Master JEE CLASSES

Kukatpally, Hyderabad.

IIT-JEE-MAINS PAPER-7

Max.Marks:360

IMPORTANT INSTRUCTIONS:

1) Immediately fill in the particulars on this page of the Test Booklet with Blue/Black Ball Point Pen. Use of pencil is strictly prohibited.
2) The test is of 3 hours duration.
3) The Test Booklet consists of 90 questions. The maximum marks are 360.
4) There are three parts in the question paper A, B, C consisting of **Mathematics, Physics** and **Chemistry** having 30 questions in each part of equal weightage. Each question is allotted 4 (four) marks for correct response.
5) Candidates will be awarded marks as stated above in instruction No. 4 for correct response of each question. (1/4) (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
6) There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction 5 above.

SYLLABUS

MATHS:

Properties of AP,AM,GP,GM; Sum of 'n' Terms of AP & GP, Properties of HP & HM; Sum of infinite GP & AGP, method of differences/Vn method (60%); Triangular Inequality, AM-GM-HM Inequalities, Cauchy-Schwartz Inequality (40%)

PHYSICS:

Vernier callipers + Screwgauge + Optical instruments without Diffraction effects (100%)

CHEMISTRY:

Methods of expressing concentration of a solution - % by weight, Molarity, Molality, Normality, Mole fraction, ppm, % labelling of oleum, volume strength of hydrogen peroxide, stoichiometry-II :Titrations, Volumetric analysis: neutralisation titrations - simple titrations, double titrations and back titrations, Redox titrations: oxalic-acid vs KMnO4, Mohr's salt vs KMnO4 ; iodometry , iodimetry, Degree of hardness of water (70%)

Mole , significant figures, laws of chemical combination, Chemical calculations based upon weight, volume relations of chemical equations, percentage composition of mixtures,empirical and molecular formula, Concept of redox reactions - oxidation number - Types of redox reactions, Balancing Redox reactions, Equivalent weight, (30%)

MATHS

1. If $3k, k$ and $\left[k^2-34\right]$ are the first three terms of a G.P., where $k \in R^+$ and [.] is the greatest integer function. Then the value of $\sum_{r=1}^{10} r^{\frac{k}{2}}$ is

   1) 55 2) 385

   3) 3025 4) None of these

2. If $a_1, a_2, a_3, ...a_{4001}$ are terms of an A.P. such that

   $$\frac{1}{a_1 a_2}+\frac{1}{a_2 a_3}+\frac{1}{a_3 a_4}+.....+\frac{1}{a_{4000} a_{4001}}=10$$

   and $a_2 + a_{4000} = 50$, then $\left|a_1 - a_{4001}\right|$ is equal to

   1) 3 2) 30

   3) 40 4) 50

3. Let $p, q, r \in R^+$ and $27\, pqr \geq (p+q+r)^3$ and $3p+4q+5r=12$, then $p^3+q^4+r^3$ is equal to

   1) 3 2) 6

   3) 2 4) 12

4. If the product of three positive real numbers a, b *and* c is 27, then the minimum value of $ab+bc+ca$ is equal to

   1) 27^4 2) 27^3

   3) 27^2 4) 27

5. If $a_1, a_2, a_3, ...a_{2n}$ are in A.P, then

   $a_1^2 - a_2^2 + a_3^2 - a_4^2 + ... + a_{2n-1}^2 - a_{2n}^2 =$

   1) 0 2) $\frac{n}{2n-1}\left(a_1^2 - a_{2n}^2\right)$

   3) $\frac{n-1}{2n-1}\left(a_1^2 - a_{2n}^2\right)$ 4) $\frac{n}{n-1}\left(a_1^2 - a_{2n}^2\right)$

6. The sum of an infinitely decreasing G.P. is equal to 4 and the sum of the cubes of its terms is $\frac{64}{7}$. Then 5^{th} term of the progression is

   1) $\frac{1}{4}$ 2) $\frac{1}{8}$

   3) $\frac{1}{16}$ 4) $\frac{1}{32}$

7. If $a_1, a_2, a_3, ...a_n$ are in H.P., then

   $$\frac{a_1}{a_2+a_3+....+a_n}, \frac{a_2}{a_1+a_3+.....+a_n}, ..., \frac{a_n}{a_1+a_2+...+a_{n-1}}$$

   are in

   1) A.P. 2) G.P.

   3) H.P. 4) A. G. P.

8. If $S_n =$

$\frac{3}{1^3}+\frac{5}{1^3+2^3}+\frac{7}{1^3+2^3+3^3}+...+\frac{2n+1}{1^3+2^3+...+n^3}$, then S_∞ is equal to

1) 3 2) 4

3)5 4) 6

9. If $ab=4a+9b,\ a>0,\ b>0,$ then the minimum value of $\sqrt{ab}$ is,

1) 13 2) 14

3) 12 4) 11

10. If $x^2+9y^2+25z^2=15yz+5xz+3xy,$ then x,y,z are in

1) A.P. 2) G.P.

3) H.P. 4) None of these

11. The sum of n terms of the series $1^2+2.2^2+3^2+2.4^2+5^2+2.6^2...$ is $\frac{n(n+1)^2}{2}$ when n is even. When n is odd , the sum is

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

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

3) $n(n+1)^2(2n+1)$

4) None of these

12. If $a,b,c\in R^+,\ 2s=a+b+c$ and the minimum value of $\frac{2s}{s-a}+\frac{2s}{s-b}+\frac{2s}{s-c}$ is

1) 18 2) 10

3) 11 4) 12

13. If $a,b,c\in R^+$, then the minimum value of $a(b^2+c^2)+b(c^2+a^2)+c(a^2+b^2)$ is equal to

1) abc 2) $2abc$

3) $3abc$ 4) $6abc$

14. Let r^{th} term of a series be given by $T_r=\frac{r}{1-3r^2+r^4},$ then $\sum_{r=1}^{\infty}T_r$ is

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

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

15. If first, second and last terms of an A.P. are a,b,c respectively then the sum of all terms is

1) $\frac{(a+b-c)(a+c)}{2(b-c)}$

2) $\frac{(b+c-a)(a+c)}{2(b-c)}$

3) $\frac{(b+c-2a)(a+c)}{2(b-a)}$

4) None of these

16. In the increasing geometric progression, the sum of the first and the last term is 66, the product of the second and the second term from the last is 128, and the sum of all terms is 126. Then the total number of terms in the progression is

