Physics Wallah

Class XI

SPRINT FOR JEE (MAINS & ADVANCED)

CHEMISTRY

CRASH COURSE

1 p-Block

BORON FAMILY

(1) Amorphous boron of low purity (called moissan boron) is obtained by reducing B_2O_3 with Mg or Na at a high temperature. It is 95–98% pure (being contaminated with metal borides), and is black in colour.

$$Na_2[B_4O_5(OH)_4].8H_2O \xrightarrow{\text{acid}} H_3BO_3 \xrightarrow{\text{heat}} B_2O_3 \xrightarrow{\text{Mg or Na}} 2B + 3\,MgO$$

(2) BORANES

Boranes are boron hydrogen compounds with general molecular formula B_nH_{n+4} or $B_n\,H_{n+6}$. They are electron deficient compounds.

(3) ALUM

Alums are double sulphates with their general formula $R_2SO_4.M_2(SO_4)_3.24H_2O$ where R = monovalent radical like Na^+, K^+, NH_4^+ and M = Trivalent radical like Al^{+3}, Cr^{+3}. Fe^{+3}.

CARBON FAMILY

(1) Carbon is found in nature in various allotropic forms which are:

(i) Crystalline Form : Diamond, Graphite, Fullerenes

(ii) Amorphous Form : Coal

(2) SILICON (Si)

Silicon is the second most abundant (27.2%) element after oxygen (45.5%) in the earth's crust. It does not occur free in nature but in the combined state, it occurs widely in form of silica and silicates. All mineral rocks, clays and soils are built of silicates of magnesium, aluminium, potassium or iron. Aluminium silicate is however the most common constituent of rocks and clays.

Silica is found in the free state in sand, flint and quartz and in the combined state as silicates like

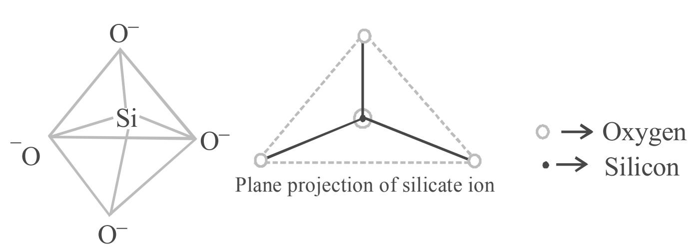
(a) Feldspar – $K_2O.Al_2O_3.6SiO_2$

(b) Kaolinite – $Al_2O_3.\ 2\ SiO_2.\ 2H_2O$

(c) Asbestos – $CaO.\ 3MgO.4SiO_2$

Silicates are also important :

Silicates have basic unit of SiO_4^{4-}, each silicon atom is bonded with four oxide ions tetrahedrally.



EXERCISE - I

BOOST YOUR PREPARATION FOR JEE MAINS

13^{TH} GROUP ELEMENTS

INTRODUCTION AND PHYSICAL PROPERTIES

[Electronic configuration, atomic radii, I.P., E.N., oxidation states and anomalous behaviour of Boron]

1. The element which shows least metallic character is.
(A) Indium (B) Boron
(C) Aluminium (D) Gallium

2. Group 13 elements show.
(A) Only +1 oxidation state
(B) ONly +3 oxidation state.
(C) Both +1 and +3 oxidation states.
(D) +1, +2 and +3 oxidation states.

3. The IE_1 among the group 13 member follows as.
(A) B > Al < Ga < Tl (B) B > Al > Ga > Tl
(C) B > Ga > Al > Tl (D) B > Ga < Al < Tl

4. Boron has a very high melting point among the elements of group 13 because of.
(A) Strong bonding between individual atoms in the solid state.
(B) Small size of B
(C) Very high electronegativity of B.
(D) Very high ionization energy of B.

5. Which of the following is used in high temperature thermometer ?
(A) Sn (B) As
(C) Hg (D) Ga

6. Which element of Group 13 is the strongest reducing agent ?
(A) B (B) Al
(C) Fe (D) Ga

7. Which of the following is most abundant in the earth's crust ?
(A) B (B) Al
(C) Ga (D) Tl

8. Which one of the following elements is a non-metal ?
(A) Boron (B) Indium
(C) Sodium (D) Magnesium

9. Out of the following group 13 elements, element with smallest atomic radius is.
(A) Al (B) Ga
(C) In (D) Tl

10. Of all the Group 13 elements, the element with lowest electronegativity is.
(A) B (B) Tl
(C) In (D) Al

11. Melting point is highest for.
(A) B (B) Al
(C) Ga (D) In

12. Boron differs from the other members of group-13 because it:
(A) reacts with dilute acids
(B) is a non-metal
(C) is good electrical conductor
(D) from unstable hydrides.

