CODE - A

NTPL
PERIODIC TEST

Batch - 2001+2002+2003+2005 [Engg]

Time : 3 Hours ***Maximum Marks : 360***

Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.
You are not allowed to leave the Examination Hall before the end of the test.

INSTRUCTIONS

A. General :

1. This booklet is your Question Paper containing **90 questions**.
2. The Question Paper **CODE** is printed on the right hand top corner of this booklet. This should be entered on the OMR Sheet.
3. Fill the bubbles completely and properly using a **Blue/Black Ball Point Pen** only.
4. Blank papers, clipboards, log tables, slide rules, calculators, cellular phones, pagers, and electronic gadgets in any form are not allowed to be carried inside the examination hall.
5. The answer sheet, a machine-readable Optical mark recognition sheet (OMR Sheet), is provided separately.
6. DO NOT TAMPER WITH / MUTILATE THE OMR OR THE BOOKLET.
7. Do not break the seals of the question-paper booklet before being instructed to do so by the invigilator.

B. Question paper format & Marking Scheme :

8. The question paper consists of **3 parts** (Physics, Chemistry and Maths).
9. The test is of **3 hours** duration. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct. Each question carries **+4 marks** for correct answer and **-1 mark** for wrong answer.

Name of the Candidate (in Capitals) ____________________

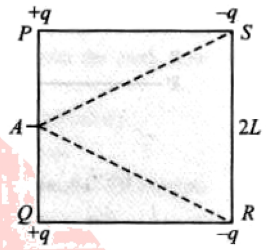
Test Centre ____________________ Centre Code ____________________

Candidate's Signature ____________________ Invigilator's Signature ____________________

1. The electric potential V at any point (*x*, *y*, *z*) (all in metre) in space is given by $V = 4x^2$ volt. The electric field at the point (1, 0, 2) in *V*/*m* is

(a) 16 along + *x*-axis (b) 8 along neg. *x*-axis (c) 8 along + *x*-axis (d) 16 along neg. *x*-axis

2. Four electric charges $+q$, $+q$, $-q$ and $-q$ are placed at the corners of a square of side 2 *L* as shown in figure. The electric potential at point A midway between the two charges $+q$ and $+q$ is



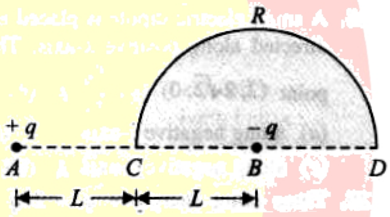
(a) $\frac{1}{4\pi \in_0} \frac{2q}{L}\left(1 - \frac{1}{\sqrt{5}}\right)$ (b) Zero

(c) $\frac{1}{4\pi \in_0} \frac{2q}{L}\left(1 + \frac{1}{\sqrt{5}}\right)$ (d) $\frac{1}{4\pi \in_0} \frac{2q}{L}\left(1 + \sqrt{5}\right)$

3. In a region, the potential is represented by $V(x, y, z) = 6x - 8xy - 8y + 6yz$, where V is in volt and *x*, *y*, *z* are in meter. The electric force experienced by a charge of 2 C situated at point (1, 1, 1) is

(a) $4\sqrt{35}$ N (b) $6\sqrt{5}$ N (c) 30 N (d) 24 N

4. Charges $+q$ and $-q$ are placed at points *A* and *B* respectively, which are at a distance 2 *L* apart. *C* is mid point of *A* and *B*. Work done in moving a charge $+Q$ along the semicircle *CRD*, figure, is



(a) $\frac{qQ}{2\pi \in_0 L}$ (b) $\frac{qQ}{6\pi \in_0 L}$

(c) $-\frac{qQ}{6\pi \in_0 L}$ (d) $\frac{qQ}{4\pi \in_0 L}$

5. Two identical charged spheres suspended from a common point by two massless strings of length *l*, are initially at a distance *x* ($x << l$) apart because of their mutual repulsion. The charges begin to leak from both the spheres at a constant rate. As a result, the spheres approach each other with a velocity *v*. Then *v* varies as a function of distance x between the spheres as

(a) $v \propto x$ (b) $v \propto x^{-1/2}$ (c) $v \propto x^{-1}$ (d) $v \propto x^{1/2}$

6. The dimensional formula of electric potential is

(a) $[MLT^{-2} A^{-1}]$ (b) $[ML^2T^{-2} A^{-1}]$ (c) $[ML^2 T^{-3} A^{-1}]$ (d) $[ML^2 T^{-3} A^{-2}]$

7. There is an electric field in x-direction. If work done on moving a charge 0.2 C through a distance of 2 m along a like making an angle of 60° with x-axis is 4.0 J. What is the value of *E*?

