Physics

SECTION-A

31. The electric field due to a short electric dipole at a large distance (r) from center of dipole on the equatorial plane varies with distance as :

(1) r

(2) $\dfrac{1}{r}$

(3) $\dfrac{1}{r^3}$

(4) $\dfrac{1}{r^2}$

Official Ans. by NTA (3)

Ans.   (3)

32. In a linear simple harmonic motion (SHM)

(A) Restoring force is directly proportional to the displacement.

(B) The acceleration and displacement are opposite in direction.

(C) The velocity is maximum at mean position.

(D) The acceleration is minimum at extreme points

Choose the correct answer from the options given below :

(1) (A), (B) and (C) only

(2) (C) and (D) only

(3) (A), (B) and (D) only

(4) (A), (C) and (D) only

Official Ans. by NTA (1)

Ans. (1)

33. Two identical particles each of mass 'm' go round a circle of radius a under the action of their mutual gravitational attraction. The angular speed of each particle will be :

(1) $\sqrt{\dfrac{Gm}{2a^3}}$

(2) $\sqrt{\dfrac{Gm}{8a^3}}$

(3) $\sqrt{\dfrac{Gm}{4a^3}}$

(4) $\sqrt{\dfrac{Gm}{a^3}}$

Official Ans. by NTA (3)

Ans.   (3)

34. The height of transmitting antenna is 180 m and the height of the receiving antenna is 245 m. The maximum distance between them for satisfactory communication in line of sight will be :

(given R = 6400 km)

(1) 48 km

(2) 56 km

(3) 96 km

(4) 104 km

Official Ans. by NTA (4)

 Ans. (4)

35. The half-life of a radioactive nucleus is 5 years, The fraction of the original sample that would decay in 15 years is :

(1) $\dfrac{1}{8}$

(2) $\dfrac{1}{4}$

(3) $\dfrac{7}{8}$

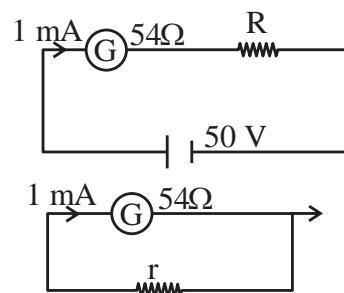(4) $\dfrac{3}{4}$

Official Ans. by NTA (3)

Ans. (3)

36. The de Broglie wavelength of an electron having kinetic energy E is λ. If the kinetic energy of electron becomes $\dfrac{E}{4}$, then its de-Broglie wavelength will be :

(1) $\dfrac{\lambda}{\sqrt{2}}$

(2) $\dfrac{\lambda}{2}$

(3) 2λ

(4) $\sqrt{2}\lambda$

Official Ans. by NTA (3)

Ans. (3)

37. For designing a voltmeter of range 50 V and an ammeter of range 10 mA using a galvanometer which has a coil of resistance 54 Ω showing a full scale deflection for 1 mA as in figure.

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(A) for voltmeter R ≈ 50 kΩ

(B) for ammeter r ≈ 0.2 Ω

(C) for ammeter r ≈ 6 Ω

(D) for voltmeter R ≈ 5 kΩ

(E) for voltmeter R ≈ 500 Ω

Choose the correct answer from the options given below :

(1) (C) and (E) (2) (C) and (D)

(3) (A) and (C) (4) (A) and (B)

Official Ans. by NTA (3)

Ans. (3)

38. (A flask contains Hydrogen and Argon in the ratio 2:1 by mass. The temperature of the mixture is 30°C. The ratio of average kinetic energy per molecule of the two gases (K argon/K hydrogen) is: (Given: Atomic Weight of Ar = 39.9)

(1) 1 (2) 2

(3) $\dfrac{39.9}{2}$ (4) 39.9

Official Ans. by NTA (1)

Ans. (1)

39. Given below are two statements:

Statement I : The equivalent resistance of resistors in a series combination is smaller than least resistance used in the combination.

Statement II : The resistivity of the material is independent of temperature.

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

(1) Statement I is false but Statement II is true

(2) Both Statement I and Statement II are false

(3) Statement I is true but Statement II is false

(4) Both Statement I and Statement II are true

Official Ans. by NTA (2)

Ans. (2)

40. A body is released from a height equal to the radius (R) of the earth. The velocity of the body when it strikes the surface of the earth will be :

(Given g = acceleration due to gravity on the earth.)

(1) $\sqrt{gR}$ (2) $\sqrt{4gR}$

(3) $\sqrt{2gR}$ (4) $\sqrt{\dfrac{gR}{2}}$

Official Ans. by NTA (1)

 Ans. (1)

41. A 12 V battery connected to a coil of resistance 6 Ω through a switch, drives a constant current in the circuit. The switch is opened in 1 ms. The emf induced across the coil is 20 V. The inductance of the coil is :

(1) 5 mH (2) 12 mH

(3) 8 mH (4) 10 mH

Official Ans. by NTA (D)

Ans. (D)

42. A wire of length 'L' and radius 'r' is clamped rigidly at one end. When the other end of the wire is pulled by a force f, its length increases by 'ℓ'.

