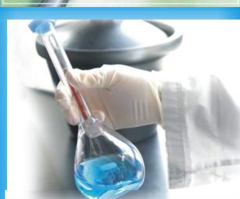

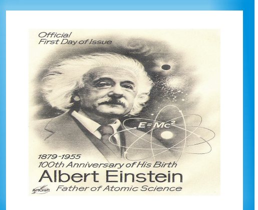


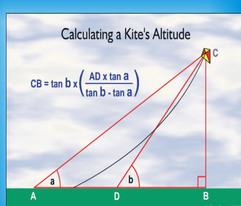


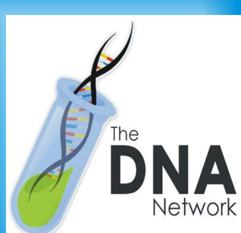


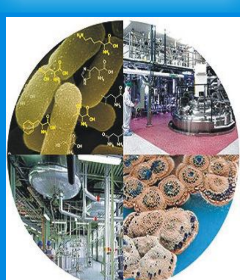

# JNU CEEB

## MOCK TEST PAPER

- **Attempt ALL the objective questions (Questions 1-120).**
  **Each of these questions carries one marks.**
  **0.5 negative mark for each wrong answer.**

- **Pattern of questions : MCQs**
- **Total marks : 120**
- **Duration of test : 3 Hours**

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**1.** When we are planning to go on a strenuous hike and are advised to eat plenty of high carbohydrate foods, for several days beforehand, why is it so.

(A) It is done to increase the body resistivity.

(B) It is done to increase the amount of stored body glycogen

(C) It is done to put on the weight

(D) Both (A) & (B) are correct

**2.** State whether the following statement are true or false:

(i) Researcher have claimed that there are several variants of glycogen.

(ii) Eating candy bars, high in sucrose rather than complex carbohydrate, helps to built up glycogen stores

(iii) Aldolase catalyzes the reverse aldole condensation of fructose 1-6 bisphosphate to glyceraldehyde - 3 - phosphate & dihydroxyacetone

(iv) Mutase enzyme is responsible to move a functional group such as phosphate to a new location in a substrate molecule

(A) T F T F

(B) T F F T

(C) T T T T

(D) T F T T

**3.** Citrate synthetase can act as a plant poison that can act as a substrate is

(A) Floroacetate

(B) Floroacetyl Co - A

(C) Compound 1080

(D) Both (A) & (B)

**4.** Which compound is considered to be the by compound for the initiation of the process of synthesis of carbohydrates and amino acids.

(A) Pyruvate

(B) Acetyl Co - A

(C) Glycogen

(D) Glycose

**5.** Many soft drinks contains citric acid as a significant part of their flavor. Choose the correct statement regarding this.

(i) It is so because it is a good nutrient

(ii) It is rapidly absorbed by mitochondria

(iii) It is completely degraded to $CO_2$ & $H_2O$

(iv) It provides flavour & taste

(A) (i) & (ii)

(B) (i), (ii) & (iii)

(C) (i) & (iv)

(D) (i), (iii) & (iv)

**6.** Match the following:

| **List - I** | **List - II** |
|---|---|
| (a) Dehydration | (i) 3 - phosphoglycerate 2- phosphoglycerate $\Delta G°' = +1.06$ kcal mol$^{-1}$ |
| (b) Isomerization | (ii) 2 - phosphoglycerate phosphoenolpyruvate + $H_2O$ $\Delta G°' = +.44$ k cal mol$^{-1}$ |
| (c) Reduction | (iii) Phosphoenolpyruvate + ADP $\rightarrow$ pyruvate + ATP $\Delta G°' = -7.5$ Kcal mol$^{-1}$ |
| (d) Phosphorylation | (iv) Pyruvate + NADH + $H^+$ lactate + $NAD^+$ $\Delta G°' = -6.0$ kcal mol$^{-1}$ |

(A) (a) – (i) (b) – (iii) (c) – (ii) (d) – (iv)

(B) (a) – (ii) (b) – (i) (c) – (iii) (d) – (iv)

(C) (a) – (ii) (b) – (i) (c) – (iv) (d) – (iii)

(D) (a) – (ii) (b) – (iii) (c) – (i) (d) – (iv)

**7.** Whenever the second stage of glycolysis occurs, it follows the process of

(A) Oxidoreduction

(B) Phosphorylation

(C) Oxidoreduction & phosphorylation

(D) Phosphorylation first & then oxidoreduction

**8.** Whenever disaccharides are ingested by higher animals, they are usually hydrolyzed to their monosaccharide components before absorption in the intestines, some of the reactions are given below, select the correct reactions.

(i) $\text{Sucrose} + H_2O \xrightarrow{\alpha\text{ - fructofuranoside}} \text{Dglucose} + \text{Dfructose}$

(ii) $\text{Maltose} + H_2O \xrightarrow{\alpha-\text{glucosidase}} 2\text{Dglucose} + \text{Dfructose}$

(iii) $\text{Sucrose} + H_2O \xrightarrow{\beta-\text{fructofuranoside}} \text{Dglucose} + \text{Dfructose}$

(iv) $\text{Lactose} + H_2O \xrightarrow{\beta-\text{Galactosidase}} \text{Dglucose} + \text{DGalactose}$

(A) (i) Only
(B) (i) & (ii)
(C) (ii), (iii) & (iv)
(D) (i), (iii) & (iv)

**9.** When malonate was added to the muscle suspension, what would be the result ?
(A) It will block the TCA cycle by blocking the activity of succinate dehydrogenase.
(B) It will enhance the TCA cycle by enhancing the activity of succinate dehydrogenase.
(C) It will show no effect on TCA cycle.
(D) It will only lead to the enhancement of the cycle

**10.** Pyruvate dehydrogenase kinase & pyruvate dehydrogenase phosphatase are the
(A) Regulatory proteins of TCA cycle
(B) Regulatory proteins of oxidative decarboxylation
(C) Inhibitory proteins of TCA cycle.
(D) Inhibitory proteins of oxidative decarboxylation.

**11.** Citrate synthase reactions is the primary pacemaker step of the TCA cycle, it's rate is largely determined by.
(A) Availability of oxaloacetic acid.
(B) Availability of acetyl – Co – A
(C) Availability of succinyl Co – A
(D) All of the above

**12.** The essential requirement for substrate level phosphorylation is that.

(A) The standard free energy of the hydrolysis reaction is more positive than that of hydrolysis of the new phosphate compound being formed.

(B) The standard free energy of the hydrolysis reaction is more negative than that of hydrolysis of the new phosphate compounds being formed

(C) Uncertain answer

(D) Both (A) & (B) are true

**13.** Porphyrins are made from :

(A) succinic acid and glycine

(B) lysine and proline

(C) alanine and glutamic acid

(D) acetyl Co-A and oxaloacetate

**14.** The most ATP per gram is yield by which substrate ?

(A) Isocitric acid

(B) Aspartic acid

(C) Oleic acid

(D) Glycogen

**15.** The rate controlling step in the synthesis of fatty acids is catalyzed by :

(A) acetyl Co-A carboxylase

(B) fatty acid synthase

(C) HMG Co-A synthase

(D) thiolase

**16.** Enzymes involved in the construction of a DNA library can include all of the following, except :

(A) DNA polymerase - I

(B) Reverse transcriptase

(C) DNA ligase

(D) RNA polymerase III

**17.** Polymerase Chain Reaction (PCR) involves all of the following, except :

(A) DNA synthesis using Taq polymerase

(B) restriction endonuclease cleavage of the DNA

(C) multiple rounds of DNA synthesis

(D) use of primers that flank the sequence being amplified

**18.** After extraction of cell lysates with phenol, the nucleic acid will be in :

(A) phenol phase

(B) aqueous phase

(C) inter phase

(D) the pellet

**19.** Ribose-5 phosphate is formed in the pentose phosphate pathway from :

(A) isomerization of ribulose-5-phosphate

(B) reaction of fructose-6-phosphate and glyceraldehyde-3-phosphate

(C) reaction of xylulose-5-phosphate and erythrose-4-phosphate

(D) none of the above

**20.** Chloroplast contains lipids, proteins and chlorophyll . The function of protein is to

(A) Help in photosynthesis .

(B) Help in providing colours .

(C) Help in formation of plastid wall .

(D) Help in transport of materials .

**21.** Which of the following are correct :

(A) Nucleus is surrounded by intermediate filaments on its both sides .

(B) Chromatin is present in nucleoplasm

(C) Nuclear lamina is sandwiched between nuclear membrane and nucleoplasm

(D) Nuclear lumen is in continuation with ER lumen

**22.** Mitochondria is a double - membrane structure . It contain proteins , lipids and DNA. Which of the following statement is incorrect about its chemical composition :

(A) Phospholipids are about 90% and are mainly lecithin and cephalin

(B) Both of its membrane have protein called cardiolipin .

(C) DNA accounts for only 0.5 %

(D) Outer membrane have 50% proteins and 50% phospholipids .

**23.** For chemi-osmotic hypothesis , which of the following statements is FALSE :

(A) Transport of electrons takes place from low redox potential carriers

(B) Transport of protons to cytoplasmic side of membrane causes positive charge on inner mitochondrial membrane

(C) Hydrogen ion reactions takes place on both sides of membrane

(D) Six protons are generated per electron pair transported.