(a) $\sqrt{3}\ N/C$ (b) 4 *N*/*C* (c) 5 *N*/*C* (d) None of these

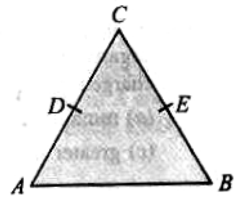
8. Kinetic energy of an electron accelerated in a potential difference of 100 V is

(a) 1.6×10^{-17} J (b) 1.6×10^{21} J (c) 1.6×10^{-29} J (d) 1.6×10^{-34} J

9. Two point charges $-q$ and $+q$ are located at points (0, 0 – *a*) and (0, 0, *a*), respectively. The potential at a point *P* (0, 0, *z*) where $z > a$ is

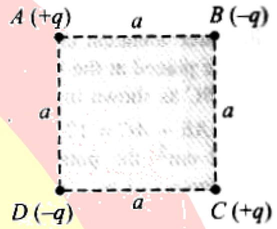
(a) $\frac{qa}{4\pi\varepsilon_0 z^2}$ (b) $\frac{q}{4\pi\varepsilon_0 a}$ (c) $\frac{2qa}{4\pi\varepsilon_0\left(z^2 - a^2\right)}$ (d) $\frac{2qa}{4\pi\varepsilon_0\left(z^2 + a^2\right)}$

10. Three charges, each $+q$, are placed at the corners of an isosceles triangle ABC of sides BC and $AC = 2\ a$. D and E are the mid points of BC and CA. The work done in taking a charge Q from D to E is



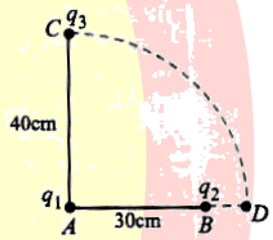
(a) zero
(b) $\dfrac{3qQ}{4\pi \in_0 a}$
(c) $\dfrac{3qQ}{8\pi \in_0 a}$
(d) $\dfrac{qQ}{4\pi \in_0 a}$

11. There are four point charges $+q$, $-q$, $+q$ and $-q$ placed at the corners A, B, C and D respectively of a square of side a. The potential energy of the system is $\dfrac{1}{4\pi\varepsilon_0}$ times.



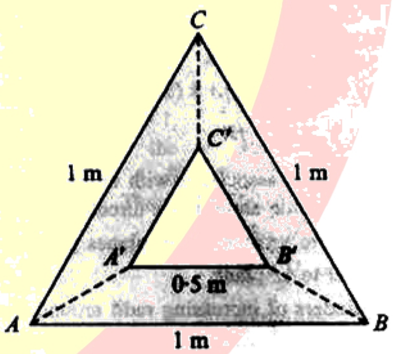
(a) $\dfrac{q^2}{a}\left(-4+\sqrt{2}\right)$
(b) $\dfrac{q^2}{2a}\left(-4+\sqrt{2}\right)$
(c) $\dfrac{4q^2}{a}$
(d) $\dfrac{-4\sqrt{2}q^2}{a}$

12. Two charges q_1 and q_2 are placed 30 cm apart, as shown in figure. A third charge q_3 is moved along the arc of a circle of radius 40 cm from C to D. The change in the potential energy of the system is $\dfrac{q_3}{4\pi \in_0}k$, where k is



(a) 8 q_2
(b) 6 q_2
(c) 8 q_1
(d) 6 q_1

13. Three point charges of 1C, 2 C and 3 C are placed at corners of an equilateral triangle of side 1 m. Work required to move these charges to the corners of a smaller equilateral triangle of side 0.5 will be

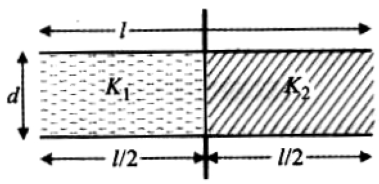


(a) 9.9×10^{10} J
(b) 9.9×10^{9} J
(c) 9.9×10^{8} J
(d) 9.9×10^{11} J

14. When a dielectric material is introduced between the plates of a charged condenser, then electric field between the plates

(a) decreases
(b) increases
(c) remains constant
(d) first (b) then (a)

15. A parallel plate capacitor is filled with two dielectrics as shown in figure. Its capacity has ratio with capacity without dielectric as



(a) $\left(K_1+K_1\right)$
(b) $\left(\dfrac{K_1+K_2}{2}\right)$
(c) $\left(\dfrac{K_1K_2}{K_1+K_2}\right)$
(d) $2\left(K_1+K_2\right)$

16. Which of the following particles will describe the smallest circle when projected with the same velocity perpendicular to the magnetic field?