Another wire of same material of length '2L' and radius '2r' is pulled by a force '2f'. Then the increase in its length will be :

(1) 2ℓ (2) ℓ

(3) 4ℓ (4) $\ell/2$

Official Ans. by NTA (2)

Ans. (2)

43. The position of a particle related to time is given by x = ($5t^2 – 4t + 5$)m. The magnitude of velocity of the particle at t = 2s will be :

(1) 10 ms^{-1} (2) 14 ms^{-1}

(3) 16 ms^{-1} (4) 06 ms^{-1}

Official Ans. by NTA (3)

Ans. (3)

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44. The position vector of a particle related to time t is given by

$$\vec{r} = \left(10t\hat{i} + 15t^2\hat{j} + 7\hat{k}\right)m$$

The direction of net force experienced by the particle is :

(1) Positive y-axis   (2) Positive x-axis

(3) Positive z-axis   (4) In x-y plane

Official Ans. by NTA (1)

Ans. (1)

45. Match List I with List II of Electromagnetic waves with corresponding wavelength range :

List I	List II
(A) Microwave	(I) 400 nm to 1 nm
(B) Ultraviolet	(II) 1 nm to 10^{-3} nm
(C) X-Ray	(III) 1 mn to 700 nm
(D) Infra-red	(IV) 0.1 m to 1mm

Choose the correct answer from the options given below :

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

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

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

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

Official Ans. by NTA (2)

Ans. (2)

46. A vector in x-y plane makes an angle of 30° with y-axis The magnitude of y-component of vector is $2\sqrt{3}$. The magnitude of x-component of the vector will be :

(1) $\dfrac{1}{\sqrt{3}}$ (2) 6

(3) $\sqrt{3}$ (4) 2
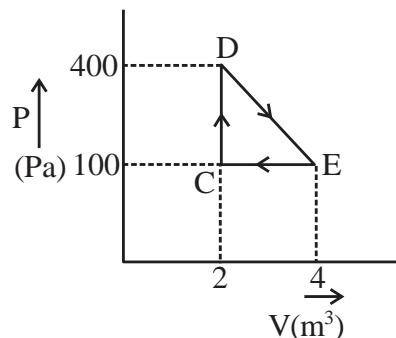
Official Ans. by NTA (4)

Ans. (4)

47. The speed of a wave produced in water is given by $\upsilon = \lambda^a \, g^b \, \rho^c$. Where λ, g and ρ are wavelength of wave, acceleration due to gravity and density of water respectively. The values of a, b and c respectively, are :

(1) $\dfrac{1}{2}, \dfrac{1}{2}, 0$ (2) 1, 1, 0

(3) 1, −1, 0   (4) $\dfrac{1}{2}, 0, \dfrac{1}{2}$

Official Ans. by NTA (1)

Ans. (1)

48. A thermodynamic system is taken through cyclic process. The total work done in the process is :

(1) 100 J   (2) 300 J

(3) Zero   (4) 200 J
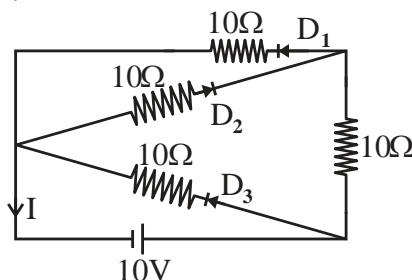
Official Ans. by NTA (2)

Ans. (2)

49. A single slit of width *a* is illuminated by a monochromatic light of wavelength 600 nm. The value of 'a' for which first minimum appears at $\theta = 30°$ on the screen will be :

(1) 0.6 µ m   (2) 1.2 µ m

(3) 1.8 µ m   (4) 3 µ m

Official Ans. by NTA (2)

Ans. (2)

50. In the given circuit, the current (I) through the battery will be :

(1) 1.5 A   (2) 1 A

(3) 2.5 A   (4) 2 A

Official Ans. by NTA (1)

Ans. (1)

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SECTION-B

51. A 20 cm long metallic rod is rotated with 210 rpm about an axis normal to the rod passing through its one end. The order end of the rod is in contact with a circular metallic ring. A constant and uniform magnetic field 0.2T parallel to the axis exists everywhere. The emf developed between the centre and the ring is _____ mV.