1) 5 2) 6

3) 7 4) 8

17. If $\sum_{r=1}^{n} r^4 = f(n)$, then the sum $\sum_{r=1}^{n}(2r-1)^4$ is

1) $f(2n)-16f(n)$

2) $f(2n)-f(n)$

3) $f(2n)-4f(n)$

4) None of these

18. If $f(n)=1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+...+\frac{1}{n}$ and $g(n)=1+\frac{3}{2}+\frac{7}{3}+...+\frac{n^2-n+1}{n}$, then

1) $g(n)=f(n)+2n^2-2$

2) $g(n)=\frac{n(n+1)}{2}+f(n)-n$

3) $g(n)=\frac{n(n-1)}{2}+f(n)$

4) None of these

19. The sum of n terms of $\frac{a_1}{1+a_1}+\frac{a_2}{(1+a_1)(1+a_2)}+\frac{a_3}{(1+a_1)(1+a_2)(1+a_3)}+....$ is

1) $1-\frac{1}{(1+a_1)(1+a_2)...(1+a_n)}$

2) $\frac{a_1+a_2+....+a_n}{(1+a_1)(1+a_2)...(1+a_n)}$

3) $\frac{a_1.a_2....a_n}{(1+a_1)(1+a_2)....(1+a_n)}$

4) None of these

space for rough work

20. The sum of n terms of the series $\frac{1}{1.2.3}+\frac{3}{2.3.4}+\frac{5}{3.4.5}+...$ is

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

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

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

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

21. Let $0<a<b<c$ and a,b,c are in A.P.. Given that $a+b+c=15$ If 1, 4 and 19 are added to a, b, c respectively, we get a G.P., then abc if equal to

1) 80 2) 45

3) 120 4) 0

22. Consider the sequence $1,2,2,4,4,4,4,8,8,8,8,8,8,8,8,...$, then 1025^{th} term will be

1) 2^9 2) 2^{11}

3) 2^{10} 4) 2^{12}

23. If $a,b,c\in R^+$, then the maximum value of $\frac{bc}{b+c}+\frac{ac}{a+c}+\frac{ab}{a+b}$ is

1) $\frac{1}{2}(a+b+c)$ 2) $\frac{1}{3}\sqrt{abc}$

3) $\frac{1}{3}(a+b+c)$ 4) $\frac{1}{2}\sqrt{abc}$

24. Let $\alpha\in R^+-\{1\}$ and $(\ln\alpha)^p,(\ln\alpha)^q,(\ln\alpha)^r,(\ln\alpha)^s$ be in G. P., then pqr, pqs, prs, qrs are in

1) A. P. 2) G. P.

3) H.P. 4) A.G.P.

25. Let $a,b,c\in R^+$ and the inequality $bx^2+\left(\sqrt{(a+c)^2+4b^2}\right)x+(a+c)\geq 0$ holds true for all $x\in R$, then e^{a+1},e^{b+1},e^{c+1} are in

1) A.P. 2) G.P.

3) H.P. 4) A.G.P.

26. If $a\neq 0$, the roots of equation $ax^3+bx^2+cx+d=0$ are in G.P., then

1) $ac^3=db^3$ 2) $a^3c=d^3b$

3) $a^3b=c^3d$ 4) $ab^3=cd^3$

27. If $[x+3],[x-1],2x$ are in A.P., where [.] denotes the greatest integer function, then the sum of all possible values of $x \in R$ is:

1) -10 2) -10.5

3)10 4) 10.5

28. Let S_n denotes the sum of an A.P. and $S_{2n} = 3S_n$, then $\frac{S_{3n}}{S_n}$ is equal to

1) 4 2) 6

3) 8 4) 10

29. If $x_1, x_2, x_3, ...x_n$ are n non zero real numbers such tha

$\left(x_1^2 + x_2^2 + x_3^2 .... + x_{n-1}^2\right)\left(x_2^2 + x_3^2 .... + x_n^2\right) \leq \left(x_1x_2 + x_2x_3 + ... + x_{n-1}x_n\right)^2$

then $x_1, x_2, x_3, ..., x_n$ are in

1) A.P. 2) G.P.

3) H.P. 4) None of these

30. Sum of n terms of

$1+(1+x)+(1+x+x^2)+(1+x+x^2+x^3)+...$ is

1) $\frac{1-n^n}{1-x}$

2) $\frac{(1+x^n)}{1+x}$

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

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

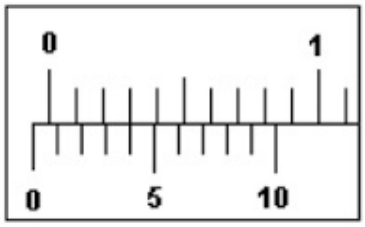
PHYSICS

31. The diameter of a cylinder is measured using vernier calipers with no zero error. It is found that the zero of the vernier scale lies between 5.10 cm and 5.15 cm of the main scale. The vernier scale has 50 divisions equivalent to 2.45 cm. The 24^{th} division of the vernier scale exactly coincides with one of the main scale divisions. The diameter of the cylinder is

1)5.112 2)5.148

3)5.124 4)5.136

32. Assume least count is 0.01 cm. Find the zero error in the measurement. The units of the main scale are in millimeters. (The top scale represents main scale and the bottom vernier scale)



