PT : - 01 [CODE-A]

TARGET : JEE (Main + Advanced) 2016-17

POTENTIAL
IIT-JEE I AIPMT I AIIMS I NTSE
EDUCATING THE FUTURE DOCTORS & ENGINEERS

Date : 23-10-2016

Duration : 3 hours
Max Marks : 360

Read the instruction carefully

IMPORTANT INSTRUCTIONS

1. Immediately fill the particulars on this page of the Test Booklet with Blue/Black Point Pen. Use of Pencil is strictly prohibited.
2. When you are directed, fill in the particulars of the Answer Sheet carefully.
3. The test is 3 hours duration.
4. The Test Booklet consists of **90** questions. The maximum marks are **360**.
5. There are three parts in the question paper **Physics**, **Chemistry** and **Mathematics** having **30** questions each.
6. For each question, you will be awarded **4** marks if you darken all the bubble(s) correspondind to the correct answer(s) and **zero** mark if no bubbles are darkened. In all other cases, **1 (one)** marks will be deducted.
7. 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 decucted accordingly as per instructions 6 above.

Filling the ORS:

Use only Black ball point pen only for filling the ORS. Do not use Gel/Ink pen as it might smudge the ORS.

8. Write your Roll no. in the books given. Also darken the corresponding bubbles with Black ball point pen only. Also fill your roll no in the space provided.
9. **Fill your Paper Code as mentioned on the Test Paper.**
10. If student does not fill his/her roll no. and paper code correctly and properly, then his/her marks will not be displayed and 5 marks will be deducted (paper wise) from the total.
11. Since it is not possible to erase and correct pen filled bubble, you are advised to be extremely careful while darkening the bubble corresponding to your answer.
12. Neither try to erase/rub/scratch the option nor make the Cross(X) mark on the option once filled. Do not scribble, smudge, cut, tear, or wrinkle the ORS. Do not put any stray marks or whitener anywhere on the ORS.
13. If there is any discrepancy between the written data and the bubbled data in your ORS the bubbled data will be taken as final.

Name of the candidate

Roll Number

I have read all the instructions and shall abide by them

....
Signature of the candidate

I have verified all the information filled in by the candidate

....
Signature of the Invigilator

Direction for Qns. No. 1 & 2 : System of units has a set of basic units. The number of these units may vary from 3 to 7. Let velocity of light c, gravitational constant G and Planck's constant h be chosen as basic units. Given $c = 3 \times 10^8$ units, $G = \dfrac{20}{3} \times 10^{-11}$ units and $h = \dfrac{20}{3} \times 10^{-34}$ units.

1. E , M , L , G denotes energy , mass , angular momentum (which is momentum x distance) and gravitational constant respectively .

   $E L^2 / (M^5 G^2)$ has the dimensions of :
   (A) length (B) mass
   (C) angle (D) time

2. The Young's modulus of a material of wire is 12.6×10^{11} dyne/cm^2. Its value in MKS system is :
   (A) 12.6×10^{12} N/m^2
   (B) 12.6×10^{10} N/m^2
   (C) 12.6×10^{6} N/m^2
   (D) 12.6×10^{8} N/m^2

3. A body is projected vertically downwards from A, the top of the tower reaches the ground in t_1 seconds. If it is projected upwards with same velocity it reaches the ground in t_2 seconds. At what time it will reach the ground if it is dropped from A.

   (A) $\sqrt{t_1/t_2}$ (B) $\sqrt{t_2/t_1}$
   (C) $\sqrt{t_1 t_2}$ (D) $t_1 t_2$

4. A body travelling with uniform acceleration crosses two points A and B with velocities 20 ms^{-1} and 30 ms^{-1} respectively. The speed of the body at the mid-point of A and B is
   (A) 24 ms^{-1} (B) 25 ms^{-1}
   (C) 25.5 ms^{-1} (D) $10\sqrt{6}$ ms^{-1}

5. A particle starts from rest with uniform acceleration a. Its velocity after 'n' second is 'v'. The displacement of the body in the last two second is

   (A) $\dfrac{2v(n-1)}{n}$ (B) $\dfrac{v(n-1)}{n}$

   (C) $\dfrac{v(n+1)}{n}$ (D) $\dfrac{2v(2n+1)}{n}$

6. A man crosses the river perpendicular to river flow in time t seconds and travels an equal distance down the stream in T seconds. The ratio of man's speed in still water to the speed of river water will be :

