

Q1. $P + \frac{a}{V^2}V - b = RT$ represents the equation of state of some gases. Where P is the pressure, V is the volume, T is 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 :

- (1) Bulk modulus (2) Modulus of rigidity
(3) Compressibility (4) Energy density

Q2. 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 $AD = 3 AB$, then average speed of the object will be :



- (1) $\frac{v_1 + v_2 + v_3}{3}$ (2) $\frac{v_1 v_2 v_3}{3v_1 v_2 + v_2 v_3 + v_3 v_1}$
(3) $\frac{3v_1 v_2 v_3}{v_1 v_2 + v_2 v_3 + v_3 v_1}$ (4) $\frac{v_1 + v_2 + v_3}{3v_1 v_2 v_3}$

Q3. 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 m s^{-1} . Neglecting the air resistance, the speed with which the stone hits the ground will be _____ m s^{-1} (given, $g = 10 \text{ m s}^{-2}$).

- (1) 20 (2) 15
(3) 30 (4) 25

Q4. A block of mass 5 kg is placed at rest on a table of rough surface. Now, if a force of 30 N 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 10 s. Coefficient of kinetic friction is (given, $g = 10 \text{ m s}^{-2}$):

- (1) 0.60 (2) 0.75
(3) 0.50 (4) 0.25

Q5. If earth has a mass nine times and radius twice to the of a planet P . Then $\frac{v_e}{3}\sqrt{x} \text{ ms}^{-1}$ will be the minimum velocity required by a rocket to pull out of gravitational force of P , where v_e is escape velocity on earth. The value of x is

- (1) 2 (2) 3
(3) 18 (4) 1

Q6. 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

- (1) Both Statement I and Statement II are true (2) Both Statement I and Statement II are false
(3) Statement I is true but Statement II is false (4) Statement I is false but Statement II is true

Q7. A mercury drop of radius 10^{-3} m is broken into 125 equal size droplets. Surface tension of mercury is 0.45 N m^{-1} . The gain in surface energy is:

- (1) $2.26 \times 10^{-5} \text{ J}$ (2) $28 \times 10^{-5} \text{ J}$
(3) $17.5 \times 10^{-5} \text{ J}$ (4) $5 \times 10^{-5} \text{ J}$

Q8. A sample of gas at temperature T is adiabatically expanded to double its volume. The work done by the gas in the process is given, (given $\gamma = \frac{3}{2}$) :

(1) $W = TR\sqrt{2} - 2$

(2) $W = \frac{T}{R}\sqrt{2} - 2$

(3) $W = \frac{R}{T}2 - \sqrt{2}$

(4) $W = RT2 - \sqrt{2}$

Q9. The average kinetic energy of a molecule of the gas is

(1) proportional to absolute temperature

(2) proportional to volume

(3) proportional to pressure

(4) dependent on the nature of the gas

Q10. A steel wire with mass per unit length $7.0 \times 10^{-3} \text{ kg m}^{-1}$ is under tension of 70 N. The speed of transverse waves in the wire will be:

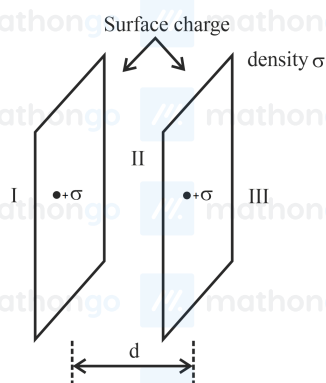
(1) $200\pi \text{ m s}^{-1}$

(2) 100 m s^{-1}

(3) 10 m s^{-1}

(4) 50 m s^{-1}

Q11. 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}



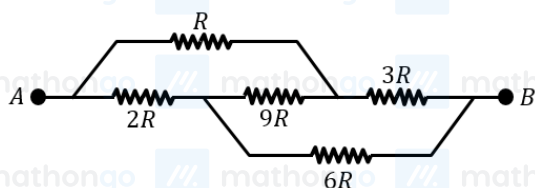
(1) $\vec{E}_I = \frac{2\sigma}{\epsilon_0}\hat{n}, \vec{E}_{II} = 0, \vec{E}_{III} = \frac{2\sigma}{\epsilon_0}\hat{n}$

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

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

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

Q12. The equivalent resistance between A and B of the network shown in figure:



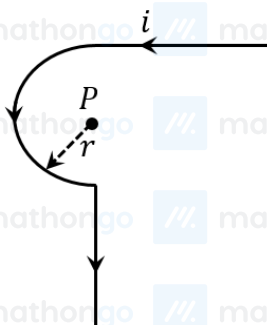
(1) $11\frac{2R}{3}$

(2) $14 R$

(3) $21 R$

(4) $\frac{8}{3} R$

Q13. Find the magnetic field at the point P in figure. The curved portion is a semicircle connected to two long straight wires.