1) -0.06 cm 2) +0.06 cm

3) -0.04 cm 4) +0.04 cm

33. The focal length of concave mirror is -40cm. Its radius of curvature is

1) -20 cm 2) +20 cm

3) -80 cm 4) +80 cm

34. Shown here are the zero error position (fig1) and the measurement (fig 2). Find the actual size of the object measured? Assume least count is 0.01 cm. The units of the main scale are in millimeters. (The top scale represents main scale and the bottom vernier scale, in each figure)

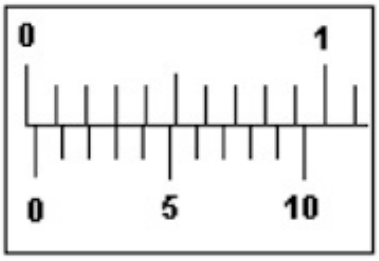


fig 1

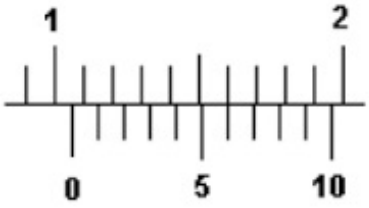


fig 2

1)1.06 cm 2)1.03 cm

3)1.0999 cm 4)1.05 cm

space for rough work

35. Shown here are the zero error position (fig 1) and the measurement (fig 2). Find the actual size of the object measured? Assume least count is 0.01 cm. The units of the main scale are in millimeters. (The top scale represents main scale and the bottom vernier scale, in each figure)

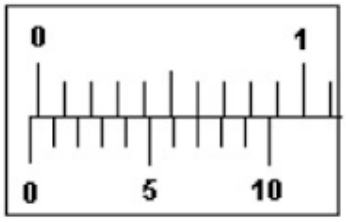


fig 1

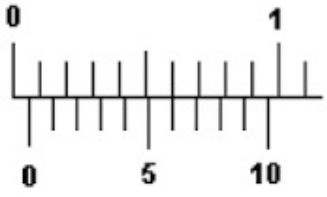


fig 2

1)0.06 cm 2)0.03 cm

3)0.09 cm 4)0.02 cm

36. A vernier calipers has 1 mm makes on the main scale. It has 20 equal divisions on the vernier scale which match with 16 main scale divisions. For this vernier calipers, the least count is

1)0.02 mm 2)0.05 mm

3)0.1 mm 4)0.2 mm

37. A screw gauge having 100 equal divisions and a pitch of length 1 mm is used to measure the diameter of a wire of length 5.6 cm. The main scale reading is 1 mm and 47^{th} circular division coincides with the main scale. Find the curved surface area of wire in cm^2 to the nearest value.

1) 2.6 2) 5.2

3) 2.5 4) 3.6

38. In the case of a screw gauge, we use the nut to rotate the circular scale. Within a nut there is a little space for the play of screw. Due to continuous use this space increases. Thus when the screw is turned in one direction the stud moves as usual. However, when the screw is rotated in the opposite direction, the stud does not move for a while. This error is called back lash error. In short"

Back lash error is the error introduced on reversing of rotation". To avoid this error one should

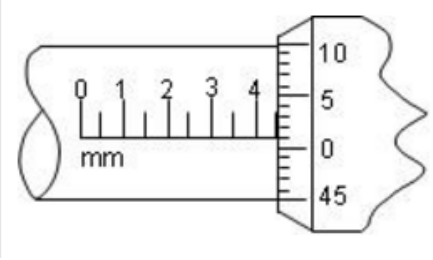
1) Turn the screw in one direction only

2) Not turn the screw at all

3) Turn the screw in two opposite directions at regular intervals.

4) None of the above

39. The diagram below part of a micrometer screw gauge. What is the reading shown? Assume the pitch is 0.5 mm.



1) 4.01 mm 2)4.51 mm

3) 5.00 mm 4) none of these

40. The focal length of objective and eye lens of a microscope are 4 cm and 8 cm respectively. If the least distance of distinct vision is 24 cm and object distance is 4.5 cm from the objective lens, then the magnifying power of the microscope is, if the final image is at least distance of distinct vision

1)18 2)32

3)64 4)20

41. The objective lens of a compound microscope produces magnification of 10. In order to get an overall magnification of 100 when image is formed at 25 cm from the eye, the focal length of the eye lens should be

1)4 cm 2)10 cm

3) $\frac{25}{9}$ cm 4)9 cm

42. When a ray of light enters a denser medium from air, its

1) Frequency increases

2) Wavelength increases

3) Wavelength decreases

4) Frequency decreases

43. In a compound microscope, maximum magnification is obtained when the final image.

1) is formed at infinity

2) is formed at the least distance of distinct vision

3) Coincides with the object

4) Coincides with the objective lens.

44. Magnification of a compound microscope is 30. Focal length of eye-piece is 5 cm and the image is formed at a distance of distinct vision of 25 cm. The magnification of the objective lens is

1)6 2)5

3)7.5 4)10

45. A compound microscope has an eye piece of focal length 10 cm and an objective of focal length 4 cm. Calculate the magnification, if an object is kept at a distance of 5 cm from the objective so that final image is formed at the least distance vision (20 cm)

1)12 2)11

3)10 4)13

46. The image formed by an objective of a compound microscope is

1) Virtual and diminished

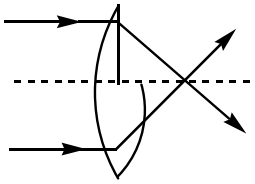
2) Real and diminished

3) real and enlarged

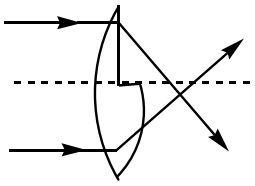
4) virtual and enlarged

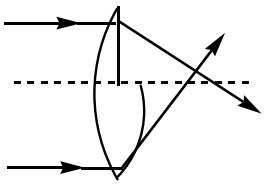
47. Choose the correct ray diagram of a thin equi-convex lens which is cut as shown in the figure.

