MITTAL CLASSES

IIT -JEE | MEDICAL | FOUNDATION

Paper Code:12E-02-A

SAMPLE PAPER

Class – XII NM **Time: 2 Hour** **M. Marks: 240**

General Instructions:

1. Answers have to be marked on the OMR sheet.

2. The question paper consists of 60 multiple choice questions (single correct option) divided into five sections.
   Section t A contains 20 questions (Q1 to Q20) of Physics.
   Section t B contains 20 questions (Q21 to Q40) of Chemistry.
   Section t C contains 20 questions (Q41 to Q60) of Mathematics.

3. Each question carries **+4** marks for correct answer and **–1** mark for wrong answer.

4. The Question Paper contains blank spaces for your rough work. No additional sheets will be provided for rough work.

5. Blank papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices, in any form, are not allowed.

6. Write your Name, Father Name, Class, MSAT Roll No. and Date in the space provided at the bottom of this sheet.

NAME: _____

FATHER NAME: _____

CLASS: _____

MSAT ROLL NO:_____

DATE: _____

PHYSICS

1. In nature, the electric charge of any system is always equal to:
   (A) half integral multiple of the least amount of charge
   (B) zero
   (C) square of the least amount of charge
   (D) integral multiple of the least amount of charge

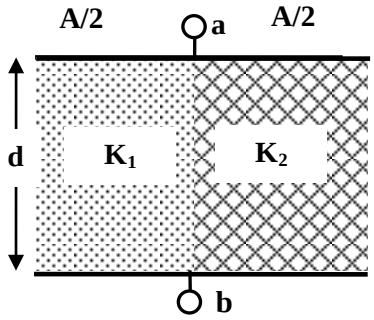
2. A point charge q_1 exerts a force F upon another point charge q_2. If a third charge q_3 be placed quite close to the charge q_2 then the force that charge q_1 exerts on the q_2 will be:
   (A) F
   (B) > F
   (C) < F
   (D) zero

3. 20 μC charge is placed inside a closed surface; then flux linked with the surface is ϕ. If 80 μC charge is put inside the surface then change in flux is
   (A) 4ϕ
   (B) 5ϕ
   (C) 3ϕ
   (D) 8ϕ

4. When a capacitor of value 200 μF charged to 200V is discharged separately through resistance of 2 ohms and 8 oms, then heat produced in joule will respectively be:
   (A) 4 and 16
   (B) 16 and 4
   (C) 4and 8
   (D) 4and 4

5. Two spheres of radii R_1 and R_2 having equal charges are joined together with a copper wire. If V is the potential of each sphere after they are separated from each other, then the initial charge on both spheres was :
   (A) $\frac{V}{k}(R_1+R_2)$
   (B) $\frac{V}{2k}(R_1+R_2)$
   (C) $\frac{V}{3k}(R_1+R_2)$
   (D) $\frac{V(R_1R_2)}{k(R_1+R_2)}$

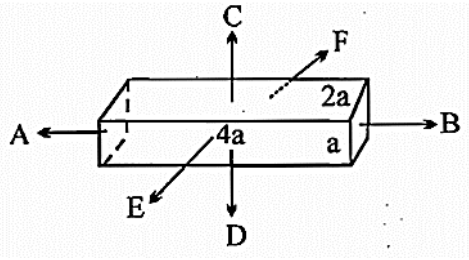
6. The capacity of a parallel plate air capacitor is 10 μF. As shown in the figure this capacitor is divided into two equal parts; these parts are filled by media of dielectric constants K_1=2 and K_2=4. Capacity of this arrangement will be :



   (A) 20 μF
   (B) 30 μF
   (C) 10 μF
   (D) 40 μF

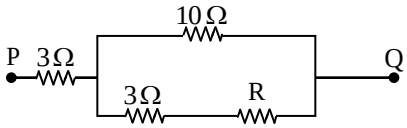
Space for rough work

7. A conductor with rectangular cross-section has dimensions (a × 2a × 4a) as shown in figure. Resistance across AB is x, across CD is y and across EF is z. Then



(A) x = y = z
(B) x > y > z
(C) y > x > z
(D) x > z > y

8. In the circuit shown here, what is the value of the unknown resistance R so that the total resistance of the circuit between point 'P' and 'Q' is also equal to R:



(A) 3Ω
(B) $\sqrt{39}\Omega$
(C) $\sqrt{69}\Omega$
(D) 10 Ω

9. Length of a potentiometer wire is kept long and uniform to achieve:
(A) uniform and more potential gradient
(B) non-uniform and more potential gradient
(C) uniform and less potential gradient
(D) non-uniform and less potential gradient