**24.** In mitochondria, permeases, a carrier proteins help in the transport of metabolite

(A) From matrix to cytosol

(B) From cytosol to matrix

(C) From perichondrial space to inner space

(D) From inner chamber to outer chamber

**25.** During chemi–osmotic hypothesis, proteins concentration gradient is established across

(A) Outer mitochondrial surface

(B) Inner chamber

(C) Between C– face and M–face of inner mitochondrial membrane

(D) Outer chamber

**26.** Which of the following statements are true (T) and false (F) for chemi -osmotic hypothesis:

1. The proteins are transported from matrix side to cytosol side

2. Proton concentration gradient causes proton translocation and oxidative phosphorylation

3. 6 ATP's are produced by movement of 3 $e^-$s in ETS across inner mitochondrial membrane

4. Hydrogen ion uptake reaction takes place towards outer side of membrane

(A) 1 – F, 2 – F, 3 – T, 4 – T

(B) 1 – T, 2 – T, 3 – T, 4 – F

(C) 1 – T, 2 – T, 3 – F, 4 – F

(D) 1 – T, 2 – T, 3 – T, 4 – T

**27.** The carrier –mediated cotransport in which a solute is actively transported across a membrane against the gradient of electrochemical potential by coupling the uphill transport of one solute to the downhill transport of another is the example of :

(A) Symport transport

(B) Primary Active transport

(C) Facilitated Diffusion

(D) Antiport transport

**28.** Red blood corpuscles placed in 0.5% sodium chloride solution will show :

(A) Bursting

(B) Plasmolysis

(C) Deplasmolysis

(D) Turgidity

**29.** Name of organelles are given in List 1 and their functions are given in List 2. Match them correctly.

| List–I | List–2 |
|---|---|
| a. Golgi Body | 1. Formation of vesicles |
| b. Endoplasmic Reticulum | 2. Formation of vacuoles |
| c. Plasma Membrane | 3. Formation of transition vesicle |
| | 4. Flow of information into the cells. |

**Codes :**

| | a | b | c |
|---|---|---|---|
| (A) | 1 | 2 | 3 |
| (B) | 2 | 4 | 3 |
| (C) | 2 | 3 | 4 |
| (D) | 2 | 1 | 4 |

**30** Afferent nerve fibres carry impules from –

(A) Effector organs to CNS

(B) Receptor to CNS

(C) CNS to receptor

(D) CNS to muscles

**31.** Acetylcholine is responsible for transmission of nerve impulses through.

(A) Cytons

(B) Dendrites

(C) Axons

(D) Synapses.

**32.** Poisons, like cyanide inhibit Na+ efflux and $K^+$ influx during cellular transport. This inhibitory effect is reversed when infections of ATP are given. This demonstrates that :

(A) $Na^+$– $K^+$ exchange pump operates in the cells.

(B) Energy for $Na^+$ –$K^+$ exchange pump comes from ATP.

(C) ATP is the carrier protein.

(D) ATP is hydrolysed by ATPase.

**33.** An action potential in a nerve fibre is produced when positive and negative charges on outside and inside of axon membrane are reversed because:

(A) More $Na^+$ enter into axon than $K^+$ leaving it.

(B) All $Na^+$ leave the axon

(C) All $K^+$ leave the axon

(D) More $K^+$ enter the axon than $Na^+$ leaving it .

**34.** Which one illustrates a reflex are;

(A) Brain $\rightarrow$ Spinal cord $\rightarrow$ Muscles.

(B) Receptor$\rightarrow$Spinal cord$\rightarrow$Muscles

(C) Muscle$\rightarrow$Spinal cord$\rightarrow$Brain

(D) Spinal cord$\rightarrow$Effector$\rightarrow$Receptor

**35.** Cerebellum of brain is concerned with

(A) Static balance

(B) Initiation of muscular contraction.

(C) Regulation of body posture and equilibrium

(D) Co-ordination of muscular movements

**36.** Deficiency of growth hormone in adults will lead to

(A) Dwarfism

(B) Acromegaly

(C) Gigantism

(D) simmond's disease

**37.** Which hormone promotes cells division, protein synthesis & bone growth

(A) GH

(B) ADH

(C) ACTH

(D) Adrenaline

**38.** The secretion of ACTH is stimulated by :

(A) High blood level of glucose

(B) Low blood level of glucose

(C) High $p^H$ level

(D) Low $p^H$ level

**39.** If pituitary is surgically removed, blood level of sodium falls and that of potassium rises because of :

(A) Atrophy of adrenal cortex

(B) Atrophy of adrenal medulla

(C) LTH from pituitary is no longer available

(D) Oxytocin from pituitary is no longer available

**40.** Chylomicrons that enter the lacteals are composed of

(A) Triglycerides alone

(B) Triglycerides around a protein core

(C) Protein coat around triglycerides

(D) Proteins alone

**41.** Individual cells can be identified by using :

(A) Marker enzyme

(B) Flow cytometry

(C) Rate zonal centrifugation

(D) Equilibrium density gradient centrifugation

**42.** What characteristic introns have being cut from a pre mRNA?

(A) Linear structure

(B) Circular form

(C) Lariat shaped

(D) Theta structure

**43.** A typical animal cell contains:

(A) $3 \times 10^9$ nucleotides

(B) $3 \times 10^2$ nucleotides

(C) $3 \times 10^4$ nucleotides

(D) $3 \times 10^5$ nucleotides

**44.** Which of the following is not a member of the immunoglobulin supergene family?

(A) Antibodies

(B) Lymphokines

(C) MHC glycoproteins

(D) T - cell receptors

**45.** Algae have cell wall made up of

(A) Cellulose, galactans and mannans

(B) Hemicellulose, pectins and proteins

(C) Pectins, cellulose and proteins

(D) Cellulose, hemicellulose and pectins

**46.** Penicillin, an antibiotic is produced by

(A) Pencillium chrysogenum

(B) P. glacum

(C) P. patulum

(D) P. griseofulvin

**47.** Which type of cancer affects lymph nodes and spleen?–

(A) Carcinoma

(B) Sarcoma

(C) Leukemia

(D) Lymphoma

**48.** Two electrons A and B in an atom have the following set of quantum numbers;

A : 3, 2, –2, +1/2; B : 3, 0, 0, +1/2

Which statement is correct for A and B ?

(A) A and B have same energy

(B) A has more energy than B

(C) B has more energy than A

(D) A and B represents same electron

**49.** When $H_2S$ is passed through $Hg_2^{2+}$, we get :

(A) HgS

(B) HgS + $Hg_2S$

(C) HgS + Hg

(D) $Hg_2S$

**50.** Among $KO_2$, $AlO_2^-$, $BaO_2$ and $NO_2^+$, unpaired electron is present in –

(A) $NO_2^+$ and $BaO_2$

(B) $KO_2$ and $AlO_2^-$

(C) $KO_2$ only

(D) $BaO_2$ only

**51.** Which of the following will exhibit optical isomerism ?

(A) $[Cr(en)(H_2O)_4]^{3+}$

(B) $[Cr(en)_3]^{3+}$

(C) trans-$[Cr(en)(Cl_2)(NH_3)_2]^+$

(D) $[Cr(NH_3]_6]^{3+}$

**52.** A light green coloured salt soluble in water gives black precipitate on passing $H_2S$. The precipitate dissolves readily in HCl. Which of the following metal ion constitutes the salt ?

(A) $Co^{2+}$

(B) $Ni^{2+}$

(C) $Fe^{2+}$

(D) $Mn^{2+}$

**53.** Which of the following is strongest base?

(A) $Be(OH)_2$

(B) $Mg(OH)_2$

(C) $Al(OH)_3$

(D) $Si(OH)_4$

**54.** In PMR, vinyl chloride gives

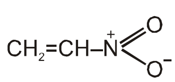
(A) one signal

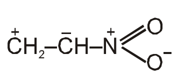
(B) two singlets

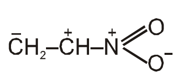
(C) three signals

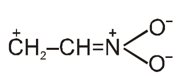
(D) one doublet and one triplet

**55.** Least contributing structure in nitroethene is :

(A) 

(B) 

(C) 

(D) 

**56.** Walden inversion is associated with :

(A) $SN^1$ reaction

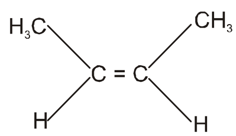
(B) $SN^2$ reaction

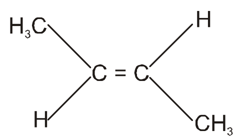
(C) Elimination reaction

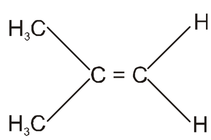
(D) Diels - Alder reaction

**57.** The compound which reacts with HBr obeying Markownikoff's rule is –

(A) $CH_2 = CH_2$

(B) 

(C) 

(D) 

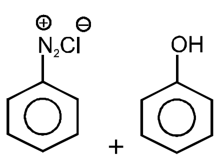
**58.** How many isomeric aromatic $C_6H_2Br_4$ are possible which on bromination $Br_2/FeBr_3$ gives only 1 type of product.

(A) 1

(B) 2

(C) 3

(D) 4

**59.**  product Which of the following statements is **incorrect** about the above reaction ?

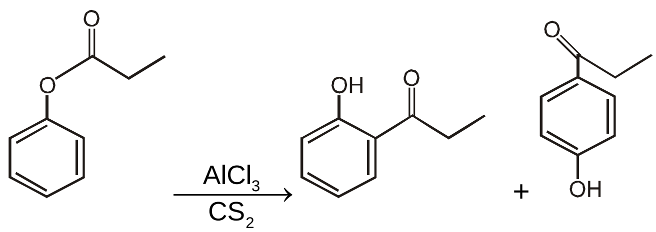
(A) Product shows geometrical isomerism

(B) Product shows colour due to extended conjugation

(C) Electophile attack at para position due to large size.

(D) Electron withdrawing group in phenol increases rate of reaction.

**60.** The conversion shown below is an example of



(A) Fries rearrangement

(B) Claisen rearrangement

(C) Friedel-Crafts acylation

(D) Reimer-Tiemann reaction

**61.** Reaction of Ph–CN with $LiAlH_4$ generates –

(A) Benzyl alcohol

(B) Benzylamine

(C) Benzoic acid

(D) Aniline

**62.** Ultra violet light absorption occurring in protein is due to the presence of

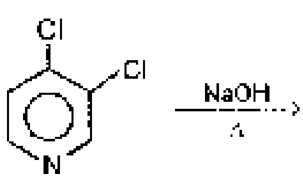
(A) Alanine

(B) Cysteine

(C) Glutamic acid

(D) Tryptophan

**63.**



**64.** If a reaction with $t_{1/2}$ = 69.3 second, have a rate constant $10^{-2}$ per second, the order is:

(A) Zero

(B) 1

(C) 2

(D) 3

**65.** Identify the least stable amongst the following

(A) $Li^-$

(B) $Be^-$

(C) $B^-$

(D) $C^-$

**66.** Which of the following amino acid have 2 chiral centres?

(A) Lysine

(B) Phenyl alanine

(C) Threonine

(D) Valine

**67.** The rusting of iron takes place as follows:-

$$2H^+ + 2e^- + \frac{1}{2}O_2 \longrightarrow H_2O(l);\ E^o = +1.23\text{ V}$$

$$Fe^{2+} + 2e^- \longrightarrow Fe(s);\ E^o = -0.44\text{ V}$$

Calculate $\Delta G^o$ for the net process.

