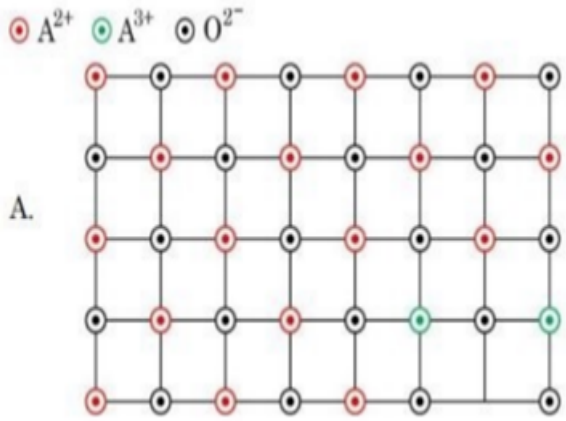
b) CO_3^{2-} has a single structure i.e., resonance hybrid of the above three structures.

c) It is possible to identify each structure individually by some physical or chemical method.

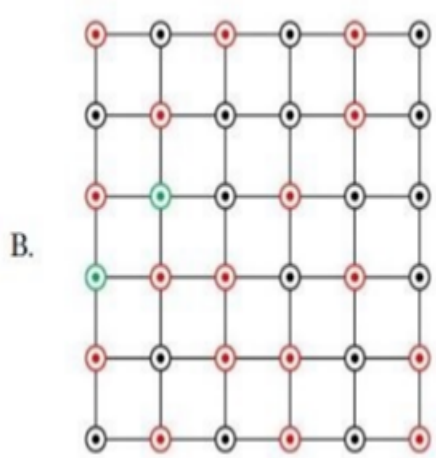
d) Each structure exists for equal a mount of time

49) **Which of the following represents the lattice structure of $A_{0.95}O$ containing A^{2+}; A^{3+} and O^{2-} ions?**

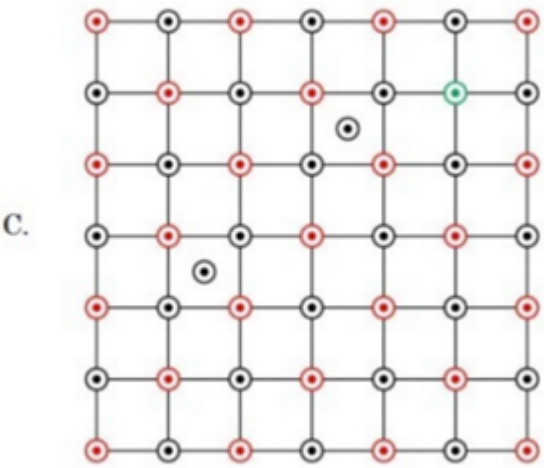
A.



B.



C.



a) A only
b) B only
c) B and C only
d) A and B only

50) Match List I with List II

	List I		**List II**
A.	Tranquilizers	I.	Anti blood clotting
B.	Aspirin	II.	Salvarsan
C.	Antibiotic	III.	antidepressant drugs
D.	Antiseptic	IV.	soframicine

Choose the correct answer from the options given below:

a) A-III, B-I, C-II, D-IV
b) A-II, B-I, C-III, D-IV
c) A-II, B-IV, C-I, D-III
d) A-IV, B-II, C-I, D-III

51) Electrons in a cathode ray tube have been emitted with a velocity 1000 m s^{-1}. The number of following statements which is/are true about the emitted radiation is _____

Given :h =6×10^{-34}Js, $m_e = 9 \times 10^{-31}$ kg.

(A) The deBroglie wavelength of the electron emitted is 666.67 nm.

(B) The characteristic of electrons emitted depend upon the material of the electrodes of the cathode ray tube.

(C) The cathode rays start from cathode and move towards anode.

(D) The nature of the emitted electrons depends on the nature of the gas present in cathode ray tube.

)

52) **Numerical Value Marking (+4, 0)**

At what pH, given half cell $\mathrm{MnO_4^-}\left(0.1\mathrm{M}\right) \mid \mathrm{Mn^{+2}}\ \left(0.001\ \mathrm{M}\right)$ will have electrode potential of 1.282 V?(Nearest Integer)

Given

$E^o_{MnO_4^-|Mn^{2+}} = 1.54V, \frac{2.303RT}{F} = 0.059V$

)

53) The density of 3 M solution of NaCl is 1.0 g mL^{-1}. Molality of the solution is _____ $\times$ 10^{-2}m. (Nearest integer). Given: Molar mass of Na and Cl is 23 and 35.5 g mol^{-1} respectively.