   (A) $\dfrac{t^2 - T^2}{t^2 + T^2}$ (B) $\dfrac{T^2 - t^2}{T^2 + t^2}$

   (C) $\dfrac{t^2 + T^2}{t^2 - T^2}$ (D) $\dfrac{T^2 + t^2}{T^2 - t^2}$

7. A swimmer crosses a river with minimum possible time 10 second. And when he reaches the other end starts swimming in the direction towards the point from where he started swimming. Keeping the direction fixed the swimmer crosses the river in 15 sec. The ratio of speed of swimmer with respect to water and the speed of river flow is (Assume constant speed of river & swimmer) -

(A) $\dfrac{3}{2}$

(B) $\dfrac{9}{4}$

(C) $\dfrac{2}{\sqrt{5}}$

(D) $\dfrac{\sqrt{5}}{2}$

8. The block of mass 'm' is being pulled by a horizontal force F = 2 mg applied to a string as shown in figure (where 'g' is acceleration due to gravity). The pulley is massless and is fixed at the edge of immovable table. The force exerted by supporting table to the pulley is

F=2mg ←

m
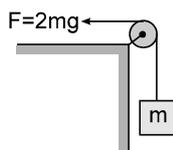
(A) mg

(B) 2mg

(C) $\sqrt{3}\,mg$

(D) $2\sqrt{2}\,mg$

9. In the figure shown the velocity of different blocks is shown. The velocity of *C* is :

8 m/s   6m/s   4 m/s

A B C D
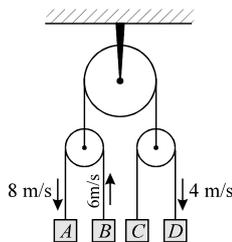
(A) 6 m/s

(B) 4 m/s

(C) 0 m/s

(D) none of these

10. A block of weight 9.8N is placed on a table. The table surface exerts an upward force of 10 N on the block. Assume g = 9.8 m/s^2.

(I) The block exerts a force of 10N on the table

(II) The block exerts a force of 19.8N on the table

(III) The block exerts a force of 9.8N on the table

(IV) The block has an upward acceleration.

(A) I & IV only

(B) II & III only

(C) I, II & III only

(D) None of these

11. Two weights W_1 & W_2 in equillibrium and at rest, are suspended as shown in figure. Then the ratio W_1/W_2 is about :

53° 37°

W_1 W_2
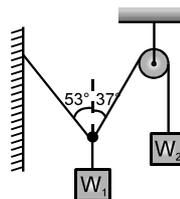
(A) 5/4

(B) 4/5

(C) 8/5

(D) none of these

12. Two blocks 'A' and 'B' each of mass 'm' are placed on a smooth horizontal surface. Two horizontal force F and 2F are applied on the 2blocks 'A' and 'B' respectively as shown in figure. The block A does not slide on block B. Then the normal reaction acting between the two blocks is : (A and B are smooth)

Space for rough work
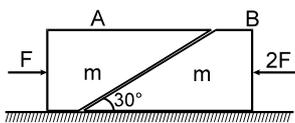
(A) F

(B) F/2

(C) $\dfrac{F}{\sqrt{3}}$

(D) 3F

13. The system starts from rest and A attains a velocity of 5 m/s after it has moved 5 m towards right. Assuming the arrangement to be frictionless every where and pulley & strings to be light, the value of the constant force

F applied on A
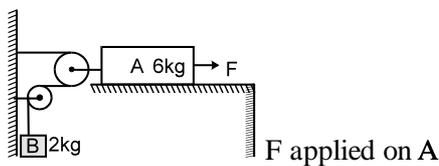
(A) 50 N

(B) 75 N

(C) 100 N

(D) 96 N

**14.** A system is as shown in the figure. All speeds shown are with respect to ground. Then the speed of Block B with respect to ground is
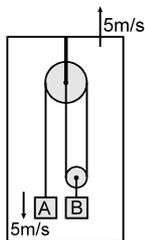
(A) 5 m/s

(B) 10 m/s

(C) 15 m/s

(D) 7.5 m/s

15. In the figure, an object is placed 25 cm from the surface of a convex mirror, and a plane mirror is set so that the image formed by the two mirrors lie adjacent to each other in the same plane. The plane mirror is placed at 20 cm from the object. What is the radius of curvature of the convex mirror?