Take $\pi = \dfrac{22}{7}$

Official Ans. by NTA (88)

Ans. (88)

52. A network of four resistances is connected to 9V battery, as shown in figure. The magnitude of voltage difference between the points A and B is _____V.
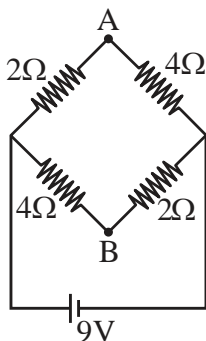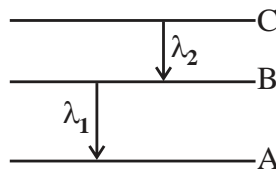

Official Ans. by NTA (3)

Ans. (3)

53. The fundamental frequency of vibration of a string stretched between two rigid support is 50 Hz. The mass of the string is 18 g and its linear mass density is 20 g/m. The speed of the transverse waves so produced in the string is_____ ms^{-1}.

Official Ans. by NTA (90)

Ans. (90)

54. As per given figure A, B and C are the first, second and third excited energy level of hydrogen atom respectively. If the ratio of the two wavelengths $\left(\text{i.e.} \dfrac{\lambda_1}{\lambda_2} \right)$ is $\dfrac{7}{4n}$, then the value of n will be _____ .

Official Ans. by NTA (5)

Ans. (5)

55. A solid sphere and a solid cylinder of same mass and radius are rolling on a horizontal surface without slipping. The ratio of their radius of gyrations respectively $(k_{sph} : k_{cyl})$ is $2 : \sqrt{x}$, then value of x is _____ .

Official Ans. by NTA (5)

Ans. (5)

56. The refractive index of a transparent liquid filled in an equilateral hollow prism is $\sqrt{2}$. The angle of minimum deviation for the liquid will be _____°.

Official Ans. by NTA (30)

Ans. (30)

57. An electron in a hydrogen atom revolves around its nucleus with a speed of 6.76×10^6 ms^{-1} in an orbit of radius 0.52 A°. The magnetic field produced at the nucleus of the hydrogen atom is _____T.

Official Ans. by NTA (40)

Ans. (40)

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58. There is an air bubble of radius 1.0 mm in a liquid of surface tension $0.075 \ Nm^{-1}$ and density 1000 kg m^{-3} at a depth of 10 cm below the free surface. The amount by which the pressure inside the bubble is greater than the atmospheric pressure is_____ Pa $(g = 10 \ ms^{-2})$
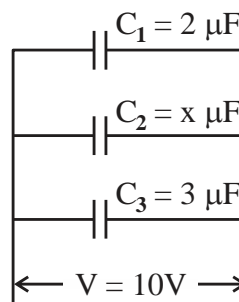
Official Ans. by NTA (1150)

Ans. (1150)

59. A block of mass 10 kg is moving along x-axis under the action of force $F = 5x$ N. The work done by the force in moving the block from $x = 2m$ to 4m will be _____J.

Official Ans. by NTA (30)

Ans. (30)

60. In the given figure the total charge stored in the combination of capacitors is 100 μC. The value of 'x' is_____ .

Official Ans. by NTA (5)

Ans. (5)

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Chemistry

SECTION-A

61. Match List I with List II:

List I – (Monomer)   List II-(Polymer)

(A) Tetrafluoroethene   (i) Orlon

(B) Acrylonitrile   (ii) Natural rubber

(C) Caprolactam   (iii) Teflon
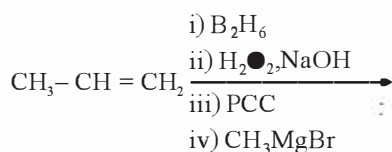
(D) Isoprene   (IV) Nylon-6

Choose the correct answer from the options given below :

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

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

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

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

Official Ans. by NTA (1)

Ans. (1)

62. The product formed in the following multistep reaction is:

$$CH_3-CH=CH_2 \xrightarrow[\substack{\text{i) } B_2H_6 \\ \text{ii) } H_2O_2, NaOH \\ \text{iii) PCC} \\ \text{iv) } CH_3MgBr}]{}$$

(1) $CH_3-CH_2-\overset{\overset{\displaystyle OH}{|}}{CH}-CH_3$

(2) $CH_3-CH_2-CH_2-CH_2-OH$

(3) $CH_3-CH_2-\overset{\overset{\displaystyle O}{||}}{C}-OCH_3$

(4) $CH_3-\overset{\overset{\displaystyle OH}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{C}}-CH_3$

Official Ans. by NTA (1)

Ans. (1)

63. The possibility of photochemical smog formation will be minimum at

(1) Kolkata in October

(2) Mumbai in May

(3) New-Delhi in August (Summer)

(4) Srinagar, Jammu and Kashmir in January

Official Ans. by NTA (4)

Ans. (4)

64. Which one of the following is not an example of calcination ?

(1) $Fe_2O_3 \cdot xH_2O \xrightarrow{\Delta} Fe_2O_3 + xH_2O$

(2) $CaCO_3 \xrightarrow{\Delta} CaO + CO_2$

(3) $CaCO_3 \cdot MgCO_3 \xrightarrow{\Delta} CaO + MgO + 2CO_2$

(4) $2PbS + 3O_2 \xrightarrow{\Delta} 2PbO + 2SO_2$

Official Ans. by NTA (4)

Ans. (4)

65. Consider the following statements:

(A) NF_3 molecule has a trigonal planar structure.