13. Mineral of aluminium that does not contain oxygen is.
(A) Corundum (B) Diaspore
(C) Bauxite (D) Cryolite

CHEMICAL PROPERTIES:

14. Which of the following metal chlorides has maximum covalent character ?
(A) NaCl (B) $AlCl_3$
(C) CsCl (D) $BaCl_2$

15. Which of the following oxides is strongly basic ?
(A) B_2O_3 (B) Al_2O_3
(C) Ga_2O_3 (D) Tl_2O_3

16. Which out of the following compound does not exist ?
(A) BF_3 (B) $TlCl_3$
(C) $TlCl_5$ (D) Both (B) and (C)

17. Which of the following does not react with aqueous NaOH ?
(A) B (B) Al
(C) Ga (D) Tl

18. The pair of amphoteric hydroxide is.
(A) $Al(OH)_3$, LiOH (B) $Be(OH)_2$,$Mg(OH)_2$
(C) $Al(OH)_3$,$Be(OH)_2$ (D) $Ni(OH)_2$,$Zn(OH)_2$

19. Which of the following is the electron deficient molecule ?
(A) C_2H_6 (B) SiH_4
(C) PH_3 (D) B_2H_6

EXERCISE - III

JEE PREVIOUS YEARS

PART - A

1. 6.02×10^{20} molecules of urea are present in 100 ml of its solution. The concentration of urea solution is : **[AIEEE-2004]**

(A) 0.001 M (B) 0.01 M

(C) 0.02 M (D) 0.1 M.

2. Which one of the following aqueous solutions will exhibit highest boiling point ? **[AIEEE-2004]**

(A) 0.01 M Na_2SO_4

(B) 0.01 M KNO_3

(C) 0.015 M urea

(D) 0.015 M glucose

3. Equimolar solutions in the same solvent have : **[AIEEE-2005]**

(A) same boiling point but different freezing point

(B) same freezing point but different boiling point

(C) same boiling and same freezing points

(D) different boiling and freezing points

4. Two solutions of a substance (non electrolyte) are mixed in the following manner. 480 ml of 1.5 M first solution + 520 mL of 1.2 M second solution. What is the molarity of the final mixture ? **[AIEEE-2005]**

(A) 1.20 M (B) 1.50 M

(C) 1.344 M (D) 2.70 M

5. Benzene and toluene form nearly ideal solutions. At 20ºC, the vapour pressure of benzene is 75 torr and that of toluene is 22 torr. The partial vapour pressure of benzene at 20 ºC for a solution containing 78 g of benzene and 46 g of toluene in torr is : **[AIEEE-2005]**

(A) 50 (B) 25 (C) 37.5 (D) 53.5

6. If α is the degree of dissociation of Na_2SO_4, the vant Hoff's factor (i) used for calculating the molecular mass is : **[AIEEE-2005]**

(A) $1 + \alpha$ (B) $1 - \alpha$

(C) $1 + 2\alpha$ (D) $1 - 2\alpha$.

7. Density of a 2.05 M solution of acetic acid in water is 1.02 g/mL. The molality of the solution is **[AIEEE-2006]**

(A) 3.28 mol Kg^{-1}

(B) 2.28 mol Kg^{-1}

(C) 0.44 mol Kg^{-1}

(D) 1.14 mol Kg^{-1}

8. A mixture of ethyl alcohol and propyl alcohol has a vapour pressure of 290 mm at 300 K. The vapour pressure of propyl alcohol is 200 mm. If the mole fraction of ethyl alcohol is 0.6, its vapour pressure (in mm) at the same temperature will be **[AIEEE-2007]**

(A) 700 (B) 360 (C) 350 (D) 300

9. A 5.25% solution of a substance is isotonic with a 1.5% solution of urea (molar mass = 60g mol^{-1}) in the same solvent. If the densities of both the solutions are assumed to be equal to 1.0 g cm^{-3}, molar mass of the substance will be **[AIEEE-2007]**