(A) –322 kJ $mol^{-1}$

(B) –161 kJ $mol^{-1}$

(C) –152 kJ $mol^{-1}$

(D) –76 kJ $mol^{-1}$

**68.** The energy of the electron in first Bohr's orbit in the hydrogen atom is –3·41 eV. The energy of the electron in second Bohr's orbit of $He^+$ ion would be –

(A) –85 eV

(B) –13·62 eV

(C) –1·70 eV

(D) –6·82 eV

**69.** Which gas when passed through dilute blood will impart a cherry red colour to the solution?

(A) $CO_2$

(B) $COCl_2$

(C) $NH_3$

(D) CO

**70.** The rates of diffusion of $SO_2$, $CO_2$, $PCl_3$ and $SO_3$ are in the following order:-

(A) $PCl_3 > SO_3 > SO_2 > CO_2$

(B) $CO_2 > SO_2 > PCl_3 > SO_3$

(C) $SO_3 > SO_2 > PCl_3 > CO_2$

(D) $CO_2 > SO_2 > SO_3 > PCl_3$

**71.** Heat of neutralisation of oxalic acid is –25.4 kcal $mol^{-1}$ using strong base, NaOH. Hence, enthalpy change of the process:-

$H_2C_2O_4 \rightleftharpoons 2H^+ + C_2O_4^{2-}$ is:-

(A) 2.0 kcal

(B) –11.8 kcal

(C) 1.0 kcal

(D) –1.0 kcal

**72.** $Z - CH = CH_2 \xrightarrow{HBr} Z - CH_2 - CH_2 - Br$

Which of the following substitute might be best suited for Z ?

(1) – Cl  (2) – $SO_3H$  (3) – $OCH_3$  (4) – $CF_3$

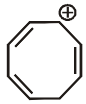
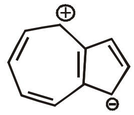
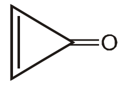
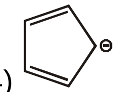
(A) 1, 3

(B) 2, 4

(C) 2, 3

(D) 3, 4

**73.** Which of the following is highly polar aromatic species ?

(1)  (2)  (3)  (4) 

(A) 2, 3

(B) 1, 3

(C) 3, 4

(D) 2, 4

**74.** Which of the following valence electron experience maximum effective nuclear charge ?

(A) $4s^1$

(B) $4p^1$

(C) $3d^1$

(D) $2p^3$

**75.** Hund's rule of maximum multiplicity suggests filling of electron in degenerate orbitals as

(A) screening values increases

(B) nuclear charge increases

(C) effective nuclear charge increases

(D) effective nuclear charge decreases

**76.** Does Le Chatelier's principle predict a change of equilibrium concentration for the following reaction if the gas mixture is compressed ?

$$N_2O_4(g) \rightleftharpoons 2NO_2(g)$$

(A) Yes, backward reaction is favoured

(B) Yes, forward reaction is favoured

(C) No change

(D) No information

**77.** If $A = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$ and $(aI + bA)^2 = A$, a, b $\in$ IR, then a and b are given by–

(A) $\pm\frac{1}{\sqrt{3}}$

(B) $\pm\frac{1}{\sqrt{5}}$

(C) $\pm\frac{1}{\sqrt{2}}$

(D) None of these

**78.** Find the area bounded by the curve $\sqrt{x} + \sqrt{y} = 1$ and the coordinate axes.

(A) $\frac{1}{2}$

(B) $\frac{1}{3}$

(C) $\frac{1}{5}$

(D) $\frac{1}{6}$.

**79.** $f(x) = x^2[x]$

(A) Increases in (0, 1)

(B) Decreases in (0, 1)

(C) increases in (-1, 0)

(D) None of these

**80.** The value of the determinant $\begin{vmatrix} 10! & 11! & 12! \\ 11! & 12! & 13! \\ 12! & 13! & 14! \end{vmatrix}$ is

(A) 2(10! 11!)

(B) 2(10! 13!)

(C) 2(10! 11! 12!)

(D) 2(11! 12! 13!)

**81.** Solution of $\frac{dy}{dx} = 2xy$ is

(A) $ae^{x^2}$

(B) $ae^{-x^2}$

(C) $ae^{2x}$

(D) $ae^{-2x}$

**82.** What is the order and degree of differential equation $\frac{d^2y}{dx^2}+\sqrt{1+\left(\frac{dy}{dx}\right)^3}=0$

(A) 1, 2

(B) 1, 1

(C) 2, 1

(D) 2, 2

**83.** $\begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+x & 1 \\ 1 & 1 & 1+y \end{vmatrix} =$

(A) 1 + x

(B) 1 + y

(C) 1 + xy

(D) xy

**84.** If x = a (θ – sin θ), y = a(1 – cos θ), then $\frac{d^2y}{dx^2}$ is–

(A) $-\frac{1}{a\sin^2\theta/2}$

(B) $-\frac{1}{4a}\text{cosec}^2\frac{\theta}{2}$

(C) $-\frac{1}{4a}\sec^2\frac{\theta}{2}\text{cosec}^2\frac{\theta}{2}$

(D) None of these

**85.** The functoin

$u = x^2 + y^2 + 6x + 12$ is

(A) Maximum at x = 3, y = 0

(B) Maximum at x = –3, y = 0

(C) Minimum at x = –3, y = 0

(D) Minimum at x = 0, y = 3

**86.** $\int \frac{dx}{(1+x^2)\sqrt{p^2+q^2(\tan^{-1}x)^2}} =$

(A) $\frac{1}{q}\log\left[q\tan^{-1}x+\sqrt{p^2+q^2\left(\tan^{-1}x\right)^2}\right]+c$

(B) $\log\left[q\tan^{-1}x+\sqrt{p^2+q^2\left(\tan^{-1}x\right)^2}\right]+c$

(C) $\frac{2}{3q}\left(p^2+q^2\tan^{-1}x\right)^{3/2}+c$

(D) None of these

**87.** If y(t) is solution of $(1+t)\frac{dy}{dt}-ty=1$ and $y(0)-1$ , then y(1) is equal to

(A) $-\frac{1}{2}$

(B) $e+\left(\frac{1}{2}\right)$

(C) $e-\frac{1}{2}$

(D) $\frac{1}{2}$

**88.** Area bounded by curves $y = x^2$ and $y = 2 – x^2$ is

(A) $\frac{8}{3}$

(B) $\frac{3}{8}$

(C) $\frac{3}{2}$

(D) None of these

**89.** The expansion of $\frac{1}{(4-3x)^{1/2}}$ by binomial theorem will be valid, if

(A) $x < 1$

(B) $|x| < 1$

(C) $-\frac{2}{\sqrt{3}} < x < \frac{2}{\sqrt{3}}$

(D) None of these

**90.** The sum of the series $\frac{1}{2.3}+\frac{1}{4.5}+\frac{1}{6.7}+\ldots=$

(A) log(2/e)

(B) log(e/2)

(C) 2/e

(D) e/2

**91.** In a simultaneous toss of four coins, what is the probability of getting exactly three heads

(A) $\frac{1}{2}$

(B) $\frac{1}{3}$

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

(D) None of these

**92.** $\tan\alpha + 2\tan 2\alpha + 4\tan 4\alpha + 8\cot 8\alpha =$

(A) $\tan\alpha$

(B) $\tan 2\alpha$

(C) $\cot\alpha$

(D) $\cot 2\alpha$

**93.** Let $g(x)=1+x-[x]$ and $f(x)=\begin{cases}-1, & x<0\\ 0, & x=0\\ 1, & x>0\end{cases}$, then for all $x$, f(g(x)) is equal to

(A) x

(B) 1

(C) f(x)

(D) g(x)

**94.** If 1 – i is a root of the equation $x^2 - ax + n = 0$, then b =

(A) –2

(B) –1

(C) 1

(D) 2

**95.** If the points (x + 1,2), (1, x + 2) , $\left(\frac{1}{x+1},\frac{2}{x+1}\right)$ are collinear, then x is

(A) 4

(B) 2

(C) –4

(D) None of these

**96.** Area bounded by curve xy = c, x – axis between x = 1 and x = 4, is

(A) c log 3 sq. unit

(B) 2 log c sq. unit

(C) 2c log 2 sq. unit

(D) 2c log 5 sq. unit

**97.** If $\cot^{-1}\alpha + \cot^{-1}\beta = \cot^{-1}x$, then x =

(A) $\alpha + \beta$

(B) $\alpha - \beta$

(C) $\frac{1+\alpha\beta}{\alpha+\beta}$

(D) $\frac{\alpha\beta-1}{\alpha+\beta}$

**98.** For the L.P. problem Min z = 2x – 10y subject to $x - y \ge 0,\ x - 5y \ge -5$ and x, y, $\ge 0$ z =

(A) –10

(B) –20

(C) 0

(D) 10

**99.** The profit function is

$$P(x) = -\frac{1}{2}x^2 + 32x - 480,$$

then the profit is maximum if the number of item (x) produced and sold is

(A) 18

(B) 17

(C) 24

(D) 32

**100.** $\cot^{-1}\left[\dfrac{\sqrt{1-\sin x}+\sqrt{1+\sin x}}{\sqrt{1-\sin x}-\sqrt{1+\sin x}}\right] =$

(A) $\pi - x$

(B) $2\pi - x$

(C) $\dfrac{x}{2}$

(D) $\pi - \dfrac{x}{2}$

**101.** The dimensions of intensity are :

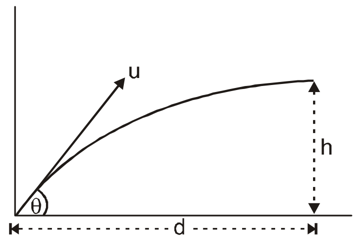
(A) $L^0 M^1 T^{-3}$

(B) $L^1 M^2 T^{-2}$

(C) $L^2 M^1 T^{-2}$

(D) $L^2 M^2 T^{-3}$

**102.** If a stone is to hit at a point which is at a distance d away and at a height h above the point from where the stone starts, then what is the value of initial speed u if stone is launched at an angle $\theta$?




(A) $\dfrac{g}{\cos\theta}\sqrt{\dfrac{d}{2(d\tan\theta - h)}}$

(B) $\dfrac{d}{\cos\theta}\sqrt{\dfrac{g}{2(d\tan\theta - h)}}$

(C) $\sqrt{\dfrac{gd^2}{h\cos^2\theta}}$

(D) $\sqrt{\dfrac{gd^2}{(d-h)}}$

**103.** A sparrow flying in air sits on a stretched telegraph wire. If weight of the sparrow is W, which of the following is true about the tension T produced in the wire ?