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

$$(3) \frac{\mu_0 i}{2r} \left(\frac{1}{2} + \frac{1}{\pi} \right)$$

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

$$(4) \frac{\mu_0 i}{2r} \left(\frac{1}{2} + \frac{1}{\pi} \right)$$

Q14. Match the List-I with List-II.

List I

- A AC generator
- B Transformer
- C Resonance phenomenon to occur
- D Sharpness of resonance

List II

- I Presence of both L and C
- II Electromagnetic Induction
- III Quality factor
- IV Mutual Inductance

Choose the correct answer from the options given below:

(1) A-IV, B-II, C-I, D-III

(2) A-II, B-I, C-III, D-IV

(3) A-II, B-IV, C-I, D-III

(4) A-IV, B-III, C-I, D-II

Q15. Match the List-I with List-II:

List I

List II

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

Choose the correct answer from the options given below:

(1) A-I, B-II, C-III, D-IV

(2) A-IV, B-I, C-II, D-III

(3) A-I, B-III, C-IV, D-II

(4) A-IV, B-III, C-II, D-I

Q16. 'n' polarizing sheets are arranged such that each makes an angle 45° with the proceeding sheet. An

unpolarized light of intensity I is incident into this arrangement. The output intensity is found to be $\frac{I}{64}$. The value of n will be:

(1) 3

(2) 6

(3) 5

(4) 4

Q17. 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-Broglie wavelength λ . The ratio of kinetic energy of proton and that of alpha particle is :

(1) 2 : 1

(2) 4 : 1

(3) 1 : 2

(4) 1 : 4

Q18. 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:

- (1) 14.2 MeV (2) 28.4 MeV
 (3) 56.8 MeV (4) 7.1 MeV

Q19. Match the List I with List II

List I

A Intrinsic Semiconductor

B n-type semiconductor

C p-type semiconductor

D Metals

List II

I Fermi-level near valence band

II Fermi-level at middle of valence and conduction band

III Fermi-level near conduction band

IV Fermi-level inside conduction band

Choose the correct answer from the options given below:

- (1) (A) $\rightarrow$ I, (B) $\rightarrow$ II, (C) $\rightarrow$ III, (D) $\rightarrow$ IV (2) (A) $\rightarrow$ II, (B) $\rightarrow$ I, (C) $\rightarrow$ III, (D) $\rightarrow$ IV
 (3) (A) $\rightarrow$ II, (B) $\rightarrow$ III, (C) $\rightarrow$ I, (D) $\rightarrow$ IV (4) (A) $\rightarrow$ III, (B) $\rightarrow$ I, (C) $\rightarrow$ II, (D) $\rightarrow$ IV

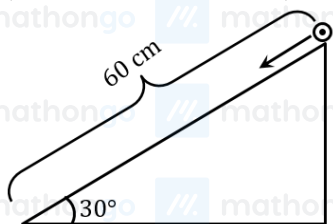
Q20. Which of the following frequencies does not belong to FM broadcast.

- (1) 106 MHz (2) 64 MHz
 (3) 99 MHz (4) 89 MHz

Q21. 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 $5\hat{i} + 2\hat{j} + 7\hat{k} \text{ N}$. The value of work done will be _____ J.

Q22. 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 _____ m s^{-1} .

(Given $g = 10 \text{ m s}^{-2}$)



Q23. 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 $\frac{3}{x}$. The value of x is _____.

Q24. 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.

Q25. Two equal positive point charges are separated by a distance $2a$. 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 _____.