10. Radius of current carrying coil is 'R'. Then ratio of magnetic fields at the centre of the coil to the axial point, which is R $\sqrt{3}$ distance away from the centre of the coil :-
(A) 1:1
(B) 1 : 2
(C) 1 : 4
(D) 8 : 1

11. Which of the following particle will experiences maximum magnetic force, when projected with the same velocity perpendicular to a magnetic field
(A) electron
(B) proton
(C) He+
(D) Li++

12. An electron having mass 'm' and kinetic energy E enters in uniform magnetic field B perpendicularly, then its frequency of uniform circular motion will be: -
(A) $\frac{eE}{qVB}$
(B) $\frac{2\pi m}{eB}$
(C) $\frac{eB}{2\pi m}$
(D) $\frac{2m}{eBE}$

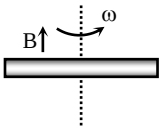
13. Magnetic field is parallel to the plane of coil then torque will be
(A) Maximum
(B) Minimum
(C) Zero
(D) None of these

14. Which one of the following is ferro-magnetic:-
(A) Co
(B) Zn
(C) Hg
(D) Pt

Space for rough work

15. A coil having an area of 2 m^2 is placed in a magnetic field which changes from 1 Weber/m^2 to 4 Weber/m^2 in 2 seconds. The e.m.f. induced in the coil will be:
(A) 4 volt
(B) 3 volt
(C) 2 volt
(D) 1 volt

16. A conducting rod of length 2*l* is rotating with constant angular speed ω about its perpendicular bisector. A uniform magnetic field $\vec{B}$ exists parallel to the axis of rotation. The emf induced between two ends of the rod is:



(A) $B\omega\ell^2$
(B) $\frac{1}{2}B\omega\ell^2$
(C) $\frac{1}{8}B\omega\ell^2$
(D) Zero

17. In an AC generator, a coil with N turns, all of the same area A and total resistance R, rotates with frequency ω in a magnetic field B. The maximum value of emf generated in the coil is:
(A) NABω
(B) NABRω
(C) NAB
(D) NABR

18. In an AC Circuit decrease in impedance with increase in frequency indicates that circuit has/have :-
(A) Only resistance
(B) Resistance & inductance.
(C) Resistance & capacitance
(D) Resistance, capacitance & inductance

19. An inductor of inductance L and resistor of resistance R are joined in series and connected by a source of frequency ω. Power dissipated in the circuit is :–
(A) $\frac{\left(R^2+\omega^2L^2\right)}{V}$
(B) $\frac{V^2R}{\left(R^2+\omega^2L^2\right)}$
(C) $\frac{V}{\left(R^2+\omega^2L^2\right)}$
(D) $\frac{\sqrt{R^2+\omega^2L^2}}{V^2}$

20. Power dissipated in pure inductance will be :
(A) $\frac{LI^2}{2}$
(B) $2LI^2$
(C) $\frac{LI^2}{4}$
(D) Zero

CHEMISTRY

21. $a \neq b \neq c, \alpha = \gamma = 90^\circ \beta \neq 90^\circ$ represents:
(A) tetragonal system
(B) orthorhombic system
(C) monoclinic system
(D) triclinic system

22. Schottky as well as frenkel defects are observed in the crystal of
(A) NaCl
(B) AgBr
(C) AgCl
(D) $MgCl_2$

Space for rough work

23. 4 : 4 Co-ordination is found in
(A) ZnS
(B) CuCl
(C) AgI
(D) All

24. The positions of Cl^- ions in NaCl structure are
(A) Corners of the cube
(B) Centres of faces of the cube
(C) Corners as well as centres of the faces of the cube
(D) Edge centres of the cube

25. A tetrahedral void in a crystal implies that
(A) shape of the void is tetrahedral
(B) molecules forming the void are tetrahedral in shape
(C) the void is surrounded tetrahedrally by four spheres
(D) the void is surrounded by six spheres

26. Close packing is maximum in the crystal lattice of
(A) Simple cubic
(B) Face centred
(C) Body centred
(D) Simple cubic and body centred

27. 8g NaOH is dissolved in one liter of solution Its molarity is
(A) 0.8 M
(B) 0.4 M
(C) 0.2 M
(D) 0.1 M

28. 1 mol of heptanes $(V.P = 92 mm of\ Hg)$ was mixed with 4 mol of octane $(V.P = 31 mm of\ Hg)$. The vapour pressure of resulting ideal solution is
(A) 46.2 mm of Hg
(B) 40.0 mm of Hg
(C) 43.2 mm of Hg
(D) 38.4 mm of Hg