(A) 105.0 g mol^{-1}

(B) 210.0 g mol^{-1}

(C) 90.0 g mol^{-1}

(D) 15.0 g mol^{-1}

10. The vapour pressure of water at 20º C is 17.5 mm Hg. If 18g of glucose ($C_6H_{12}O_6$) is added to 178.2 g of water at 20° C, the vapour pressure of the resulting solution will be **[AIEEE-2008]**

(A) 15.750 mm Hg

(B) 16.500 mm Hg

(C) 17.325 mm Hg

(D) 17.675 mm Hg

11. At 80º C , the vapour pressure of pure liquid 'A' is 520 mm Hg and that of pure liquid 'B' is 1000 mm Hg. If a mixture solution of 'A' and 'B' boils at 80º C and 1 atm pressure, the amount of 'A' in the mixture is 1atm = 760 mm Hg) **[AIEEE-2008]**

(A) 34 mol percent

(B) 48 mol percent

(C) 50 mol percent

(D) 52 mol percent

12. A binary liquid solution is prepared by mixing n-heptane and ethanol. Which one of the following statement is correct regarding the behaviour of the solution ? **[AIEEE-2009]**

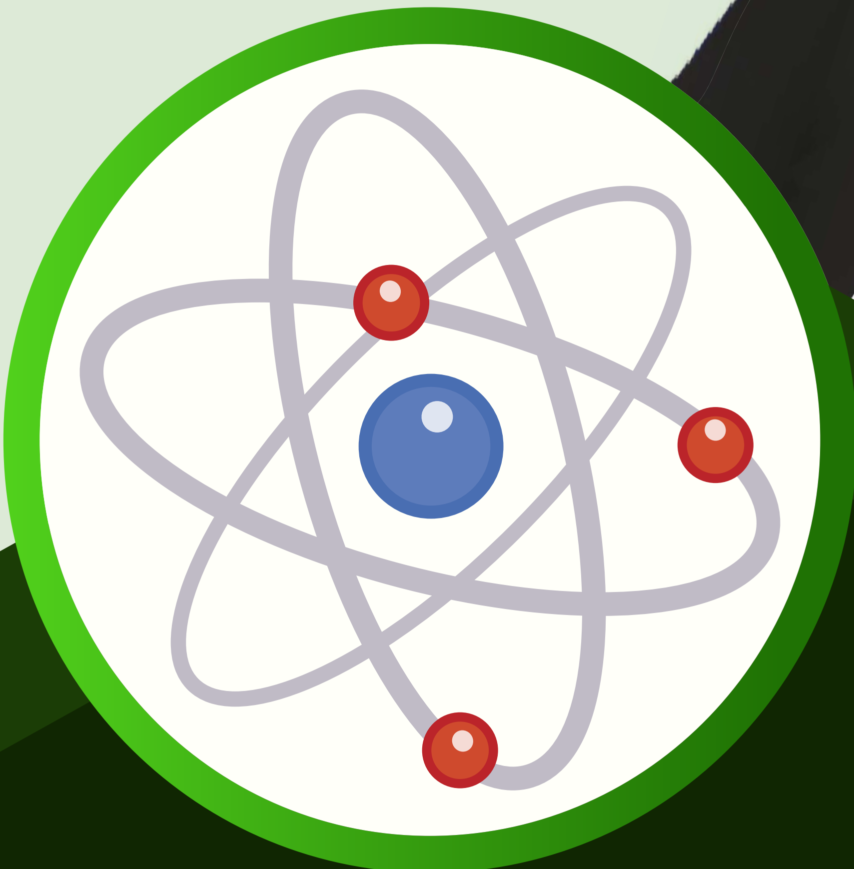
(A) The solution is non-ideal, showing +ve deviation from Raoult's Law.

(B) The solution in non-ideal, showing –ve deviation from Raoult's Law.

(C) n-heptane shows +ve deviation while ethanol shows –ve deviation from Raoult's Law.

(D) The solution formed is an ideal solution.