(a) Electron (b) Proton (c) α -particle (d) Deutron

17. A particle having positive charge is released from rest in an electric field acting horizontally and moves under the influence of both electric field and gravity. Which one of the following quantities connected with the charge particles continuously increase with time?

(a) Electric potential energy (b) Gravitational potential energy

(c) Electrical charge (d) Kinetic energy

18. If a charged particle enters perpendicular in the uniform magnetic field, then

(a) energy and angular momentum both remain constant

(b) energy remains constant but angular momentum changes

(c) both energy and angular momentum change

(d) energy changes but angular momentum remains constant

19. An electron and a proton enters a magnetic field perpendicularly. Both have same kinetic energy. Which of the following is true?

(a) Trajectory of electron is less curved (b) Trajectory of proton is less curved

(c) Both trajectories are equal (d) Both move in straight line path

20. The cyclotron frequency of an electron orbiting in a magnetic field of 1 T is approximately

(a) 28 MHz (b) 280 M Hz (c) 2.8 G Hz (d) 28 G Hz

21. In the figure, the electron enters into the magnetic field. It deflects in ... direction

(a) +ve X-direction

(b) –ve X-direction

(c) +ve Y-direction

(d) –ve Y-direction

22. If the strength of the magnetic field produced 10 cm away from an infinitely long straight conductor is 10^{-5} weber/m^2, the value of the current flowing in the conductor will be

(a) 5 A (b) 10 A (c) 500 A (d) 1000 A

23. A wire in the form of a square of side *a* carries a current *I*. The magnetic field induction at the centre of the square wire is (Magnetic permeability of free space $= \mu_0$)

(a) $\frac{\mu_0 I}{2\pi a}$ (b) $\frac{\mu_0 I\sqrt{2}}{\pi a}$ (c) $\frac{2\sqrt{2}\mu_0 I}{\pi a}$ (d) $\frac{\mu_0 I}{\sqrt{2}\pi a}$

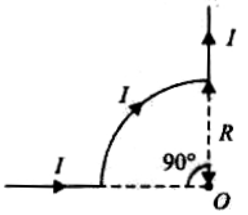
24. A wire of length *L* is bent into a semicircle. The magnetic field at the centre is

(a) $\frac{\mu_0 \pi I}{4L}$ (b) $\frac{\mu_0 I}{4\pi L}$ (c) $\frac{\mu_0 I}{\pi L}$ (d) $\frac{\mu_0 I}{4L}$

25. A circular coil of radius 10 cm and 100 turns carries a current 1 A. What is the magnetic moment of the coil?

(a) 3.142 Am^2 (b) 3142 × 10^4 Am^2 (c) 3 Am^2 (d) 10^4 Am^2

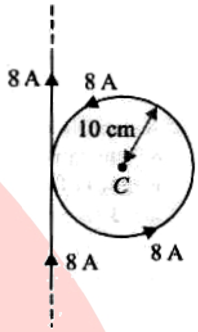
26. A current carrying conductor is bent into a quarter of a circle of radius R as shown in figure. The magnetic field at the centre O is



(a) $\frac{\mu_0 I}{8R}$ inwards (b) $\frac{\mu_0 I}{8R}$ outwards

(c) $\frac{\mu_0 I}{4R}$ inwards (d) $\frac{\mu_0 I}{4R}$ outwards

27. A long, straight wire is turned into a loop of radius 10 cm figure. If a current of 8 A is passed through the loop, then the value of the magnetic field and its direction at the centre C of the loop shall be close to



(a) 5.0×10^{-5} N A^{-1} m^{-1}, upward

(b) 3.4×10^{-5} N A^{-1} m^{-1}, upward

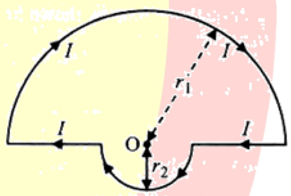
(c) 1.6×10^{-5} N A^{-1} m^{-1}, downward

(d) 1.6×10^{-5} N A^{-1} m^{-1}, upward

28. A thin ring of radius R metre has charge q coulomb uniformly spread on it. The ring rotates about its axis with a constant frequency of f revolutions/s. The value of magnetic induction in Wb/m^2 at the centre of the ring is

(a) $\frac{\mu_0 q f}{2\pi R}$ (b) $\frac{\mu_0 q}{2\pi f R}$ (c) $\frac{\mu_0 q}{2 f R}$ (d) $\frac{\mu_0 q f}{2R}$