29. At constant temperature, the osmotic pressure of a solution is:
(A) Directly proportional to the concentration
(B) Inversely proportional to the concentration
(C) Directly proportional to the square of concentration
(D) Directly proportional to the square root of concentration

30. The gas which is used in Holme's signals –
(A) SO_2
(B) PH_3
(C) SO_3
(D) NH_3

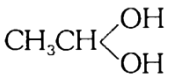
31. Which 16^{th} group element have only positive oxidation state only
(A) S
(B) Se
(C) Te
(D) Po

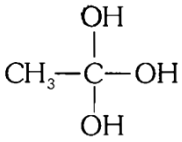
32. NH_3 act as a –
(A) Lewis acid
(B) Lewis base
(C) Amphoteric
(D) None

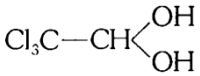
33. Incorrect match is
(A) Iodoform –Antiseptic
(B) Pyrene - Fire extinguisher
(C) Freon 12 - aerosol propellants
(D) DDT - Fat insoluble

Space for rough work

34. A compound containing two –OH groups attached with one carbon atoms is unstable but which one of the following is stable

(A) 

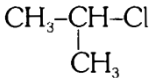
(B) 

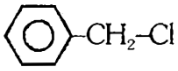
(C) 

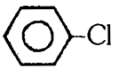
(D) All

35. Which of the following undergoes nucleophilic substitution by S_N1 mechanism at fastest rate

(A) $CH_3–CH_2–Cl$

(B) 

(C) 

(D) 

36. Which of the following does not turn orange colour of chromic acid to green
(A) 1° alcohol
(B) 2° alcohol
(C) 3° alcohol
(D) Allyl alcohol

37. Deoxygenation of phenol can be achieved by distillation with:
(A) Raney nickel
(B) Lithium aluminium hydride
(C) Sodium borohydride
(D) Zinc dust

38. The change in the optical rotation of freshly prepared solution of glucose is known as
(A) tautomerism
(B) racemisation
(C) specific rotation
(D) mutarotation

39. Which of the following B group vitamins can be stored in our body.
(A) Vitamin B_1
(B) Vitamin B_2
(C) Vitamin B_6
(D) Vitamin B_{12}

40. Which of the following are polysaccharides-
(a) Starch
(b) Cellulose
(c) Dextrins
(d) Glycogen
(A) a, b and c
(B) a, b, d
(C) a and c
(D) a, b, c, d

MATHEMATICS

41. The range of the function $f(x) = |x - 1| + |x - 2|$, $-1 \le x \le 3$, is
(A) [1, 3]
(B) [1, 5]
(C) [3, 5]
(D) none of these

42. The domain of the function $f(x) = \log_{10}\log_{10}(1 + x^3)$ is
(A) $(-1, +\infty)$
(B) $(0, +\infty)$
(C) $[0, +\infty)$
(D) $(-1, 0)$

Space for rough work

43. Let f : R $\to$R be a function such that $f(x) = x^3 - 6x^2 + 11x - 6$. Then
(A) f is one-one and into
(B) f is many-one and into
(C) f is one-one and onto
(D) f is many-one and onto

44. $f(x) = \log_{10}(x + \sqrt{x^2 + 1})$ is
(A) an odd function
(B) a periodic function
(C) an even function
(D) none of these

45. Let $f(x) = \sec^{-1}x \tan^{-1}x$. Then f(x) is real for
(A) $x \in [-1, 1]$
(B) $x \in R$
(C) $x \in (-\infty, -1] \cup [1, \infty)$
(D) none of these

46. The principal value of $\sin^{-1}\left\{\sin\frac{5\pi}{6}\right\}$ is
(A) $\frac{\pi}{6}$
(B) $\frac{5\pi}{6}$
(C) $\frac{7\pi}{6}$
(D) none of these

47. The value of $\cos\left\{\tan^{-1}\left(\tan\frac{15\pi}{4}\right)\right\}$ is
(A) $\frac{1}{\sqrt{2}}$
(B) $-\frac{1}{\sqrt{2}}$
(C) 1
(D) none of these

48. If $A^2 = 8A + kI$ where $A = \begin{bmatrix} 1 & 0 \\ -1 & 7 \end{bmatrix}$ then k is
(A) 7
(B) -7
(C) 1
(D) -1

49. If $A = \begin{bmatrix} 0 & -4 & 1 \\ 2 & \lambda & -3 \\ 1 & 2 & -1 \end{bmatrix}$ then A^{-1} exists (i.e., A is invertible) if
(A) $\lambda \neq 4$
(B) $\lambda \neq 8$
(C) $\lambda = 4$
(D) none of these