(A) T = W

(B) T < W

(C) T = 0

(D) T > W

**104.** A charged particle is released from rest in a region of steady and uniform electric and magnetic fields which are parallel to each other. The particle will move in a:

(A) Straight line

(B) Circle

(C) Helix

(D) Cycloid

**105.** When a potential difference is applied across, the current passing through:

(A) An insulator at 0 K is finite

(B) A semiconductor at 0 K is zero

(C) A metal at 0 K is finite

(D) A p-n diode at 300 K is finite, if it is reverse biased

**106.** A light string passing over a smooth light pulley connects two blocks of masses $m_1$ and $m_2$ (vertically ). If the acceleration of the system is (g/8), then the ratio of masses is

(A) 8 : 1

(B) 9 : 7

(C) 4 : 3

(D) 5 : 3

**107.** If momentum of a body increases by 50% , its kinetic energy will increase by

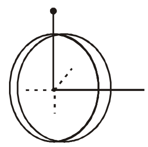
(A) 50%

(B) 100%

(C) 125%

(D) 150%

**108.** Two insulating rings, one of slightly smaller diameter than the other are suspended along their common diameter as shown. Initially the planes of the rings are mutually perpendicular. When a steady current is set up in each of them



(A) The two rings rotate into a common plane

(B) The inner ring oscillates about its initial position

(C) The inner ring stays stationary while the outer one moves into the plane of the inner ring

(D) The outer ring stays stationary while the inner one moves into plane of the outer ring.

**109.** A metallic wire bent in the form of a semi-circle of radius 0.1 m is moved in a direction parallel to its plane, but perpendicular to a magnetic field B = 20mT with a vel. of 10 m/s. Find the e.m.f. induced in the wire.

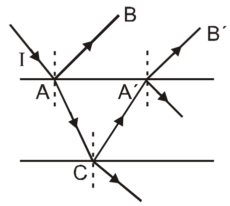
(A) 4V

(B) 0.4V

(C) 0.04V

(D) 0.004V

**110.** A ray of light of intensity I is incident on a parallel glass- slab at a point A as shown. It undergoes partial reflection and refraction. At each reflection 25% of incident energy is reflected. The rays AB and A' B' undergo interference. The ratio $I_{max} / I_{min}$ is:




(A) 4 : 1

(B) 8 : 1

(C) 7 : 1

(D) 49 : 1.

**111.** A glass prism of refractive index 1.5 is immersed in water (refractive index 4/3). A light beam incident normally on the face AB is totally reflected to reach the face BC if :

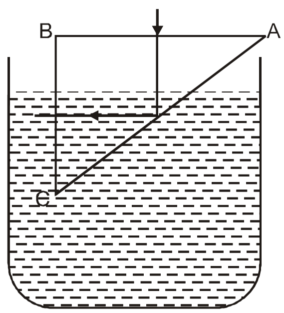
(A) sin C = 8 /9

(B 2/3 sin C = 8/9

(C) sin C = 2/3

(D) sin C = 3/2

where C is the critical angle.




**112.** In the nuclear reaction,

$$_6C^{11} \rightarrow {}_5B^{11} + \beta^+ + X.$$

What does X stand for ?

(A) An electron

(B) A proton

(C) A neutron

(D) A neutrino.

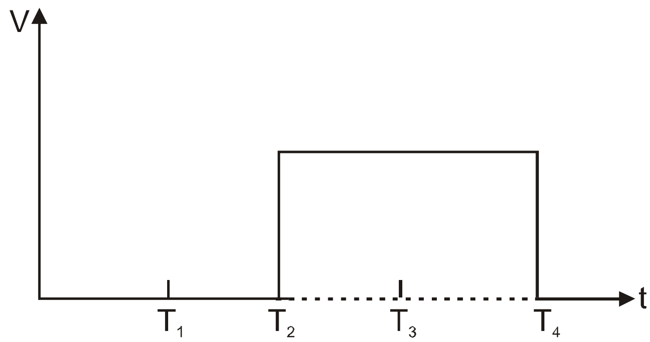
**113.** The fig. shows the waveforms for two inputs A and B and that for the output Y of a logic circuit. The logic circuit is

(A) an AND gate

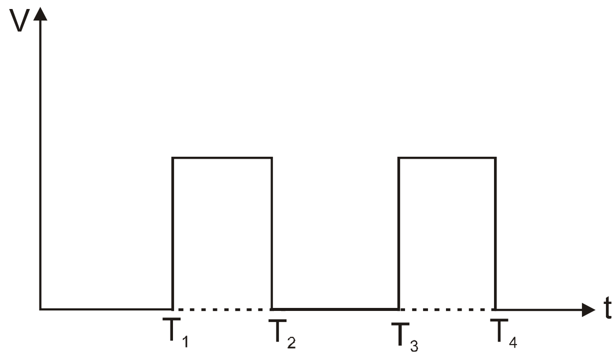
(B) an OR gate

(C) a NAND gate

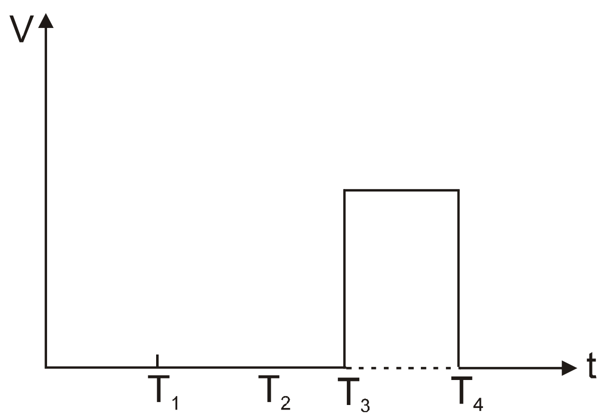
(D) an exclusive OR gate




(A)

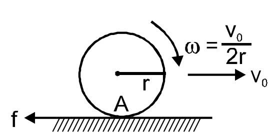



(B)




(Y)

**114.** A force G acts tangentially at the highest point of a sphere of mass m kept on a rough horizontal plane. If the sphere rolls without slipping. Find he acceleration of the centre of the sphere.



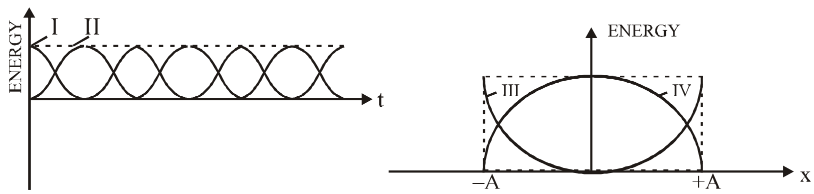

(A) $\frac{2}{5}\frac{F}{m}$

(B) $\frac{7}{10}\frac{F}{m}$

(C) $\frac{2}{10}\frac{F}{m}$

(D) $\frac{10}{7}\frac{F}{m}$

**115.** For a particle executing simple harmonic motion, the displacement x is given by $x = A \sin \omega t$. Identify the graph which represents the variation of potential energy (PE) as a function of time t and displacement x



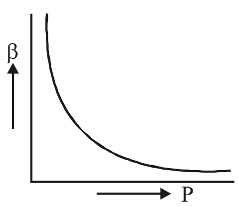

(A) I, III

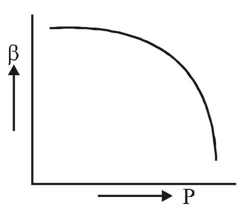
(B) II, III

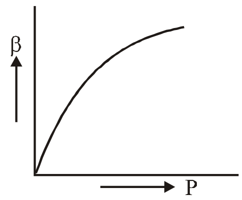
(C) I, IV

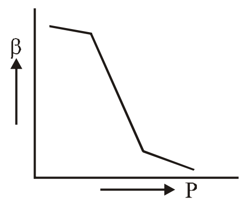
(D) II, IV

**116.** Which of the following graphs correctly represents the variation of $\beta = -\frac{dV/dP}{V}$, with P for an ideal gas at constant temperature ?

(A)



(B)


(C) 


(D) 


**117.** A capacitor is connected to a 12 V battery through a resistance of $10\Omega$ i. It is found that the potential difference across the capacitor rises to 4.0 V in $1\mu s$. Find the capacitance of the capacitor.

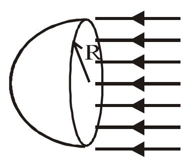
(A) 25 $\mu$F

(B) 2.5 $\mu$F

(C) 0.25 $\mu$F

(D) 0.025 $\mu$F

**118.** Find out flux through the curved surface of the hemisphere of radius R if it is placed in uniform electric field E as shown in figure.




(A) Zero

(B) $E\pi R^2$

(C) $3E\pi R^2$

(D) $4E\pi R^2$

**119.** The K.E. of one mole of an ideal gas is E $\frac{3}{2}$=RT. Then $C_p$ will be

(A) 0·5 R

(B) 0·1 R

(C) 1·5 R

(D) 2·5 R

**120.** The radioactive decay of uranium into thorium is expressed by the equation $_{92}U^{238} \rightarrow {}_{90}Th^{234} + x$ where 'X' is

(A) An electron

(B) A proton

(C) A deutron

(D) An alpha particle

## ANSWER KEY

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Question | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Answer | B | C | D | B | B | C | C | C | A | B | D | D | A | C | A | D | B | B | A | C |
| Question | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| Answer | A | B | B | B | C | C | D | A | C | B | D | B | A | B | D | A | A | B | A | C |
| Question | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| Answer | B | C | A | B | A | A | D | B | A | C | B | C | B | D | B | B | D | C | D | A |
| Question | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| Answer | B | D | B | B | B | C | A | B | D | C | A | B | A | D | C | A | C | D | C | C |
| Question | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
| Answer | A | D | D | D | C | A | A | A | D | B | A | C | D | D | C | C | D | A | D | D |
| Question | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 |
| Answer | A | B | D | A | B | B | C | A | C | D | A | D | A | D | B | A | C | B | D | D |

## HINTS AND SOLUTION

**1.(B)** When we are planning to go on a strenuous hike and are advised to eat plenty of high carbohydrate foods for several days beforehand so as to increase the amount of stored body glycogen. Glycogen is a major reserve food of animals stored in liver and muscles of animals.