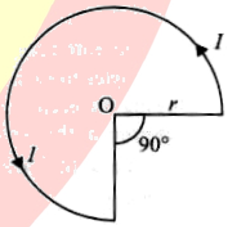
29. In the figure shown, there are two semicircles of radii r_1 and r_2 in which a current I is flowing. The magnetic field induction at the centre O will be



(a) $\frac{\mu_0 I}{2}(r_1 + r_2)$ (b) $\frac{\mu_0 I}{4}(r_1 - r_2)$

(c) $\frac{\mu_0 I}{4}\left(\frac{r_1 + r_2}{r_1 r_2}\right)$ (d) $\frac{\mu_0 I}{4}\left(\frac{r_2 - r_1}{r_1 r_2}\right)$

30. Refer to figure, the magnitude of magnetic field induction at point O due to current I in the arrangement is

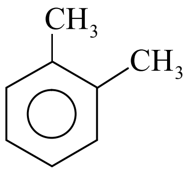
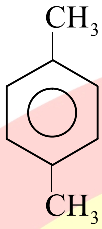


(a) $\frac{\mu_0}{4\pi}\frac{I}{r}$ (b) $\frac{\mu_0}{8\pi}\frac{I}{r}$

(c) $\frac{\mu_0}{4\pi}\frac{I}{r}(1+\pi)$ (d) $\frac{3\mu_0 I}{8r}$

31. $CH_3-CH_2-CH_2-Cl$ and $CH_3-\underset{\displaystyle Cl}{\underset{|}{CH}}-CH_3$ shows which type isomerism

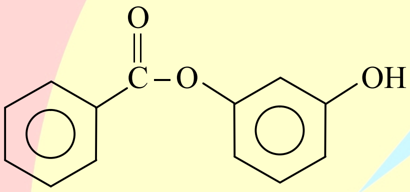
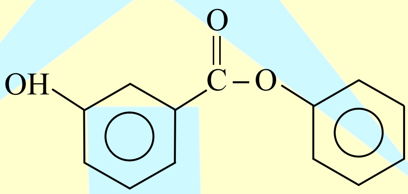
(a) Chain isomer (b) Position isomers (c) Functional isomers (d) Metamers

32.  and  shows which type of isomerism

(a) Position isomers (b) Chain isomers (c) Functional isomers (d) Metamers

33. CH_3-CH_2-COOH and $CH_3-\overset{\displaystyle O}{\overset{||}{C}}-O-CH_3$ express which of isomerism

(a) Position isomers (b) Chain isomers (c) Metamers (d) Functional isomerism

34.  and  express which type of isomers

(a) Metamers (b) Tautomers (c) Functional isomers (d) Chain isomers

35. The molecules which not exhibit metamerism are

(a) $C_4H_{10}O$ (ethers) (b) C_4H_8 (Alkene) (c) $C_5H_{10}O$ (ketone) (d) $C_4H_{11}N$ (Amine)

36. Which molecule has higher enol contents

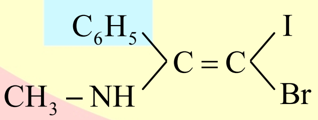
(a) $CH_3-\overset{\displaystyle O}{\overset{||}{C}}-CH_3$

(b) $H-\overset{\displaystyle O}{\overset{||}{C}}-CH_2-\overset{\displaystyle O}{\overset{||}{C}}-H$

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

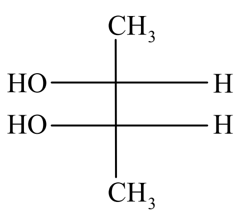
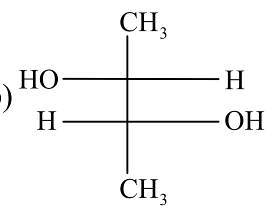
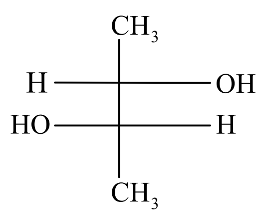
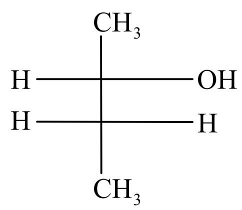
(d) $CH_3-O-\overset{\displaystyle O}{\overset{||}{C}}-CH_2-\overset{\displaystyle O}{\overset{||}{C}}-O-CH_3$