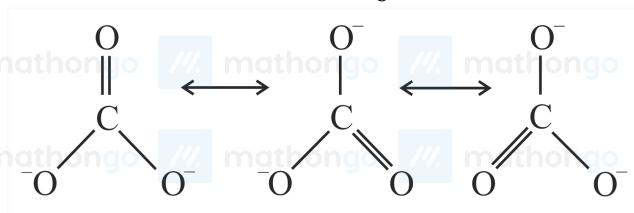
- Q26.** In an experiment to find emf of a cell using potentiometer, the length of null point for a cell of emf 1.5 V is found to be 60 cm. If this cell is replaced by another cell of emf E , the length-of null point increases by 40 cm. The value of E is $\frac{x}{10}$ V. The value of x is _____.
- Q27.** A charge particle of 2 μC accelerated by a potential difference of 100 V 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.
- Q28.** A series LCR circuit is connected to an ac source of 220 V, 50 Hz. The circuit contain a resistance $R = 100 \Omega$ and an inductor of inductive reactance $X_L = 79.6 \Omega$. The capacitance of the capacitor needed to maximize the average rate at which energy is supplied will be _____ μF .
- Q29.** 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 _____.
- Q30.** 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 $h = 4.14 \times 10^{-15}$ eVs, $c = 3 \times 10^8$ m s $^{-1}$)
- Q31.** 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
 (1) A is true but R is false
 (2) Both A and R are true but R is NOT the correct explanation of A
 (3) A is false but R is true
 (4) Both A and R are true and R is the correct explanation of A
- Q32.** Match List I with List II
- | | |
|------------------------|---|
| (A) Slaked lime | (I) NaOH |
| (B) Dead burnt plaster | (II) $\text{Ca}(\text{OH})_2$ |
| (C) Caustic soda | (III) $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ |
| (D) Washing soda | (IV) CaSO_4 |
- Choose the correct answer form the options given below:
- | | |
|--|--|
| (1) (A) - I, (B) - IV, (C) - II, (D) - III | (2) (A) - III, (B) - IV, (C) - II, (D) - I |
| (3) (A) - II, (B) - IV, (C) - I, (D) - III | (4) (A) - III, (B) - II, (C) -IV, (D) -I |
- Q33.** Choose the correct statement(s):
- Beryllium oxide is purely acidic in nature.
 - Beryllium carbonate is kept in the atmosphere of CO_2 .
 - Beryllium sulphate is readily soluble in water.
 - Beryllium shows anomalous behavior.
- Choose the correct answer from the options given below:

(1) A, B and C only

(3) A and B only

(2) B, C and D only

(4) A only

Q34. Resonance in carbonate ion CO_3^{2-} is

Which of the following is true?

(1) It is possible to identify each structure

individually by some physical or chemical method.

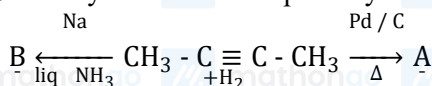
(2) All these structures are in dynamic equilibrium

with each other.

(3) Each structure exists for equal amount of time.

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

Q35. But-2-yne is reacted separately with one mole of Hydrogen as shown below:



Identify the incorrect statements from the options given below:

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.

(1) B and C only

(2) B, C and D only

(3) A, C and D only

(4) A and B only

Q36. How can photochemical smog be controlled?

(1) By using tall chimneys

(2) By complete combustion of fuel

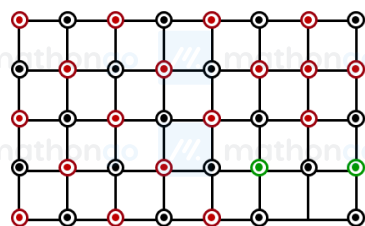
(3) By using catalytic converters in the automobiles/industry

(4) By using catalyst

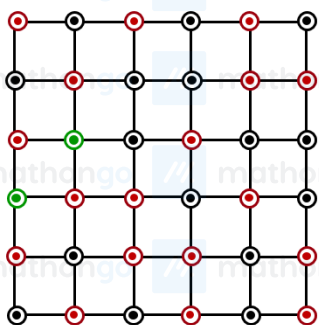
Q37. Which of the following represents the lattice structure of $\text{A}_{0.95}\text{O}$ containing A^{2+} , A^{3+} and O^{2-} ions?

● A^{2+}
● A^{3+}
● O^{2-}

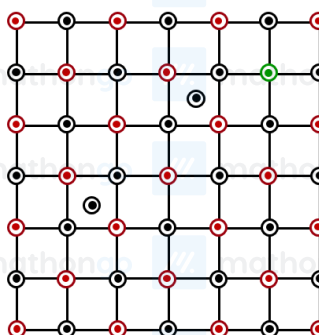
A.



B.



C.



(1) B and C only

(2) B only

(3) A and B only

(4) A only

Q38. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R.

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

Reason R: The critical volume V_c ($\text{cm}^3 \text{ mol}^{-1}$) 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.