)

54) 25 mL of an aqueous solution of KCl was found to require 20 mL of 1 M $AgNO_3$ solution when titrated using K_2CrO_4 as an indicator. What is the depression in freezing point of KCl solution of the given concentration?

_____ (Nearest integer). (Given: K_f = 2.0 K kg mol^{-1})

Assume 1) 100% ionization and

2) density of the aqueous solution as 1 g mL^{-1}

)

55) At 25°C, the enthalpy of the following processes are given:

$H_2(g) + O_2(g) \rightarrow 2OH(g)$ **$\Delta H° = 78$ kJ mol^{-1}**

$H_2(g) + 1/2O_2(g) \rightarrow H_2O(g)$ **$\Delta H° = -242$ kJ mol^{-1}**

$H_2(g) \rightarrow 2H(g)$ **$\Delta H° = 436$ kJ mol^{-1}**

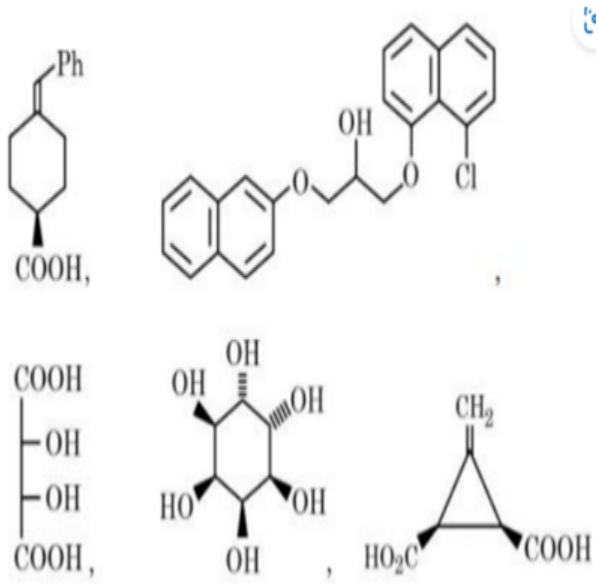
$1/2\ O_2(g) \rightarrow O(g)$ **$\Delta H° = 249$ kJ mol^{-1}**

What would be the value of X for the following reaction? (Nearest integer)

$H_2O(g) \rightarrow H(g) + OH(g)\ \Delta H° = X$ kJ mol^{-1}

)

56) The total number of chiral compound/s from the following is _____



)

57) Sum of oxidation states of bromine in bromic acid and perbromic acid is _____

)

58) A and B are two substances undergoing radioactive decay in a container.

The half life of A is 15 min and that of B is 5 min. If the initial concentration of B is 4 times that of A and they both start decaying at the same time, how much time will it take for the concentration of both of them to be same?

)

59) Number of isomeric compounds with molecular formula $C_9H_{10}O$ which (i) do not dissolve in NaOH (ii) do not dissolve in HCl. (iii) do not give orange precipitate with 2,4-DNP (iv) on hydrogenation give identical compound with molecular formula $C_9H_{12}O$ is _____

)

60) (i) $X(g) \rightleftharpoons Y(g) + Z(g)$ Kp = 3

(ii) $A(g) \rightleftharpoons 2B(g)$ Kp = 1

If the degree of dissociation and initial concentration of both the reactants X(g) and A(g) are equal, then the ratio of the total pressure at equilibrium

$\left(\frac{p_1}{p_2}\right)$ is equal to x : 1. The value of x is _____ (Nearest integer)

)

MATHEMATICS

61) **The sum to 10 terms of the series** $\frac{1}{1+1^2+1^4} + \frac{2}{1+2^2+2^4} + \frac{3}{1+3^2+3^4} + \ldots. \; is$

a) $\frac{59}{111}$ b) $\frac{56}{111}$

c) $\frac{55}{111}$ d) $\frac{58}{111}$

62) **Let S denote the set of all real values of λ such that the system of equations**

λx + y + z = 1

x + λy + z = 1

x + y + λz = 1

is inconsistent, then $\sum_{\lambda \in S}\left(|\lambda|^2 + |\lambda|\right)$ **is equal to**

a) 12 b) 4

c) 2 d) 6

63) **Let S = {x : x ∈ R and** $\left(\sqrt{3}+\sqrt{2}\right)^{x^2-4} + \left(\sqrt{3}-\sqrt{2}\right)^{x^2-4} = 10\Big\}$.