37. Give the E-Z designation of the following compound –

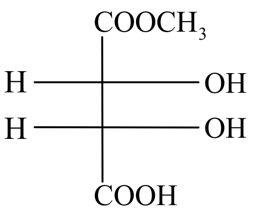


(a) Z (b) E (c) E-Z (d) E-E

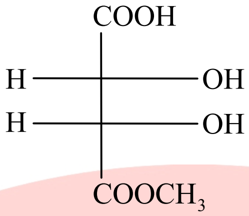
38. A Fischer projection of (2R, 3S) -2,3-butanediol is

(a)  (b)  (c)  (d) 

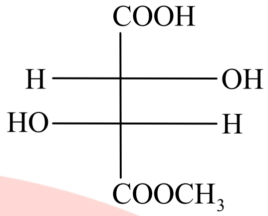
39. The correct statement about the compound A, B and C



A



B



C

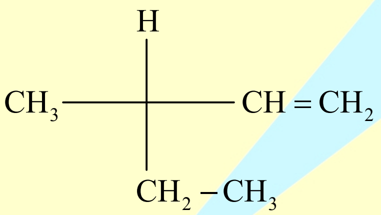
(a) A & B are diasteromers

(b) A & B are Identical

(c) A & C are enantiomers

(d) None of these

40. The following hydrocarbon can exhibit



(a) Optical isomerism

(b) Geometrical isomerism

(c) Both (a) & (b)

(d) Metamerism

41. The density of a pure substance 'A' whose atoms pack in cubic close pack arrangement is 1 g/cc. If B atoms can occupy tetrahedral void and if all the tetrahedral voids are occupied by 'B' atom. What is the density of resulting solid in g/cc. [Atomic mass (A) = 30 g/mol and atomic mass (B) = 50 g/mol]

(a) 3.33 (b) 4.33 (c) 2.33 (d) 5.33

42. How many unit cells are present in 5.0 gm of crystal AB (formula mass of $AB = 40$) having rock salt type structure? (N_A = Avogadro's no.)

(a) N_A (b) $\frac{N_A}{10}$ (c) $4N_A$ (d) none of these

43. The density of CaF_2 (fluorite structure) is $3.18\ g/cm^3$. The length of the side of the unit cell is :

(a) 253 pm (b) 344 pm (c) 546 pm (d) 273 pm

44. First three nearest neighbour distances for body centered cubic lattice are respectively :

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

45. When heated above 916°C, iron changes its bcc crystalline form to fcc without the change in the radius of atom. The ratio of density of the crystal before heating and after heating is:

(a) 1.069 (b) 0.918 (c) 0.725 (d) 1.231

46. A solution of urea (mol. mass 60 g mol^{-1}) boils at 100.18°C at the atmospheric pressure. If K_f and K_b for water are 1.86 and 0.512 K kg mol^{-1} respectively, the above solution will freeze at :

(a) 0.654°C (b) –0.654°C (c) 6.54°C (d) –6.54°C

47. 18 g glucose ($C_6H_{12}O_6$) is added to 178.2 g of water. The vapour pressure of water for this aqueous solution at 100°C is:

(a) 759 torr (b) 7.60 torr (c) 76 torr (d) 752.4 torr

48. Relationship between osmotic pressure at 273 K when 1% glucose (π_1), 1% urea (π_2), 81% sucrose (π_3), are dissolved in 1 litre of water :

(a) $\pi_1 > \pi_2 > \pi_3$ (b) $\pi_2 > \pi_1 > \pi_3$ (c) $\pi_3 > \pi_1 > \pi_2$ (d) $\pi_1 = \pi_2 = \pi_3$

49. A 0.004 M solution of Na_2SO_4 is isotonic with a 0.010 M solution of glucose at same temperature. The apparent degree of dissociation of Na_2SO_4 is :

(a) 25% (b) 50% (c) 75% (d) 85%

50. The amount of ice that will separate out on cooling a solution containing 50 g of ethylene glycol in 200 g water to –9.3°C is :

$\left(K_f' = 1.86 \text{ K molality}^{-1}\right)$

(a) 38.71 g (b) 38.71 mg (c) 42 g (d) 42 mg

51. Rate of reaction $A + B \longrightarrow C$ is given below as function of different initial concentrations of A and B.

	[A] mol L^{-1}	**[B] mol L^{-1}**	**Initial rate**
1.	0.01	0.01	0.005
2.	0.02	0.01	0.010
3.	0.01	0.02	0.005

Determine the order with respect to A and B.