(B) Bond length of N_2 is shorter than O_2.

(C) Isoelectronic molecules or ions have identical bond order.

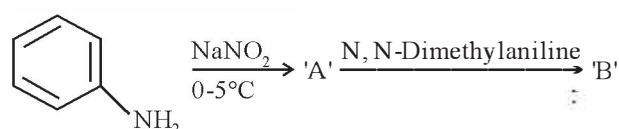(D) Dipole moment of H_2S is higher than that of water molecule.

Choose the correct answer from the option below:

(1) (A) and (D) are correct

(2) (C) and (D) are correct

(3) (A) and (B) are correct

(4) (B) and (C) are correct

Official Ans. by NTA (4)

Ans. (4)

66. Consider the following sequence of reactions:

The product 'B' is

(1) $H_2NHN-\langle\text{benzene}\rangle-\langle\text{benzene}\rangle-N\overset{\displaystyle CH_3}{\underset{\displaystyle CH_3}{<}}$

(2) $\langle\text{benzene}\rangle-N=N-\langle\text{benzene}\rangle-N\overset{\displaystyle CH_3}{\underset{\displaystyle CH_3}{<}}$

(3) $\langle\text{benzene}\rangle-\underset{\underset{\displaystyle H}{|}}{N}-\underset{\underset{\displaystyle H}{|}}{N}-\langle\text{benzene}\rangle-N\overset{\displaystyle CH_3}{\underset{\displaystyle CH_3}{<}}$

(4) $\langle\text{benzene}\rangle-\underset{\underset{\displaystyle CH_3}{|}}{N}-\underset{\underset{\displaystyle CH_3}{|}}{N}-\langle\text{benzene}\rangle-NH_2$

Official Ans. by NTA (2)

Ans. (2)

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67. The number of P – O – P bonds in $H_4P_2O_7$, $(HPO_3)_3$ and P_4O_{10} are respectively.

(1) 1, 3, 6

(2) 0, 3, 6

(3) 0, 3, 4

(4) 1, 2, 4

Official Ans. by NTA (1)

Ans. (1)

68. Given below are two statements:

Statement I : According to Bohr's model of hydrogen atom, the angular momentum of an electron in a given stationary state is quantised.

Statement II : The concept of electron in Bohr's orbit, violates the Heisenberg uncertainty principle.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both Statement I and Statement II are correct.

(2) Statement I is correct but Statement II is incorrect.

(3) Statement I is incorrect but Statement II is correct

(4) Both Statement I and Statement II are incorrect.

Official Ans. by NTA (1)

Ans. (1)

69. Decreasing order of reactivity towards electrophilie substitution for the following compounds is :

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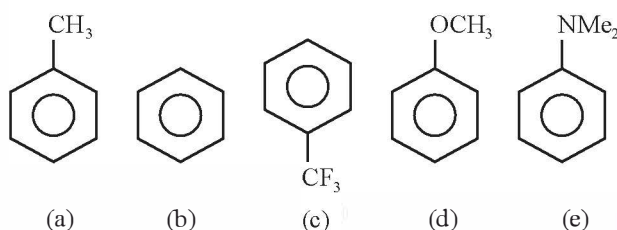
(1) c > b > a > d > e

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

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

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

Official Ans. by NTA (2)

Ans. (2)

70. Which of the following statement(s) is/are correct?

(A) The pH of 1×10^{-8} M HCl solution is 8.

(B) The conjugate base $H_2PO_4^-$ is HPO_4^{2-}.

(C) K_w increases with increase in temperature.

(D) When a solution of weak monoprotic acid is titrated against a strong base at half neutralisation point, $pH = \dfrac{1}{2}pK_a$

Choose the correct answer from the option given below.

(1) (B), (C), (D)

(2) (A), (D)

(3) (A), (B), (C)

(4) (B), (C)

Official Ans. by NTA (4)

Ans. (4)

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

**Assertion (A) :** $BeCl_2$ and $MgCl_2$ produce characteristic flame.

Reason (R) : The excitation energy is high in $BeCl_2$ and $MgCl_2$

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

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

(2) (A) is false but (R) is true

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

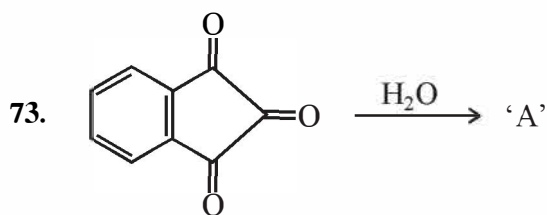(4) (A) is true but (R) is false.