Physics Wallah



Class XI

SPRINT FOR JEE (MAINS & ADVANCED)

PHYSICS

CRASH COURSE

EXERCISE - II

BOOST YOUR PREPARATION FOR JEE ADVANCED CORNER

SINGLE CORRECT ANSWER TYPE

1. A ray of light is incident on a plane mirror along a vector $\hat{i}+\hat{j}-\hat{k}$. The normal to the mirror at the point of incidence is along $\hat{i}+\hat{j}$. Then unit vector along the reflected ray is

(A) $\frac{1}{\sqrt{3}}\left(\hat{i}+\hat{j}+\hat{k}\right)$

(B) $-\frac{1}{\sqrt{3}}(\hat{i}+\hat{j}+\hat{k})$

(C) $-\frac{1}{\sqrt{3}}(-\hat{i}-\hat{j}+\hat{k})$

(D) $-\frac{1}{\sqrt{3}}\left(i+j-k\right)$

2. A concave mirror is placed on a horizontal table, with its axis directed vertically upwards. Let O be the pole of the mirror and C its centre of curvature. A point object is placed at C. It has a real image, also located at C. If the mirror is now filled with water, the image will be

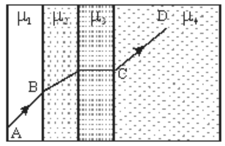
(A) real and will remain at C

(B) real and located at a point between C and ∞

(C) virtual and located at a point between C and O

(D) real and located at a point between C and O

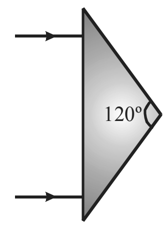
3. A ray of light passes through four transparent media with refractive indices μ_1, μ_2, μ_3 and μ_4 as shown in the figure, the surfaces of all media are parallel. If the emergent ray CD is parallel to the incident ray AB, we must have



(A) $\mu_1=\mu_2$ (B) $\mu_2=\mu_3$

(C)\ $\mu_3=\mu_4$ (D) $\mu_4=\mu_1$

4. An isosceles prism of angle 120º has a refractive index of $\sqrt{2}$. Two parallel monochromatic rays enter the prism parallel to each other in air as shown. the rays emerging from the opposite faces



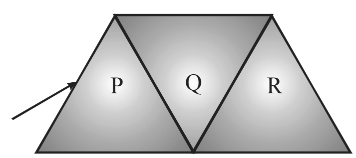
(A) are parallel to each other

(B) are diverging

(C) make an angle 30º with each other

(D) make an angle 60º with each other.

5. A given ray of light suffers minimum deviation in an equilateral prism P. Additional prisms Q and R of identical shape and of the same material as P are now added as shown in the figure. The ray will now suffer



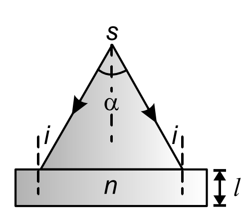
(A) greater deviation

(B) no deviation

(C) same deviation as before

(D) total internal reflection

6. A diverging beam of light from a point source S having divergence angle α, falls symmetrically on a glass slab as shown. the angles of incidence of the two extreme rays are equal. If the thickness of the glass slab is t and the refractive index n, then the divergence angle of the emergent beam is



(A) zero

(B) α

(C) $\sin^{-1}(1/n)$

(D) $2\sin^{-1}(1/n)$

ANSWER KEY

Exercise - I

1. (B)	**2.** (A)	**3.** (D)	**4.** (C)	**5.** (C)	**6.** (B)	**7.** (A)	**8.** (C)	**9.** (B)	**10.** (A)
11. (D)	**12.** (A)	**13.** (A)	**14.** (C)	**15.** (B)	**16.** (D)	**17.** (B)	**18.** (B)	**19.** (B)	**20.** (B)
21. (C)	**22.** (C)	**23.** (A)	**24.** (C)	**25.** (C)	**26.** (B)	**27.** (C)	**28.** (C)	**29.** (A)	**30.** (A)
31. (A)	**32.** (A)	**33.** (B)	**34.** (B)	**35.** (C)	**36.** (A)	**37.** (A)	**38.** (C)	**39.** (B)	**40.** (A)
41. (B)	**42.** (A)	**43.** (A)	**44.** (D)	**45.** (D)	**46.** (A)	**47.** (A)	**48.** (A)	**49.** (B)	**50.** (B)
51. (A)	**52.** (B)	**53.** (A)	**54.** (D)	**55.** (B)	**56.** (B)	**57.** (C)	**58.** (A)	**59.** (A)	**60.** (B)
61. (D)	**62.** (D)	**63.** (C)	**64.** (D)	**65.** (B)	**66.** (C)	**67.** (D)	**68.** (C)	**69.** (B)	**70.** (B)
71. (A)	**72.** (B)	**73.** (B)	**74.** (A)	**75.** (D)	**76.** (A)	**77.** (B)	**78.** (C)	**78.** (B)	**80.** (A)
81. (C)	**82.** (D)	**83.** (B)	**84.** (B)	**85.** (D)	**86.** (B)	**87.** (C)	**88.** (A)	**89.** (A)	**90.** (C)
91. (A)	**92.** (B)	**93.** (B)	**94.** (D)	**95.** (A)	**96.** (A)	**97.** (C)	**98.** (C)	**99.** (D)	**100.** (B)
101. (A)	**102.** (A)	**103.** (B)	**104.** (B)	**105.** (A)	**106.** (D)				