**2.(C)** Researchers have claimed that there are several variants of glycogen. Eating candy bars high in sucrose rather than complex carbohydrate helps to built up glycogen stores. Aldolases catalyses the reverse aldole condensation of fructose 1, 6- biphosphate to glyceraldehyde - 3 - phosphate and dihydroxyacetone. Mutase enzyme is responsible to move a functional group such as phosphate to a new location in the substrate molecule.

**3.(D)** Citrate synthetase can act as a plant poison that can act as a substrate is Floroacetate and Floroacetyl Co – A.

**4.(B)** Acetyl CoA is considered to be the by compound for the initiation of the process of synthesis of carbohydrates and amino acids.

**5.(B)** Citric acid is used for flavouring cold drinks because it is a good nutrient absorbed rapidly by mitochondria, It is completely degraded to $Co_2$ and $H_2O$.

**6.(C)** (a) Dehydration (ii) 2 - phosphoglycerate phosphoenolpyruvate + $H_2O$ $\Delta G°' = + .44$ k cal $mol^{-1}$

(b) Isomerization (i) 3 - phosphoglycerate 2- phosphoglycerate $\Delta G°' = + 1.06$ kcal $mol^{-1}$

(c) Reduction (iv) Pyruvate + NADH + $H^+$ lactate + $NAD^+$ $\Delta G°' = -6.0$ kcal $mol^{-1}$

(d) Phosphorylation (iii) Phosphoenolpyruvate + ADP $\rightarrow$ pyruvate + ATP $\Delta G°' = -7.5$ Kcal $mol^{-1}$

**7.(C)** Whenever Phase II or Pay off phase of glycolysis beings it follows the process of oxidoreduction and phosphorylation.

**8.(C)** The hydrolyzation of disaccharide into monosaccharide takes place. For e.g.. Maltose to 2 D-glucose and D-fructose, Sucrose to D-glucose and D- fructose and Lactose to D-glucose and D - galactose.

**9 .(A)** When malonate was added to muscle suspension it would block TCA cycle by blocking the activity of succinate dehydrogenase, Succinate dehydrogenase is an integral part of inner mitochondrial membrane and if tightly bound to it.

**10.(B)** The oxidative decarboxylation of pyruvate to form acetyl Co-A is the link between glycolysis and citric acid cycle. The reaction occurs in the mitochondrial matrix. Here pyruvate derived from fructose by glycolysis is dehydrogenated to yield acetyl CoA and $Co_2$ by the enzyme pyruvate dehydrogenase complex (abbreviated as PDC) which is located in the matrix space of mitochondria of eukaryotes and in cytoplasm of the prokaryotes.

**11.(D)** The TCA cycle starts with the joining of G-carbon unit, oxaloacetate (OAA) and a 2 - carbon unit, the acetyl group of acetyl Co-A .Oxaloacetate reacts with acetyl CoA plus water to yield $C_6$ compound, citrate plus coenzyme A in the presence of regulatory enzyme citrate synthetase.

**12.(D)** Phosphorylation of ADP (or some other nucleoside 5'-diphosphate) coupled to the dehydrogenation of an organic substrate, results in ATP production, independent of electron transport system used in oxidative phosphorylation is known as substrate-level phosphorylation.

**13.(A)** Biosynthesis of protoporphyrin in the body occurs by glycine and active succinate in the presence of pyridoxal phosphate.

**14.(C)** On oxidation, fats and oils furnish about 9 kcal/gram while the carbohydrates give only 4 kcal/gram. Oleic acid is a common unsaturated fatty acid found in natural fats.

**15.(A)** The reaction catalysed by acetyl Co-A carboxylase is the rate limiting step in the biosynthesis of fatty acids and this enzyme is an important site of regulation.

**16.(D)** DNA library is the collection of cloned DNA molecules, representing either an entire genome (Genomic library) or DNA copies of the m-RNA produced by a cell (c-DNA library). DNA polymerase, reverse transcriptase and DNA ligase enzymes are used in this process.

**17.(B)** PCR was discovered by 'Kary Mullis' in 1985 which required Taq DNA polymerase, a primer and essential poly nucleoside triphosphates. While restriction endonuclease is not required.

**18.(B)** After release of nucleic acids from the cells, RNA is removed by treatment of RNAse and protein is removed by shaking the solution with water saturated phenol or with phenol/chloro form mixture. After extraction of cell lysates with phenol, aqueous solution (aqueous phase) is recovered.

**19.(A)** In pentose phosphate pathway ribulose-5 phosphate is converted into ribose-5 phosphate and xylulose-5-phosphate by the enzymes isomerase and epimerase respectively.

**20.(C)** The chloroplasts are composed of the carbohydrates, lipids, proteins, chlorophyll, carotenoids, DNA, RNA and certain enzymes and coenzymes. The function of proteins is to help in the formation of plastid wall.

**21.(A)** Nucleus is surrounded by intermediate filaments on its both sides. The space between nuclear envelope and nucleolus is filled by matrix known as nucleoplasm. The nuclear components such as chromatin threads and nucleolus remain suspended in the nucleoplasm.

**22.(B)** The inner mitochondrial membrane is rich in one type of phospholipid called cardiolipin which makes this membrane impermeable to variety of ions and small molecules (eg. $Na^+$, $K^+$, $Cl^-$, $NAD^+$, AMP, GTP, CoA and so on).

**23.(B)** In chemi-osmotic hypothesis protons ($H^+$) are ejected toward the cytoplasmic side (C – side) while $OH^-$ remain on matrix side. This vectorial movement of protons creates a difference in $p^H$ (i.e lower $p^H$ on C-side and higher on M-side), which results in an electrical potential.

**24.(B)** Permeases also known as carrier proteins help in the transport of metabolite in mitochondria from cytosol to matrix.

**25.(C)** During chemi-osmotic hypothesis vectorial movement of protons creates a difference in $p^H$ (i.e. lower $p^H$ on C side and higher on M-side), which results in an electrical potential.

**26.(C)** In chemi-osmotic hypothesis one ATP molecule is produced for every 2 protons passing through $F_0 – F_1$ complex. Hydrogen ion uptake reactions takes place towards inner or matrix side (m-side) of inner mitochondrial membrane and Hydrogen ion liberation reactions takes place towards C-side of membrane.

**27.(D)** Some carrier proteins function as coupled transporters in which the transfer of one solute depends on simultaneous transfer of second solute either in same direction (symport) or in opposite direction (antiport) Both symport and antiport collectively form the cotransport.

**28.(A)** The 0.9% solution of NaCl is isotonic to RBC's. So if RBC is placed in 0.5% solution of NaCl then the erythrocytes will small up due to endosmosis and since animals cell lacks cell wall it will burst

**29.(C)** Golgi body helps in the formation of vacuoles. Endoplasmic reticulum helps in the formation of transition vesicle, which fuses with Golgi body Plasma membrane helps in the flow of information into the cells.

**30.(B)** Nerves that cannot only receptor organ to the CNA are purely sensory or afferent nerves because these contain only sensory nerve fibres. Similarly, nerves that connect only effectors of the CNA are purely motor or efferent nerves.

**31.(D)** The synapse has polarity it allows an impulse to travel in one direction only from axon of one neuron to dendrite of other on reaching the terminal buttons of an axon the impulse induces them to produce a small amount of a neurotransmitter, acetyl choline therefore all synapses are called cholinergic.

**32.(B)** Certain poisons like cyanide inhibit $Na^+$ efflux and $K^+$ influx into cells. This inhibitory effect is reversed by giving infections of ATP, demonstrating the significance of ATP in the operation of $Na^+$,-$K^+$ pump.

**33.(A)** An action potential in a nerve fibre is produced when positive and negative changes on outside and inside of axon membrane are reversed because more Na+ enter into axon than $K^+$ leaving it.

**34.(B)** The entire impulse circuit of a reflex response receptors $\rightarrow$ CNS $\rightarrow$ effectors $\rightarrow$ is called a reflex arc. It is the basic function unit of nervous system.

**35.(D)** Cerebellum of brain is concerned with co-ordination of muscular movements.

**36.(A)** Deficiency of growth hormone in adults will lead to Dwarfism. Hyposecretion (Undersecretion) of growth hormone during adolescence (between 13 to 22 years of age) restricts body height, so that the person remains short-saturated Undersecretion after growth period (about the age of 22) causes pituitary myxoedema.

**37.(A)** Growth Hormone (GH) or Somatotropin is the most important stimulant of proper normal growth of body. It promoted biosynthesis of DNA, RNA and proteins in all body cells. Thus if acts as an anabolic growth factor.

**38.(B)** The secretion of ACTH is stimulated by low blood level of glucose, shock conditions and presence of a compound called interleukin - 1 (IC - 1) secreted by macrophages.

**39.(A)** If pituitary is surgically removed blood level of sodium falls and that of potassium rises because of atrophy of adrenal cortex.

**40.(C)** Chylomicrons that enters the lacteals is composed of protein coat around triglycerides.

**41.(B)** Individual cells can be identified by using flow cytometry. For transfer of whole chromosomes, the chromosomes are first isolated from metaphase cells by hypotonic lysis and may be fractionated using density centrifugation or flow cytometry or particle.

**42.(C)** Nuclear splicing involves formation of lariat structure. This occurs in two stages – Firstly, a cut is made at left end of intron, releasing separate RNA molecule with left axon and right

RNA molecule with intron and right axons. The 5'terminus at left end of intron-axon molecule gets linked. This linkage generates a lariat.

**43.(A)** A nucleotide is derived from a nucleoside by addition of a molecule of phosphonic acid. A typical animal cell contains $3 \times 10^9$ nucleotides.

**44. (B)** Lymphokine is a cytokinin released by lymphocytes is not a member of immunoglobulin supergene family.

**45.(A)** Like plants, algae have cell walls contain either polysaccharides such as cellulose (a glucan) or a variety of glycoproteins or both. The inclusion of additional polysaccharide in algal cell walls is used as a feature for algal taxonomy. Mannas form microfibrils in the cell walls of a number of marine green algae including those from the genera Codium, Acetabularia as well as in the walls of some red algae like Porphyra.

**46.(A)** Penicillin was first antibiotic produced industrially by Flaming with mold P. notatum. Now commercially it is also produced using P.chrysogenum.

**47.(D)** Lymphoma cancer affects lymph nodes and spleen.

**48.(B)** For A, $(n+l) = 5$ Thus, larger is value of $(n+l)$.

For B, $(n+l) = 3$

Thus A has more energy than B.

