COMMON ENTRANCE TEST - 2011

DATE	SUBJECT	TIME
28-04-2011	PHYSICS	10.30 AM to 11.50 AM

MAXIMUM MARKS	TOTAL DURATION	MAXIMUM TIME FOR ANSWERING
60	80 MINUTES	70 MINUTES

MENTION YOUR CET NUMBER	QUESTION BOOKLET DETAILS	
	VERSION CODE	SERIAL NUMBER
	A - 1	538497

DOs :

1. Check whether the CET No. has been entered and shaded in the respective circles on the OMR answer sheet.
2. This Question Booklet is issued to you by the Invigilator after the **2nd Bell**, i.e., after **10.30 a.m.**
3. The Serial Number of this question booklet should be entered on the OMR answer sheet.
4. The Version Code of this question booklet should be entered on the OMR answer sheet and the respective circles should be shaded completely.
5. Compulsory sign at the bottom portion of the OMR answer sheet in the space provided.

DON'Ts :

1. **The timing and marks printed on the OMR answer sheet should not be damaged/mutilated/spoiled.**
2. The **3rd Bell** rings at **10.40 a.m.** till then;
   - Do not remove the seal/staple present on the right hand side of this question booklet.
   - Do not look inside this question booklet.
   - Do not start answering on the OMR answer sheet.

IMPORTANT INSTRUCTIONS TO CANDIDATES

1. This question booklet contains 60 questions and each question will have one statement and four distracters (four different options / choices).
2. After the **3rd Bell** is rung at **10.40 a.m.**, remove the seal/staple present on the right hand side of this question booklet and start answering on the OMR answer sheet.
3. During the subsequent 70 minutes :
   - Read each question carefully.
   - Choose the correct answer from out of the four available distracters (options/choices) given under each question/statement.
   - Completely **darken/shade** the relevant circle with a **BLUE OR BLACK INK BALLPOINT PEN against the question number on the OMR answer sheet.**

CORRECT METHOD OF SHADING THE CIRCLE ON THE OMR SHEET IS AS SHOWN BELOW :

4. Please note that even a minute unintended ink dot on the OMR sheet will also be recognized and recorded by the scanner. Therefore, avoid multiple markings of any kind on the OMR answer sheet.
5. Use the space provided on each page of the question booklet for Rough Work. Do not use the OMR answer sheet for the same.
6. After the **last bell** is rung at **11.50 a.m.**, stop writing on the OMR answer sheet and affix your LEFT HAND THUMB IMPRESSION on the OMR answer sheet as per the instructions.
7. Hand over the OMR answer sheet to the room Invigilator as it is.
8. After separating and retaining the top sheet (KEA Copy), the Invigilator will return the bottom sheet replica (Candidate's copy) to you to carry home for self-evaluation.
9. Preserve the replica of the OMR answer sheet for a minimum period of ONE year.

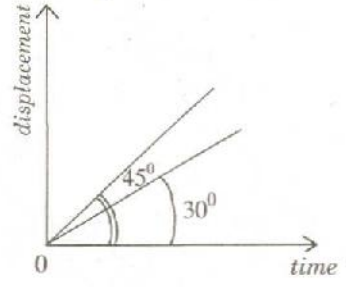
PHYSICS

1. If C be the capacitance and V be the electric potential, then the dimensional formula of CV^2 is .....

   1) $M^1L^2T^{-2}A^0$ 2) $M^1L^1T^{-2}A^{-1}$

   3) $M^0L^1T^{-2}A^0$ 4) $M^1L^{-3}T^1A^1$

2. The displacement-time graphs of two moving particles make angles of 30^0 and 45^0 with the X-axis. The ratio of their velocities is .....



   1) $\sqrt{3} : 2$

   2) $1 : 1$

   3) $1 : 2$

   4) $1 : \sqrt{3}$

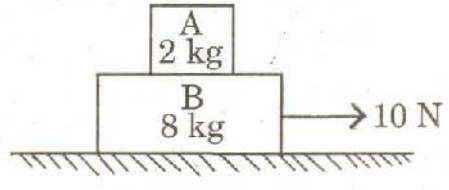
3. Block A of mass 2 kg is placed over block B of mass 8 kg. The combination is placed over a rough horizontal surface. Coefficient of friction between B and the floor is 0.5. Coefficient of friction between A and B is 0.4. A horizontal force of 10 N is applied on block B. The force of friction between A and B is ..... ($g = 10\ ms^{-2}$).

   1) 100 N

   2) 40 N

   3) 50 N

   4) zero



4. The height y and the distance x along the horizontal plane of a projectile on a certain planet (with no surrounding atmosphere) are given by $y = 8t - 5t^2$ meter and $x = 6t$ meter, where t is in seconds. The velocity with which the projectile is projected is .....

   1) $6\ ms^{-1}$ 2) $8\ ms^{-1}$

   3) $10\ ms^{-1}$ 4) $14\ ms^{-1}$

5. A body of mass 5 kg is thrown vertically up with a kinetic energy of 490 J. The height at which the kinetic energy of the body becomes half of the original value is ..... (acceleration due to gravity = $9.8\ ms^{-2}$).

   1) 5 m 2) 2.5 m

   3) 10 m 4) 12.5 m

(Space for Rough Work)

6. A solid sphere of mass m rolls down an inclined plane without slipping, starting from rest at the top of an inclined plane. The linear speed of the sphere at the bottom of the inclined plane is v. The kinetic energy of the sphere at the bottom is .....

1) $\frac{1}{2}mv^2$ 2) $\frac{5}{3}mv^2$

3) $\frac{2}{5}mv^2$ 4) $\frac{7}{10}mv^2$

7. Two satellites of mass m and $9\,m$ are orbiting a planet in orbits of radius R. Their periods of revolution will be in the ratio of .....

1) 9 : 1 2) 3 : 1

3) 1 : 1 4) 1 : 3

8. The following four wires of length L and radius r are made of the same material. Which of these will have the largest extension, when the same tension is applied?

1) $L = 100$ cm, $r = 0.2$ mm 2) $L = 200$ cm, $r = 0.4$ mm

3) $L = 300$ cm, $r = 0.6$ mm 4) $L = 400$ cm, $r = 0.8$ mm

9. The resultant of two forces acting at an angle of 120^0 is 10 kg wt and is perpendicular to one of the forces. That force is .....

1) $10\sqrt{3}$ kg wt 2) $20\sqrt{3}$ kg wt

3) 10 kg wt 4) $\frac{10}{\sqrt{3}}$ kg wt

10. Eight equal drops of water are falling through air with a steady velocity of 10 cm s^{-1}. If the drops combine to form a single drop big in size, then the terminal velocity of this big drop is .....

1) 40 cm s^{-1} 2) 10 cm s^{-1}

3) 30 cm s^{-1} 4) 80 cm s^{-1}

(Space for Rough Work)

11. Two capillary tubes of different diameters are dipped in water. The rise of water is .....

1) the same in both tubes
2) greater in the tube of larger diameter
3) greater in the tube of smaller diameter
4) independent of the diameter of the tube

12. A perfect gas at 27^0C is heated at constant pressure so as to double its volume. The increase in temperature of the gas will be .....

1) 600^0C
2) 327^0C
3) 54^0C
4) 300^0C

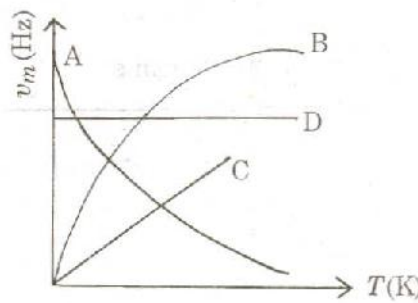
13. Three identical rods A, B and C are placed end to end. A temperature difference is maintained between the free ends of A and C. The thermal conductivity of B is THRICE that of C and HALF of that of A. The effective thermal conductivity of the system will be ..... (K_A is the thermal conductivity of rod A).