Exercise - II

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

59. (A) – (p), (q), (r), (s), (B) – (q), (C) – (p), (q), (r), (s), (D) – (p), (q), (r), (s)

60. (i) – (AC); (ii) – (BD); (iii) – (ABCD); (iv) – (ABCD) **61.** (A) – p,r; (B) – q,s,t; (C) – p,r,t; (D) – q,s

62. (6)	**63.** (6)	**64.** (3)	**65.** (6)	**66.** (3)	**67.** (3)	**68.** (5)	**69.** (4)	**70.** (1)	**71.** (3)

Exercise - III

(PART – A)

1. (D)	**2.** (B)	**3.** (C)	**4.** (D)	**5.** (B)	**6.** (B)	**7.** (A)	**8.** (B)	**9.** (A)	**10.** (D)
11. (D)	**12.** (D)	**13.** (B)	**14.** (C)	**15.** (B)	**16.** (B)	**17.** (A)	**18.** (D)	**19.** (B)	**20.** (D)
21. (D)	**22.** (A)	**23.** (C)	**24.** (D)	**25.** (C)	**26.** (A)	**27.** (A)	**28.** (C)	**29.** (D)	**30.** 1
31. 6.25	**32.** 5	**33.** (D)	**34.** 50	**35.** 5	**36.** (A,B)	**37.** (A)	**38.** 90	**39.** (D)	**40.** (D)
41. (A)	**42.** (B)	**43.** (B)	**44.** 60	**45.** (D)	**46.** (B)	**47.** (C)			

(PART – B)

1. (B) **2.** (B,C,D) **3.** 50 (49.00 to 51.00) **4.** 1.39 (1.35 to 1.45)

7 Wave Optics

1. Huygen`s Wave Theory:

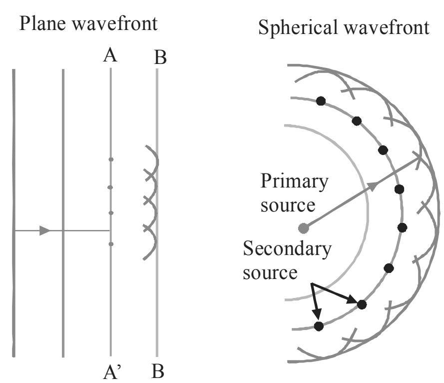
Huygen`s in 1678 assumed that a body emits light in the form of longitudinal waves.

(a) Each point source of light is a centre of disturbance from which waves spread in all directions. The locus of all the particles of the medium vibrating in the same phase at a given instant is called a wavefront.

(b) Each point on a wave front is a source of new disturbance, called secondary wavelets. These wavelets are spherical and travel with speed of light in that medium.

(c) The forward envelope of the secondary wavelets at any instant gives the new wavefront.

(d) In homogeneous medium, the wavefront is always perpendicular to the direction of wave propagation.



2. Coherent Sources:

Two sources will be coherent if and only if they produce waves of same frequency (and hence wavelength) and have a constant phase difference.

3. Incoherent Sources:

The sources are said to be incoherent if they have different frequency and phase difference is not constant w.r.t. time.