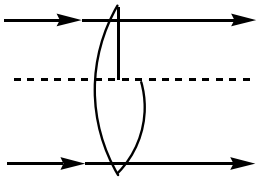
1)



2)



3) 

4) 

48. The ratio of powers of thin convex and thin concave lens is $\frac{3}{2}$ and equivalent focal length of the combination is contact is 30 cm. Their individual focal lengths respectively (in cm) are

1) 75,-50 2) 75, 50

3) 10,-15 4) 15, –10

49. Two identical glass $(\mu_g = 3/2)$ equi-convex lenses of focal length f are kept in contact. The space between the two lenses is filled with water $(\mu_w = 4/3)$. The focal length of the combination is

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

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

50. Distance of an object from the first focus of an equi convex lens is 10 cm and the distance of its real image from second focus is 40 cm. The focal length of the lens is

1)25 cm 2)10 cm

3) 20 cm 4) 40 cm

51. Two point sources S_1 and S_2 are 24 cm apart. Where a convex lens of focal length 9 cm be placed in between then so that the images of both sources are formed at the same place?

1) 6 cm from S_1

2) 15 cm from S_1

3) 10 cm from S_1

4) 12 cm from S_1

52. For relaxed eye, the magnifying power of a microscope is

1) $\frac{v_o}{u_o} \times \frac{D}{f_e}$ 2) $\frac{u_o}{v_o} \times \frac{D}{f_e}$

3) $\frac{v_o}{u_o} \times \frac{f_e}{D}$ 4) $\frac{u_o}{v_o} \times \left(-\frac{D}{f_e}\right)$

53. The astronomical telescope consists of objective and eye-piece. The focal length of the objective is

1) five times shorter than that of the eye-piece

2) equal to that of the eye-piece

3) greater than that of the eye-piece

4) shorter than that of the eye-piece

54. A telescope has focal length of objective and eyepiece as 200 cm and 5 cm respectively. What is magnification of telescope?

1) 40 2) 80

3) 50 4) 0.01

55. The focal length of a convex lens is 5 cm. It is used as a simple microscope. The magnification produced by it when the image is formed at least distance of distinct vision (25 cm).

1) 5 2) 6

3) 4 4) 125

56. The focal length of a thin plano-convex lens is 60 cm and the refractive index of its glass is 1.5. Its radius of curvature is R. When the plane surface of the lens is silvered, it behaves like a concave mirror of focal length f. Then

1) R = 40 cm 2) R = 120 cm

3) f = 10 cm 4) f = 30 cm

57. The eyepiece of a refracting telescope (astronomical) has a focal length of 9.00 cm. The distance between the objective and the eyepiece is 1.80m, and the final image is at infinity. The angular magnification (magnitude) of the telescope is

1) 19 2) 20

3) 50 4) 25

58. A simple microscope consists of a lens of focal length 2cm. The least distance of distinct vision is 30cm. The magnifying power when the image is at least distance of distinct vision is

1) 14 2) 15

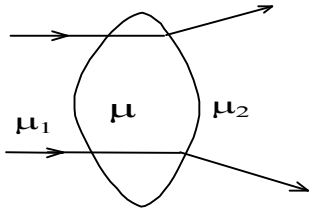
3) 16 4) 17

59. Four convergent lenses have focal length 100cm, 10cm, 5cm and 0.3cm. For a telescope with maximum possible magnification we choose the lenses of focal lengths

1) 10cm, 0.3cm 2) 10cm, 5cm

3) 100cm, 4cm 4) 100cm, 0.3cm

60. If the behaviour of light rays through a convex lens is as shown in the adjoining figure, then;



1) $\mu = \mu_2$ 2) $\mu < \mu_2$

3) $\mu > \mu_2$ 4) None of these.

CHEMISTRY

61. 600 ml O_2 in a closed container is heated to convert 15% O_2 into O_3. The final volume of gaseous mixture is ____ ml $3O_2 \rightarrow 2O_3$

1) 510 2) 60

3) 570 4) 90

62. 25 g of a dibasic acid is completely neutralised by 25 ml of 0.25 M $Ba(OH)_2$ solution. Molecular mass of the acid is

1)100 2)150

3)120 4)200

63. On reduction with hydrogen, 3.6 g of an oxide of metal left 3.2 g of metal. Then equivalent weight of metal is _____

1) 64 2) 32

3) 16 4) 8

64. In the reaction, $4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$, When 1 mole of ammonia and 1 mole of O_2 are made to react to completion

1)1.0 mole of H_2O is produced

2)1.0 mole of NO will be produced

3) All the oxygen will be consumed

4) All the ammonia will be consumed

65. Which of the following does not involve in iodometric titrations

1) $I^- \rightarrow I_2$ 2) $Cu^{2+} \rightarrow Cu^+$

3) $Cu_2SO_4 \rightarrow CuSO_4$ 4) both 1 & 2

66. The number of moles of $KMnO_4$ that will be needed to react completely with one mole of ferrous oxalate in acid solution to form Mn^{+2}, Fe^{+3} & CO_2 is

1) 3/5 2) 2/5

3) 4/5 4) 1

67. A 100 ml solution of 0.1 N HCl was titrated with 0.2 N NaOH solution. The volume of NaOH required for completing the titration is

1) 50 ml 2) 32 ml

3) 35 ml 4) 16 ml

68. For the reaction, $2A + 3B + 4C \rightarrow D + 2E$, if the molecular masses of A, B, C , D & E are 20, 30, 15, 40 & 60 respectively & total 18 moles of A, B, & C were taken initially in mole ratio of

coefficients in equation then what could be the max mass of E which can be obtained from the above amount.