(a) 1, 0 (b) 0, 1 (c) 1, 1 (d) 2, 1

52. The rate of reaction between A and B increases by a factor of 1000 when concentration of A is changed from 0.5 mol L^{-1} to 5 mol L^{-1}. The order of reaction with respect to A is

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

53. For reaction $A \rightarrow B$, the rate constant $k_1 = A_{1e^{-E_{a1}/RT}}$ and for the reaction $P \rightarrow Q$, the rate constant $k_2 = A_{2e^{-E_{a2}/RT}}$ If $A_1 = 10^8, A_2 = 10^{10}$ and $E_{a_1} = 600, E_{a_2} = 1200$, then the temperature at which $k_1 = k_2$ is

(a) $\frac{600}{R}$ (b) $300 \times 4.606R$ (c) $\frac{600}{4.606R}$ (d) $\frac{4.606}{600R}$

54. There are two reactions $X \longrightarrow$ Products and $Y \longrightarrow$ Products have rate constants k_1 and k_2 at temperature T and activation energies E_1 and E_2 respectively.

If $k_1 > k_2$ and $E_1 < E_2$. Assuming that the Arrhenius factor is same for both the temperatures, then

(a) On increasing the temperature, the increases in k_2 will be greater than increase in k_1

(b) On increasing the temperature, the increases in k_1 will be greater than increase in k_2

(c) At lower temperature, k_1 will be closer to k_2

(d) At lower temperature, $k_1 < k_2$

55. For an endothermic process, where ΔH represents the enthalpy of reaction in kJ/mol, the minimum value for the energy activation will be

(a) Less than ΔH (b) Zero (c) More than ΔH (d) Equal to ΔH

56. Three faradays of electricity are passed through molten Al_2O_3, aqueous solution of $CuSO_4$ and molten NaCl in three different electrolytic cells. The amount of Al, Cu, Na deposited at the cathodes will be in mole ratio of

(a) 1:2:3 (b) 1:1:5:3 (c) 3:2:1 (d) 1:5:2:3

57. Given :

$$Hg_2^{2+} + 2e^- \rightleftharpoons 2Hg \quad E^\circ = 0.789\,V$$

$$Hg^{+2} + 2e^- \rightleftharpoons Hg \quad E^\circ = 0.854\,V$$

Calculate the equilibrium constant for $Hg_2^{+2} \rightleftharpoons Hg + Hg^{+2}$

(a) 3.13×10^{-3} (b) 3.13×10^{-4} (c) 6.26×10^{-3} (d) 6.26×10^{-4}

58. The saturated reduction potential for Cu^{+2}/Cu is $+0.34$ Volt. Calculate reduction potential at $pH = 14$ for the above couple K_{SP} of $Cu(OH)_2$ is 1×10^{-19}

(a) $0.2214\,V$ (b) $-0.2214\,V$ (c) $2.214\,V$ (d) $0.1107\,V$

59. Reduction potential diagram for Cu in acid solution is

$$Cu^{+2} \xrightarrow{0.15\text{ volt}} Cu^{+} \xrightarrow{0.50\text{ volt}} Cu$$

$$Cu^{+2} \rightarrow Cu: \quad E^\circ = x\text{ volt}$$

Calculate x.

(a) -0.325 V (b) 3.25 V (c) 0.032 V (d) 0.325 V

60. For $I_2 + 2e^- \longrightarrow 2I^-$, standard reduction potential $= 0.54$ volt

For $2Br^- \longrightarrow Br_2 + 2e^-$ standard oxidation potential $= -1.08$ volt

For $Fe^{2+} + 2e^- \longrightarrow Fe$ standard reduction potential $= -0.44$ volt

Which of the following reactions is non–spontaneous?

(a) $Br_2 + 2I^- \longrightarrow 2Br^- + I_2$ (b) $Fe + Br_2 \longrightarrow Fe^{2+} + 2Br^-$

(c) $Fe + I_2 \longrightarrow Fe^{2+} + 2I^-$ (d) $I_2 + 2Br^- \longrightarrow 2I^- + Br_2$

61. If $g\left(x^3+1\right)=x^6+x^3+2$, then the value of $g\left(x^2-1\right)$ is:

(a) x^4-3x^2+3 (b) x^4+x^2+4 (c) x^4-3x^2+4 (d) x^4+x+2

62. Let $f:R\to R$ be defined as $f(x)=x^{12}-x^9+x^4-x+1$, then:

(a) f is one-one function (b) the equation $f(x)=0$ possesses real roots

(c) the equation $f'(x)=0$ has no real roots (d) $f(x)$ takes only positive values