1) $\frac{1}{3} K_A$
2) $3 K_A$
3) $2 K_A$
4) $\frac{2}{3} K_A$

14. The quantities of heat required to raise the temperatures of two copper spheres of radii r_1 and r_2 ($r_1 = 1.5\, r_2$) through 1 K are in the ratio of .....

1) $\frac{27}{8}$
2) $\frac{9}{4}$
3) $\frac{3}{2}$
4) 1

15. Which one of the following is $\upsilon_m - T$ graph for perfectly black body? υ_m is the frequency of radiation with maximum intensity. T is the absolute temperature.



1) A
2) B
3) C
4) D

(Space for Rough Work)

16. A particle executing a simple harmonic motion has a period of 6sec. The time taken by the particle to move from the mean position to half the amplitude, starting from the mean position is .....

1) $\frac{3}{2}$ sec
2) $\frac{1}{2}$ sec
3) $\frac{3}{4}$ sec
4) $\frac{1}{4}$ sec

17. The equation of a wave is given by $y = 10\ Sin\left(\frac{2\pi}{45}t + \alpha\right)$. If the displacement is 5 cm at $t = 0$, then the total phase at $t = 7.5$ sec. is .....

1) $\frac{\pi}{3}$
2) $\frac{\pi}{2}$
3) $\frac{\pi}{6}$
4) π

18. Two tuning forks, A and B, produce notes of frequencies 258 Hz and 262 Hz. An unknown note sounded with A produces certain beats. When the same note is sounded with B, the beat frequency gets doubled. The unknown frequency is .....

1) 250 Hz
2) 252 Hz
3) 254 Hz
4) 256 Hz

19. A wire under tension vibrates with a fundamental frequency of 600 Hz. If the length of the wire is doubled, the radius is halved and the wire is made to vibrate under one-ninth the tension. Then the fundamental frequency will become .....

1) 200 Hz
2) 300 Hz
3) 600 Hz
4) 400 Hz

20. Faintest stars are called .....

1) zero magnitude stars
2) second magnitude stars
3) sixth magnitude stars
4) dwarfs

(Space for Rough Work)

21. Wavelength of given light waves in air and in a medium are $6000\,\mathring{A}$ and $4000\,\mathring{A}$ respectively. The critical angle is .....

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

3) $Sin^{-1}\left(\frac{2}{3}\right)$ 4) $Sin^{-1}\left(\frac{3}{2}\right)$

22. The time required for the light to pass through a glass slab (refractive index = 1.5) of thickness 4 mm is ..... ($c = 3 \times 10^8\ ms^{-1}$, speed of light in free space).

1) 10^{-11} sec 2) 2×10^{-11} sec

3) $2 \times 10^{+11}$ sec 4) 2×10^{-5} sec

23. A prism having refractive index 1.414 and refracting angle 30^0 has one of the refracting surfaces silvered. A beam of light incident on the other refracting surface will retrace its path, if the angle of incidence is .....

1) 0^0 2) 30^0

3) 60^0 4) 45^0

24. A planoconvex lens has a maximum thickness of 6 cm. When placed on a horizontal table with the curved surface in contact with the table surface, the apparent depth of the bottommost point of the lens is found to be 4 cm. If the lens is inverted such that the plane face of the lens is in contact with the surface of the table, the apparent depth of the center of the plane face is found to be $\left(\frac{17}{4}\right)$ cm. The radius of curvature of the lens is .....

1) 68 cm 2) 75 cm

3) 128 cm 4) 34 cm

25. Two thin lenses have a combined power of +9D. When they are separated by a distance of 20 cm, their equivalent power becomes $+\frac{27}{5}$ D. Their individual powers (in diopters) are .....

1) 1, 8 2) 2, 7

3) 3, 6 4) 4, 5

(Space for Rough Work)

26. Wavefront is the locus of all points, where the particles of the medium vibrate with the same .....

1) phase 2) amplitude

3) frequency 4) period

27. Two monochromatic light waves of amplitudes 3A and 2A interfering at a point have a phase difference of 60^0. The intensity at that point will be proportional to .....

1) $5\,A^2$ 2) $13\,A^2$

3) $7\,A^2$ 4) $19\,A^2$

28. Consider the following statements in case of Young's double slit experiment.

a) A slit S is necessary if we use an ordinary extended source of light.

b) A slit S is not needed if we use an ordinary but well collimated beam of light.

c) A slit S is not needed if we use a spatially coherent source of light.

Which of the above statements are correct?

1) a), b) and c) 2) a) and b)

3) b) and c) 4) a) and c)

29. A parallel beam of light of wavelength $6000\,\mathring{A}$ gets diffracted by a single slit of width 0.3 mm. The angular position of the first minima of diffracted light is .....

1) 2×10^{-3} rad 2) 3×10^{-3} rad

3) 1.8×10^{-3} rad 4) 6×10^{-3} rad

30. The critical angle of a certain medium is $Sin^{-1}\left(\frac{3}{5}\right)$. The polarizing angle of the medium is .....

1) $Sin^{-1}\left(\frac{4}{5}\right)$ 2) $Tan^{-1}\left(\frac{5}{3}\right)$

3) $Tan^{-1}\left(\frac{3}{4}\right)$ 4) $Tan^{-1}\left(\frac{4}{3}\right)$

(Space for Rough Work)

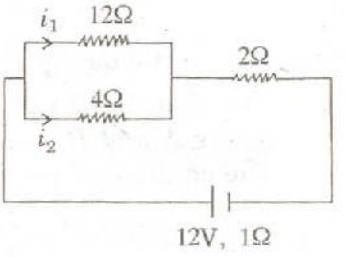
31. Two identical charged spheres of material density ρ, suspended from the same point by inextensible strings of equal length make an angle θ between the strings. When suspended in a liquid of density σ the angle θ remains the same. The dielectric constant K of the liquid is .....

1) $\frac{\rho}{\rho-\sigma}$ 2) $\frac{\rho-\sigma}{\rho}$ 3) $\frac{\rho}{\rho+\sigma}$ 4) $\frac{\rho+\sigma}{\rho}$

32. The electric field at a point due to an electric dipole, on an axis inclined at an angle $\theta\left(<90^0\right)$ to the dipole axis, is perpendicular to the dipole axis, if the angle θ is .....

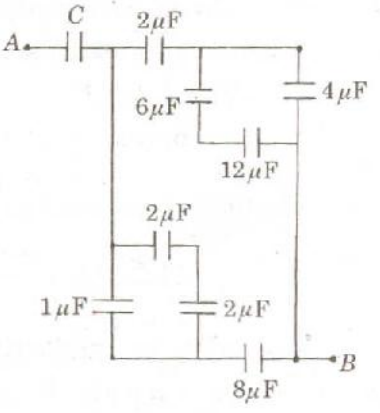
1) $Tan^{-1}(2)$ 2) $Tan^{-1}\left(\frac{1}{2}\right)$ 3) $Tan^{-1}\left(\sqrt{2}\right)$ 4) $Tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$

33. In the circuit shown, the currents i_1 and i_2 are .....



1) $i_1 = 1.5$ A, $i_2 = 0.5$ A
2) $i_1 = 0.5$ A, $i_2 = 1.5$ A
3) $i_1 = 1$ A, $i_2 = 3$ A
4) $i_1 = 3$ A, $i_2 = 1$ A

34. In the given network, the value of C, so that an equivalent capacitance between A and B is 3μF, is .....



1) $\frac{1}{5}\mu$F
2) $\frac{31}{5}\mu$F
3) 48 μF
4) 36 μF

35. A conductor wire having 10^{29} free electrons/m^3 carries a current of 20A. If the cross-section of the wire is 1mm^2, then the drift velocity of electrons will be ..... ($e = 1.6 \times 10^{-19}$ C).