(A) R = 75 cm

(B) R = 70 cm

(C) R = 69 cm

(D) None of these

16. Choose the correct mirror-image of figure given below.
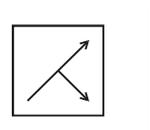
(A)

(B)

(C)

(D)

17. A converging beam (not converging towards focus) of light is incident on a convex mirror. The image formed by its reflection :

(A) will be real

(B) will be virtual

(C) will not be formed

(D) may be real.

18. A luminous point object is moving along the principal axis of a concave mirror of focal length 12 cm towards it. When its distance from the mirror is 20 cm its velocity is 4 cm/s. The velocity of the image in cm/s at that instant is

(A) 6, towards the mirror

(B) 6, away from the mirror

(C) 9, away from the mirror

(D) 9, towards the mirror.

19. In the figure shown a slab of refractive index $\frac{3}{2}$ is moved towards a stationary observer. A point 'O' is observed by the observer with the help of paraxial rays through the slab. Both 'O' and observer lie in air. The velocity with which the image will move is
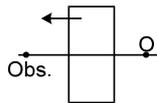
(A) 2 m/s towards left (B) $\frac{4}{3}$ m/s towards left

(C) 3 m/s towards left (D) zero

20. Two diverging lenses are kept as shown in the figure. The final image formed will be :
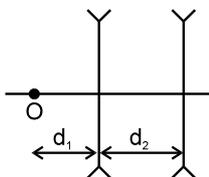
(A) virtual for any value of d_1 & d_2

(B) real for any value of d_1 & d_2

(C) virtual or real depends on d_1 & d_2 only

(D) virtual or real depends on d_1 & d_2 & also on the focal lengths of the lens.

21. An object approaches a fixed diverging lens with a constant velocity from infinity along the principal axis. The relative velocity between object and its image will be :

(A) increasing

(B) decreasing

(C) first increases then decreases

(D) first decreases and then increases.

$$V_i = \frac{v^2}{u^2} V_0 \ \& \ v = \frac{uf}{-u-f} \Rightarrow \frac{-f}{u+f} = \frac{v}{u} V_{rel}$$

$$= \ V_0 - V_i = \left(1 - \frac{v^2}{u^2}\right) \ V_0 = \left[1 - \left(\frac{f}{f+u}\right)^2\right] V_0$$

as u increases v_{rel} decreases.

22. A particle revolves in clockwise direction (as seen from point A) in a circle C of radius 1 cm and completes one revolution in 2 sec. The axis of the circle and the principal axis of the mirror M coincide. Call it AB. The radius of curvature of the mirror is 20 cm. Then the direction of revolution (as seen from A) of the image of the particle and its speed is
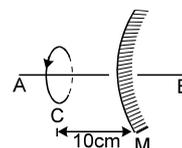
(A) Clockwise, 1.57 cm/s

(B) Clockwise, 3.14 cm/s

(C) Anticlockwise, 1.57 cm/s

(D) Anticlockwise, 3.14 cm/s

23. A concave spherical surface of radius of curvature 10 cm separates two mediums X and Y of refractive indices 4/3 and 3/2 respectively. Centre of curvature of the surface lies in the medium X. An object is placed in medium X.

(A) Image is always real

(B) Image is real if the object distance is greater than 90 cm.

(C) Image is always virtual.

Space for rough work

(D) Image is virtual only if the object distance is less than 90 cm.

24. A luminous point object is placed at O, whose image is formed at I as shown in figure. Line AB is the optical axis. Which of the following statement incorrect ?


(A) If a lens is used to obtain the image, then it must be a converging lens and its optical centre will be the intersection point of line AB and OI.

(B) If a lens is used to obtain the image, then it must be a diverging lens and its optical centre will be the intersection point of line AB and OI.

(C) If a mirror is used to obtain the image then the mirror must be concave and object and image subtend equal angles at the pole of the mirror.

(D) I is a real Image.