Official Ans. by NTA (2)

Ans. (2)

72.
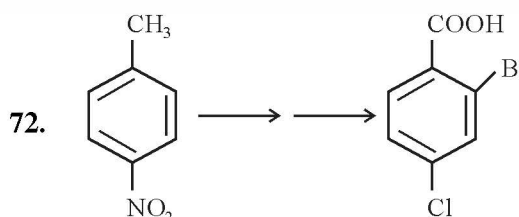
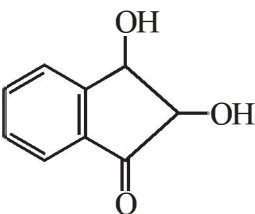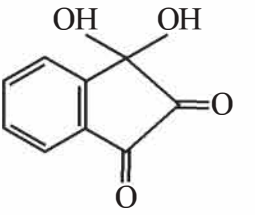In the above conversion the correct sequence of reagents to be added is
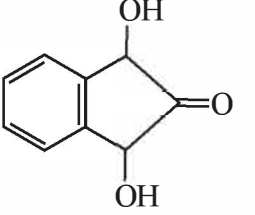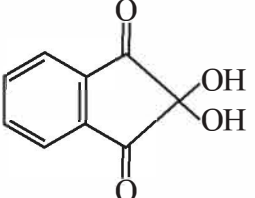
(1) (i) Fe/H$^+$, (ii) HONO, (iii) CuCl, (iv) KMnO$_4$, (v) Br$_2$

(2) (i) KMnO$_4$, (ii) Br$_2$/Fe, (iii) Fe/H$^+$, (iv) Cl$_2$

(3) (i) Br$_2$/Fe, (ii) Fe/H$^+$, (iii) HONO, (iv) CuCl, (v) KMnO$_4$

(4) Br$_2$/Fe, (ii) Fe/H$^+$, (iii) KMnO$_4$, (iv) Cl$_2$

Official Ans. by NTA (3)

Ans. (3)

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73.

major product 'A' formed in the above reaction is

(1)

(2)

(3)

(4)

Official Ans. by NTA (4)

Ans. (4)

74. Which is not true for arginine?

(1) It is a crystalline solid.

(2) It is associated with more than one pK_a values.

(3) It has a fairly high melting point.

(4) It has high solubility in benzene.

Official Ans. by NTA (4)

Ans. (4)

75. During water-gas shift reaction

(1) carbon monoxide is oxidized to carbon dioxide.

(2) carbon is oxidized to carbon monoxide.

(3) carbon dioxide is reduced to carbon monoxide.

(4) water is evaporated in presence of catalyst.

Official Ans. by NTA (1)

Ans. (1)

76. For a good quality cement, the ratio of silica to alumina is found to be

(1) 3

(2) 4.5

(3) 2

(4) 1.5

Official Ans. by NTA (1)
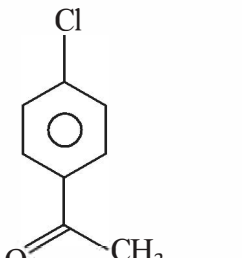
Ans. (1)
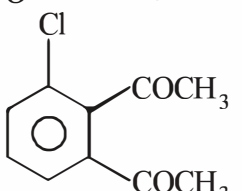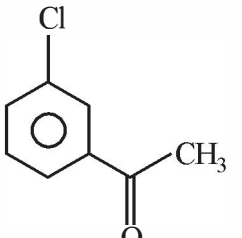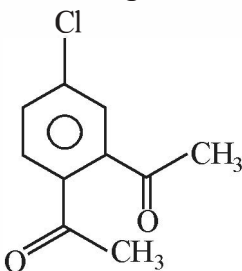
77. Which of the following statement is correct for paper chromatography ?

(1) Water present in the mobile phase gets absorbed by the paper which then forms the stationary phase.

(2) Water present in the pores of the paper forms the stationary phase.

(3) Paper sheet forms the stationary phase.

(4) Paper and water present in its pores together form the stationary phase.

Official Ans. by NTA (2)

Ans. (2)

78. The major product formed in the Friedel-Craft acylation of chlorobenzene is .

(1)

(2)

(3)

(4)

Official Ans. by NTA (1)

Ans. (1)

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79. The complex with highest magnitude of crystal field splitting energy (Δ_o) is

(1) $[Cr(OH_2)_6]^{3+}$

(2) $[Ti(OH_2)_6]^{3+}$

(3) $[Fe(OH_2)_6]^{3+}$

(4) $[Mn(OH_2)_6]^{3+}$

Official Ans. by NTA (1)

Ans. (1)

80. Which of the following expressions is correct in case of a CsCl unit cell (edge length 'a')?

(1) $r_{Cs^+} + r_{Cl^-} = \dfrac{a}{\sqrt{2}}$

(2) $r_{Cs^+} + r_{Cl^-} = a$

(3) $r_{Cs^+} + r_{Cl^-} = \dfrac{\sqrt{3}}{2}a$

(4) $r_{Cs^+} + r_{Cl^-} = \dfrac{a}{2}$

Official Ans. by NTA (3)