Then n(S) is equal to

a) 0 b) 4

c) 6 d) 2

64) **Let**

$$f\left(x\right) = \begin{vmatrix} 1+\sin^2 x & \cos^2 x & \sin 2x \\ \sin^2 x & 1+\cos^2 x & \sin 2x \\ \sin^2 x & \cos^2 x & 1+\sin 2x \end{vmatrix}$$

$x \in \left[\frac{\pi}{6}, \frac{\pi}{3}\right]$**. If α and β respectively are the maximum and the minimum values of f, then**

a) $\alpha^2 + \beta^2 = \frac{9}{2}$ b) $\beta^2 - 2\sqrt{\alpha} = \frac{19}{4}$

c) $\alpha^2 - \beta^2 = 4\sqrt{3}$ d) $\beta^2 + 2\sqrt{\alpha} = \frac{19}{4}$

65) **The negation of the expression q ∨ ((~ q) ∧ p) is equivalent to**

a) (~p) ∧ (~ q) b) (~p) ∨ (~ q)

c) (~p) ∨ q d) p ∧ (~ q)

66) **If the orthocentre of the triangle, whose vertices are (1, 2), (2, 3) and (3, 1) is (α, β), then the quadratic equation whose roots are α + 4β and 4α + β, is**

a) $x^2 - 22x + 120 = 0$ b) $x^2 - 18x + 80 = 0$

c) $x^2 - 19x + 90 = 0$ d) $x^2 - 20x + 99 = 0$

67) **The shortest distance between the lines** $\frac{x-5}{1} = \frac{y-2}{2} = \frac{z-4}{-3}$ **and** $\frac{x+3}{1} = \frac{y+5}{4} = \frac{z-1}{-5}$ **is**

a) $4\sqrt{3}$ b) $7\sqrt{3}$

c) $5\sqrt{3}$ d) $6\sqrt{3}$

68) **The mean and variance of 5 observations are 5 and 8 respectively. If 3 observations are 1, 3, 5, then the sum of cubes of the remaining two observations is**

a) 1456 b) 1216

c) 1072 d) 1792

69) **If y = y(x) is the solution curve of the differential equation**

$\frac{dy}{dx}$ **+ y tan x = x sec x, 0 ≤ x ≤** $\frac{\pi}{3}$ **, y(0) = 1, then** $y\left(\frac{\pi}{6}\right)$ **is equal to**

a) $\frac{\pi}{12} + \frac{\sqrt{3}}{2}\log_e\left(\frac{2}{e\sqrt{3}}\right)$ b) $\frac{\pi}{12} + \frac{\sqrt{3}}{2}\log_e\left(\frac{2\sqrt{3}}{e}\right)$

c) $\frac{\pi}{12} - \frac{\sqrt{3}}{2}\log_e\left(\frac{2\sqrt{3}}{e}\right)$ d) $\frac{\pi}{12} - \frac{\sqrt{3}}{2}\log_e\left(\frac{2}{e\sqrt{3}}\right)$

70) **In a binomial distribution B(n, p), the sum and the product of the mean and the variance are 5 and 6 respectively, then S(n +p – q) is equal to**

a) 50 b) 53
c) 51 d) 52

71) **The area enclosed by the closed curve C given by the differential equation**

$\frac{dy}{dx}+\frac{x+a}{y-2}=0$ **, y(1) = 0 is 4π**

Let P and Q be the points of intersection of the curve C and the y-axis. If normals at P and Q on the curve C intersect x-axis at points R and S respectively, then the length of the line segment RS is

a) $2\sqrt{3}$ b) $\frac{2\sqrt{3}}{3}$
c) $\frac{4\sqrt{3}}{3}$ d) 2

72) $\lim_{n\to\infty}\left[\frac{1}{1+n}+\frac{1}{2+n}+\frac{1}{3+n}+\ldots+\frac{1}{2n}\right]$ is equal to

a) $\log_e\left(\frac{2}{3}\right)$ b) $\text{Log}_e 2$
c) $\log_e\left(\frac{3}{2}\right)$ d) 0

73) **For a triangle ABC, the value of cos2A + cos2B + cos2C is least. If its inradius is 3 and incentire is M, then which of the following is not correct?**

a) $\overrightarrow{MA}.\overrightarrow{MB}=-18$

b) area of Δ ABC is $\frac{27\sqrt{3}}{2}$

c) perimeter of Δ ABC is $18\sqrt{3}$

d) sin 2A + sin 2B + sin 2C = sin A + sin B + sin C

74) **The combined equation of the two lines ax + by + c = 0 and a'x + b'y + c' = 0 can be written as (ax + by + c)(a'x +b'y + c') = 0.**

The equation of the angle bisectors of the lines represented by the equation $2x^2 + xy – 3y^2 = 0$ is

a) $3x^2 + xy - 2y^2 = 0$ b) $3x^2 + 5xy + 2y^2 = 0$
c) $x^2 - y^2 + 10xy = 0$ d) $x^2 - y^2 - 10xy = 0$