25. If 4 seconds be the time in which a projectile reaches a point P of its path and 5 seconds the time from P till it reaches the horizontal plane through the point of projection . The height of P above the horizontal plane will be -

[g = 9.8 m/sec^2]

(A) 98 meters   (B) 49 meters

(C) 196 meters   (D) 147 meters

26. From the ground level, a ball is to be shot with a certain speed. Graph shows the range R it will have versus the launch angle θ. The least speed the ball will have during its flight if θ is chosen such that the flight time is half of its maximum possible value, is equal to (take g = 10 m/s^2)
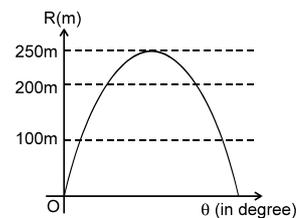
(A) 250 m/s   (B) $50\sqrt{3}$ m/s

(C) 50 m/s   (D) $25\sqrt{3}$ m/s

27. A particle is projected from a horizontal floor with speed 10 m/s at an angle 30° with the floor and striking the floor after sometime. State which is correct.

(A) Velocity of particle will be perpendicular to initial direction two seconds after projection.

(B) Minimum speed of particle will be 5 m/sec.

(C) Displacement of particle after half second will be 35/4 m.

(D) None of these

28. Two forces P and Q acting at a point are such that if P is reversed, the direction of the resultant is turned through 90°. Then

(A) P = Q   (B) P = 2Q

(C) $P = \dfrac{Q}{2}$

(D) No relation between P and Q.

29. The sum of the magnitudes of two forces acting at a point is 16 N. The resultant of these force is perpendicular to the smaller force and has a magnitude of 8 N. If the smaller force is of magnitude x, then the value of x is
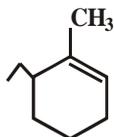
(A) 2 N   (B) 4 N

(C) 6 N   (D) 7 N

30. A given force is resolved into components P & Q equally inclined to it . Then :
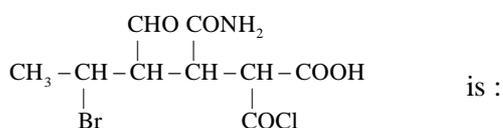
(A) P = 2Q   (B) 2P = Q

(C) P = Q   (D) none of these

31. IUPAC name of given compund is

(A) 3-ethyl-2-methyl cyclohex-1-ene

(B) 2-methl-3-ethyl cyclohex-1-ene

(C) 1-methl-6-ethyl cyclohex-1-ene

(D) 6-ethyl-1-methyl cyclohex-1-ene

32. The IUPAC name of the given compound

is :

(A) 2-Bromo-4-carbamoyl-5-chloroformyl-3-formylhexanoic acid

(B) 5-Bromo-3-carbamoyl-2-chloroformyl-4-formylhexanoic acid

(C) 4-Formyl-2-chloroformyl-3-carbamoyl-5-bromohexanoic acid

(D) 2-Chloroformyl-3-carbamoyl-4-formyl-5-bromohexanoic acid

33. The total number of isomers of $C_4H_{11}N$ would be :
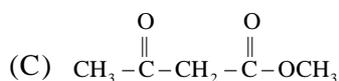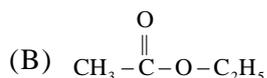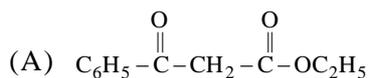
(A) 4   (B) 8

(C) 5   (D) 10

34. The number of isomeric aldehydes and ketones with formula $C_5H_{10}O$ are :
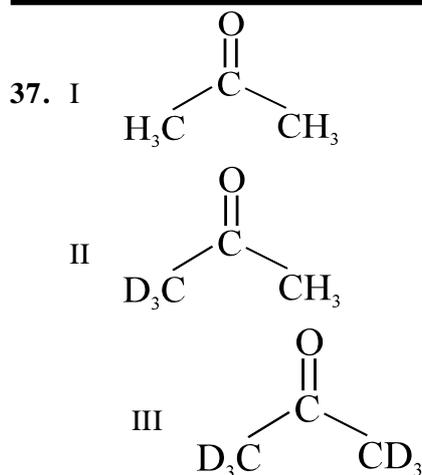
(A) 7   (B) 6

(C) 5   (D) 8

35. The chloride of metal is 71% chloride by weight and the vapour density of it is 50. The atomic mass of metal will be (valency of metal is 2)
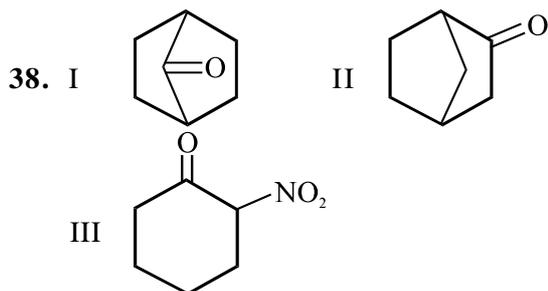
(A) 29   (B) 8