1) 240 gm 2) 120 gm

3) 540 gm 4) 380 gm

69. KClO3 on heating decomposes in two modes

$4KClO3 \longrightarrow 3KClO4 + KCl$

$2KClO3 \longrightarrow 2KCl + 3O2$

If 10 mole of KClO3 yields on heating a residue in which the mole of KClO4 is 6. How many moles of O2 are evolved ?

1) 6 2) 1

3) 2 4) 3

70. $15\%\left(\frac{\omega}{v}\right)$ aqueous solution of urea (N_2H_4CO) is _____M

1) 2.5 2) 1.25

3) 0.025 4) 0.125

71. Sulphur trioxide is prepared by the following two reactions

S_8 (s) + 8O2(g) $\rightarrow$ 8SO2(g)

2 SO2(g) + O2(g) $\rightarrow$ 2SO3 (g)

How many grams of SO3 are produced from 1 mol of S_8 ?

1) 1280.0 2) 640.0

3) 960.0 4) 320.0

72. Which of the following cannot be the % label for Oleum Sample

1) 105 2) 125

3) 118 4) both 2 & 3

73. 2 mole of 'X' (At. Wt. = 36) and 3 mole of 'Y' (At.wt. = 24) are reacted to form the compound X_2Y_3. Then:

1) X is the limiting reagent

2) Y is the limiting reagent

3) No reactant is left over

4) 1 mole 'Y' is left over

74. 200 ml of a "10 Vol" solution of H2O2 is mixed with 50 ml of "20 Vol" H2O2 solution. What will be the volume strength of resulting solution?

1) 15 2) 12

3) 16 4) 20/3

75. 10 ml of SO_2 is heated with 15 ml of O2. After reaction formed SO_3 was found to be ____ml $2SO_2 + O_2 \rightarrow 2SO_3$

1) 10 2) 5

3) 15 4) 20

76. Which will be the proper alternative in place of A in the following equation.

$2Fe^{3+}(aq) + Sn^{2+}(aq) \rightarrow 2Fe^{2+}(aq) + A$

1) Sn^{4+} 2) Sn^{3+}

3) Sn^{2+} 4) Sn

77. In the following change-

$3Fe + 4H_2O \longrightarrow Fe_3O_4 + 4H_2$. If the atomic weight of iron is 56, then its equivalent weight will be-

1) 42 2) 21

3) 63 4) 84

78. 0.1 mole $Fe(OH)_3$ is present in 100 ml aqueous solution then normality of solution to form $FeCl_3$

1) 2 N 2) 1 N

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

79. Hydrochloric acid solutions A and B have concentrations 0.5 N and 0.1 N respectively. The volumes of solution A and solution B required to make a 2-litre solution of 0.2 N HCl are

1) 0.5 L of A and 1.5L of B

2) 3.5 L of A and 0.5 L of B

3) 1.0 L of A and 1.0 L of B

4) 0.75 L of A and 1.25 L of B

80. Molarity of 100 volume H_2O_2 [perhydrol] is __

1) 30.4 2) 8.9

3) 17.8 4) 100

81. 800 ml, 0.5M aqueous solution of glucose is diluted to 2L. Molarity of final solution is ___

1) 0.1 2) 0.2

3) 0.4 4) 0.8

82. As_2O_3 is oxidized to H_3AsO_6 by $KMnO_4$ in acidic medium forms Mn^{+2}. Volume of 0.02M $KMnO_4$ required to oxidize 0.001 mol of As_2O_3 will be

1) 10 mL 2) 20 mL

3) 40 mL 4) 80 mL

83. A 5.0-mL solution of H_2O_2 liberates 0.508 g of iodine from an acidified Kl solution. The volume strength of the H_2O_2 solution at STP is approximately

$H_2O_2 + 2KI + H_2SO_4 \rightarrow K_2SO_4 + I_2 + 2H_2O$

1) 4.00 2) 4.5

3) 6.05 4) 5.5

84. In an experiment, 50 ml of 0.1 M solution of a salt (M^{+3}) reacted with 25 ml of 0.1 M solution of sodium sulphite completely.

$M^{+3} + SO_3^{2-} \xrightarrow{H^+} SO_4^{2-} + M^{+x}$

then x value is ___

1) 0 2) 4

3) 2 4) 5

85. What number of equivalents of MnO_2 is reduced by 500 ml of 0.16 N oxalic acid in acid solution? The skeleton equation is

$MnO_2 + H_2C_2O_4 \xrightarrow{H^+} CO_2 + Mn^{2+}$

1) 0.16 2) 0.08

3) 0.04 4) 0.02

86. $H_3PO_4 + 2KOH \rightarrow K_2HPO_4$ 3 mole H_3PO_4 completely neutralize _____ mole KOH as per above reaction.

1) 3 2) 1.5

3) 6 4) 2

87. Which of the following equations is a balanced one-

1) $5BiO_3^- + 22H^+ + Mn^{2+} \rightarrow 5Bi^{3+} + 7H_2O + MnO_4^-$

2) $5BiO_3^- + 14H^+ + 2Mn^{2+} \rightarrow 5Bi^{3+} + 7H_2O + 2MnO_4^-$

3) $2BiO_3^- + 4H^+ + Mn^{2+} \rightarrow 2Bi^{3+} + 2H_2O + MnO_4^-$

4) $6BiO_3^- + 12H^+ + 3Mn^{2+} \rightarrow 6Bi^{3+} + 6H_2O + 3MnO_4^-$

88. 10 gram $NaOH$ is present in dissolved state in 2L aqueous solution then concentration of solution is _____

1) 5M 2) $\frac{1}{8}M$

3) 0.5M 4) 4M

89. What mass of $K_2Cr_2O_7\ (M.W = 294)$ has to be present in 2L solution such that concentration of solution is 0.3N $\left[Cr_2O_7^{2-} \rightarrow Cr^{+3}\right]$

1) 29.4 2) 1.47

3) 58.8 4) 0.7

90. a mole $NaOH$ completely neutralizes x mole H_2SO_4 then $\frac{a}{x} =$ ___

1) 2 2) 0.5

3) 4 4) 1

Master JEE CLASSES

Kukatpally, Hyderabad.