50. The system of equations
$x + y + z = 2$
$2x - y + 3z = 5$
$x - 2y - z + 1 = 0$
written in matrix form is
(A) $\begin{bmatrix} x \\ y \\ z \end{bmatrix}\begin{bmatrix} 1 & 1 & 1 \\ 2 & -1 & 3 \\ 1 & -2 & -1 \end{bmatrix} = \begin{bmatrix} 2 \\ 5 \\ -1 \end{bmatrix}$
(B) $\begin{bmatrix} 1 & 1 & 1 \\ 2 & -1 & 3 \\ 1 & -2 & -1 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -2 \\ -5 \\ 1 \end{bmatrix}$
(C) $\begin{bmatrix} 1 & 1 & 1 \\ 2 & -1 & 3 \\ 1 & -2 & -1 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2 \\ 5 \\ -1 \end{bmatrix}$
(D) none of these

Space for rough work

51. If $a \neq b \neq c$ such that $\begin{vmatrix} a^3-1 & b^3-1 & c^3-1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix} = 0$ then

(A) ab + bc + ca = 0
(B) a + b + c = 0
(C) abc = 1
(D) a + b + c = 1

52. The value of the determinant $\begin{vmatrix} bc & ca & ab \\ p & q & r \\ 1 & 1 & 1 \end{vmatrix}$, where a, b, c are the pth, qth and rth terms of a HP, is

(A) ap + bq + cr
(B) (a + b + c)(p + q + r)
(C) 0
(D) none of these

53. The value of $\begin{vmatrix} {}^{10}C_4 & {}^{10}C_5 & {}^{11}C_m \\ {}^{11}C_6 & {}^{11}C_7 & {}^{12}C_{m+2} \\ {}^{12}C_8 & {}^{12}C_9 & {}^{13}C_{m+4} \end{vmatrix}$ is equal to zero when m is

(A) 6
(B) 4
(C) 5
(D) none of these

54. A function f(x) is defined as below

$$f(x) = \frac{\cos(\sin x) - \cos x}{x^2}, x \neq 0 \text{ and } f(0) = a.$$

f(x) is continuous at x = 0 if a equals

(A) 0
(B) 4
(C) 5
(D) 6

55. Let $f(x) = (\sin x)^{\frac{1}{\pi - 2x}}, x \neq \frac{\pi}{2}$.

If f(x) is continuous at $x = \frac{\pi}{2}$ then $f\left(\frac{\pi}{2}\right)$ is

(A) e
(B) 1
(C) 0
(D) none of these

56. If $y = |\cos x| + |\sin x|$ then $\frac{dy}{dx}$ at $x = \frac{2\pi}{3}$ is

(A) $\frac{1-\sqrt{3}}{2}$
(B) 0
(C) $\frac{1}{2}(\sqrt{3}-1)$
(D) none of these

57. If $x^y = e^{x-y}$ then $\frac{dy}{dx}$ at x = 1 is equal to

(A) 0
(B) -2
(C) 1
(D) none of these

58. The slope of the tangent to the curve $y = x^2 - x$ at the point where the line y = 2 cuts the curve in the first quadrant is

(A) 2
(B) 3
(C) -3
(D) none of these

Space for rough work

59. The number of tangent to the curve $x^{3/2}+y^{3/2}=a^{3/2}$, where the tangents are equally inclined to the axes, is
(A) 2
(B) 1
(C) 0
(D) 4

60. The maximum value of $f(x) = 3\cos^2 x + 4\sin^2 x + \cos\frac{x}{2}+\sin\frac{x}{2}$ is
(A) 4
(B) $3+\sqrt{2}$
(C) $4+\sqrt{2}$
(D) none of these

Space for rough work

ANSWER

1.	D	21.	C	41.	B
2.	A	22.	B	42.	B
3.	A	23.	D	43.	D
4.	D	24.	C	44.	A
5.	B	25.	C	45.	C
6.	B	26.	B	46.	A
7.	D	27.	C	47.	A
8.	C	28.	C	48.	B
9.	C	29.	A	49.	B
10.	D	30.	B	50.	C
11.	D	31.	D	51.	C
12.	C	32.	B	52.	C
13.	A	33.	D	53.	C
14.	A	34.	C	54.	A
15.	B	35.	C	55.	B
16.	D	36.	C	56.	C
17.	A	37.	D	57.	A
18.	C	38.	D	58.	B
19.	B	39.	D	59.	B
20.	A	40.	D	60.	C

Space for rough work