(C) 35.5   (D) 71

36. Which of the following will have highest percentage of enol content ?

(A) $C_6H_5 - \overset{\overset{O}{\|}}{C} - CH_2 - \overset{\overset{O}{\|}}{C} - OC_2H_5$

(B) $CH_3 - \overset{\overset{O}{\|}}{C} - O - C_2H_5$

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

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

Space for rough work

37. I

II

III
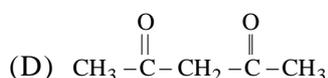
Among the ketones which of the following is the correct order of the ease of their enolization .

(A) I > II > III   (B) III > II > I

(C) II > I > III   (D) III > I> II

38. I

II

III

Among these compounds which of following is the correct order of % enol content .

(A) I > II > III   (B) III > II > I

(C) II > III > I   (D) I > III > II

39. How many bonds are greater than 90° in $XeOF_4$?

(A) 3   (B) 2
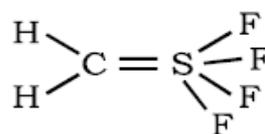
(C) 1   (D) 0

40. Number of sigma bonds in P_4O_{10} is:

(A) 6   (B) 7

(C) 17   (D) 16

41. Which of the following has $p\pi$ - $d\pi$ bonding:

(A) NO_3^{-} (B) SO_3^{2-}

(C) BO_3^{3-} (D) CO_3^{2-}

42. In the structure of

($H_2C = SF_4$) which the following statement is incorrect ?

(A) Two C – H bonds are in the same plane of axial S – F bonds

(B) Two C – H bonds are in the same plane of equatorial S – F bonds

(C) Total six atoms are in the same plane

(D) Equatorial S – F plane in perpendicular to plane of π-bond

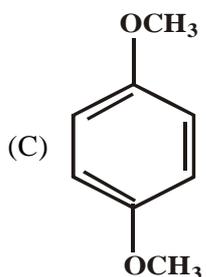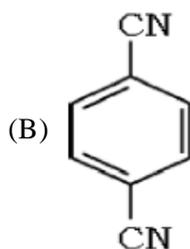**43.** SbF_5 reacts with XeF_4 and XeF_6 to form ionic compounds $[XeF_3^{+}][SbF_6^{-}]$ and $[XeF_5^{+}][SbF_6^{-}]$. The geometry of XeF_3^{+} and XeF_5^{+} ion respectively is,
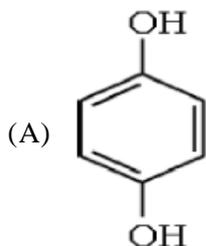
(A) Square pyramidal, T-shaped

(B) bent T-shaped, square pyramidal

(C) See saw, Square pyramidal

(D) square pyramidal, see saw

44. Which of the following molecules have zero dipole moment ?
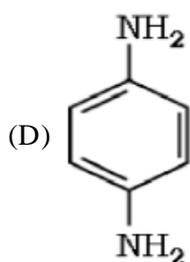
45. Nitroethane can exhibit one of the following kind of isomerism

(A) Metamerism   (B) Optical activity

(C) Tautomerism   (D) Position isomerism

46. Which compound can act as only reducing agent

(A) HNO_2 (B) H_2SO_5

(C) HCl (D) H_2O_2

47. Which of the molecule is not planar ?

(A) $F_2C = C = CF_2$

(B) $F_2B - C \equiv C - BF_2$

(C) $(SiH_3)_3N$ (D) $NH_2 - NH_2$

48. Which are the molecules which have maximum dipole moment out of the 4 ?

(A) CH_3Cl (B) CCl_4

(C) CH_2Cl_2 (D) $CHCl_3$

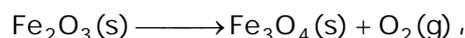**49.** 1 M 100 ml NaCl is mixed with 3M 100ml HCl solution and 1M 200ml $CaCl_2$ solution.