IIT-JEE-MAINS PAPER-7

Max. Marks: 360

KEY SHEET

MATHS

1	3	**2**	2	**3**	1	**4**	4	**5**	2	**6**	2
7	3	**8**	2	**9**	3	**10**	3	**11**	1	**12**	1
13	4	**14**	3	**15**	3	**16**	2	**17**	1	**18**	3
19	1	**20**	3	**21**	1	**22**	3	**23**	1	**24**	3
25	2	**26**	1	**27**	2	**28**	2	**29**	2	**30**	3

PHYSICS

31	3	**32**	1	**33**	3	**34**	2	**35**	3	**36**	4
37	1	**38**	1	**39**	2	**40**	2	**41**	3	**42**	3
43	2	**44**	2	**45**	1	**46**	3	**47**	3	**48**	3
49	4	**50**	3	**51**	1	**52**	1	**53**	3	**54**	1
55	2	**56**	4	**57**	1	**58**	3	**59**	4	**60**	2

CHEMISTRY

61	3	**62**	4	**63**	1	**64**	3	**65**	3	**66**	1
67	1	**68**	1	**69**	4	**70**	1	**71**	2	**72**	2
73	3	**74**	2	**75**	1	**76**	1	**77**	2	**78**	4
79	1	**80**	2	**81**	2	**82**	3	**83**	2	**84**	3
85	2	**86**	3	**87**	2	**88**	2	**89**	1	**90**	1

SOLUTIONS

MATHS

1. $k^2 = 3k\left(\left[k^2 - 34\right]\right)$

   $\frac{k}{3} = \left[k^2 - 34\right]$

   $\Rightarrow k$ is a multiple of 3

2. $a_1 + a_{4001} = a_2 + a_{4000} = 50$

   $a_1 - a_2 = a_2 - a_3 = ... = a_{4000} - a_{4000} = -d$

   Where d is the common difference

   $\frac{1}{a_1 a_2} + \frac{1}{a_2 a_3} ..... + \frac{1}{a_{4000} a_{4001}} = 10$

   $\Rightarrow \frac{1}{a_1} - \frac{1}{a_{4001}} = 10d$

   $a_1 a_{4001} = 400$

3. $A.M \geq G.M$

   $\frac{p+q+r}{3} \geq (pqr)^{\frac{1}{3}}$

   $\frac{p+q+r}{3} = (pqr)^{\frac{1}{3}}$

   $p = q = r$

4. $A.M \geq G.M$

   $\frac{ab+bc+ca}{3} \geq (ab.bc.ca)^{1/3}$

5. $a_1 - a_2 = a_2 - a_3 = ... = -d$

6. $\frac{a}{1-r} = 4 \; \frac{a^3}{1-r^3} = \frac{64}{7}$

7. $\frac{1}{a_1}, \frac{1}{a_2}, ... \frac{1}{a_n}$ are in A.P

   $\frac{\sum a_1}{a_1} - 1, \frac{\sum a_1}{a_2} - 1....$ are in A.P

8. $t_n = \frac{4(2n+1)}{n^2(n+1)^2} = 4\left(\frac{1}{n^2} - \frac{1}{(n+1)^2}\right)$

9. $A.M \geq G.M$

   $\frac{4a+9b}{2} \geq \sqrt{4a.9b}$

10. $\frac{1}{2}\left[(a-b)^2 + (b-c)^2 + (c-a)^2\right]$

    $= a^2 + b^2 + c^2 - ab - ac - bc = 0$

    $\Rightarrow a = b = c$

11. $a(n) = \frac{(n-1)n^2}{2} + n^2$ (when n is odd)

12. $A.M \geq H.M$

$$\frac{(s-a)+(s-b)+(s-c)}{3} \geq \frac{3}{\frac{1}{s-a}+\frac{1}{s-b}+\frac{1}{s-c}}$$

13. $A.M \geq G.Ml$

$$\frac{ab^2+ac^2+bc^2+ba^2+ca^2+cb^2}{6} \geq \left(ab^2.ac^2.bc^2.ba^2.ca^2.cb^2\right)^{\frac{1}{6}}$$

14. $$T_r = \frac{r}{1-3r^2+r^4} = \frac{1}{2}\left[\frac{1}{r^2-r-1}-\frac{1}{r^2+r-1}\right]$$

15. $c.d = b-a$

$c = a+(n-1)d$

16. $a+ar^{n-1} = 66$

$a^2r^{n-1} = 128$

$$\frac{a\left(1-r^n\right)}{1-r} = 126$$

17. $$\sum_{r=1}^{n}(2r-1)^4 = 1^4+2^4+....+(2n)^4-\left(2^4+4^4.....+(2n)^4\right)$$

$= f(2n)-16f(n)$

18. $$g(n) = \sum\frac{n^2-n+1}{n} = \sum(n-1)+\frac{1}{n}$$

19. Add & subtract $\frac{1}{(1+a_1)(1+a_2)....(1+a_n)}$

The series telescopes

20. $$s_n = \sum\frac{2n-1}{n(n+1)(n+2)}$$

$$= \sum\frac{2}{(n+1)(n+2)}-\sum\frac{1}{n(n+1)(n+2)}$$

Use V_n method

21. let $a = b-d$ & $c = b+d$

Where d is the $c-d$

$(b+a)^2 = (a+1)(c+19)$ & $b = 5$

22. $s_n = 1+2+4.....+2^{n-1} = 2^n-1$

$n = 10,\ s_{10} = 1023$

$n = 11,\ s_{11} = 2047$

23. $A.M \geq H.M$

$$\frac{b+c}{2} \geq \frac{2bc}{b+c}$$

$$\Rightarrow \frac{bc}{b+c} \leq \frac{b+c}{4}$$

24. p,q,r,s are in A.P

$\Rightarrow \frac{p}{pqrs}, \frac{q}{pqrs}, \frac{r}{pqrs}, \frac{s}{pqrs}$ are in A.P