(1) A is true but R is false

(2) A is false but R is true

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

(4) Both A and R are true and R is the correct explanation A

Q39. 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

(1) Both A and R are correct and R is the correct explanation of A

(2) A is not correct but R is correct

(3) Both A and R are correct but R is NOT the correct explanation of A

(4) A is correct but R is not correct

Q40. 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

- (1) Both the statements I and II are true
(2) Statement I is true but Statement II is false
(3) Statement I is false but Statement II is true
(4) Both the Statements I and II are false

Q41. A solution of FeCl_3 when treated with $\text{K}_4\text{Fe}(\text{CN})_6$ gives a prussian blue precipitate due to the formation of

- (1) $\text{KFe}_2(\text{CN})_6$
(2) $\text{FeFe}(\text{CN})_6$
(3) $\text{Fe}_3\text{Fe}(\text{CN})_{62}$
(4) $\text{Fe}_4\text{Fe}(\text{CN})_{63}$

Q42. 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

- (1) A and C only
(2) A and D only
(3) B and D only
(4) B and C only

Q43. Which of the following complex will show largest splitting of d-orbitals?

- (1) $\text{FeC}_2\text{O}_4^{3-}$
(2) FeF_6^{3-}
(3) $\text{Fe}(\text{CN})_6^{3-}$
(4) FeNH_3^{3+}

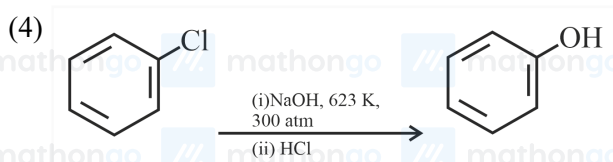
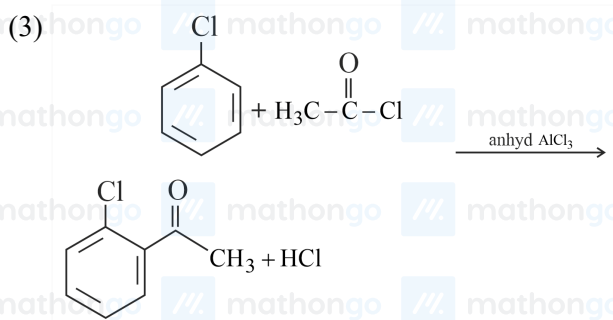
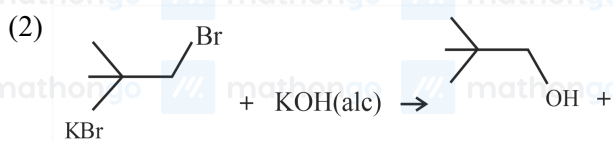
Q44. Which of the following are the example of double salt?

- (A) $\text{FeSO}_4 \cdot \text{NH}_4\text{SO}_4 \cdot 6\text{H}_2\text{O}$
(B) $\text{CuSO}_4 \cdot 4\text{NH}_3 \cdot \text{H}_2\text{O}$
(C) $\text{K}_2\text{SO}_4 \cdot \text{Al}_2\text{SO}_4 \cdot 24\text{H}_2\text{O}$
(D) $\text{Fe}(\text{CN})_2 \cdot 4\text{KCN}$

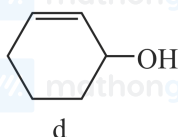
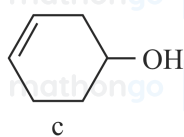
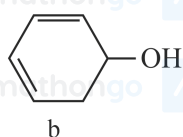
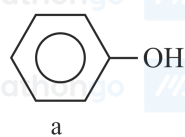
Choose the correct answer.

- (1) A and C only
(2) A and B only
(3) A, B and D only
(4) B and D only

Q45. Identify the incorrect option from the following:



Q46. Decreasing order of dehydration of the following alcohols is



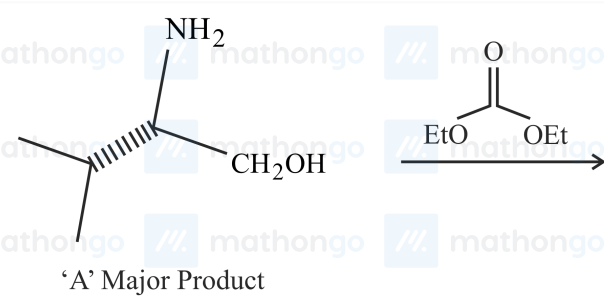
(1) $a > d > b > c$

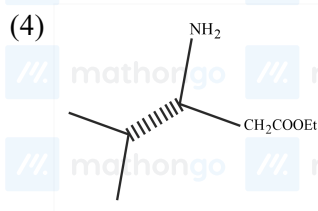
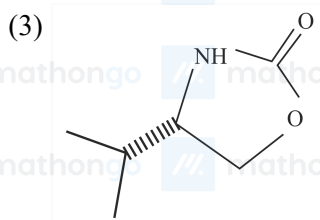
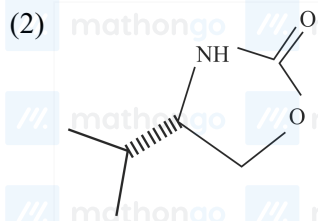
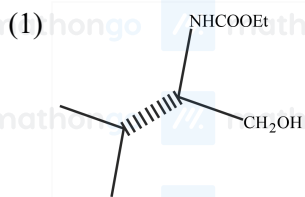
(3) $b > a > d > c$

(2) $b > d > c > a$

(4) $d > b > c > a$

Q47. In the following reaction, 'A' is





Q48. Match List I with List II

List I

List II

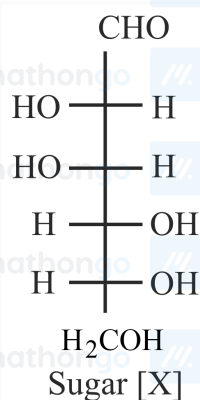
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|-------------------|----------------------------|
| (A) Tranquilizers | (I) Anti blood clotting |
| (B) Aspirin | (II) Salvarsan |
| (C) Antibiotic | (III) Antidepressant drugs |
| (D) Antiseptic | (IV) Soframicine |

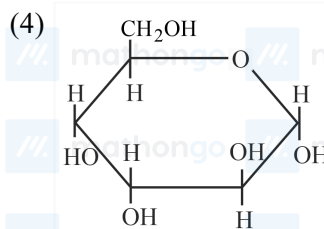
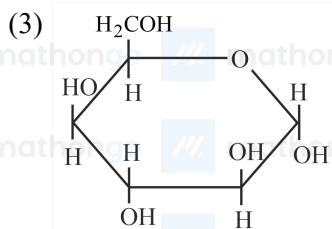
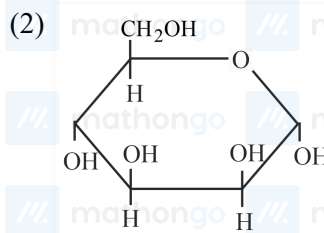
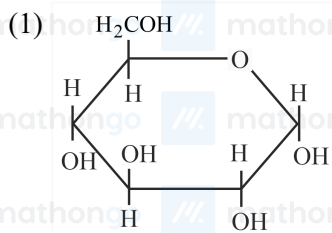
Choose the correct answer from the options given below:

- (1) (A)–IV, (B)–II, (C)–I, (D)–III
 (3) (A)–III, (B)–I, (C)–II, (D)–IV

- (2) (A)–II, (B)–I, (C)–III, (D)–IV
 (4) (A)–II, (B)–IV, (C)–I, (D)–III

Q49. The correct representation in six membered pyranose form for the following sugar [X] is





Q50. Match List I and List II

List I

Test

- (A) Molisch's Test
- (B) Biuret Test
- (C) Carbylamine Test
- (D) Schiff's Test

List II

- Functional group /
Class of Compound
- (I) Peptide
 - (II) Carbohydrate
 - (III) Primary amine
 - (IV) Aldehyde

Choose the correct answer from the options given below:

- (1) (A) - I, (B) - II, (C) - III, (D) - IV
- (2) (A) - III, (B) - IV, (C) - I, (D) - II
- (3) (A) - II, (B) - I, (C) - III, (D) - IV
- (4) (A) - III, (B) - IV, (C) - II, (D) - I

Q51. The density of 3M solution of NaCl is 1.0 g mL^{-1} . Molality of the solution is $\text{_____} \times 10^{-2} \text{ m}$ (Nearest integer).

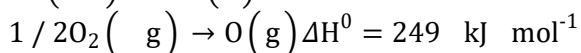
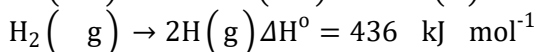
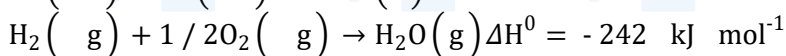
Given: Molar mass of Na and Cl is 23 and 35.5 g mol^{-1} respectively.