(A) The ratio of concentration of cation and anion = 2/4

(B) The ratio of concentration of cation and anion = 2

(C) $[Cl^-] = 2$ M

(D) $[Cl^-] = 3/2$ M

50. 2.0 g sample contain mixture of SiO_2 and Fe_2O_3, on very strong heating leave a residue weighing 1.96 g. The reaction responsible for loss of weight is (Fe = 56)

$Fe_2O_3(s) \longrightarrow Fe_3O_4(s) + O_2(g)$,

(unbalance equation)

What is the percentage by mass of SiO_2 in original sample:

(A) 10%   (B) 20%

(C) 40%   (D) 60%

51. Calculate the volume of Cl_2 gas liberated at 1 atm & 273K. When 1.74 gm MnO_2 react with 2.19 gm HCl according to the reaction with 40% yield (Mn = 55)

$MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$:

(A) 336 ml   (B) 112 ml

(C) 134.4 ml   (D) 44.8 ml

Space for rough work

52. 5 moles of A, 6 moles of B and excess amount of C are mixed to produce a final product D, according to the reaction:

A + 2B → I

I + C → B + D
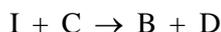
What is the maximum moles of D, which can be produced assuming that the products formed can also be reused in the reaction:

(A) 3 moles   (B) 4.5 moles

(C) 5 moles   (D) 6 moles

53. The number of atoms of oxygen in 0.11 g of CO_2 is not the same as in:

(A) The no. of oxygen atoms in 1/400 moles of NO_2

(B) The no. of oxygen atoms in 1/800 moles of H_2SO_4

(C) The no. of oxygen atoms in 1/600 moles of HNO_3

(D) The no. of Cl atoms in 1/100 moles of HCl

54. One mole of a mixture of CO and CO_2 requires exactly 20 gram of NaOH in solution for complete conversion of all the CO_2 into Na_2CO_3. How many grams more of NaOH would it require for conversion into Na_2CO_3 if the mixture (one mole) is completely oxidized to CO_2 .

(A) 60 grams   (B) 80 grams

(C) 40 grams   (D) 20 grams

55. What volume of 96 % H_2SO_4 by weight solution (density 1.83 g/ml) is required to prepare 2.00 L of 3.00 M H_2SO_4 solution ?

(A) 335 ml   (B) 670 ml

(C) 167.5 ml   (D) none

56. $$MgCO_3 \xrightarrow{\Delta} MgO + CO_2 \xrightarrow{H_2O} Mg(OH)_2$$
$$\underset{(4.2\,g)}{}$$

$$\downarrow H_2SO_4$$
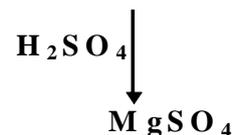
$$MgSO_4$$

Then weight of MgSO4 be formed in this series of reaction

(A) 6   (B) 5

(C) 4   (D) 3

57. The IUPAC name of given compound is

$$\begin{array}{ccc} CH_2 & - CH & - CH_2 \\ | & | & | \\ CHO & CHO & CHO \end{array}$$
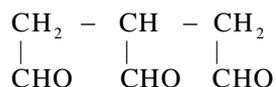
(A) 2-Formyl pentane-1,4-dial

(B) 1,2,3-Triformyl propane

(C) Propane-1,2,3-trial

(D) Propane-1,2,3-tricarbaldehyde

58. How many total number of substituent are present in the following compound ?
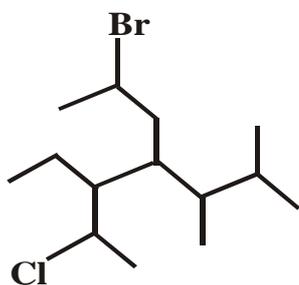
(A) 3   (B) 4

(C) 5   (D) 6

59. In hypothetical molecule AX_2L_n (where A is central atom, x is surrounding atom, L is lone pair and n is no of lone pair). If possible value of n is x and x + 3 with molecule having minimum dipole moment find the value of x.

(A) 3   (B) 2

(C) 1   (D) 0

60. How many nodal plane are present in π_{2p_y} anti bonding molecular orbital ?

(A) 3   (B) 2

(C) 1   (D) 0

61. A function f : A → B, where A = {x : –1 ≤ x ≤ 1} and B = {y : 1 ≤ y ≤ 2} is defined by the rule y = f(x) = 1 + x². Which of the following statement is correct ?