**49.(A)** $Hg^{+2} + H_2S \to 2HgS + 2H^+$

**50.(C)** $K^+O_2^-$; $O_2^-$ has one unpaired electron.

**51.(B)** When an octahedral complex contains all the three bidentate ligands, it show optical isomerism.

**52.(C)** $Fe^{+2} + H_2S \to \underset{\text{Black}}{FeS\downarrow} + 2H^+$

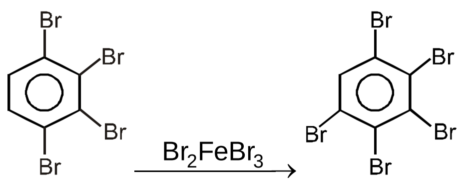
**53.(B)** Hydroxides of Alkaline earth metals are strongly basic.

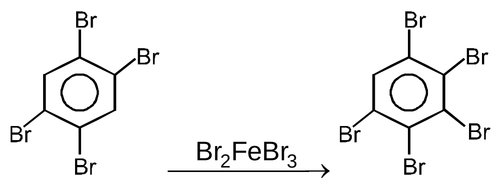
**54.(D)** $\underbrace{CH_2}_{\text{doublet}} = \underbrace{CH}_{\text{triplet}} - Cl$

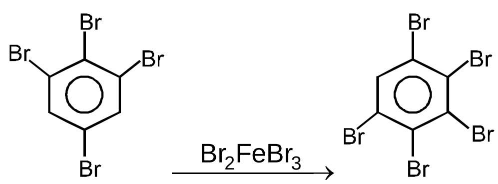
**55.(B)** $\overset{+}{C}H_2-\overset{-}{C}H-\overset{+}{N}\langle^{O}_{O^-}$ –ve charge at adjacent atoms repel each other.

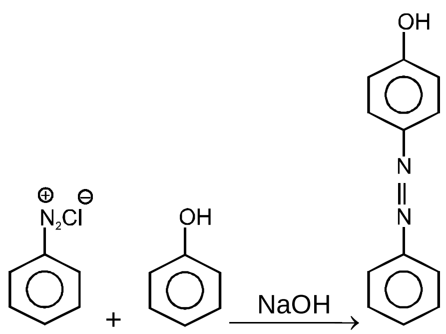
**56.(B)** In $SN^2$ reaction there is complete inversion of configuration. So this is called walden inversion.

**57.(D)** Except (D), all are symmetrical alkenes, hence Markownikoff's addition occurs only in (D).

**58.(C)** (1) 

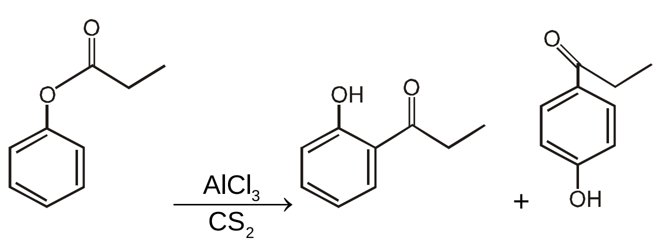

(2) 


(3) 


**59.(D)** 


Product shows geometrical isomerism

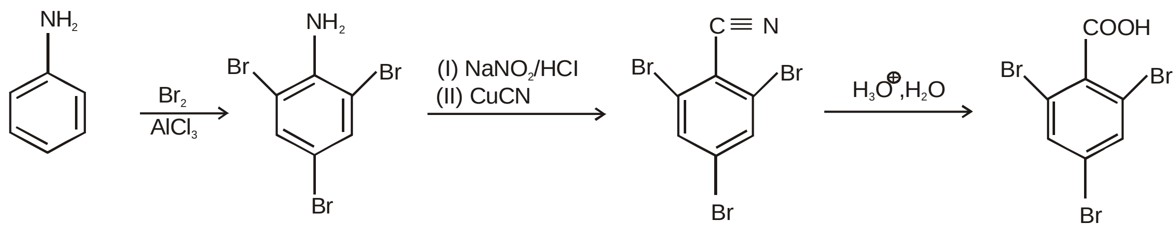
Product shows colour due to extended conjugation

**60.(A)** 

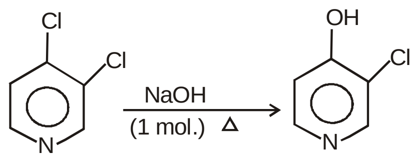
is Fries rearrangement.

**61.(B)** $PhCN + LiAlH_4 \rightarrow Ph - CH_2NH_2$

**62.(D)** Tryptophan is Aromatic.



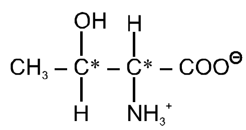

**63. (B)**




**64.(B)** The unit of rate constant suggests it to be I order.

**65.(B)** Adding an electron to a full subshell ($2s^2$ configuration of Be) is not favorable energetically.

**66.(C)** Threonine —




**2 Chiral Centre**

**67.(A)** Reactions:-

(i) $Fe(s) \longrightarrow Fe^{2+} + 2e^-$, $E^o = +0.44$ V and $\Delta G_1^\circ = nE^oF = -2 \times 0.44 \times F$

(ii) $2H^+ + 2e^- + \frac{1}{2}O_2 \longrightarrow H_2O(l)$, $E^o = +1.23$ V and $\Delta G_2^\circ = -2 \times (+1.23) \times F$

Net reaction

$$Fe(s) + 2H^+ + \frac{1}{2}O_2 \rightarrow Fe^{2+} + H_2O(l)$$

$\Delta G_3^\circ = \Delta G_1^\circ + G_2^\circ = -2 \times (+0.44) \times F + (-2 \times 1.23 \times F) = -0.88\ F - 2.46\ F = -3.34\ F = -3.34 \times 96500\ J\ mol^{-1}$

$= -322.31\ kJ \approx -322\ kJ\ mol^{-1}$

**68.(B)** $E_{2He^+} = \frac{E_{1H} \times Z^2}{2^2} = \frac{-3.41 \times 4^2}{2^2}$ $E_{1H} = -13{\cdot}62$ eV

**69.(D)** CO reacts with red colouring haemoglobin molecules in blood to form a complex of cherry red colour.

**70.(C)** Rate of diffusion $\propto \sqrt{\left[\frac{1}{M}\right]}$

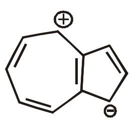
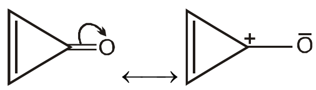
**71.(A)** $H_2C_2O_4 \rightleftharpoons 2H^+ + C_2O_4^{2-}$ $\quad\quad \Delta H = Q$

$2H^+ + 2OH^- \rightleftharpoons 2H_2O$ $\quad\quad \Delta H = -13.7 \times 2$

$\therefore \quad Q - 27.4 = -25.4$

$\therefore \quad Q = 2$ kcal

**72.(B)** $HO_3S - CH = CH_2$, $F_3C - CH = CH_2$ both are strong electron withdrawing group destabilize carbocation at the carbon linked to that.

**73.(A)**  ; 

**74.(D)** Electrons closer to nucleus will experience higher ENC. $2p^3$ is closer to $4s^1$ as principal quantum number is concerned first.

**75.(C)** Additional electron in a new orbital prevents shielding for degenerate orbitals, thus effective nuclear charge increases, stability increases.

**76.(A)** An increase in pressure will favour the reactions having decrease in volume, i.e., backward reaction.

**77.(C)** $(aI + bA)^2 = A$

$$\Rightarrow \left(\begin{bmatrix} a & 0 \\ 0 & a \end{bmatrix} + \begin{bmatrix} 0 & b \\ -b & 0 \end{bmatrix}\right)^2 = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} a & b \\ -b & a \end{bmatrix}^2 = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} a & b \\ -b & a \end{bmatrix}\begin{bmatrix} a & b \\ -b & a \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} a^2 - b^2 & 2ab \\ -2ab & -b^2 + a^2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$$

$\Rightarrow a^2 - b^2 = 0 \quad\quad \Rightarrow a = b$

$2ab = 1 \qquad 2a^2 = 1$

$$a = b = \pm\frac{1}{\sqrt{2}}$$

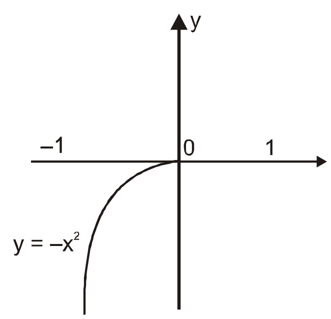
**78.(D)** Putting x = 0 and y = 0 we find that the given curve meets y and x-axes in (0, 1) and (1, 0) respectively.

$\therefore$ Required area

$$= \int_{x=0}^{1} y \; dx = \int_0^1 \left(1-\sqrt{x}\right)^2 \; dx, \qquad \text{From (i)}$$

$$= \int_0^1 \left(1-2x^{1/2}+x\right) \; dx = \left(x-\frac{4}{3}x^{3/2}+\frac{1}{2}x^2\right)_0^1 = 1-(4/3)+\frac{1}{2} = 1/6 \; .$$

**79.(C)** $f(x) = x^2[x]$




$$\Rightarrow f(x) = \begin{cases} -x^2 & -1 < x < 0 \\ 0 & 0 \le x < 1 \end{cases}$$

$\Rightarrow$ f(x) increases in (–1, 0).

**80.(C)** $\begin{vmatrix} 10! & 11! & 12! \\ 11! & 12! & 13! \\ 12! & 13! & 14! \end{vmatrix} = 10!\,11!\,12! \begin{vmatrix} 1 & 11 & 11\times 12 \\ 1 & 12 & 12\times 13 \\ 1 & 13 & 13\times 14 \end{vmatrix}$

Applying $R_2 \to R_2 - R_1$ and $R_3 \to R_3 - R_1$

$$= 10!\,11!\,12! \begin{vmatrix} 1 & 11 & 11\times 12 \\ 0 & 1 & 24 \\ 0 & 2 & 50 \end{vmatrix} = 2(10!\,11!\,12!).$$

**81.(A)** $\dfrac{dy}{dx} = 2xy$

then $\dfrac{dy}{y} = 2x\,dx$

$\log y = x^2 + c$

$y = ae^{x^2} \qquad \{e^c = a\}$

**82.(D)** $\frac{d^2y}{dx^2} + \sqrt{1+\left(\frac{dy}{dx}\right)^3} = 0 \Rightarrow \frac{d^2y}{dx^2} = -\sqrt{1+\left(\frac{dy}{dx}\right)^3} \Rightarrow \left(\frac{d^2y}{dx^2}\right)^2 = 1+\left(\frac{dy}{dx}\right)^3$ order = 2, degree = 2.