25. $\Delta \leq 0$

$a+c = 2b$

a,b,c are in A.P

26. $\alpha + \alpha r + \alpha r^2 = -\frac{b}{a}$

$\alpha^2 r + \alpha^2 r^2 + \alpha^2 r^3 = \frac{c}{a}$

$\alpha^3 r^3 = \frac{d}{a}$

27. put $x = [x] + \{x\}$ in the equation

Use $0 \le \{x\} < 1$

$[x] = -6, -5 \;\&\; \{x\} = \frac{1}{2}, 0$

$x = -5 - 5, -5$

28. $\frac{2n}{2}\left[2a + (2n-1)d\right] = \frac{3n}{2}\left[2a + (n-1)d\right]$

$(n+1)d = 2a$

29. Equality holds when $a_i = rb_i$ in causly – Schwarz inquality

30. $s_n = 1 + (1+x) + (1+x+x^2) + ...xs_n = x + (x+x^2) ....$ subtract

PHYSICS

31. Main scale division (s) = 0.05 cm; Vernier scale division (v) = 0.049

Least count = 0.05 – 0.049 = .001 cm

Diameter: 5.10 + 24 × .001 = 5.124 cm

32. The 4th division on vernier coincides with main scale. And the Zero of the main scale is to the right of the

vernier suggesting a negative error.

$-1mm + (0.1)4mm = -0.6mm$

33. R=2f

34. Zero error=+0.03 cm ; correction is negative.

Correct reading:

1.06 cm-(+03 cm)=1.03 cm

35. Zero error=-0.03 cm

Correct reading:

0.06 cm-(-0.03 cm)=0.09 cm

36. 20 VSD=16 MSD

$1VSD = \frac{4}{5}MSD; \quad LC = 1MSD - 1VSD$

$= 1MSD - \frac{4}{5}MSD = 0.2\ mm$

37. Least count of screw gauge

$= \frac{picth}{N} = \frac{1mm}{100} = 0.01mm$

$Diameter = D = 1 + (47 \times 0.01) = 1.47mm$

Area of curved surface $= \pi Dl$

$S = \frac{22}{7} \times 1.47 \times 56mm^2 = 2.58724cm^2$

Round off to two significant digits=2.6 cm^2

38. Slowly moving the screw in one direction will ensure the back lash error can be avoided.

39. LC = 0.01 mm; Reading = 4.5 mm + 0.01 (1) mm = 4.51 mm

40. Ans (2)

For objective lens $\frac{1}{f_o} = \frac{1}{v_o} - \frac{1}{u_o}$

$\Rightarrow \frac{1}{(+4)} = \frac{1}{v_o} - \frac{1}{(-4.5)} \Rightarrow v_o = 36cm$

$\therefore |m_D| = \frac{v_o}{u_o}\left(1 + \frac{D}{f_o}\right) = \frac{36}{4.5}\left(1 + \frac{24}{8}\right) = 32$

41. Ans (3)

$m = m_o \times m_e \Rightarrow m = m_o \times \left(1 + \frac{D}{f_e}\right)$

$\Rightarrow 100 = 10 \times \left(1 + \frac{25}{f_e}\right) \Rightarrow f_e = \frac{25}{9}cm$

42. Velocity of air in denser medium is less

43. conceptual

44. Ans(2)

$m = \frac{v_o}{u_o}\left(1 + \frac{D}{f_e}\right) = m_o\left(1 + \frac{D}{f_e}\right)$

$\Rightarrow 30 = m_o\left(1 + \frac{25}{5}\right) = m_o \times 6 \Rightarrow m_o = 5$

45. Ans (1)

For objective lens $\frac{1}{f_o} = \frac{1}{v_o} - \frac{1}{u_o}$

$$\Rightarrow \frac{1}{v_o}=\frac{1}{f_o}+\frac{1}{u_o}=\frac{1}{4}+\frac{1}{-5}=\frac{1}{20}\Rightarrow v_o=20cm$$

Now $M=\frac{v_o}{u_o}\left(1+\frac{D}{f_e}\right)=\frac{20}{5}\left(1+\frac{20}{10}\right)=12$

46. conceptual

47. Ans (3)

Focal length of cut part will be more than the other part.

48. $\frac{P_C}{P_D}=\frac{3}{2}\Rightarrow\frac{f_C}{f_D}=\frac{2}{3}$ and $\frac{1}{f_C}+\frac{1}{f_D}=\frac{1}{30}$, solving $f_C=10,\ f_D=-15$ cm

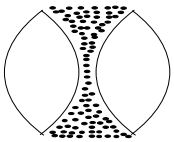
49 Ans (4)

Let R be the radius of curvature of each surface. Then

$$\frac{1}{f}=(1.5-1)\left(\frac{1}{R}+\frac{1}{R}\right)$$

For the water lens

$$\frac{1}{f'}=\left(\frac{4}{3}-1\right)\left(-\frac{1}{R}+\frac{1}{R}\right)=\frac{1}{3}\left(-\frac{2}{f}\right);\frac{1}{f'}=\frac{2}{3f}$$



Now using $\frac{1}{F}=\frac{1}{f_1}+\frac{1}{f_2}+\frac{1}{f_3}$ we have

$$\frac{1}{F}=\frac{1}{f}+\frac{1}{f}+\frac{1}{f'}$$

$$=\frac{2}{f}-\frac{2}{3f}=\frac{4}{3f};\Rightarrow F=\frac{3f}{4}$$

50. $\frac{1}{f+40}-\frac{1}{-(f+10)}=\frac{1}{f}$; Solving f *=20 cm*

51. Option (2) gives one image at infinity and other at finite distance. Option (3) and (4) both gives a real image of the two sources which form on either of lens, hence can't coincide. Option (1) gives one image virtual at 18 and the other real at 18, thus coinciding.