Q52. Electrons in a cathode ray tube have been emitted with a velocity of 1000 ms^{-1} . The number of following statements which is/are true about the emitted radiation is

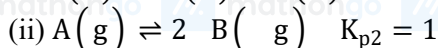
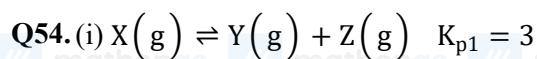
Given : $h = 6 \times 10^{-34} \text{ Js}$, $m_e = 9 \times 10^{-31} \text{ kg}$

- (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..

Q53. At 25°C , the enthalpy of the following processes are given:

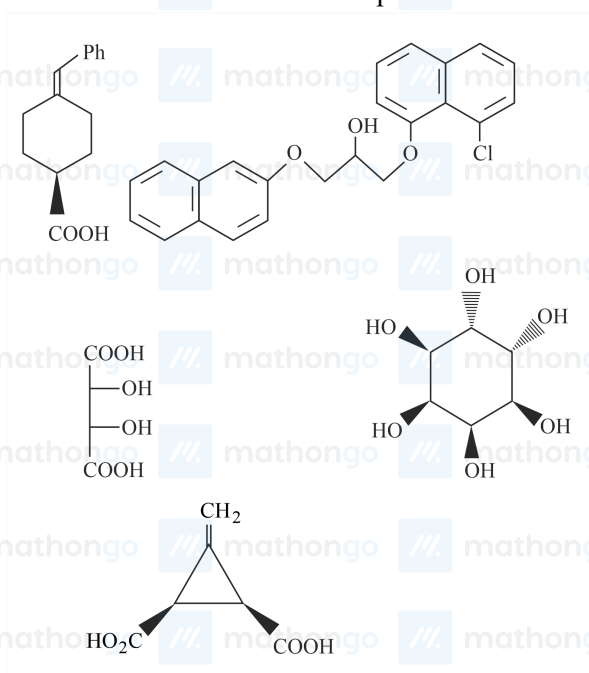


What would be the value of X for the following reaction? (Nearest integer)



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

Q55. The total number of chiral compound/s from the following is



Q56. 25 mL of an aqueous solution of KCl was found to require 20 mL of 1M 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 : $K_f = 2.0 \text{ K kg mol}^{-1}$)

Assume

- 1) 100% ionization and
- 2) density of the aqueous solution as 1 g mL^{-1}

Q57. At what pH, given half cell $\text{MnO}_4^- (0.1\text{M}) \mid \text{Mn}^{2+} (0.001 \text{ M})$ will have electrode potential of 1.282 V ? (Nearest Integer)

Given $E^\circ_{\text{MnO}_4^- / \text{Mn}^{2+}} = 1.54 \text{ V}$, $\frac{2.303RT}{F} = 0.059 \text{ V}$

Q58. 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? _____ min.

Q59. Sum of oxidation states of bromine in bromic acid and perbromic acid is

Q60. 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

Q61. Let

$S = \{x : x \in \mathbb{R} \text{ and } \sqrt{3} + \sqrt{2}^{x^2-4} + \sqrt{3} - \sqrt{2}^{x^2-4} = 10\}$. Then nS is equal to

- (1) 2
- (2) 4
- (3) 6
- (4) 0

Q62. If the center and radius of the circle $\frac{z-2}{z-3} = 2$ are respectively α, β and γ , then $3\alpha + \beta + \gamma$ is equal to

- (1) 11
- (2) 9
- (3) 10
- (4) 12

Q63. The sum to 10 terms of the series

$\frac{1}{1+1^2+1^4} + \frac{2}{1+2^2+2^4} + \frac{3}{1+3^2+3^4} + \dots$ is :-

- (1) $\frac{111}{56}$
- (2) $\frac{55}{111}$
- (3) $\frac{56}{111}$
- (4) $\frac{58}{111}$

Q64. The value of

$\frac{1}{1!50!} + \frac{1}{3!48!} + \frac{1}{5!46!} + \dots + \frac{1}{49!2!} + \frac{1}{51!1!}$ is

- (1) $\frac{2^{50}}{50!}$
- (2) $\frac{2^{50}}{51!}$
- (3) $\frac{2^{51}}{51!}$
- (4) $\frac{2^{51}}{50!}$

Q65. The combined equation of the two lines $ax + by + c = 0$ and $a'x + b'y + c' = 0$ can be written as $ax + by + ca'x + b'y + c' = 0$. The equation of the angle bisectors of the lines represented by the equation $2x^2 + xy - 3y^2 = 0$ is

- (1) $3x^2 + 5xy + 2y^2 = 0$
- (2) $x^2 - y^2 + 10xy = 0$
- (3) $3x^2 + xy - 2y^2 = 0$
- (4) $x^2 - y^2 - 10xy = 0$