(A) f is injective but not surjective

(B) f is surjective but not injective

(C) f is both injective and surjective

(D) f is neither injective nor surjective

62. $\lim_{x \to 0}(1^{\cosec^2 x} + 2^{\cosec^2 x} + ... + n^{\cosec^2 x})^{\sin^2 x}$ is equal to

(A) 1 　　　　　(B) 1/n

(C) n 　　　　　(D) 0

63. If A = [–1, 1] and f : A → A is defined as f(x) = x|x|, ∀ x ∈ A, then f(x) is

(A) many-one and into function

(B) one-one and into function

(C) many-one and onto function

(D) one-one and onto function

64. If the function f(x) satisfies $\lim_{x \to 1}\dfrac{f(x)-2}{x^2 -1} = \pi$, then $\lim_{x \to 1} f(x)$ is equal to

(A) 1 　　　　　(B) 2

(C) 0 　　　　　(D) 3

65. The function f : R → R defined by f(x) = (x – 1)(x – 2)(x – 3) is

(A) one-one but not onto

(B) onto but not one-one

(C) both one-one and onto

(D) neither one-one nor onto

66. If $\lim_{x \to 0}[1 + x \log (1 + b^2)]^{1/x} = 2b \sin^2 \theta$, b > 0 and θ (–π, π], then the value of θ is

(A) $\pm\dfrac{\pi}{4}$ 　　　　(B) $\pm\dfrac{\pi}{3}$

(C) $\pm\dfrac{\pi}{6}$ 　　　　(D) $\pm\dfrac{\pi}{2}$

67. The range of the function $y = 3\sin\left(\sqrt{\dfrac{\pi^2}{16} - x^2}\right)$ is

(A) $[0, \sqrt{3/2}]$ 　　　(B) [0, 1]

(C) $[0, 3/\sqrt{2}]$ 　　　(D) [0, ∞)

68. $\lim_{x \to 0}\left(\dfrac{16^x + 9^x}{2}\right)^{1/x}$ is equal to

(A) 25/2 　　　　(B) 12

(C) 1 　　　　　(D) 1/4

69. The domain of the function $f(x) = \sqrt{\cos^{-1}\left(\dfrac{1-|x|}{2}\right)}$ is

(A) (–3, 3) 　　　(B) [–3, 3]

(C) (–∞, –3) ∪ (3, ∞)

(D) (–∞, –3] ∪ [3, ∞)

Space for rough work 　　　　**Page. 13**

70. If f : R → R is a positive increasing function with $\lim\limits_{x\to\infty}\dfrac{f(3x)}{f(x)}=1.$ Then, $\lim\limits_{x\to\infty}\dfrac{f(2x)}{f(x)}$ is equal to

(A) 1   (B) $\dfrac{2}{3}$

(C) $\dfrac{3}{2}$ (D) 3

71. If f : R → R and g : R → R are defined by f(x) = |x| and g(x) = [x − 3] for x ∈ R, then $\left\{g(f(x)): -\dfrac{8}{5}<x<\dfrac{8}{5}\right\}$ is equal to {where [.] → greatest integer function}

(A) {0, 1}   (B) {1, 2}

(C) {−3, −2}   (D) {2, 3}

72. If $\lim\limits_{x\to\infty}\left[\dfrac{x^3+1}{x^2+1}-(ax+b)\right]=2,$ then

(A) a = 1 and b = 1

(B) a = 1 and b = −1

(C) a = 1 and b = −2

(D) a = 1 and b = 2

73. The period of the function

$f(x)=\dfrac{\sin 8x\cos x-\sin 6x\cos 3x}{\cos 2x\cos x-\sin 3x\sin 4x}$ is

(A) π   (B) 2π

(C) $\dfrac{\pi}{2}$ (D) None of these

74. If $f(x)=\begin{cases}1, & \text{when x is rational}\\0, & \text{when x is irrational}\end{cases}$, then $\lim\limits_{x\to 0}f(x)$ is equal to

(A) 0   (B) 1

(C) $\dfrac{1}{2}$ (D) None of these

75. The value of $\lim\limits_{x\to\infty}\sqrt{a^2x^2+ax+1}-\sqrt{a^2x^2+1}$ is

(A) 1/2   (B) 1

(C) 2   (D) None of these

76. The period of the function

$f(x) = a^{\{\tan(\pi x)+x-[x]\}}$, where a > 0, [ ] denotes the greatest integer function and x is a real number, is