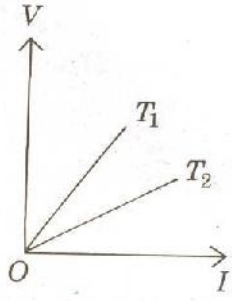
1) 1.25×10^{-4} ms^{-1} 2) 1.25×10^{-3} ms^{-1}
3) 1.25×10^{-5} ms^{-1} 4) 6.25×10^{-3} ms^{-1}

(Space for Rough Work)

36. A resistor has a colour code of green, blue, brown and silver. What is its resistance?

1) $56\Omega \pm 5\%$
2) $560\Omega \pm 10\%$
3) $560\Omega \pm 5\%$
4) $5600\Omega \pm 10\%$

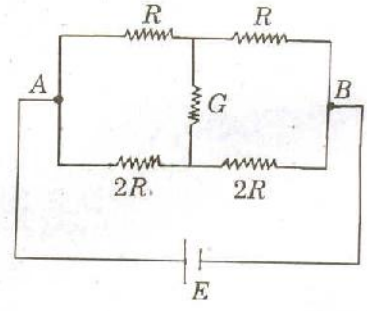
37. The voltage V and current I graphs for a conductor at two different temperatures T_1 and T_2 are shown in the figure. The relation between T_1 and T_2 is .....



1) $T_1 > T_2$
2) $T_1 < T_2$
3) $T_1 = T_2$
4) $T_1 = \frac{1}{T_2}$

38. Consider the following statements regarding the network shown in the figure.

a) The equivalent resistance of the network between points A and B is independent of value of G.
b) The equivalent resistance of the network between points A and B is $\frac{4}{3}R$.
c) The current through G is zero.

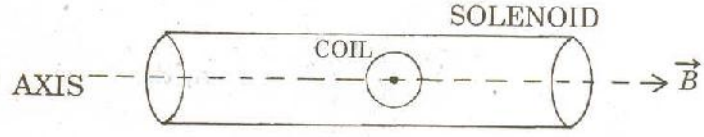


Which of the above statements is/are TRUE?

1) a) alone
2) b) alone
3) b) and c)
4) a), b) and c)

39. The torque required to hold a small circular coil of 10 turns, area 1 mm^2 and carrying a current of $\left(\frac{21}{44}\right)$A in the middle of a long solenoid of 10^3 turns/m carrying a current of 2.5A, with its axis perpendicular to the axis of the solenoid is .....

1) 1.5×10^{-6} N-m
2) 1.5×10^{-8} N-m
3) $1.5 \times 10^{+6}$ N-m
4) $1.5 \times 10^{+8}$ N-m

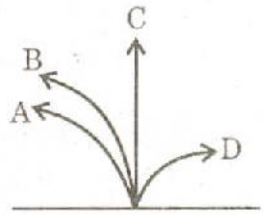


40. A particle of charge e and mass m moves with a velocity v in a magnetic field B applied perpendicular to the motion of the particle. The radius r of its path in the field is .....

1) $\frac{mv}{Be}$
2) $\frac{Be}{mv}$
3) $\frac{ev}{Bm}$
4) $\frac{Bv}{em}$

(Space for Rough Work)

41. A neutron, a proton, an electron and an α-particle enter a region of uniform magnetic field with the same velocities. The magnetic field is perpendicular and directed into the plane of the paper. The tracks of the particles are labelled in the figure. The electron follows the track .....



1) A
2) B
3) C
4) D

42. The deflection in a moving coil galvanometer is reduced to half when it is shunted with a 40 Ω coil. The resistance of the galvanometer is .....

1) 80 Ω
2) 40 Ω
3) 20 Ω
4) 15 Ω

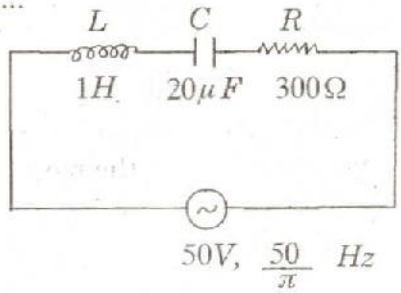
43. A current of $\left(\frac{2}{\sqrt{3}}\right)$A produces a deflection of 60^0 in a tangent galvanometer. The reduction factor is .....

1) $\left(\frac{2}{\sqrt{3}}\right)$A
2) $\left(\frac{2}{3}\right)$A
3) 2A
4) $\left(\frac{3}{2}\right)$A

44. In an A.C. circuit, V and I are given by $V = 150\ Sin(150t)$ volt and $I = 150 Sin\left(150t + \frac{\pi}{3}\right)$ ampere. The power dissipated in the circuit is .....

1) 106 W
2) 150 W
3) 5625 W
4) zero

45. In the series L–C–R circuit shown, the impedance is .....



1) 200 Ω
2) 100 Ω
3) 300 Ω
4) 500 Ω

(Space for Rough Work)

46. The energy stored in an inductor of self inductance L henry carrying a current of I ampere is .....

1) $\frac{1}{2}L^2I$ 2) $\frac{1}{2}LI^2$

3) LI^2 4) L^2I

47. A transformer works on the principle of .....

1) self induction
2) electrical inertia
3) mutual induction
4) magnetic effect of the electrical current

48. Flash spectrum confirms a/an .....

1) total solar eclipse 2) lunar eclipse
3) earthquake 4) magnetic storm

49. The photoelectric threshold wavelength for silver is λ_0. The energy of the electron ejected from the surface of silver by an incident wavelength $\lambda(\lambda < \lambda_0)$ will be .....

1) $hc(\lambda_0 - \lambda)$ 2) $\frac{hc}{\lambda_0 - \lambda}$

3) $\frac{h}{c}\left(\frac{\lambda_0 - \lambda}{\lambda\lambda_0}\right)$ 4) $hc\left(\frac{\lambda_0 - \lambda}{\lambda\lambda_0}\right)$

50. Rutherford's atomic model could account for .....

1) stability of atoms
2) origin of spectra
3) the positively charged central core of an atom
4) concept of stationary orbits

(Space for Rough Work)

51. When an electron jumps from the orbit $n = 2$ to $n = 4$, then wavelength of the radiations absorbed will be ..... (R is Rydberg's constant).

1) $\frac{16}{3R}$ 2) $\frac{16}{5R}$

3) $\frac{5R}{16}$ 4) $\frac{3R}{16}$

52. The thermonuclear reaction of hydrogen inside the stars is taking place by a cycle of operations. The particular element which acts as a catalyst is .....

1) nitrogen 2) oxygen

3) helium 4) carbon

53. The ratio of minimum wavelengths of Lyman and Balmer series will be .....

1) 1.25 2) 0.25

3) 5 4) 10

54. The fraction of the initial number of radioactive nuclei which remain undecayed after half of a half-life of the radioactive sample is .....

1) $\frac{1}{4}$ 2) $\frac{1}{2\sqrt{2}}$

3) $\frac{1}{2}$ 4) $\frac{1}{\sqrt{2}}$

55. 1 curie represents .....

1) 3.7×10^7 disintegrations per second

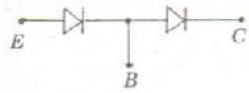
2) 3.7×10^{10} disintegrations per second

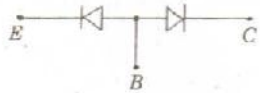
3) 10^6 disintegrations per second

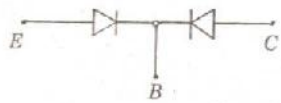
4) 1 disintegration per second

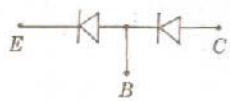
(Space for Rough Work)

56. An n–p–n transistor can be considered to be equivalent to two diodes, connected. Which of the following figures is the CORRECT ONE?