52. conceptual

53. **$F_o > F_e$**

54. **M=: F_o / F_e**

55. $m=\left(1+\frac{D}{f}\right)=\left(1+\frac{25}{5}\right)=6$

56. $P=2P_{lens}+P_{mirror}$; $P=2\frac{1}{30}+\frac{1}{\infty}=-\frac{1}{F_{mirror}}$

i.e 15 cm

57. $d=f_o+f_e$; $m=\frac{f_o}{f_e}$

$f_e=180-9=171cm$; $m=\frac{171}{9}=19$

58. **M=1+D/f**

59. Conceptual

60. Conceptual

CHEMISTRY

61Q) $3O_2 \rightarrow 2O_3$

600

$\frac{-15}{100}600=90 \rightarrow 60=510+60=570$

62Q) Valency factor of dibasic acid=2

$\therefore (\frac{1.25}{mol.wt})\times 2=(0.25\times 2)\times\frac{25}{1000}$

$\Rightarrow$Mol .wt=200

63Q) $3.6g\ M_xo_y - 3.2g\ M = 0.4g\ O_2$

$0.4g\ O_2$ _____ $3.2g\ M$

$8gO_2$ _____ 64

64Q) $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$

1 mol 1 mol

O_2 is limiting reagent.

$\therefore$ Mol of NO formed = $\frac{4}{5}$

Mol of H_2O formed = $\frac{6}{5}$

65Q) Iodometric titrations are used for oxidizing agent

66Q) $FeC_2O_4 + MnO_4^- \xrightarrow{H^+} Fe^{+3} + CO_2 + Mn^{+2}$

V.f = 3 V.f = 5

Eq of FeC_2O_4 = Eq of MnO_4^-

1 x 3 = (moles of $KMnO_4^-$) x5

$\therefore$ mol of $KMnO_4 = \frac{3}{5}$

67Q) Meq of Hcl = Meq of NaoH

10 = 0.2x

68Q) for maximum product, reactants should be taken in the mole ratio of their coefficients.

$\therefore$ mol of A=4 mol of B= 6 mol of C= 9

$\therefore$ mol of E formed = 4

Mass of E .formed = 4 x 60 =240 g

69Q) $4Kclo_3 \rightarrow 3Kclo_4 + Kcl$

X mol $\frac{3x}{4} mol$ $\frac{x}{4} mol$

$2kclo_3 \rightarrow 2Kcl + 3O_2$

(10-x)mol (10-x)mol $\frac{3}{2}(10-x) mol$

hence x= 8 so 3 mol

Given, $X_{kclo4} = 6 = \frac{3x}{4} mol$ O_2

70Q) $\Rightarrow 15\,g\ N_2H_4CO$ in 100 ml solution

$\Rightarrow M = \frac{15}{60 \times 0.1} = 2.5$

71) By Law of mass conservation,

1 mol of S_8 will produce 8 mol of SO_3

$\therefore$ Mass of SO_3 produced = 8x80g =640g

72Q) Strength of Oleum is between 100 & 122.5

73Q) 2 X + 3Y $\rightarrow$ X_2Y_3 (72g of each is taken)

2mol 3mol

Mol of X & Y are in their combining ratio

$\therefore$ No Limiting Reagent

Mol of X_2Y_3 formed =144g

74Q) Vol. strength $\frac{10\times200+20\times50}{250}=12$

75Q) Limiting reagent is SO_2 so 10ml SO_3 form

76) Sn^{+4} charge balance

77) Valiancy factor Fe = $\frac{8}{3} \Rightarrow Eg_{\text{Wt}} = \frac{56}{8/3} = 21$

78) $N=\frac{0.1\times3}{0.1}$

79) 0.2 X 2 = 0.5(V) + 0.1(2-V) $\therefore$ V = 0.5

80) $\frac{100}{11.2}$

81) $M=\frac{0.8\times0.5}{2}$

82) $As_2O_3 + MnO_4^- \rightarrow H_3\overset{+5}{As}O_4 + Mn^{+2}$

V.f = 4 V.f = 5

Eq of As_2O_3 = Eq of $KMnO_4$

X 4 = 0.02 X 5 X V $\therefore$ V = 40 ml

83) $H_2O_2 + I^- \rightarrow I_2 + KOH$

V.f = 2 V f = 1 V f = 2

Eq of H_2O_2 = Eq of I_2

N X 5 = $\frac{0.508}{254}$ X 2 X 1000 $\Rightarrow$ N = $\frac{4}{5}$

$\therefore$ V of strength = $\frac{4}{5}$ x 5.6 = 4.48 $\simeq$ 4.5

84) Eq of salt = Eq of SO_3^{-2}

x V.f) x 50 = 0.1x2x25 $\Rightarrow$ V.f of salt = 1 hence +3 decreases by 1so +2

$\therefore$ salt is undergoing reduction then O.N of metal will decrease by 1

85) V.f for $MnO_2 = 2$ Vf for $H_2C_2O_4 = 2$

Eq of MnO_2 = Eq of $H_2C_2O_4 = 0.5 \times 0.16$

86) 1:2

87)

$$(2e^- + 6H^+ + BiO_3^- \rightarrow Bi^{+3} + 3H_2O) \times 5$$

$$(4H_2O + Mn^{+2} \rightarrow MnO_4^- + 8H^+ + 5e^-) \times 2$$

$$5BiO_3^- + 2Mn^{+2} + 14H^+ \rightarrow 5Bi^{+3} + 2MnO_4^- + 7H_2O$$

88) $\frac{10}{40 \times 2}$

89) $VF = 3 \times 2 = 6$ hence $0.3 = \frac{6W}{2 \times 294}$

60) $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + H_2O$