Ans. (3)

SECTION-B

81. The homoleptic and octahedral compex of Co^{2+} and H_2O has_____unpaired electron(s) in the t_{2g} set of orbitals.

Official Ans. by NTA (1)

Ans. (1)

82. The volume (in mL) of 0.1 M $AgNO_3$ required for complete precipatation of chloride ions present in 20 mL of 0.01 M solution of $[Cr(H_2O)_5Cl]Cl_2$ as silver chloride is_____

Official Ans. by NTA (4)

Ans. (4)

83. The total change in the oxidation state of manganese involved in the reaction of $KMnO_4$ and potassium iodide in the acidic medium is_____

Official Ans. by NTA (5)

Ans. (5)

84. In Chromyl chloride, the oxidation state of chromium is (+)_____

Official Ans. by NTA (6)

Ans. (6)

85. The total number of isoelectronic species from the given set is _____

O^{2-} ,F^- ,Al ,Mg^{2+} ,Na^+ ,O^+ ,Mg ,Al^{3+} ,F

Official Ans. by NTA (5)

Ans. (5)

86. The vapour pressure of 30% (w/v) aqueous solution of glucose is_____mm Hg at 25°C.

[Given : The density of 30% (w/v), aqueous solution of glucose is 1.2 g cm^{-3} and vapour pressure of pure water is 24 mm Hg.]

(Molar mass of glucose is 180 g mol^{-1}.)

Official Ans. by NTA (23)

Ans. (23)

87. 20 mL of 0.5 M NaCl is required to coagulate 200 mL of As_2S_3 solution in 2 hours. The coagulating value of NaCl is _____

Official Ans. by NTA (50)

Ans. (50)

88. For a reversible reaction $A \rightleftharpoons B$, the $\Delta H_{forward\ reaction}$ =20 kJ mol^{-1} . The activation energy of the uncatalysed forward reaction is 300 kJ mol^{-1}. When the reaction is catalysed keeping the reactant concentration same, the rate of the catalysed forward reaction at 27°C is found to be same as that of the uncatalysed reaction at 327°C. The activation energy of the catasyed backward reactoion is _____kJ mol^{-1}.

Official Ans. by NTA (130)

Ans. (130)

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89. The number of correct statements from the following is _____

(A) Conductivity always decreases with decrease in concentration for both strong and weak electrolytes.

(B) The number of ions per unit volume that carry current in a solution increases on dilution.

(C) Molar conductivity increases with decrease in concentration.

(D) The variation in molar conductivity is different for strong and weak electrolytes.

(E) For weak electrolytes, the change in molar conductivity with dilution is due to decrease in degree of dissociation.

Official Ans. by NTA (3)

Ans. (3)

90. 30.4 kJ of heat is required to melt one mole of sodium chloride and the entropy change at the melting point is 28.4 J K^{-1} mol^{-1} at 1 atm. The melting point of sodium chloride is _____K (Nearest Integer)

Official Ans. by NTA (1070)

Ans. (1070)

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Mathematics

SECTION-A

1. The total number of three-digit numbers, divisible by 3, which can be formed using the digits 1, 3, 5, 8, if repetition of digits is allowed, is:
(1) 22 (2) 18
(3) 21 (4) 20
Official Ans. by NTA (1)
Ans. (1)

2. Let S be the set of all values of λ, for which the shortest distance between the lines $\frac{x-\lambda}{0} = \frac{y-3}{4} = \frac{z+6}{1}$ and $\frac{x+\lambda}{3} = \frac{y}{-4} = \frac{z-6}{0}$ is 13.

Then $8\left|\sum_{\lambda \in S} \lambda\right|$ is equal to

(1) 304 (2) 308
(3) 306 (4) 302
Official Ans. by NTA (3)

Ans. (3)

3. The mean and standard deviation of 10 observations are 20 and 8 respectively. Later on, it was observed that one observation was recorded as 50 instead of 40. Then the correct variance is:
(1) 14 (2) 13
(3) 12 (4) 11
Official Ans. by NTA (2)

Ans. (2)

4. Let ABCD be a quadrilateral. If E and F are the mid points of the diagonals AC and BD respectively and $\left(\overrightarrow{AB} - \overrightarrow{BC}\right) + \left(\overrightarrow{AD} - \overrightarrow{DC}\right) = k\ \overrightarrow{FE}$,

then k is equal to
(1) 2 (2) –2
(3) –4 (4) 4
Official Ans. by NTA (3)

Ans. (3)

5. Let x = x (y) be the solution of the differential equation $2(y + 2)\log_e (y + 2)dx + (x + 4 - 2\log_e (y + 2))dy = 0$, $y > -1$ with $x (e^4 - 2) = 1$. Then $x (e^9 - 2)$ is equal to

(1) $\frac{4}{9}$ (2) $\frac{10}{3}$

(3) $\frac{32}{9}$ (4) 3

Official Ans. by NTA (3)