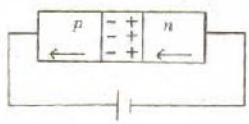
1) 

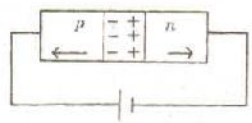
2) 

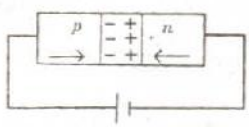
3) 

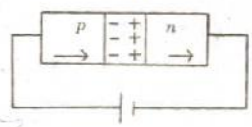
4) 

57. In the case of forward biasing of a p–n junction diode, which one of the following figures correctly depicts the direction of conventional current (indicated by an arrow mark)?

1) 

2) 

3) 

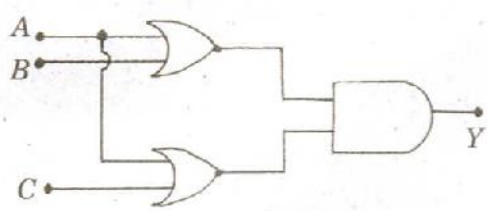
4) 

58. An electron of mass m_e and a proton of mass m_p are moving with the same speed. The ratio of their de-Broglie's wavelengths λ_e / λ_p is .....

1) 1
2) 1836
3) $\frac{1}{1836}$
4) 918

59. The output of given logic circuit is .....

1) A · (B + C)
2) A · (B · C)
3) (A + B) · (A + C)
4) A + B + C



60. If the scattering intensity of a liquid is 8 units at a wavelength of 500 nm, then the scattering intensity at a wavelength of 400 nm will be approximately .....

1) 13 units
2) 16 units
3) 20 units
4) 24 units

(Space for Rough Work)

COMMON ENTRANCE TEST - 2011

DATE	SUBJECT	TIME
28-04-2011	CHEMISTRY	02.30 PM to 03.50 PM

MAXIMUM MARKS	TOTAL DURATION	MAXIMUM TIME FOR ANSWERING
60	80 MINUTES	70 MINUTES

MENTION YOUR CET NUMBER	QUESTION BOOKLET DETAILS	
	VERSION CODE	SERIAL NUMBER
	A - 1	727393

DOs :

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CHEMISTRY

1. Which one of the following statements is FALSE?

   1) During roasting, moisture is removed from the ore.

   2) The ore is freed from almost all nonmetallic impurities.

   3) Calcination of ore is carried out in the absence of any blast of air.

   4) The concentrated zinc blende is subjected to calcination during its extraction by pyrometallurgy.

2. Which one of the following sets of quantum numbers represents the highest energy level in an atom?

   1) $n = 4,\ l = 0,\ m = 0,\ s = +\frac{1}{2}$ 2) $n = 3,\ l = 1,\ m = 1,\ s = +\frac{1}{2}$

   3) $n = 3,\ l = 2,\ m = -2,\ s = +\frac{1}{2}$ 4) $n = 3,\ l = 0,\ m = 0,\ s = +\frac{1}{2}$

3. When O_2 is converted into O_2^+; .....

   1) both paramagnetic character and bond order increase

   2) bond order decreases

   3) paramagnetic character increases

   4) paramagnetic character decreases and the bond order increases

4. In chromite ore, the oxidation number of iron and chromium are respectively .....

   1) +3, +2 2) +3, +6

   3) +2, +6 4) +2, +3

5. The number of naturally occurring *p*-block elements that are diamagnetic is .....

   1) 18 2) 6

   3) 5 4) 7

(Space for Rough Work)

6. If the energies of the two photons are in the ratio of 3 : 2, their wavelengths will be in the ratio of .....

1) 9 : 4 2) 2 : 3

3) 1 : 2 4) 3 : 2

7. Which one of these is NOT TRUE for benzene?

1) There are three carbon-carbon single bonds and three carbon-carbon double bonds.
2) It forms only one type of monosubstituted product.
3) The bond angle between carbon-carbon bonds is 120^0.
4) Heat of hydrogenation of benzene is less than the theoretical value.

8. Generally, the first ionization energy increases along a period. But there are some exceptions. The one which is NOT an exception is .....

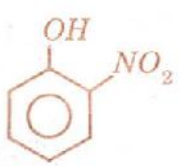
1) *Na* and *Mg* 2) *Be* and *B*

3) *N* and *O* 4) *Mg* and *Al*

9. Out of the given two compounds, the vapour pressure of B at a particular temperature is .....

1) lower than that of A
2) higher than that of A
3) same as that of A
4) higher or lower than A depending on the size of the vessel

(A)



(B)

10. Increasing order of carbon-carbon bond length for the following is .....

C_2H_4	C_2H_2	C_6H_6	C_2H_6
(A)	(B)	(C)	(D)

1) B < C < A < D 2) C < B < A < D

3) B < A < C < D 4) D < C < A < B

(Space for Rough Work)

11. A mixture of $CaCl_2$ and $NaCl$ weighing 4.44 g is treated with sodium carbonate solution to precipitate all the calcium ions as calcium carbonate. The calcium carbonate so obtained is heated strongly to get 0.56 g of CaO. The percentage of $NaCl$ in the mixture is ..... [Atomic mass of Ca = 40].

1) 31.5 2) 75

3) 25 4) 40.2

12. 50 cm^3 of 0.2 N HCl is titrated against 0.1 N $NaOH$ solution. The titration was discontinued after adding 50 cm^3 of $NaOH$. The remaining titration is completed by adding 0.5 N KOH. The volume of KOH required for completing the titration is .....

1) 10 cm^3 2) 12 cm^3

3) 16.2 cm^3 4) 21.0 cm^3

13. The rms velocity of hydrogen is $\sqrt{7}$ times the rms velocity of nitrogen. If T is the temperature of the gas, which of the following is true?

1) $T_{N_2} = T_{H_2}$ 2) $T_{H_2} = \sqrt{7}\,T_{N_2}$

3) $T_{N_2} = 2T_{H_2}$ 4) $T_{N_2} = \sqrt{7}\,T_{H_2}$

14. 25 g of each of the following gases are taken at 27°C and 600 mm pressure. Which of these will have the least volume?

1) HBr 2) HCl

3) HF 4) HI

15. The amount of heat evolved when 500 cm^3 of 0.1 M HCl is mixed with 200 cm^3 of 0.2 M $NaOH$ is .....

1) 1.292 kJ 2) 2.292 kJ

3) 0.292 kJ 4) 22.9 kJ

(Space for Rough Work)

16. The enthalpy of vaporization of benzene is +35.3 kJ/mol at its boiling point of 80°C. The entropy change in the transition of vapour to liquid at its boiling point is ..... [in J mol^{-1} K^{-1}].

1) −100 2) +100

3) +342 4) −342

17. Based on the first law of thermodynamics, which one of the following is correct?

1) For an isothermal process, $q = +w$

2) For an isochoric process, $\Delta U = -q$

3) For an adiabatic process, $\Delta U = -w$

4) For a cyclic process, $q = -w$

18. Consider the following gaseous equilibria with equilibrium constants K_1 and K_2 respectively.

$SO_{2(g)} + \frac{1}{2} O_{2(g)} \rightleftharpoons SO_{3(g)}$

$2SO_{3(g)} \rightleftharpoons 2SO_{2(g)} + O_{2(g)}$

The equilibrium constants are related as .....