4. Interference: YDSE

5. Resultant intensity for coherent sources $I = I_1 + I_2 + \sqrt{I_1 I_2}\cos\phi_0$

6. Resultant intensity for incoherent sources $I = I_1 + I_2$

7. Intensity $\propto$ width of slit $\propto$ amplitude

$$\Rightarrow \frac{I_1}{I_2} = \frac{W_1}{W_2} = \frac{a_1^2}{a_2^2} \Rightarrow \frac{I_{max}}{I_{min}} = \frac{\left(\sqrt{I_1}+\sqrt{I_2}\right)^2}{\left(\sqrt{I_1}-\sqrt{I_2}\right)^2} = \left(\frac{a_1+a_2}{a_1-a_2}\right)^2$$

8. Distance of n^{th} bright fringe $X_n = \frac{n\lambda D}{d}$

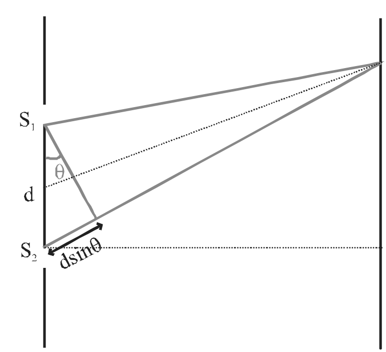
Path difference $= n\lambda$

where n = 0, 1, 2, 3, ...

Distance of m^{th} dark fringe

$$X_m = \frac{(2m+1)\lambda D}{2d}$$

Path difference $= (2m + 1)\frac{\lambda}{2}$ where m = 0, 1, 2, 3, ...



Physics Wallah

SPRINT

FOR JEE (MAINS & ADVANCED)

MATHEMATICS

CRASH COURSE

Class XII

3 Limit, Continuity & Derivability

LIMIT

1. Definition

Let f(x) be defined on an open interval about 'a' except possibly at 'a' itself. If f(x) gets arbitrarily close to L (a finite number) for all x sufficiently close to 'a' we say that f(x) approaches the limit L as x approaches 'a' and we write $\operatorname{Lim}_{x \to a} f(x) = L$ and say "the limit of f(x), as x approaches a, equals L".

2. Left Hand Limit and Right Hand Limit of a Function

Left hand limit (LHL) = $\operatorname{Lim}_{x \to a^-} f(x) = \operatorname{Lim}_{h \to 0} f(a - h)$.

Right han limit (RHL) = $\operatorname{Lim}_{x \to a^+} f(x) = \operatorname{Lim}_{h \to 0} f(a + h)$.

Limit of a function f(x) is said to exist as, $x \to a$ when $\operatorname{Lim}_{x \to a^-} f(x) = \operatorname{Lim}_{x \to a^+} f(x)$ = Finite quantity.

Important note:

In $\operatorname{Lim}_{x \to a} f(x)$, $x \to a$ necessarily implies $x \neq a$. That is while evaluating limit at x = a, we are not concerned with the value of the function at x = a. In fact the function may or may not be defined at x = a.

Also it is necessary to note that if f(x) is defined only on one side of **'x = a'**, one sided limits are good enough to establish the existence of limits, & if f(x) is defined on either side of **'a'** both sided limits are to be considered.

3. Fundamental Theorems on Limits

Let $\lim_{x \to a} f(x) = l$ & $\lim_{x \to a} g(x) = m$. If l & m exists finitely then :

(A) Sum rule : $\lim_{x \to a} \{f(x) + g(x)\} = l + m$

(B) Difference rule : $\lim_{x \to a} \{f(x) - g(x)\} = l - m$

(C) Product rule : $\lim_{x \to a} f(x) . g(x) = l . m$

(D) Quotient rule : $\lim_{x \to a} \frac{f(x)}{g(x)} = \frac{l}{m}$ provided m ¹ 0

(E) Constant multiple rule : $\operatorname{Lim}_{x \to a} kf(x) = k \operatorname{Lim}_{x \to a} f(x)$; where k is constant.

(F) Power rule : If m and n are integers then $\operatorname{Lim}_{x \to a} [f(x)]^{m/n} = l^{m/n}$ provided $l^{m/n}$ is a real number.

(G) $\lim_{x \to a} f[g(x)] = f\left(\lim_{x \to a} g(x)\right) = f(m)$; provided f(x) is continuous at x = m.

For example : $\lim_{x \to a} \ln(f(x)) = \ln[\lim_{x \to a} f(x)]$; provided lnx is defined at x = $\lim_{t \to a}$ f(t).