Ans. (3)

6. Let [x] denote the greatest integer function and $f(x) = \max \{1 + x + [x], 2 + x, x + 2[x]\}, 0 \le x \le 2$. Let m be the number of points in [0,2], where f is not continuous and n be the number of points in (0,2), where f is not differentiable. Then $(m + n)^2 + 2$ is equal to:

(1) 11 (2) 2
(3) 6 (4) 3

Official Ans. by NTA (4)

Ans. (4)

7. The number of real roots of the equation $x|x| - 5|x + 2| + 6 = 0$, is

(1) 5 (2) 3
(3) 6 (4) 4
Official Ans. by NTA (2)

Ans. (2)

8. Let $(a + bx + cx^2)^{10} = \sum_{i=0}^{20} p_i x^i$, a, b, c $\in \mathbb{N}$. If $p_1 = 20$ and $p_2 = 210$, then $2(a + b + c)$ is equal to
(1) 8 (2) 12
(3) 15 (4) 6
Official Ans. by NTA (2)

Ans. (2)

9. Let the determinant of a square matrix A of order m be m – n, where m and n satisfy 4m + n = 22 and 17m + 4n = 93. If det (n adj(adj(mA))) = $3^a 5^b 6^c$. then a + b + c is equal to:
(1) 96 (2) 101
(3) 109 (4) 84
Official Ans. by NTA (1)

Ans. (1)

10. Let A_1 and A_2 be two arithmetic means and G_1, G_2, G_3 be three geometric means of two distinct positive numbers. The $G_1^4 + G_2^4 + G_3^4 + G_1^2 G_3^2$ is equal to

(1) $2(A_1 + A_2)G_1 G_3$

(2) $(A_1 + A_2)^2 G_1 G_3$

(3) $(A_1 + A_2)G_1^2 G_3^2$

(4) $2(A_1 + A_2)G_1^2 G_3^2$

Official Ans. by NTA (2)

Ans. (2)

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11. If the set $\left\{ \text{Re}\left(\dfrac{z - \overline{z} + z\overline{z}}{2 - 3z + 5\overline{z}} \right) : z \in \mathbb{C}, \text{Re}(z) = 3 \right\}$ is equal to the interval $(\alpha, \beta]$, then $24(\beta - \alpha)$ is equal to

(1) 36   (2) 42

(3) 27   (4) 30

Official Ans. by NTA (4)

Ans. (4)

12. The number of common tangents, to the circles $x^2 + y^2 - 18x - 15y + 131 = 0$ and $x^2 + y^2 - 6x - 6y - 7 = 0$, is

(1) 3   (2) 2

(3) 1   (4) 4

Official Ans. by NTA (1)

Ans. (1)

13. Negation of $p \wedge (q \wedge \sim (p \wedge q))$ is

(1) $\sim (p \vee q)$ (2) $p \vee q$

(3) $(\sim (p \wedge q)) \wedge q$ (4) $(\sim (p \wedge q)) \vee p$

Official Ans. by NTA (4)

Ans. (4)

14. Let the system of linear equations

$-x + 2y - 9z = 7$

$-x + 3y + 7z = 9$

$-2x + y + 5z = 8$

$-3x + y + 13z = \lambda$

has a unique solution $x = \alpha$, $y = \beta$, $z = \gamma$. Then the distance of the point (α, β, γ) from the plane $2x - 2y + z = \lambda$ is

(1) 9   (2) 11

(3) 13   (4) 7

Official Ans. by NTA (4)

Ans. (4)

15. If (α, β) is the orthocentre of the triangle ABC with vertices A(3, –7), B(–1, 2) and C(4, 5), then $9\alpha - 6\beta + 60$ is equal to:

(1) 30   (2) 25

(3) 40   (4) 35

Official Ans. by NTA (2)

Ans. (2)

16. Let the foot of perpendicular of the point P(3, –2, –9) on the plane passing through the points (–1, –2, –3), (9, 3, 4), (9, –2, 1) be Q (α, β, γ). Then the distance of Q from the origin is:

(1) $\sqrt{29}$ (2) $\sqrt{35}$

(3) $\sqrt{42}$ (4) $\sqrt{38}$

Official Ans. by NTA (3)

Ans. (3)

17. A bag contains 6 white and 4 black balls. A die is rolled once and the number of balls equal to the number obtained on the die are drawn from the bag at random. The probability that all the balls drawn are white is:

(1) $\dfrac{1}{4}$ (2) $\dfrac{9}{50}$

(3) $\dfrac{1}{5}$ (4) $\dfrac{11}{50}$

Official Ans. by NTA (3)

Ans. (3)

18. If

$$\int_0^1 \frac{1}{\left(5 + 2x - 2x^2\right)\left(1 + e^{(2-4x)}\right)} dx = \frac{1}{\alpha} \log_e \left(\frac{\alpha + 1}{\beta} \right),$$