1) $2K_1 = K_2^2$ 2) $K_1^2 = \frac{1}{K_2}$

3) $K_2^2 = \frac{1}{K_1}$ 4) $K_2 = \frac{2}{K_1^2}$

19. During the adsorption of Krypton on activated charcoal at low temperature; .....

1) $\Delta H < 0$ and $\Delta S < 0$ 2) $\Delta H > 0$ and $\Delta S < 0$

3) $\Delta H > 0$ and $\Delta S > 0$ 4) $\Delta H < 0$ and $\Delta S > 0$

20. For the reversible reaction, $A_{(g)} + B_{(g)} \rightleftharpoons C_{(g)} + D_{(g)}$ $\Delta G^0 = -350\,kJ$, which one of the following statements is true?

1) The reaction is thermodynamically nonfeasible.

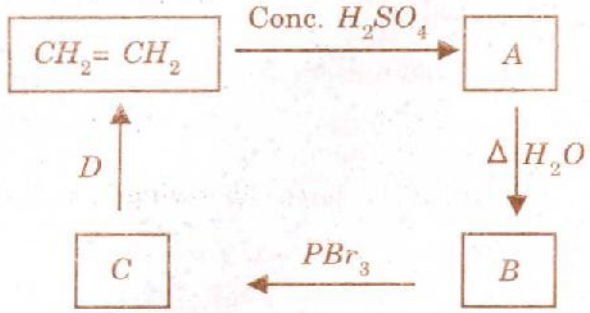
2) The entropy change is negative.

3) Equilibrium constant is greater than one.

4) The reaction should be instantaneous.

(Space for Rough Work)

21. Identify B and D in the following sequence of reactions.



1) Methanol and bromoethane
2) Ethyl hydrogen sulphate and alcoholic KOH
3) Ethyl hydrogen sulphate and aqueous KOH
4) Ethanol and alcoholic KOH

22. The compound which gives turbidity immediately with Lucas reagent at room temperature is .....

1) butan-1-ol
2) butan-2-ol
3) 2-methyl propan-2-ol
4) 2-methyl propan-1-ol

23. Ethyl benzene CANNOT be prepared by .....

1) Wurtz reaction
2) Wurtz-Fittig reaction
3) Friedel-Crafts reaction
4) Clemmensen reduction

24. 1.2 g of organic compound on Kjeldahlization liberates ammonia which consumes 30 cm^3 of 1 N HCl. The percentage of nitrogen in the organic compound is .....

1) 30
2) 35
3) 46.67
4) 20.8

25. Carbon cannot reduce Fe_2O_3 to Fe at a temperature below 983 K because .....

1) free energy change for the formation of CO is more negative than that of Fe_2O_3
2) CO is thermodynamically more stable than Fe_2O_3
3) carbon has higher affinity towards oxygen than iron
4) iron has higher affinity towards oxygen than carbon

(Space for Rough Work)

26. The yellow precipitate formed during the chromyl chloride test is chemically .....

1) chromic acid
2) lead chromate
3) lead acetate
4) sodium chromate

27. One gram of silver gets distributed between 10 cm^3 of molten zinc and 100 cm^3 of molten lead at 800°C. The percentage of silver still left in the lead layer is approximately .....

1) 2
2) 5
3) 3
4) 1

28. Which one of the following is true?

1) *NaOH* is used in the concentration of bauxite ore.
2) *NaOH* is a primary standard in volumetric analysis.
3) Manganous hydroxide is soluble in excess of *NaOH* solution.
4) *NaOH* solution does not react with Cl_2.

29. In Ramsay and Rayleigh's isolation of noble gases from air, the nitrogen of the air is finally converted into .....

1) $NaNO_2$ only
2) NO and NO_2
3) $NaNO_3$ only
4) $NaNO_2$ and $NaNO_3$

30. The spin only magnetic moment of Fe^{2+} ion (in BM) is approximately .....

1) 4
2) 7
3) 5
4) 6

(Space for Rough Work)

31. The IUPAC name of the complex $\left[Co(NH_3)_4Cl_2\right]Cl$ is .....

1) dichloro tetraammine cobalt (III) chloride
2) tetraammine dichloro cobalt (III) chloride
3) tetraammine dichloro cobalt (II) chloride
4) tetraammine dichloro cobalt (IV) chloride

32. Excess of silver nitrate solution is added to 100 ml of 0.01 M Pentaaqua chloro chromium (III) chloride solution. The mass of silver chloride obtained in grams is ..... [Atomic mass of silver is 108].

1) 287×10^{-3}
2) 143.5×10^{-3}
3) 143.5×10^{-2}
4) 287×10^{-2}

33. The following data were obtained during the first order decomposition of $2A_{(g)} \rightarrow B_{(g)} + C_{(s)}$ at a constant volume and at a particular temperature.

Sr. No.	Time	Total pressure in Pascal
1	At the end of 10 min	300
2	After completion	200

The rate constant in min^{-1} is .....

1) 0.0693
2) 69.3
3) 6.93
4) 6.93×10^{-4}

34. The time required for 100% completion of a zero order reaction is .....

1) ak
2) $\frac{a}{2k}$
3) $\frac{a}{k}$
4) $\frac{2k}{a}$

35. The activation energy of a reaction at a given temperature is found to be 2.303 RT J mol^{-1}. The ratio of rate constant to the Arrhenius factor is .....

1) 0.01
2) 0.1
3) 0.02
4) 0.001

(Space for Rough Work)

36. pH value of which one of the following is NOT equal to one?

1) 0.1 M CH_3COOH
2) 0.1 M HNO_3
3) 0.05 M H_2SO_4
4) 50 cm^3 0.4 M HCl + 50 cm^3 0.2 M $NaOH$

37. A buffer solution contains 0.1 mole of sodium acetate dissolved in 1000 cm^3 of 0.1 M acetic acid. To the above buffer solution, 0.1 mole of sodium acetate is further added and dissolved. The pH of the resulting buffer is .....

1) pK_a
2) $pK_a + 2$
3) $pK_a - Log\ 2$
4) $pK_a + Log\ 2$

38. H_2S is passed into one dm^3 of a solution containing 0.1 mole of Zn^{2+} and 0.01 mole of Cu^{2+} till the sulphide ion concentration reaches 8.1×10^{-19} moles. Which one of the following statements is true?
[K_{sp} of ZnS and CuS are 3×10^{-22} and 8×10^{-36} respectively]

1) Only ZnS precipitates
2) Both CuS and ZnS precipitate
3) Only CuS precipitates
4) No precipitation occurs

39. E_1, E_2 and E_3 are the emfs of the following three galvanic cells respectively :

(i) $Zn(s) \mid Zn^{2+}(0.1M) \parallel Cu^{2+}(1M) \mid Cu(s)$

(ii) $Zn(s) \mid Zn^{2+}(1M) \parallel Cu^{2+}(1M) \mid Cu(s)$

(iii) $Zn(s) \mid Zn^{2+}(1M) \parallel Cu^{2+}(0.1M) \mid Cu(s)$

Which one of the following is true?

1) $E_2 > E_1 > E_3$
2) $E_1 > E_2 > E_3$
3) $E_3 > E_1 > E_2$
4) $E_3 > E_2 > E_1$

40. 0.023 g of sodium metal is reacted with 100 cm^3 of water. The pH of the resulting solution is .....

1) 10
2) 8
3) 9
4) 12

(Space for Rough Work)

41. The standard emf of a galvanic cell involving 2 moles of electrons in its redox reaction is 0.59 V. The equilibrium constant for the redox reaction of the cell is .....

1) 10^{20} 2) 10^{5}

3) 10 4) 10^{10}

42. 9.65 coulombs of electric current is passed through fused anhydrous $MgCl_2$. The magnesium metal thus obtained is completely converted into a Grignard reagent. The number of moles of Grignard reagent obtained is .....