Q66. If the orthocentre of the triangle, whose vertices are 1, 2, 3 and 3, 1 is α, β , then the quadratic equation whose roots are $\alpha + 4\beta$ and $4\alpha + \beta$, is

- (1) $x^2 - 19x + 90 = 0$
- (2) $x^2 - 18x + 80 = 0$
- (3) $x^2 - 22x + 120 = 0$
- (4) $x^2 - 20x + 99 = 0$

Q67. The negation of the expression $q \vee ((\sim q) \wedge p)$ is equivalent to

- (1) $(\sim p) \wedge (\sim q)$
- (2) $p \wedge (\sim q)$
- (3) $(\sim p) \vee (\sim q)$
- (4) $(\sim p) \vee q$

Q68. 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

- (1) 1072
- (2) 1792
- (3) 1216
- (4) 1456

Q69. For a triangle ABC , the value of $\cos 2A + \cos 2B + \cos 2C$ is least. If its inradius is 3 and incentre is M , then which of the following is NOT correct?

(1) Perimeter of ΔABC is $18\sqrt{3}$

(3) $\vec{MA} \cdot \vec{MB} = -18$

(2) $\sin 2A + \sin 2B + \sin 2C = \sin A + \sin B + \sin C$

(4) area of ΔABC is $\frac{27\sqrt{3}}{2}$

Q70. Let R be a relation on $\mathbb{R}$, given by $R = \{a, b: 3a - 3b + \sqrt{7} \text{ is an irrational number}\}$. Then R is

(1) Reflexive but neither symmetric nor transitive

(2) Reflexive and transitive but not symmetric

(3) Reflexive and symmetric but not transitive

(4) An equivalence relation

Q71. Let S denote the set of all real values of λ such that the system of equations

$$\lambda x + y + z = 1$$

$$x + \lambda y + z = 1$$

$$x + y + \lambda z = 1$$

is inconsistent, then $\sum_{\lambda \in S} \lambda^2 + \lambda$ is equal to

(1) 2

(2) 12

(3) 4

(4) 6

Q72. Let S be the set of all solutions of the equation $\cos^{-1} 2x - 2\cos^{-1} \sqrt{1-x^2} = \pi$, $x \in [-\frac{1}{2}, \frac{1}{2}]$. Then $\sum_{x \in S} 2\sin^{-1} x^2 - 1$ is equal to

(1) 0

(2) $-\frac{2\pi}{3}$

(3) $\pi - \sin^{-1} \frac{\sqrt{3}}{4}$

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

Q73. Let $f(x) = 2x + \tan^{-1} x$ and $g(x) = \log_e \sqrt{1+x^2} + x$, $x \in (0, 3)$. Then

(1) There exists $x \in (0, 3)$ such that $f'(x) < g'(x)$

(2) $\max f(x) > \max g(x)$

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

(4) $\min f'(x) = 1 + \max g'(x)$

Q74. Let $f(x) = \frac{1 + \sin^2 x}{\sin^2 x} \cdot \frac{\cos^2 x}{1 + \cos^2 x} \cdot \frac{\sin 2x}{\sin 2x}$, $x \in (\frac{\pi}{6}, \frac{\pi}{3})$. If α and β respectively are the maximum and the minimum values of f , then

(1) $\beta^2 - 2\sqrt{\alpha} = \frac{19}{4}$

(2) $\beta^2 + 2\sqrt{\alpha} = \frac{19}{4}$

(3) $\alpha^2 - \beta^2 = 4\sqrt{3}$

(4) $\alpha^2 + \beta^2 = \frac{9}{2}$

Q75. $\lim_{n \rightarrow \infty} \frac{1}{1+n} + \frac{1}{2+n} + \frac{1}{3+n} + \dots + \frac{1}{2n}$ is equal to :-

(1) 0

(2) $\log_e 2$

(3) $\log_e \frac{3}{2}$

(4) $\log_e \frac{2}{3}$

Q76. 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

(1) $2\sqrt{3}$

(2) $\frac{2\sqrt{3}}{3}$

(3) 2

(4) $\frac{4\sqrt{3}}{3}$

Q77. If $y = yx$ is the solution curve of the differential equation $\frac{dy}{dx} + y \tan x = x \sec x$, $0 \leq x \leq \frac{\pi}{3}$, $y_0 = 1$, then $y^{\frac{\pi}{6}}$ is equal to