75) **Let the image of the point P(2, – 1, 3) in the plane x + 2y – z = 0 be Q. Then the distance of the plane 3x +2y + z + 29 = 0 from the point Q is**

a) $\frac{24\sqrt{2}}{7}$ b) $\frac{22\sqrt{2}}{7}$
c) $2\sqrt{14}$ d) $3\sqrt{14}$

76) **If the center and radius of the circle $\left|\frac{z-2}{z-3}\right|=2$ are respectively (α, β) and γ, then 3(α + β + γ) is equal to**

a) 10 b) 12
c) 9 d) 11

77) **Let f(x) = 2x + $\tan^{-1}$ x and g(x) =** $\log_e\left(\sqrt{1+x^2}+x\right)$ **, x ∈ [0, 3]. Then**

a) max f(x) > max g(x)

b) min f'(x) = 1 + max g'(x)

c) there exists $\widehat{x} \in [0, 3]$ such that $f'(\widehat{x}) < g(\widehat{x})$

d) there exist $0 < x_1 < x_2 < 3$ such that f(x) < g(x), $\forall\ x \in (x_1, x_2)$

78) **Let R be a relation on R, given by**

R = {(a, b) : 3a – 3b + $\sqrt{7}$ is an irrational number }.

Then R is

a) reflexive but neither symmetric nor transitive

b) an equivalence relation

c) reflexive and symmetric but not transitive

d) reflexive and transitive but not symmetric

79) **The value of** $\frac{1}{1!50!}+\frac{1}{3!48!}+\frac{1}{5!46!}+\ldots+\frac{1}{49!2!}+\frac{1}{51!1!}$ **is**

a) $\frac{2^{51}}{51!}$ b) $\frac{2^{50}}{50!}$
c) $\frac{2^{50}}{51!}$ d) $\frac{2^{51}}{50!}$

80) **Let S be the set of all solutions of the equation $\cos^{-1}(2x) - 2\cos^{-1}(\sqrt{1-x^2}) = \pi$, $x \in \left[-\frac{1}{2}, \frac{1}{2}\right]$. Then $\sum_{x \in S} 2\sin^{-1}\left(x^2 - 1\right)$ is equal to**

a) $\pi - 2\sin^{-1}\left(\frac{\sqrt{3}}{4}\right)$ b) $\frac{-2\pi}{3}$

c) $\pi - \sin^{-1}\left(\frac{\sqrt{3}}{4}\right)$ d) 0

81) Let $a_1 = 8, a_2, a_3, \ldots a_n$ be an A.P. If the sum of its first four terms is 50 and the sum of its last four terms is 170, then the product of its middle two terms is _____

)

82) The remainder, when $19^{200} + 23^{200}$ is divided by 49 , is _____

)

83) If $f(x) = x^2 + g'(1)x + g''(2)$ and $g(x) = f(1)x^2 + xf'(x) + f''(x)$, then the value of $f(4) - g(4)$ is equal to _____

)

84) A(2, 6, 2), B($-$ 4, 0, λ), C(2, 3, $-$ 1) and D(4, 5, 0), $|\lambda| \leq 5$ are the vertices of a quadrilateral ABCD. If its area is 18 square units, then $5 - 6\lambda$ is equal to _____

)

85) The number of 3-digit numbers, that are divisible by either 2 or 3 but not divisible by 7, is _____

)

86) Let $\vec{v} = a\hat{i} + 2\hat{j} - 3\hat{k}, \vec{w} = 2a\hat{i} + \hat{j} - \hat{k}$ and $\vec{u}$ be a vector such that $\left|\vec{u}\right| = \alpha > 0$. If the minimum value of the scalar triple product $\left[\vec{u}\ \vec{v}\ \vec{w}\right]$ is $-\alpha\sqrt{3401}$, and $\left|\vec{u}.\hat{i}\right|^2 = \frac{m}{n}$ where m and n are copnme natural numbers, then m + n is equal to _____ .

)

87) Let f : R $\rightarrow$ R be a differentiable function such that f'(x) + f(x) = $\int_0^2 f\left(t\right)dt$

If f(0) = e^{-2}, then 2f(0) $-$ f(2) is equal to _____

)

88) Let A be the area hounded by the curve y = $x|x-3|$, the x-axis and the ordinates x = $-$ 1 and x = 2. Then 12 A is equal to _____

)

89) If $\int_0^1 \left(x^{21} + x^{14} + x^7\right)\left(2x^{14} + 3x^7 + 6\right)^{1/7} dx$ = $\frac{1}{l}\left(11\right)^{m/n}$ where l, m, n $\in$ N, m and n are coprime then l + m + n is equal to _____.

)

90) The number of words, with or without meaning, that can be formed using all the letters of the word ASSASSINATION so that the vowels occur together, is _____ .

)