63. The domain of the function

$f(x)=(x+0.5)^{\log_{(0.5+x)}\left(\frac{x^2+2x-3}{4x^2-4x-3}\right)}$ is

(a) $(-\infty,-3)\cup\left(\frac{-1}{2},1\right)\cup\left(\frac{3}{2},\infty\right)$ (b) $(-\infty,-3)\cup\left(\frac{-1}{2},\frac{1}{2}\right)\cup\left(\frac{1}{2},1\right)\cup\left(\frac{3}{2},\infty\right)$

(c) $\left(\frac{1}{2},1\right)\cup\left(\frac{3}{2},\infty\right)$ (d) $\left(\frac{-1}{2},\frac{1}{2}\right)\cup\left(\frac{1}{2},1\right)\cup\left(\frac{3}{2},\infty\right)$

64. Let $P(x)=\left(x^2+2kx+\frac{3}{4}-k\right)$. If graph of $P(x)$ does not intersect y-axis, then the range of k is

(a) $\left(-\infty,\frac{3}{4}\right)$ (b) $\left(\frac{3}{4},\infty\right)$ (c) $\left[\frac{-3}{2},\frac{1}{2}\right]$ (d) ϕ

65. If the equation $|2-x|-|x+1|=k$ has exactly one solution, them number of integral values of k is

(a) 7 (b) 5 (d) 4 (d) 3

66. For $x\neq\frac{n\pi}{2}$ where $n\in I$, the range of function

$f(x)=\operatorname{sgn}(\sin x)+\operatorname{sgn}(\cos x)+\operatorname{sgn}(\tan x)+\operatorname{sgn}(\cot x)$ is equal to:

[Note: sgn x denotes signum function of x.]

(a) $\{-2,4\}$ (b) $\{-2,0,4\}$ (c) $\{-4,-2,0,4\}$ (d) $\{0,2,4\}$

67. The value of x satisfying the equation

(a) $\left(\sqrt{\pi}\right)^{\log_{\pi}x}.\left(\sqrt{\pi}\right)^{\log_{\pi^2}x}.\left(\sqrt{\pi}\right)^{\log_{\pi^4}x}.\left(\sqrt{\pi}\right)^{\log_{\pi^8}x}.....\infty=3$ is equal to:

(a) $\sqrt{\pi}$ (b) π (c) 3 (d) $\frac{1}{3}$

68. The range of function $f(x)=\log_2\left(\frac{\pi+2\sin^{-1}\left(\frac{3-x}{7}\right)}{\pi}\right)$ is equal to:

(a) $(-\infty,1)$ (b) $(1,\infty)$ (c) $(-\infty,1]$ (d) $[1,\infty)$

69. The greatest value of the function

$f(x)=\sum_{n=1}^{3}\left(\left(\sin^2 x\right)^n+\left(\cos^2 x\right)^n\right)$ for all $x\in R$ is equal to:

(a) 1 (b) 3 (c) $\frac{7}{4}$ (d) 5

70. $\lim_{x\to-\infty}\frac{x^2\tan\left(\frac{1}{x}\right)-x}{1-|x|}$ equals:

(a) 0 (b) -1 (c) 1 (d) Does not exist

71. $\lim_{x\to\infty}2^{x-1}\left(\sin\frac{\pi}{2^x}+\tan\frac{\pi}{2^x}\right)$ is equal to:

(a) 0 (b) 1 (c) π (d) $\frac{\pi}{2}$

72. $\lim_{n\to\infty}\left(\sqrt{\left(n^2+n+1\right)}-\left[\sqrt{\left(n^2+n+1\right)}\right]\right)$ where [ ] denotes the greatest integer function

(a) 0 (b) $\frac{1}{2}$ (c) $\frac{2}{3}$ (d) $\frac{1}{4}$

73. Let $f:R\to R$ be a function defined by $f(x)=\max\left\{x,x^3\right\}$. The set of all points where $f(x)$ is not differentiable is:

(a) $\{-1,1\}$ (b) $\{-1,0\}$ (c) $\{0,1\}$ (d) $\{-1,0,1\}$

74. $\lim_{x\to1}\frac{\sqrt{\left[1-\cos2(x-1)\right]}}{(x-1)}$

(a) exists and it equals $+\sqrt{2}$

(b) exists and it equals $-\sqrt{2}$

(c) does not exist because $(x-1)\to0$

(d) does not exist because left hand limit is not equal to right hand limit

75. If $a+b+c=0$, then the quadratic equation $3ax^2+2bx+c=0$ has:

(a) at least one root in $[0,1]$ (b) one root in $[2,3]$ and the other in $[-2,-1]$