1) 5×10^{-4} 2) 1×10^{-4}

3) 5×10^{-5} 4) 1×10^{-5}

43. The empirical formula of a nonelectrolyte is CH_2O. A solution containing 3 g of the compound exerts the same osmotic pressure as that of 0.05 M glucose solution. The molecular formula of the compound is .....

1) CH_2O 2) $C_2H_4O_2$

3) $C_4H_8O_4$ 4) $C_3H_6O_3$

44. Which one of the following is a covalent crystal?

1) Rock salt 2) Ice

3) Quartz 4) Dry ice

45. Which one of the following DOES NOT involve coagulation?

1) Clotting of blood by the use of ferric chloride

2) Formation of delta region

3) Treatment of drinking water by potash alum

4) Peptization

(Space for Rough Work)

46. A solution of two liquids boils at a temperature more than the boiling point of either of them. Hence, the binary solution shows .....

1) negative deviation from Raoult's law
2) positive deviation from Raoult's law
3) no deviation from Raoult's law
4) positive or negative deviation from Raoult's law depending upon the composition

47. Which one of the nitrogen atoms in $H_2N - NH - \overset{\overset{O}{\|}}{C} - NH_2$ is the most nucleophilic?
(I, II, III)

1) III
2) I
3) II
4) All three nitrogen atoms are equally strong nucleophilic centers

48. The maximum number of possible optical isomers in 1-bromo-2-methyl cyclobutane is ...

1) 4
2) 2
3) 8
4) 16

49. Which one of the following is the most energetic conformation of cyclohexane?

1) Boat
2) Twisted boat
3) Chair
4) Half chair

50. Which one of the following is an intermediate in the reaction of benzene with CH_3Cl in the presence of anhydrous $AlCl_3$?

1) Cl^+
2) CH_2^-
3) CH_3^+
4) 

(Space for Rough Work)

51. Which one of the following is NOT TRUE for the hydrolysis of *t*-butyl bromide with aqueous *NaOH*?

1) Reaction occurs through the S_N1 mechanism.
2) The intermediate formed is a carbocation.
3) Rate of the reaction doubles when the concentration of alkali is doubled.
4) Rate of the reaction doubles when the concentration of *t*-butyl bromide is doubled.

52. Following is the substitution reaction in which *–CN* replaces *–Cl*.

$$R-Cl + KCN \xrightarrow[(alcoholic)]{\Delta} R-CN + KCl$$

To obtain propanenitrile, *R–Cl* should be .....

1) chloroethane
2) 1-chloropropane
3) chloromethane
4) 2-chloropropane

53. The conversion of *m*-nitrophenol to resorcinol involves respectively .....

1) hydrolysis, diazotization and reduction
2) diazotization, reduction and hydrolysis
3) hydrolysis, reduction and diazotization
4) reduction, diazotization and hydrolysis

54. Formic acid is a stronger acid than acetic acid. This can be explained using .....

1) +M effect
2) –I effect
3) +I effect
4) –M effect

55. The reagent with which both acetaldehyde and acetone react is .....

1) Fehling's solution
2) I_2 / *NaOH*
3) Tollens' reagent
4) Carbonic acid

(Space for Rough Work)

56. Which of the following gives an aldehyde on dry distillation?

1) Calcium formate + calcium acetate
2) Calcium acetate + calcium benzoate
3) Calcium acetate
4) Calcium benzoate

57. α-maltose consists of .....

1) one α-D-glucopyranose unit and one β-D-glucopyranose unit with 1-2 glycosidic linkage
2) two α-D-glucopyranose units with 1-2 glycosidic linkage
3) two β-D-glucopyranose units with 1-4 glycosidic linkage
4) two α-D-glucopyranose units with 1-4 glycosidic linkage

58. Which one of the following DOES NOT correctly match with each other?

1) Silk-polyamide
2) Lipase-enzyme
3) Butter-fat
4) Oxytocin-enzyme

59. In an alkaline medium, glycine predominantly exists as/in a/an .....

1) cation
2) anion
3) zwitterion
4) covalent form

60. The IUPAC name of  is .....

1) but-3-enoic acid
2) but-1-enoic acid
3) pent-4-enoic acid
4) prop-2-enoic acid

(Space for Rough Work)

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MATHEMATICS

1. If $\frac{Log\,x}{b-c} = \frac{Log\,y}{c-a} = \frac{Log\,z}{a-b}$, then the value of $x^{b+c} \cdot y^{c+a} \cdot z^{a+b}$ is .....

   1) 1 2) 2
   3) 0 4) –1

2. The sum of the first n terms of $\frac{1^2}{1} + \frac{1^2+2^2}{1+2} + \frac{1^2+2^2+3^2}{1+2+3} + \ldots\ldots$ is .....

   1) $\frac{n^2-2n}{3}$ 2) $\frac{2n^2+n}{3}$
   3) $\frac{n(n+2)}{3}$ 4) $\frac{2n^2-n}{3}$

3. In n is an odd positive integer and $\left(1+x+x^2+x^3\right)^n = \sum_{r=0}^{3n} a_r x^r$, then

   $a_0 - a_1 + a_2 - a_3 + \ldots\ldots - a_{3n}$ is = ...

   1) 4^n 2) 1
   3) –1 4) 0

4. If r^{th} and $(r+1)^{th}$ terms in the expansion of $(p+q)^n$ are equal, then $\frac{(n+1)q}{r(p+q)}$ is .....

   1) 0 2) 1
   3) $\frac{1}{4}$ 4) $\frac{1}{2}$

5. If α, β and γ are roots of $x^3 - 2x + 1 = 0$, then the value of $\sum\left(\frac{1}{\alpha+\beta-\gamma}\right)$ is .....

   1) $\frac{-1}{2}$ 2) –1
   3) 0 4) $\frac{1}{2}$

(Space for Rough Work)

6. Define a relation R on $A = \{1, 2, 3, 4\}$ as ${}_xR_y$ if x divides y. R is .....

1) reflexive and transitive
2) reflexive and symmetric
3) symmetric and transitive
4) equivalence

7. The negation of $p \rightarrow (\sim p \vee q)$ is .....

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

8. In any triangle ABC, the simplified form of $\frac{Cos\,2A}{a^2} - \frac{Cos\,2B}{b^2}$ is .....

1) $a^2 - b^2$
2) $\frac{1}{a^2 - b^2}$
3) $\frac{1}{a^2} - \frac{1}{b^2}$
4) $a^2 + b^2$

9. Angles of elevation of the top of a tower from three points (collinear) A, B and C on a road leading to the foot of the tower are 30^0, 45^0 and 60^0 respectively. The ratio of AB to BC is .....

1) $\sqrt{3} : 1$
2) $\sqrt{3} : 2$
3) $1 : 2$
4) $2 : \sqrt{3}$

10. The value of $Sin10 \cdot Sin30 \cdot Sin50 \cdot Sin70$ is .....

1) $\frac{1}{8}$
2) $\frac{3}{16}$
3) $\frac{\sqrt{3}}{16}$
4) $\frac{1}{16}$

(Space for Rough Work)

11. Locus of a point which moves such that its distance from the X-axis is twice its distance from the line $x - y = 0$ is .....

1) $x^2 + 4xy - y^2 = 0$ 2) $2x^2 - 4xy + y^2 = 0$

3) $x^2 - 4xy + y^2 = 0$ 4) $x^2 - 4xy - y^2 = 0$

12. The points $A(1, 2)$, $B(2, 4)$ and $C(4, 8)$ form a/an .....

1) isosceles triangle 2) equilateral triangle

3) straight line 4) right angled triangle

13. If lines represented by $x + 3y - 6 = 0$, $2x + y - 4 = 0$ and $kx - 3y + 1 = 0$ are concurrent, then the value of k is .....