4. Indeterminate Forms

$\frac{0}{0}, \frac{\infty}{\infty}, \infty - \infty, 0 \times \infty, 1^{\infty}, 0^0, \infty^0$.

EXERCISE - I

BOOST YOUR PREPARATION FOR JEE MAINS

LIMIT

EVALUATION OF ALGEBRA OF LIMITS

1. $\lim_{x\to 0}\frac{\sqrt[K]{1+x}-1}{x}$ (K is a positive integer)

(A) K (B) $-K$ (C) $\frac{1}{K}$ (D) $-\frac{1}{K}$

2. $\lim_{x\to 1}\frac{(2x-3)(\sqrt{x}-1)}{2x^2+x-3}=$

(A) $\frac{1}{10}$ (B) $-\frac{1}{10}$ (C) $\frac{2}{5}$ (D) $-\frac{2}{5}$

3. $\lim_{x\to 0}\frac{\sqrt[3]{1+\sin x}-\sqrt[3]{1-\sin x}}{x}=$

(A) 0 (B) 1 (C) $\frac{2}{3}$ (D) $\frac{3}{2}$

4. If $\lim_{x\to 5}\frac{x^k-5^k}{x-5}=500$, then the positive integral value of k is

(A) 3 (B) 4 (C) 5 (D) 6

5. $\lim_{x\to 1}\frac{\sqrt{x^2-1}+\sqrt{x-1}}{\sqrt{x^2-1}}=$

(A) $1+\frac{1}{\sqrt{2}}$ (B) $1-\frac{1}{\sqrt{2}}$

(C) $-1+\frac{1}{\sqrt{2}}$ (D) $-1-\frac{1}{\sqrt{2}}$

6. If a > 0 and $\lim_{x\to a}\frac{a^x-x^a}{x^x-a^a}=-1$ then a =

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

7. $\lim_{x\to 0}\frac{x\left(1-\sqrt{1-x^2}\right)}{\sqrt{1-x^2}\left(\sin^{-1}(x)\right)^3}=$

(A) 1 (B) $\frac{1}{2}$ (C) $-\frac{1}{2}$ (D) –1

8. If $\lim_{x\to 0}\left(\frac{\cos 4x+a\cos 2x+b}{x^4}\right)$ is finite then the value of a,b respectively

(A) 5 (B) –5, –4 (C) –4,3 (D) 4,5

9. $\lim_{x\to 1}\left(\sec\left(\frac{\pi x}{2}\right)\log x\right)$ is

(A) $-\frac{2}{\pi}$ (B) $-\frac{\pi}{2}$ (C) $\frac{2}{\pi}$ (D) $\frac{\pi}{2}$

10. $\lim_{x\to 0}\frac{\sqrt{1+x^2}-\sqrt{1-x+x^2}}{3^x-1}=$

(A) log9 (B) $\frac{1}{\log 9}$

(C) $\log 3$ (D) $\frac{1}{\log 3}$

EVALUATION OF LEFT & RIGHT HAND LIMITS

11. $\lim_{x\to 0}\frac{\sin x}{\sqrt{x^2}}=$

(A) 1 (B) –1

(C) 0 (D) doesn't exist

12. $\lim_{x\to 2^+}\left(\frac{[x]^3}{3}-\left[\frac{x}{3}\right]^3\right)$ is (where [ ] is g.i.f)

(A) 0 (B) $\frac{64}{27}$ (C) $\frac{8}{3}$ (D) $\frac{10}{3}$

13. If $f:R\to R$ is defined by (where [ ] is g.i.f)

$f(x)=[x-3]+|x-4|$ for $x\in R$ then

$\lim_{x\to 3^-}f(x)=$

(A) –2 (B) –1 (C) 0 (D) 2

EVALUATION OF TRIGONOMETRIC LIMITS

14. $\lim_{x\to 0}\frac{e^x-e^{\sin x}}{2(x-\sin x)}=$

(A) –1/2 (B) 1/2 (C) 1 (D) 3/2

15. $\lim_{x\to 0}\frac{1-\cos^3 x}{x\sin 2x}=$

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

EXERCISE - III

JEE PREVIOUS YEARS

PART - A

1. Let $f : R \to R$ be a positive increasing function with $\lim_{x\to\infty} \frac{f(3x)}{f(x)} = 1$. Then $\lim_{x\to\infty} \frac{f(2x)}{f(x)} =$ **[AIEEE-2010]**