$\alpha, \beta > 0$, then $\alpha^4 - \beta^4$ is equal to:

(1) 21   (2) 0

(3) 19   (4) –21

Official Ans. by NTA (1)

Ans. (1)

19. Let S be the set of all (λ, μ) for which the vectors $\lambda \hat{i} - \hat{j} + \hat{k}$, $\hat{i} + 2\hat{j} + \mu\hat{k}$ and $3\hat{i} - 4\hat{j} + 5\hat{k}$, where $\lambda - \mu = 5$, are coplanar, then $\displaystyle\sum_{(\lambda, \mu) \in S} 80(\lambda^2 + \mu^2)$ is equal to :

(1) 2370   (2) 2130

(3) 2290   (4) 2210

Official Ans. by NTA (3)

Ans. (3)

20. If the domain of the function $f(x) = \log_e\left(4x^2 + 11x + 6\right) + \sin^{-1}(4x + 3) + \cos^{-1}\left(\dfrac{10x + 6}{3}\right)$ is $(\alpha, \beta]$, then $36|\alpha + \beta|$ is equal to

(1) 63   (2) 45

(3) 72   (4) 54

Official Ans. by NTA (2)

Ans. (2)

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SECTION-B

21. If the sum of the series $\left(\frac{1}{2} - \frac{1}{3}\right) + \left(\frac{1}{2^2} - \frac{1}{2.3} + \frac{1}{3^2}\right) +$

$\left(\frac{1}{2^3} - \frac{1}{2^2.3} + \frac{1}{2.3^2} - \frac{1}{3^3}\right) +$

$\left(\frac{1}{2^4} - \frac{1}{2^3.3} + \frac{1}{2^2.3^2} - \frac{1}{2.3^3} + \frac{1}{3^4}\right) + \dots$ is $\frac{\alpha}{\beta}$, where

α and β are co-prime, then $\alpha + 3\beta$ is equal to....

Official Ans. by NTA (7)

Ans. (7)

22. A person forgets his 4-digit ATM pin code. But he remembers that in the code all the digits are different, the greatest digit is 7 and the sum of the first two digits is equal to the sum of the last two digits. Then the maximum number of trials necessary to obtain the correct code is____ **Official Ans. by NTA (72)**

Ans. (72)

23. Let the plane P contain the line

2x + y − z − 3 = 0 = 5x − 3y + 4z + 9 and be

parallel to the line $\frac{x+2}{2} = \frac{3-y}{-4} = \frac{z-7}{5}$. Then

the distance of the point A(8, −1, −19) from the plane P measured parallel to the line

$\frac{x}{-3} = \frac{y-5}{4} = \frac{2-z}{-12}$ is equal to____

Official Ans. by NTA (26)

Ans. (26)

24. Let an ellipse with centre (1, 0) and latus rectum of

length $\frac{1}{2}$ have its major axis along x-axis. If its

minor axis subtends an angle 60° at the foci, then the square of the sum of the lengths of its minor and major axes is equal to____

Official Ans. by NTA (9)

Ans. (9)

25. Let A = {1, 2, 3, 4} and R be a relation on the set A × A defined by $R = \{((a,b),(c,d)) : 2a + 3b = 4c + 5d\}$. Then the number of elements in R is:

Official Ans. by NTA (6)

Ans. (6)

26. The number of elements in the set

{ $n \in \mathbb{N} : 10 \le n \le 100$ and $3^n - 3$ is a multiple of 7}

is____

Official Ans. by NTA (15)

Ans. (15)

27. If the line x = y = z intersects the line

sin A + y sin B + z sin C − 18 = 0 = x sin 2A + y sin 2B + z sin 2C − 9, where A, B, C are the angles of a triangle ABC, then

$80\left(\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}\right)$ is equal to____

Official Ans. by NTA (5)

Ans. (5)

28. If the area bounded by the curve $2y^2 = 3x$, lines

x + y = 3, y = 0 and outside the circle $(x-3)^2 + y^2 = 2$ is

A, then $4(\pi + 4A)$ is equal to____

Official Ans. by NTA (42)

Ans. (42)

29. Consider the triangles with vertices A(2, 1) B (0, 0) and C (t, 4), t ∈ [0, 4]. It the maximum and the minimum perimeters of such triangles are obtained at t = α and t = β respectively, then 6α + 21β is equal to____

Official Ans. by NTA (48)

Ans. (48)

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30. Let $f(x) = \int \dfrac{dx}{(3+4x^2)\sqrt{4-3x^2}}, |x| < \dfrac{2}{\sqrt{3}}$. If $f(0) = 0$

and $f(1) = \dfrac{1}{\alpha\beta}\tan^{-1}\left(\dfrac{\alpha}{\beta}\right), \alpha, \beta > 0$, then $\alpha^2 + \beta^2$ is

equal to_____

Official Ans. by NTA (28)

Ans. (28)

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