(c) imaginary roots. (d) none of the above

76. The maximum value of the function $f(x)=2x^3-15x^2+36x-48$ on the set $A=\left\{x\mid x^2+20\le9x\right\}$ is at:

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

77. Let $a,b\in R$ be such that the function f given by $f(x)=\ln|x|+bx^2+ax, x\ne0$ has extreme values at $x=-1$ and $x=2$

Statement – 1: f has local maximum at $x=-1$ and at $x=2$

Statement – 2: $a=\frac{1}{2}$ and $b=\frac{-1}{4}$

(a) Statement – 1 is true, Statement – 2 is true and Statement – 2 is not a correct explanation for Statement – 1

(b) Statement – 1 is true, statement – 2 is false

(c) Statement – 1 is false and statement – 2 is true

(d) Statement – 1 is true, statement – 2 is true, statement-2 is a correct explanation for Statement – 1.

78. If equation of tangent to the curve $y=-e^{-x/2}$ where it crosses the y-axis is $\frac{x}{a}+\frac{y}{b}=1$, then $(a-b)$ is equal to:

(a) –3 (b) –2 (c) 2 (d) 3

79. The normal to the curve

$x=a(\cos\theta+\theta\sin\theta), y=a(\sin\theta-\theta\cos\theta)$ at any point θ is such that

(a) it makes a constant angle with the $x-$axis. (b) it passes through the origin

(c) it is at a constant distance from the origin (d) none of the above

80. If the curve $\frac{x^2}{c}+\frac{y^2}{4}=1$ and $y^2=16x$ intersect at right angles, then c is equal to:

(a) $\frac{3}{4}$ (b) $\frac{1}{2}$ (c) $\frac{4}{3}$ (d) 2

81. If the largest possible interval in which $f(x)=x^3+6x^2+px+7$ is decreasing function is $(-3,-1)$, then the value of p is equal to:

(a) 5 (b) 6 (c) 9 (d) 11

82. The value of $5\cdot\cot\left(\sum_{k=1}^{5}\cot^{-1}(k^2+k+1)\right)$ is equal to

(a) $\frac{5}{2}$ (b) 7 (c) –7 (d) $\frac{7}{2}$

83. Range of $f(x)=\sin^{-1}\log[x]+\log(\sin^{-1}[x])$, where [ ] denotes GIF is

(a) {1} (b) {0} (c) $\left\{\log\frac{\pi}{2}\right\}$ (d) None of these

84. If the equation $5\,\text{arc}\tan(x^2+x+k)+3\ \text{arc}\cot(x^2+x+k)=2\pi$, has two distinct solutions, then the range of k, is

(a) $\left(0, \frac{5}{4}\right]$ (b) $\left(-\infty, \frac{5}{4}\right)$ (c) $\left(\frac{5}{4}, \infty\right)$ (d) $\left(-\infty, \frac{5}{4}\right]$

85. If $\cot^{-1}\left(\frac{n^2-10n+21\cdot 6}{\pi}\right)>\frac{\pi}{6}$, $n\in N$, then find the minimum value of n.

(a) 2 (b) 3 (c) 4 (d) None of these

86. Find the sum of greatest and least value of; $\left(\sin^{-1}x\right)^3+\left(\cos^{-1}x\right)^3$.

(a) $\frac{6\pi^3}{8}$ (b) $\frac{7\pi^3}{8}$ (c) $\frac{9\pi^3}{8}$ (d) None of these

87. If A and B are square matrices of the same order and A is nonsingular, then for a positive integer $n, \left(A^{-1}BA\right)^n$ is equal to

(a) $A^{-n}B^nA^n$ (b) $A^nB^nA^{-n}$ (c) $A^{-1}B^nA$ (d) $n\left(A^{-1}BA\right)$

88. If $A^2-A+I=0,$ then the inverse of A is

(a) A^{-2} (b) $A+I$ (c) $I-A$ (d)

89. When the determinant $\begin{vmatrix} \cos 2x & \sin^2 x & \cos 4x \\ \sin^2 x & \cos 2x & \cos^2 x \\ \cos 4x & \cos^2 x & \cos 2x \end{vmatrix}$ is expanded in powers of $\sin x,$ then the constant term in that expression is

(a) 1 (b) 0 (c) -1 (d) 2

90. If $\Delta=\begin{vmatrix} 3 & 4 & 5 & x \\ 4 & 5 & 6 & y \\ 5 & 6 & 7 & z \\ x & y & z & 0 \end{vmatrix}=0,$ then

(a) x,y,z are in A.P. (b) x,y,z are in G. P. (c) x,y,z are in H.P. (d) none of these

ANSWER KEY

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