(A) π   (B) $\dfrac{\pi}{2}$

(C) $\dfrac{\pi}{4}$ (D) 1

77. The period of the function $f(x)=\sin\left(\sin\dfrac{x}{5}\right)$ is

(A) 2π   (B) 2π/5

(C) 10π   (D) 5π

78. If f : R R is defined by

$f(x)=\begin{cases}\dfrac{x-2}{x^2-3x+2}, & \text{if } x\in R-\{1,2\}\\ 2, & \text{if }\quad x=1\\ 1, & \text{if }\quad x=2\end{cases}$

then $\lim\limits_{x\to 2}\dfrac{f(x)-f(2)}{x-2}$ is equal to

(A) 0

(B) –1

(C) 1

(D) $-\dfrac{1}{2}$

79. The domain of the function

$f(x) = \log_e (x - [x])$ is

(A) R

(B) R – Z

(C) $(0, + \infty)$

(D) Z

80. If the function $f(x) = \dfrac{a^x + a^{-x}}{2}$, where $a > 2$.

Then, $f(x + y) + f(x - y)$ is equal to

(A) $f(x) - f(y)$

(B) $f(y)$

(C) $2f(x)f(y)$

(D) None of these

81. If $\displaystyle\lim_{x \to 0} \dfrac{2a \sin x - \sin 2x}{\tan^3 x}$ exists and is equal to

1, then the value of a is

(A) 2

(B) 1

(C) 0

(D) –1

82. If $f(x) = x^2 + 2bx + 2c^2$ and $g(x) = -x^2 - 2cx + b^2$ are such that min $f(x) >$ max $g(x)$, then relation between b and c is

(A) no relation

(B) $0 < c < b/2$

(C) $|c| < \sqrt{2}\,|b|$

(D) $|c| > \sqrt{2}\,|b|$

83. If $f(x) = \begin{vmatrix} \sin x & \cos x & \tan x \\ x^3 & x^2 & x \\ 2x & 1 & x \end{vmatrix}$, then $\displaystyle\lim_{x \to 0} \dfrac{f(x)}{x^2}$

is equal to

(A) 0

(B) 3

(C) 2

(D) 1

84. If $f(x) = 2x^4 - 13x^2 + ax + b$ is divisible by $x^2 - 3x + 2$, then (a, b) is equal to

(A) (–9, –2)

(B) (6, 4)

(C) (9, 2)

(D) (2, 9)

85. If $f(x) = \begin{cases} \sin x, & x \neq n\pi \\ 2, & x = n\pi \end{cases}$, where $n \in I$ and

$g(x) = \begin{cases} x^2 + 1, & x \neq 2 \\ 3, & x = 2 \end{cases}$, then $\displaystyle\lim_{x \to 0} g[f(x)]$ is

equal to

(A) 1

(B) 0

(C) 3

(D) does not exist

86. If $f : R \to R$ is defined by $f(x) = |x|$, then

(A) $f^{-1}(x) = -x$

(B) $f^{-1}(x) = \dfrac{1}{|x|}$

(C) $f^{-1}(x)$ does not exist

(D) $f^{-1}(x) = \dfrac{1}{x}$

87. $\displaystyle\lim_{n \to \infty}\left(\dfrac{1^2}{1 - n^3} + \dfrac{2^2}{1 - n^3} + \dots \dfrac{n^2}{1 - n^3}\right)$ is equal to

(A) $\dfrac{1}{3}$

(B) $-\dfrac{1}{3}$

(C) $\dfrac{1}{6}$

(D) $-\dfrac{1}{6}$

88. If $f(x) = \cos(\log x)$,

$f(x)f(y) - \dfrac{1}{2}\left[f\left(\dfrac{x}{y}\right) + f(xy)\right]$ has the value

(A) –1

(B) 1/2

(C) –2

(D) 0

Space for rough work

89. If $f(x) = \dfrac{x}{x-1}, x \neq 1,$ then $\underbrace{(fofo...of)(x)}_{19 \text{ times}}$ is equal to

(A) $\dfrac{x}{x-1}$

(B) $\left(\dfrac{x}{x-1}\right)^{19}$

(C) $\dfrac{19x}{x-1}$

(D) x

90. If $f : (2, 3) \to (0, 1)$ is defined by $f(x) = x - [x]$, then $f^{-1}(x)$ is equal to {where $[.] \to$ greatest integer function}

(A) $x - 2$

(B) $x + 1$

(C) $x - 1$

(D) $x + 2$