1) $\frac{6}{19}$ 2) $\frac{19}{6}$

3) $\frac{-19}{6}$ 4) $\frac{-6}{19}$

14. $\underset{x \to a}{Lim} \left[\frac{\sqrt{a+2x} - \sqrt{3x}}{\sqrt{3a+x} - \sqrt[3]{x}} \right] =$ .....

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

3) $\frac{3\sqrt{3}}{2}$ 4) $\frac{2}{3\sqrt{3}}$

15. If $f(x) = \begin{cases} \frac{Log\, x}{x-1} & \text{if } x \neq 1 \\ k & \text{if } x = 1 \end{cases}$ is continuous at $x = 1$, then the value of k is .....

1) 0 2) -1

3) 1 4) e

(Space for Rough Work)

16. If $A = \begin{bmatrix} Cos\theta & Sin\theta \\ -Sin\theta & Cos\theta \end{bmatrix}$, then $A \cdot A'$ is .....

1) I 2) A

3) $-A$ 4) A^2

17. If $\begin{bmatrix} 1 & 2 & -1 \\ 1 & x-2 & 1 \\ x & 1 & 1 \end{bmatrix}$ is singular, then the value of x is .....

1) 2 2) 3

3) 1 4) 0

18. If A and B are symmetric matrices of the same order, then which one of the following is NOT true?

1) $A + B$ is symmetric 2) $A - B$ is symmetric

3) $AB + BA$ is symmetric 4) $AB - BA$ is symmetric

19. If ω is an imaginary cube root of unity, then the value of $\begin{vmatrix} 1 & \omega^2 & 1-\omega^4 \\ \omega & 1 & 1+\omega^5 \\ 1 & \omega & \omega^2 \end{vmatrix}$ is .....

1) -4 2) $\omega^2 - 4$

3) ω^2 4) 4

20. If $\vec{a}, \vec{b}$ and $\vec{c}$ are unit vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ then angle between $\vec{a}$ and $\vec{b}$ is .....

1) $\frac{\pi}{2}$ 2) $\frac{\pi}{3}$

3) $\frac{2\pi}{3}$ 4) π

(Space for Rough Work)

21. If $\vec{a}, \vec{b}$ and $\vec{c}$ are noncoplanar, then the value of $\vec{a}\cdot\left\{\frac{\vec{b}\times\vec{c}}{3\vec{b}\cdot(\vec{c}\times\vec{a})}\right\}-\vec{b}\cdot\left\{\frac{\vec{c}\times\vec{a}}{2\vec{c}\cdot(\vec{a}\times\vec{b})}\right\}$ is .....

1) $\frac{-1}{2}$ 2) $\frac{-1}{3}$

3) $\frac{-1}{6}$ 4) $\frac{1}{6}$

22. If $2\hat{i}+3\hat{j}$, $\hat{i}+\hat{j}+\hat{k}$ and $\lambda\hat{i}+4\hat{j}+2\hat{k}$ taken in an order are coterminous edges of a parallelopiped of volume 2 *Cu* units, then value of λ is .....

1) -4 2) 2

3) 3 4) 4

23. A unit vector perpendicular to both $\hat{i}+\hat{j}+\hat{k}$ and $2\hat{i}+\hat{j}+3\hat{k}$ is .....

1) $\left(2\hat{i}-\hat{j}-\hat{k}\right)\sqrt{6}$ 2) $\frac{\left(2\hat{i}-\hat{j}-\hat{k}\right)}{\sqrt{6}}$

3) $2\hat{i}+\hat{j}+\hat{k}$ 4) $\frac{3\hat{i}+\hat{j}-2\hat{k}}{\sqrt{6}}$

24. The digit in the unit's place of $7^{171}+(177)!$ is .....

1) 3 2) 2

3) 1 4) 0

25. The sum of all positive divisors of 242 except 1 and itself is .....

1) 156 2) 242

3) 342 4) 399

(Space for Rough Work)

26. On the set of all nonzero reals, an operation $*$ is defined as $a*b=\frac{3ab}{2}$. In this group, a solution of $(2*x)*3^{-1}=4^{-1}$ is .....

1) 6 2) 1

3) $\frac{1}{6}$ 4) $\frac{3}{2}$

27. $G=\left\{\begin{bmatrix} x & x \\ x & x \end{bmatrix}, x \text{ is a nonzero real number}\right\}$ is a group with respect to matrix multiplication. In this group, the inverse of $\begin{bmatrix} \frac{1}{3} & \frac{1}{3} \\ \frac{1}{3} & \frac{1}{3} \end{bmatrix}$ is .....

1) $\begin{bmatrix} 4/3 & 4/3 \\ 4/3 & 4/3 \end{bmatrix}$ 2) $\begin{bmatrix} 3/4 & 3/4 \\ 3/4 & 3/4 \end{bmatrix}$

3) $\begin{bmatrix} 3 & 3 \\ 3 & 3 \end{bmatrix}$ 4) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

28. If $2x^2+2y^2+4x+5y+1=0$ and $3x^2+3y^2+6x-7y+3k=0$ are orthogonal, then value of k is .....

1) $\frac{17}{12}$ 2) $\frac{12}{17}$

3) $\frac{-12}{17}$ 4) $\frac{-17}{12}$

29. The total number of common tangents of $x^2+y^2-6x-8y+9=0$ and $x^2+y^2=1$ is .....

1) 4 2) 2

3) 3 4) 1

30. The center of a circle which cuts $x^2+y^2+6x-1=0$, $x^2+y^2-3y+2=0$ and $x^2+y^2+x+y-3=0$ orthogonally is .....

1) $\left(\frac{1}{7}, \frac{9}{7}\right)$ 2) $\left(\frac{-1}{7}, \frac{-9}{7}\right)$

3) $\left(\frac{1}{7}, \frac{-9}{7}\right)$ 4) $\left(\frac{-1}{7}, \frac{9}{7}\right)$

(Space for Rough Work)

31. The length of the latus rectum of $3x^2 - 4y + 6x - 3 = 0$ is .....

1) $\frac{3}{4}$ 2) $\frac{4}{3}$

3) 2 4) 3

32. The sum of the reciprocals of focal distances of a focal chord PQ of $y^2 = 4ax$ is .....

1) $\frac{1}{a}$ 2) a

3) $2a$ 4) $\frac{1}{2a}$

33. If the focii of $\frac{x^2}{16} + \frac{y^2}{4} = 1$ and $\frac{x^2}{a^2} - \frac{y^2}{3} = 1$ coincide, then value of a is .....

1) $\sqrt{3}$ 2) $\frac{1}{\sqrt{3}}$

3) 2 4) 1

34. The equation of a hyperbola whose asymptotes are $3x \pm 5y = 0$ and vertices are $(\pm 5, 0)$ is .....

1) $3x^2 - 5y^2 = 25$ 2) $5x^2 - 3y^2 = 225$

3) $25x^2 - 9y^2 = 225$ 4) $9x^2 - 25y^2 = 225$

35. The domain of $f(x) = Sin^{-1}\left[Log_2\left(\frac{x}{2}\right)\right]$ is .....

1) $0 \le x \le 1$ 2) $0 \le x \le 4$

3) $1 \le x \le 4$ 4) $4 \le x \le 6$

(Space for Rough Work)

36. If $Tan^{-1}x = \frac{\pi}{4} - Tan^{-1}\left(\frac{1}{3}\right)$, then x is .....

1) $\frac{1}{3}$ 2) $\frac{1}{2}$

3) $\frac{1}{4}$ 4) $\frac{1}{6}$

37. A value of θ satisfying $Sin5\theta - Sin3\theta + Sin\theta = 0$ such that $0 < \theta < \frac{\pi}{2}$ is .....

1) $\frac{\pi}{12}$ 2) $\frac{\pi}{6}$

3) $\frac{\pi}{4}$ 4) $\frac{\pi}{2}$

38. The value of $\left|\frac{1+i\sqrt{3}}{\left(1+\frac{1}{i+1}\right)^2}\right|$ is .....

1) 20 2) 9

3) $\frac{5}{4}$ 4) $\frac{4}{5}$

39. If ω is an imaginary cube root of unity, then the value of $\left(1-\omega+\omega^2\right)\cdot\left(1-\omega^2+\omega^4\right)\cdot\left(1-\omega^4+\omega^8\right)\cdot$.....$(2n$ factors$)$ is .....