**83.(D)** $\Delta = (1+x)(1+y) - 1 \ -1\times(1+y) + 1 \ + (1-(1+x))$

$\Delta = x + y + xy - y + x$

$\Delta = xy$

**84.(D)** $x = a(\theta - \sin\theta)$,

$y = a(1 - \cos\theta)$,

$\therefore \quad \frac{dx}{d\theta} = a(1-\cos\theta),$

$\frac{dy}{d\theta} = a\sin\theta$

$\frac{dy}{dx} = \frac{dy/d\theta}{dx/d\theta}$

$= \frac{a\sin\theta}{a(1-\cos\theta)}$

$= \frac{2\sin\theta/2\cos\theta/2}{2\sin^2\theta/2}$

$= \cot\frac{\theta}{2}$

$\therefore \quad \frac{d^2y}{dx^2} = \frac{d}{dx}\left(\cot\frac{\theta}{2}\right)$

$= -\mathrm{cosec}^2\frac{\theta}{2}\cdot\frac{1}{2}\frac{d\theta}{dx}$

$= \frac{-1}{2}\mathrm{cosec}^2\frac{\theta}{2}\cdot a\frac{1}{(1-\cos\theta)}$

$= \frac{-1}{2\sin^2\frac{\theta}{2}}\cdot\frac{1}{2a\sin^2\frac{\theta}{2}}$

$$= -\frac{1}{4a}\operatorname{cosec}^4\frac{\theta}{2}$$

**85.(C)** Given that $u = x^2 + y^2 + 6x + 12$

$ux = 2x + 6,$

$uy = 2y$

$A = u_{xx} = 2,$

$B = u_{xy} = 0,$

$C = u_{yy} = 2$

For maximum and minimum $u_x = 0$, $u_y = 0$

$u_x = 0$

$\Rightarrow \quad 2x + 6 = 0$

$\Rightarrow \quad x = -3$

and $\quad u_y = 0$

$\Rightarrow \quad 2y = 0$

$\Rightarrow \quad y = 0$

At $\quad x = -3, y = 0,$

$A = 2, B = 0, C = 2.$

$\therefore$ $AC - B^2 = 2.(2) - (0)^2 = 4 > 0$ and $A = 2 > 0$

Hence, u is minima at $x = -3$ and $y = 0$

The correct answer is (C).

**86.(A)** Putting $q\tan^{-1}x = t$

$$\Rightarrow \frac{q}{1+x^2}dx = dt \Rightarrow \frac{1}{1+x^2}dx = \frac{dt}{q}$$

$$\Rightarrow \int \frac{dx}{\left(1+x^2\sqrt{p^2+q^2\left(\tan^{-1}x\right)^2}\right)} = \frac{1}{q}\int\frac{dt}{\sqrt{p^2+t^2}}$$

$$= \frac{1}{q}\log\left[q\tan^{-1}x + \sqrt{p^2+q^2\left(\tan^{-1}x\right)^2}\right] + c.$$

**87.(A)** Rearrangement the terms, $\frac{dy}{dt}-\frac{t}{1+t}y=\frac{1}{1+t}$

I.F. $e^{\int \frac{1}{1+t}dt}=e^{-t}.(1+t)$

$\therefore$ Solution is $ye^{-t},(1+t)=\int(1+t).e^{-t}\frac{1}{(1+t)}+c$

$ye^{-t}(1+t)=-e^{-t}+c$

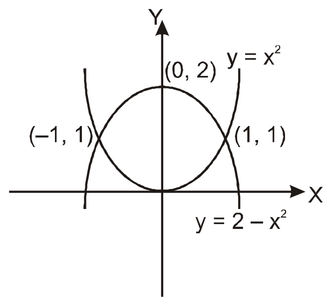
Also, $y(0)=-1\Rightarrow c=0\Rightarrow y(1)=\frac{-1}{2}.$

**88.(A)** $y = x^2$ ...(i)

$y = 2 - x^2$ ...(ii)

$\therefore$ By equation (i) and (ii), we get, $x = \pm 1$

$\therefore$ $y = \pm 1$




$\therefore$ Required area = $\left[\int_0^1(2-x^2)dx-\int_0^1 x^2\,dx\right]$

$=2\left[2x-\frac{2x^3}{3}\right]_0^1 = 4\left[x-\frac{x^3}{3}\right]_0^1 = 4\left(\frac{2}{3}\right)=\frac{8}{3}$ .

**89.(D)** The given expression can be written as $4^{-1/2}\left(1-\frac{3}{4}x\right)^{-1/2}$ and it is valid only when

$\left|\frac{3}{4}x\right|<1\Rightarrow -\frac{4}{3}<x<\frac{4}{3}.$

**90.(B)** $\frac{1}{2.3}+\frac{1}{4.5}+\frac{1}{6.7}+....$

$\left(\frac{1}{2}-\frac{1}{3}\right)+\left(\frac{1}{4}-\frac{1}{5}\right)+\left(\frac{1}{6}-\frac{1}{7}\right)+.....\infty=1-\log_e 2$

$$= \log_e e - \log_e 2 = \log\left(\frac{e}{2}\right).$$

**91.(A)** Total number of ways to form the numbers of three digit with 1, 2, 3 and 4 are ${}^4P_3 = 4! = 24$

If the numbers are divisible by three then their sum of digits must be 3, 6 or 9.

But sum 3 is impossible. Then for sum 6, digit are 1,2, 3 Number of ways = 3!

Similarly for sum 9, digits are 2, 3, 4. Number of ways = 3!

Thus number of favourable ways = 3! + 3!

Hence required probability $= \frac{3!+3!}{4!} = \frac{12}{24} = \frac{1}{2}.$

**92.(C)** $\tan\alpha + 2\tan 2\alpha + 4\tan 4\alpha + 8\cot 8a$

$$= \tan\alpha + 2\tan 2\alpha + 4\left[\frac{\sin 4\alpha}{\cos 4\alpha} + 2\frac{\cos 8\alpha}{\sin 8\alpha}\right]$$

$$= \tan\alpha + 2\tan 2\alpha + 4\left[\frac{\cos 4\alpha\cos 8\alpha + \sin 4\alpha\sin\alpha + \cos 4\alpha\cos 8\alpha}{\sin 8\alpha\cos 4\alpha}\right]$$

$$= \tan\alpha + 2\tan 2\alpha + 4\left[\frac{\cos 4\alpha\cos 4\alpha\cos 8\alpha}{\sin 8\alpha\cos 4\alpha}\right]$$

$$= \tan\alpha + 2\tan 2\alpha + 4\left[\frac{\cos 4\alpha(1+\cos 8\alpha)}{\cos 4\alpha\sin 8\alpha}\right]$$

$$= \tan\alpha + 2\tan 2\alpha + 4\left[\frac{2\cos^2 4\alpha}{2\sin 4\alpha\ \cos 4\alpha}\right]$$

$= \tan\alpha + 2\tan 2\alpha + 4\cot 4\alpha$

$= \tan\alpha + 2(\tan 2\alpha + 2\cot 4\alpha)$

$$= \tan\alpha + 2\left[\frac{\sin 2\alpha}{\cos 2\alpha} + 2\frac{\cos 4\alpha}{\sin 4\alpha}\right]$$

$$= \tan\alpha + 2\left[\frac{\cos 2\alpha(1+\cos 4\alpha)}{\sin 4\alpha\cos 2\alpha}\right]$$

$$= \tan\alpha + 2\cot 2\alpha\frac{\sin\alpha}{\cos\alpha} + \frac{2\cos 2\alpha}{\sin 2\alpha}$$

$$= \frac{\cos\alpha + \cos\alpha\cos 2\alpha}{\sin 2\alpha\cos\alpha}$$

$$= \frac{1+\cos\alpha}{\sin 2\alpha} = \frac{2\cos^2\alpha}{2\sin\alpha\cos\alpha} = \cot\alpha.$$

**Aliter :** Put a = 30° then option (b) and (c) satisfy.

Now put a = 60° option (c). So option is (c).

**93.(D)** Here g(x) = 1 + n – n = 1, x = n $\in$ Z

1 + n + k – n = 1 + k, x = n + k (where n $\in$ Z, 0 < k < 1)

$$\text{Now } f(g(x)) = \begin{cases} -1, & g(x) < 0 \\ 0, & g(x) = 0 \\ 1, & g(x) > 0 \end{cases}$$

**94.(D)** 1 – i is a root of the equation so x = 1 – i

$\Rightarrow$ (x – 1) = –i $\Rightarrow$ $(x-1)^2 = (-i)^2$ $\Rightarrow$ $x^2 - 2x + 2 = 0$

By comparison, a = 2, b = 2.

**95.(C)** Let $A \equiv (x+1, 2), B \equiv (1, x+2), C \equiv \left(\frac{1}{x+1}, \frac{2}{x+1}\right)$

then A, B, C are collinear if area of $\Delta ABC = 0$

$$\begin{vmatrix} x+1 & 2 & 1 \\ 1 & x+2 & 1 \\ \frac{1}{x+1} & \frac{2}{x+1} & 1 \end{vmatrix} = 0 \Rightarrow \begin{vmatrix} x+1 & -x & 0 \\ 1 & x+2 & 1 \\ \frac{1}{x+1} & \frac{2}{x+1} & 1 \end{vmatrix} = 0 \qquad (R_1 \to R_1 - R_2)$$

$$\begin{vmatrix} x & 0 & 0 \\ 1 & x+3 & 1 \\ \frac{1}{x+1} & \frac{3}{x+1} & 1 \end{vmatrix} = 0 \qquad (C_2 \to C_2 + C_1)$$

$$\Rightarrow \quad x\left(x+3-\frac{3}{x+1}\right) = 0 \Rightarrow x\left(x^2+3+4x-3\right) = 0$$

$\Rightarrow$ $x^2(x + 4) = 0$ $\Rightarrow$ x = 0, – 4.