(A) 1 (B) $\frac{2}{3}$ (C) $\frac{3}{2}$ (D) 3

2. $\lim_{x\to 2}\left(\frac{\sqrt{1-\cos\{2(x-2)\}}}{x-2}\right)$ **[AIEEE-2011]**

(A) equals $-\sqrt{2}$ (B) equals $\frac{1}{\sqrt{2}}$

(C) does not exist (D) equals $\sqrt{2}$

3. Let $f : R \to [0, \infty)$ be such that $\lim_{x\to 5} f(x)$ exists and $\lim_{x\to 5}\frac{(f(x))^2-9}{\sqrt{|x-5|}} = 0$. Then $\lim_{x\to 0} f(x)$ equal **[AIEEE-2011]**

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

4. If function f(x) is differentiable at x = a then $\lim_{x\to a}\frac{x^2 f(a) - a^2 f(x)}{x-a}$ **[AIEEE-2011]**

(A) $2a\, f(a) + a^2 f'(a)$ (B) $-a^2 f'(a)$

(C) $af(a) - a^2 f'(a)$ (D) $2af(a) - a^2 f'(a)$

5. $\lim_{x\to 0}\frac{(1-\cos 2x)(3+\cos x)}{x\tan 4x}$ is equal to: **[JEE(Main)-2013]**

(A) $-\frac{1}{4}$ (B) $\frac{1}{2}$ (C) 1 (D) 2

6. $\lim_{x\to 0}\frac{\sin\left(\pi\cos^2 x\right)}{x^2}$ is equal to: **[JEE(Main)-2014]**

(A) $\frac{\pi}{2}$ (B) 1 (C) $-\pi$ (D) π

7. $\lim_{x\to 0}\frac{(1-\cos 2x)(3+\cos x)}{x\tan 4x}$ is equal to **[JEE(Main)-2015]**

(A) 2 (B) $\frac{1}{2}$ (C) 4 (D) 3

8. Let f(x) be a polynomial of degree four having extreme values at x = 1 and x = 2.

If $\lim_{x\to 0}\left[1+\frac{f(x)}{x^2}\right] = 3$, then f(2) is equal to : **[JEE(Main)-2015]**

(A) 0 (B) 4 (C) – 8 (D) – 4

9. Let $p = \lim_{x\to 0+}\left(1+\tan^2\sqrt{2}\right)^{\frac{1}{2x}}$ then log p is equal to: **[JEE(Main)-2016]**

(A) 1 (B) $\frac{1}{2}$ (C) $\frac{1}{4}$ (D) 2

10. $\lim_{n\to\infty}\left(\frac{(n+1)(n+2)....3n}{n^{2n}}\right)^{\frac{1}{n}}$ is equal to : **[JEE(Main)-2016]**

(A) $\frac{27}{e^2}$ (B) $\frac{9}{e^2}$

(C) 3 log 3 – 2 (D) $\frac{18}{e^4}$

11. $\lim_{x\to\frac{\pi}{2}}\frac{\cot x - \cos x}{(\pi - 2x)^3}$ equals **[JEE(Main)-2017]**

(A) $\frac{1}{24}$ (B) $\frac{1}{16}$

(C) $\frac{1}{8}$ (D) $\frac{1}{4}$

12. For each $t \in R$, let [t] be the greatest integer less than or equal to t. Then

$$\lim_{x\to 0^+} x\left(\left[\frac{1}{x}\right]+\left[\frac{2}{x}\right]+..........+\left[\frac{15}{x}\right]\right)$$

[JEE(Main)-2018]

(A) is equal to 120

(B) does not exist (in R)

(C) is equal to 0

(D) is equal to 15

13. $\lim_{y\to 0}\frac{\sqrt{1+\sqrt{1+y^4}}-\sqrt{2}}{y^4}$ **[JEE(Main)-2019]**

(A) exists and equals $\frac{1}{2\sqrt{2}}$.

(B) exists and equals $\frac{1}{2\sqrt{2}\,(\sqrt{2}+1)}$.

(C) does not exist.

(D) exists and equals $\frac{1}{4\sqrt{2}}$.