1) 2^{2n} 2) 2^n

3) 1 4) 0

40. If $P(x, y)$ denotes $z = x + iy$ in Argand's plane and $\left|\frac{z-1}{z+2i}\right| = 1$, then the locus of P is a/an .....

1) hyperbola 2) ellipse

3) circle 4) straight line

(Space for Rough Work)

41. If $\sqrt{r} = a e^{\theta Cot \alpha}$ where a and α are real numbers, then $\frac{d^2r}{d\theta^2} - 4r Cot^2\alpha$ is .....

1) r 2) $\frac{1}{r}$

3) 1 4) 0

42. The derivative of $Tan^{-1}\left[\frac{Sin x}{1+Cos x}\right]$ with respect to $Tan^{-1}\left[\frac{Cos x}{1+Sin x}\right]$ is .....

1) 2 2) –1

3) 0 4) –2

43. $\frac{d}{dx}\left[Cos^2\left(Cot^{-1}\sqrt{\frac{2+x}{2-x}}\right)\right]$ is .....

1) $\frac{1}{4}$ 2) $\frac{1}{2}$

3) $\frac{-1}{2}$ 4) $\frac{-3}{4}$

44. If $f(x) = \frac{Sin^2x}{1+Cot x} + \frac{Cos^2x}{1+Tan x}$, then $f'\left(\frac{\pi}{4}\right)$ is .....

1) $\sqrt{3}$ 2) $\frac{1}{\sqrt{3}}$

3) 0 4) $-\sqrt{3}$

45. If $Cos^{-1}\left(\frac{y}{b}\right) = n Log\left(\frac{x}{n}\right)$, then .....

1) $xy_1 = n\sqrt{b^2 - y^2}$ 2) $xy_1 + n\sqrt{b^2 - y^2} = 0$

3) $y_1 = x\sqrt{b^2 - y^2}$ 4) $xy_1 - \sqrt{b^2 - y^2} = 0$

(Space for Rough Work)

46. Area of a triangle formed by tangent and normal to the curve $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ at $P\left(\frac{a}{\sqrt{2}},\frac{b}{\sqrt{2}}\right)$ with the X-axis is .....

1) $4ab$ 2) $\frac{ab\sqrt{a^2+b^2}}{4}$

3) $\frac{ab\sqrt{a^2-b^2}}{4}$ 4) $\frac{b\left(a^2+b^2\right)}{4a}$

47. The angle between $y^2=4x$ and $x^2+y^2=12$ at a point of their intersection is .....

1) $Tan^{-1}\sqrt{2}$ 2) $Tan^{-1}2$

3) $Tan^{-1}2\sqrt{2}$ 4) $Tan^{-1}\left(\frac{1}{2}\right)$

48. A sphere increases its volume at the rate of π cc/s. The rate at which its surface area increases when the radius is 1 cm is .....

1) 2π sq.cm/s 2) π sq.cm/s

3) $\frac{3\pi}{2}$ sq.cm/s 4) $\frac{\pi}{2}$ sq.cm/s

49. The value of $\int_0^4 |x-1|\,dx$ is .....

1) $\frac{5}{2}$ 2) 5

3) 4 4) 1

50. If $I_n=\int_0^{\pi/4} Tan^n x\,dx$, where n is a positive integer, then $I_{10}+I_8$ is .....

1) $\frac{1}{9}$ 2) $\frac{1}{8}$

3) $\frac{1}{7}$ 4) 9

(Space for Rough Work)

51. $\int e^x \left[\frac{Sin\,x + Cos\,x}{1 - Sin^2 x}\right] dx$ is .....

1) $\left(e^x \cdot Cosec\,x\right) + c$
2) $e^x Cot\,x + c$
3) $\left(e^x \cdot Sec\,x\right) + c$
4) $e^x Tan\,x + c$

52. When $x > 0$, then $\int Cos^{-1}\left(\frac{1-x^2}{1+x^2}\right) dx$ is .....

1) $2\left[x\,Tan^{-1}x - Log\left(1+x^2\right)\right] + c$
2) $2\left[x\,Tan^{-1}x + Log\left(1+x^2\right)\right] + c$
3) $2x\,Tan^{-1}x + Log\left(1+x^2\right) + c$
4) $2x\,Tan^{-1}x - Log\left(1+x^2\right) + c$

53. If the area between $y = mx^2$ and $x = my^2\ (m > 0)$ is $\frac{1}{4}$ sq. units, then value of m is .....

1) $\pm 3\sqrt{2}$
2) $\pm 2\sqrt{3}$
3) $\sqrt{2}$
4) $\sqrt{3}$

54. If m and n are degree and order of $\left(1 + y_1^2\right)^{2/3} = y_2$, then the value of $\frac{m+n}{m-n}$ is .....

1) 3
2) 4
3) 5
4) 2

55. The general solution of $\frac{dy}{dx} = 1 - x^2 - y^2 + x^2y^2$ is .....

1) $2Sin^{-1}y = x\sqrt{1-x^2} + Sin^{-1}x + c$
2) $Cos^{-1}y = x\,Cos^{-1}x + c$
3) $Sin^{-1}y = \frac{1}{2}Sin^{-1}x + c$
4) $2Sin^{-1}y = x\sqrt{1-y^2} + c$

(Space for Rough Work)

56. If $x\,Cos\alpha + y\,Sin\alpha = 4$ is tangent to $\frac{x^2}{25}+\frac{y^2}{9}=1$, then the value of α is .....

1) $Tan^{-1}(3/7)$
2) $Tan^{-1}(\sqrt{3}/7)$
3) $Tan^{-1}(7/3)$
4) $Tan^{-1}(3/\sqrt{7})$

57. If P is a point on $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ with focii S and S', then the maximum value of triangle SPS' is .....

1) ab
2) abe^2
3) abe
4) ab/e

58. In Argand's plane, the point corresponding to $\frac{(1-i\sqrt{3})(1+i)}{(\sqrt{3}+i)}$ lies in .....

1) quadrant I
2) quadrant II
3) quadrant III
4) quadrant IV

59. If $y = Sin\,x \cdot Sin\,2x \cdot Sin\,3x \ldots\ldots\ldots \cdot Sin\,nx$, then y' is .....

1) $\sum_{k=1}^{n} k\,Tan\,kx$
2) $y \cdot \sum_{k=1}^{n} k\,Cot\,kx$
3) $y \cdot \sum_{k=1}^{n} k\,Tan\,kn$
4) $\sum_{k=1}^{n} Cot\,kx$

60. $\begin{vmatrix} Sin\alpha & Cos\alpha & Sin(\alpha+\delta) \\ Sin\beta & Cos\beta & Sin(\beta+\delta) \\ Sin\gamma & Cos\gamma & Sin(\gamma+\delta) \end{vmatrix} =$ .....

1) 0
2) 1
3) $1 + Sin\alpha\,Sin\beta\,Sin\gamma$
4) $1-(Sin\alpha - Sin\beta)(Sin\beta - Sin\gamma)(Sin\gamma - Sin\alpha)$

(Space for Rough Work)