(1) $\frac{\pi}{12} - \frac{\sqrt{3}}{2} \log_e \frac{2}{e^{\sqrt{3}}}$
 (3) $\frac{\pi}{12} - \frac{\sqrt{3}}{2} \log_e \frac{2\sqrt{3}}{e}$

(2) $\frac{\pi}{12} + \frac{\sqrt{3}}{2} \log_e \frac{2\sqrt{3}}{e}$
 (4) $\frac{\pi}{12} + \frac{\sqrt{3}}{2} \log_e \frac{2}{e^{\sqrt{3}}}$

Q78. 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

(1) $\frac{22\sqrt{2}}{7}$

(2) $\frac{24\sqrt{2}}{7}$

(3) $2\sqrt{14}$

(4) $3\sqrt{14}$

Q79. 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

(1) $7\sqrt{3}$

(2) $5\sqrt{3}$

(3) $6\sqrt{3}$

(4) $4\sqrt{3}$

Q80. In a binomial distribution $B(n, p)$, the sum and product of the mean & variance are 5 and 6 respectively, then find $6(n + p - q)$ is equal to :-

(1) 51

(2) 52

(3) 53

(4) 50

Q81. 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 _____.

Q82. Let $a_1 = 8, a_2, a_3, \dots, a_n$ 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 _____.

Q83. The number of 3-digit numbers, that are divisible by either 2 or 3 but not divisible by 7 is _____.

Q84. The remainder when $19^{200} + 23^{200}$ is divided by 49, is _____.

Q85. If $fx = x^2 + g'1x + g''2$ and $gx = f1x^2 + xf'x + f''x$, then the value of $f4 - g4$ is equal to _____.

Q86. If $\int_0^1 x^{2l} + x^{14} + x^{7l} 2x^{14} + 3x^7 + 6^{1/7} dx = \frac{1}{l} 11^{m/n}$ where $l, m, n \in \mathbb{N}$, m and n are co-prime then $l + m + n$ is equal to _____.

Q87. Let A be the area bounded by the curve $y = xx - 3$, the x -axis and the ordinates $x = -1$ and $x = 2$. Then $12A$ is equal to _____.

Q88. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a differentiable function such that $f'x + fx = \int_0^2 ftdt$. If $f0 = e^{-2}$, then $2f0 - f2$ is equal to _____.

Q89. Let $\vec{v} = \hat{a}\hat{i} + 2\hat{j} - 3\hat{k}$, $\vec{w} = 2\hat{a}\hat{i} + \hat{j} - \hat{k}$, and $\vec{u}$ be a vector such that $\vec{u} = \alpha \vec{v}$, $\alpha > 0$. If the minimum value of the scalar triple product $\vec{u} \cdot \vec{v} \cdot \vec{w}$ is $-\alpha\sqrt{3401}$, and $\vec{u} \cdot \hat{i} = \frac{m}{n}$ where m and n are coprime natural numbers, then $m + n$ is equal to _____.

Q90. $A(2, 6)$, $B(2, -4)$, $C(3, -1)$ and $D(4, 5)$ are the vertices of a quadrilateral $ABCD$. If its area is 18 square units, then $5 - 6\lambda$ is equal to _____.

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ANSWER KEYS

1. (3)	2. (3)	3. (2)	4. (3)	5. (1)	6. (3)	7. (1)	8. (4)
9. (1)	10. (2)	11. (4)	12. (4)	13. (3)	14. (3)	15. (2)	16. (2)
17. (2)	18. (2)	19. (3)	20. (2)	21. (40)	22. (2)	23. (1)	24. (2)
25. (2)	26. (25)	27. (144)	28. (40)	29. (32)	30. (828)	31. (2)	32. (3)
33. (2)	34. (4)	35. (2)	36. (3)	37. (4)	38. (1)	39. (4)	40. (1)
41. (4)	42. (1)	43. (3)	44. (1)	45. (2)	46. (2)	47. (2)	48. (3)
49. (2)	50. (3)	51. (364)	52. (2)	53. (499)	54. (12)	55. (2)	56. (3)
57. (3)	58. (15)	59. (12)	60. (2)	61. (2)	62. (4)	63. (2)	64. (2)
65. (4)	66. (4)	67. (1)	68. (1)	69. (4)	70. (1)	71. (4)	72. (1)
73. (2)	74. (1)	75. (2)	76. (4)	77. (1)	78. (4)	79. (3)	80. (2)
81. (50400)	82. (754)	83. (514)	84. (29)	85. (14)	86. (63)	87. (62)	88. (1)
89. (3501)	90. (11)						