**96.(C)** Required area = $\int_1^4 y\,dx = c\int_1^4 \frac{1}{x}dx = 2c\log 2$ sq. unit

**97.(D)** Given that cot–1α + cot–1β = $\cot^{-1} x$

$$\Rightarrow \cot^{-1}\left(\frac{\alpha\beta-1}{\alpha+\beta}\right)=\cot^{-1}x \Rightarrow x=\frac{\alpha\beta-1}{\alpha+\beta}.$$

**98.(A)** After drawing the graph, we get the minimum value of x at points (–5, 0), (0, 1) and (5/4, 5/4) and Min z = 2(0) – 10(1) = –10

**99.(D)** Here, $P(x)=-\frac{1}{2}x^2+32x-480$

Now $\frac{d}{dx}P(x)=0$

$\Rightarrow$ $-x + 32 = 0$

$\Rightarrow$ $x = 32$

Now, $\frac{d^2}{dx^2}P(x)=-1<0$ when x = 32

Hence, at x = 32, P(x) is maximum.

**100.(D)** $\cot^{-1}\left[\frac{\sqrt{1-\sin x}+\sqrt{1+\sin x}}{\sqrt{1-\sin x}-\sqrt{1+\sin x}}\right]$

$$=\cot^{-1}\left[\frac{\sqrt{1-\sin x}+\sqrt{1+\sin x}}{\sqrt{1-\sin x}-\sqrt{1+\sin x}}.\frac{(\sqrt{1-\sin x}+\sqrt{1+\sin x})}{(\sqrt{1-\sin x}+\sqrt{1+\sin x})}\right]$$

$$=\cot^{-1}\left[\frac{(1-\sin x)+(1+\sin x)+2\sqrt{1-\sin^2 x}}{(1-\sin x)-(1+\sin x)}\right]$$

$$=\cot^{-1}\left[\frac{2(1+\cos x)}{-2\sin x}\right]=\cot^{-1}\left[-\frac{2\cos^2(x/2)}{2\sin(x/2)\cos(x/2)}\right]$$

$$=\text{Cot}^{-1}\left(-\cot\frac{x}{2}\right)=\cot^{-1}\left[\cot\left(\pi-\frac{x}{2}\right)\right]=\pi-\frac{\pi}{2}$$

**101.(A)** Intensity = Energy per second per unit area

$$=\frac{ML^2T^{-2}}{T.L^2}=\left[M^1L^0T^{-3}\right]$$

**102.(B)** $h = (u \sin\theta)\, t - \frac{1}{2} gt^2$ **.......(i)**

$d = u \cos\theta \times t$

or $t = d/(u\cos\theta)$

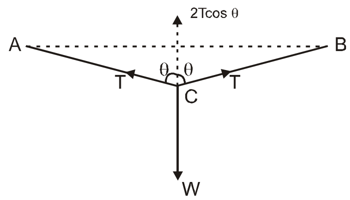
From (i), $h = u\sin\theta \times \dfrac{d}{u\cos\theta} - \dfrac{1}{2}g\dfrac{d^2}{u^2\cos^2\theta}$

or $\quad u = \dfrac{d}{\cos\theta}\sqrt{\dfrac{g}{2(d\tan\theta - h)}}.$

**103.(D)** As is clear from Fig.

$$2T\cos\theta = W,$$

$$T = \frac{W}{2\cos\theta}$$

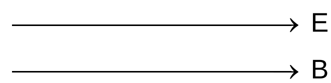



As $\quad \theta \approx 90^o$

$\therefore \quad T >> W$

**104.(A)** Force on a charged particle due to magnetic field = 0

and due to electric field $= q\vec{E}$. Further, $\vec{v} = \vec{u} + \vec{a}t$, as




$\vec{u} = 0$. So velocity is always along $\vec{E}$, i.e., path will be a straight line.

**105.(B)** The resistance of insulator is infinite and resistance of semiconductor becomes infinite at 0 K.

The resistance of metal at 0 K is zero (a phenomenon called superconductivity). So, current will be infinite in this case.

**106.(B)** In the given system,

$$a = \frac{(m_1 - m_2)g}{m_1 + m_2} = \frac{g}{8}$$

$$\therefore \quad \frac{m_1 - m_2}{m_1 + m_2} = \frac{1}{8}$$

$$8m_1 - 8m_2 = m_1 + m_2$$

$7m_1 = 9m_2$

$\frac{m_1}{m_2} = \frac{9}{7}$

**107.(C)** As $p_2 = \frac{3}{2}p_1$ $\quad\therefore\quad \upsilon_2 = \frac{3}{2}\upsilon_1$

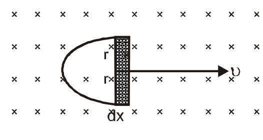
As $E \propto \upsilon^2$ $\quad\therefore\quad E_2 = \frac{9}{4}E_1$

Increase in K.E. = $\frac{(E_2 - E_1)100}{E_1} = 125\%$

**108.(A)** Both the rings rotate due to magnetic field induction of the other, till both while rotating come along the common plane .

**109.(C)** Here , r = 0 .10m, B = 20 mT = 20 × $10^{-3}$ T

$\upsilon$ = 10 m/s; e = ?




In a small time dt, let the semi-circular wire move through a small distance dx (in or out of the field)

As $\quad e = \frac{d\phi}{dt} = \frac{d}{dt}(B \times A) = B\frac{dA}{dt}$

$\therefore \quad e = \frac{B\,(2r\;dx)}{dt} = 2Br\,\upsilon$

$= 2 \times 20 \times 10^{-3} \times 0.1 \times 10 = 0.04$ V

**Note.** If the entire loop remains inside the field , despite moving e = 0.

**110.(D)** Intensity reflected along AB, $I_1 = I/4$

Intensity transmitted along AC = 3 $I/4$

Intensity reflected along CA' = $\frac{1}{4} \times \frac{3I}{4} = 3I/16$

Intensity reflected at A´ = $\frac{1}{4} \times \frac{3I}{16} = \frac{3I}{64}$

$\therefore$ Intensity transmitted along

A´B´ $= I_2 = \frac{3I}{16} - \frac{3I}{64} = \frac{9I}{64}$

$\frac{I_1}{I_2} = \frac{I}{4} \times \frac{64}{9I} = \frac{16}{9}$

$\therefore \quad \frac{I_1}{I_2} = \frac{a^2}{b^2} \Rightarrow \frac{a^2}{b^2} = \frac{16}{9}$

$\therefore \quad \frac{a}{b} = \frac{4}{3}$

$$\frac{I_{max}}{I_{min}} = \frac{(a+b)^2}{(a-b)^2} = \frac{(4+3)^2}{(4-3)^2} = \frac{49}{1}.$$

**111.(A)** $\frac{\mu_2}{\mu_1} = \frac{1}{\sin c}, \frac{1.5}{4/3} = \frac{1}{\sin c}$

or $\quad \sin c = \frac{8}{9}$

**112.(D)** Let ${}_zX^A$ be the nucleus or particle formed. From conservation of mass number,

$11 = 11 + 0 + A \qquad \therefore \qquad A = 0$

From conservation of charge number,

$6 = 5 + 1 + Z \qquad \therefore \qquad Z = 0$

$\therefore$ X can be neutrino only.

**113.(A)** In time $t_1$ and $t_2$, A = 0, B = 1, y = 0

In time $t_2$ to $t_3$ A = 1, B = 0, y = 0

In time $t_3$ to $t_4$ A = 1, B = 1, y = 1

It means A.B = y. Hence the circuit is AND gate.

**114.(D)** The situation is shown in figure As the force F rotates the sphere the point of contact has a tendency to slip towards left so that the static friction on the sphere will act towards right. Let r be the radius of the sphere and a be the linear acceleration of the centre of the sphere. The angular acceleration about the centre of the sphere is $\alpha = a/r$, as there is no slipping.

For the linear motion of the centre,

$F + f = ma$ ......(i)

and for the rotational motion about the centre.

$Fr - f\,r = I\,\alpha = \left(\frac{2}{5}mr^2\right)\left(\frac{a}{r}\right)$ or , $F - f = \frac{2}{5}ma$ , ....(iii)

From (i) and (ii)

$2F = \frac{7}{5}ma$ or, $a = \frac{10F}{7m}$

**115.(B)** $x = r\sin\omega t$ ; $\frac{dx}{dt} = r\,\omega\cos\omega t$

and $\frac{d^2x}{dt^2} = -\omega^2\ r\sin\ \omega t = -\omega^2 x$

Force = $-\,m\left(\omega^2 x\right)$

P.E. $= \int_0^x m\,\omega^2\ x\,dx$ ; Then

P.E. $= \frac{1}{2}m\,\omega^2 x^2$

$= \frac{1}{2}m\,\omega^2 r^2\ \sin^2\ \omega t.$

On plotting a graph between P.E. and time (t), we shall get a curve II and graph between P.E. and x we shall get curve III.

**116.(A)** Here , $\beta = \frac{-dV/dP}{V} = -\frac{dV}{V(dP)} = -\frac{dV/V}{dP}$

$\beta = \frac{1}{K}$, where K is bulk modulus of elasticity

But $K \propto P\ \therefore\ \beta \propto \frac{1}{P}$

Hence $\beta$ versus P graph will be a rectangular hyperbola. Choice (a) is correct.

**117.(C)** The charge on the capacitor during charging is given by $Q = Q_0(1 - e^{-t/RC})$ .

Hence, the potential difference across the capacitor is $V = Q/C = Q_0/C\ (1 - e^{-t/RC})$.

Here, at t =1 $\mu$s, the potential difference is 4V whereas the steady potential difference is $Q_0/C$ = 12V. So,

$$4V = 12V\,(1 - e^{-t/RC})$$

or, $$1 - e^{-t/RC} = \frac{1}{3}$$

or, $$e^{-t/RC} = \frac{2}{3}$$

or, $$\frac{t}{RC} = \ell n\left(\frac{3}{2}\right) = 0.405$$

or, $$RC = \frac{t}{0.405} = \frac{1\mu s}{0.405} = 2.469\ \mu s$$

or, $$C = \frac{2.469\mu s}{10\Omega} = 0.2469\,\mu F \approx 0.25\,\mu F.$$

**118.(B)** The electric lines which are passing through area $\pi R^2$ are also the same which will pass through hemisphere so, $\phi = E\pi R^2$

**119.(D)** E = $C_v$ 1 . T =RT

$\therefore$ $$C_v = \frac{3}{2}R$$

$$C_p = \frac{3}{2}C_v + R = \frac{3}{2}R + R = \frac{5}{2}R = 2{\cdot}5\ R$$

**120.(D)** Mass number of X = 238—234 = 4

Charge number of X = 92—90 = 2

$\therefore$ X = ${}_2He^4$ i.e. $\alpha$ particle.