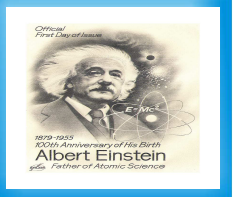

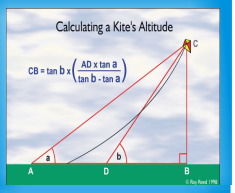

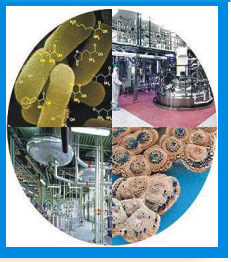

IIT-JAM - BIOTECHNOLOGY

MOCK TEST PAPER

- *Attempt ALL the objective questions (Questions 1-100). Each of these questions carries three marks. 1 negative mark for each wrong answer.*
- *Pattern of questions : MCQs*
- *Total marks : 300*
- *Duration of test : 3 Hours*

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1. 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

2. During a reduction reaction which occurs in metabolism
   (A) Electrons are lost from a substrate molecule
   (B) Large amounts of energy are usually obtained
   (C) Electrons are added to a substrate molecule
   (D) The substrate molecules are oxidized.

3. Which of the following single nucleotide mutations in an mRNA codon is most likely to be a "silent" mutation?
   (A) 5' CAU3 $\rightarrow$ CUU
   (B) 5' UUU $\rightarrow$ UUC
   (C) 5' AGA $\rightarrow$ CGA
   (D) 5' GUG $\rightarrow$ GGG

4. Nucleic acid sequence is normally determined using which of the following techniques?
   (A) Agarose gel electrophoresis
   (B) Capillary electrophoresis
   (C) Starch gel electrophoresis
   (D) Denaturing polyacrylamide gel electrophoresis

5. Individual cells can be identified by using :
   (A) Marker enzyme
   (B) Flow cytometry
   (C) Rate zonal centrifugation
   (D) Equilibrium density gradient centrifugation

6. Ribozyme is
   (A) Catalytic RNA which catalyses both synthesis and degradation of small oligonucleotides
   (B) Derivative of vitamin riboflavin
   (C) Name of the scientist who discovered ribosomes

(D) None of the above

7. In the laboratory the kind of mRNA triplet oligomer that occurs most readily by nonenzymatic reaction is (R = purine

Y = pyrimidine)

(A) RRR

(B) YRY

(C) YYY

(D) RRY

8. A gene inherited from a female is not expressed in either male or female offspring, but the same gene is expressed in both male and female offspring when inherited from a male. This can be example of gene

(A) Recombination

(B) Repression

(C) Deletion

(D) Imprinting

9. DNA that is located within genes and is not used to specify a product but is discarded during RNA processing is known as

(A) Intron DNA

(B) Exon DNA

(C) spacer DNA

(D) Regulatory DNA

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

(A) Linear structure

(B) Circular form

(C) Lariat shaped

(D) Theta structure

11. A typical animal cell contains:

(A) 3×10^9 nucleotides

(B) 3×10^2 nucleotides

(C) 3×10^4 nucleotides

(D) 3×10^5 nucleotides

12. Which antibody can block bacterial attachment to mucosal epithetical cells, which is the first line of defense against host function?

(A) IgG

(B) IgA

(C) IgM

(D) IgE

13. Immune complexes can form in various regions of the body including the skin joints & kidneys. When the complexes form in the skin a condition called _____ can result. This condition is characterized by butterfly shaped rash on the skin in the joints immune complexes can lead to a condition called _____

(A) Rheumatoid arthritis, systemic lupus erythematosis

(B) Systemic lupus erythematosis, rheumatoid arthritis

(C) Systemic lupus erythematosis, sickle cells anemia.

(D) Rheumatoid arthritis, sickle cell anemia.

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

(A) Antibodies

(B) Lymphokines

(C) MHC glycoproteins

(D) T - cell receptors

15. What kind of genomes do retroviruses have?

(A) One copy of plus ssRNA

(B) One copy of minus ssRNA

(C) Two copies of plus ssRNA

(D) Two copies of minus ssRNA

16. Which is not retrovirus?

(A) Oncovirus

(B) Lentivirus

(C) Spumavirus

(D) Rubivirus

17. Choose the true & false statements:-

(A) Preen gland is found in birds & helps in keeping feathers oily

(B) Osphridium is an organ of olfaction in molluscs

(C) Tentacles are sensory organs of echinoderms

(D) Statocyst is the balancing organ of invertebrates

(A) T, T, F, T

(B) F, T, F, T

(C) T, F, F, T

(D) T, F, T, F

18. A compound that transfers reducing equivalent from mitochondria to the cytosol during gluconeogenesis is:

(A) Phosphoenolpyruvate

(B) Glycerol 3-phosphate

(C) Aspartate

(D) Malate

19. The transition from G_2 to M phase takes place:

(A) By activation of Thr 161.

(B) By dephosphorylation of Tyr 15, Thr 14

(C) Both A and B

(D) None of the above.

20. Cell cycle regulator in all eukaryotes is:

(A) MPF (maturation promoting factor)

(B) Cyclin dependent kinase 1

(C) Cyclin

(D) None of the above.

21. 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

22. Some hyperthermophilic organisms that grow in highly acidic (pH2) habitats belong to the two groups called

(A) Eubacteria and archaebacteria

(B) Cyanobacteria and diatoms

(C) Protists and mosses

(D) Liverworts and yeasts

23. Apomictic embryos in Citrus arise from

(A) Synergids

(B) Maternal sporophytic tissue in ovule

(C) Antipodal cells

(D) Diploid egg

24. Transfer of pollen grains from a male flower to the stigma of another female flower of the same plant is called
(A) Xenogamy
(B) Geitonogamy
(C) Karyogamy
(D) Autogamy

25. Penicillin, an antibiotic is produced by
(A) Pencillium chrysogenum
(B) P. glacum
(C) P. patulum
(D) P. griseofulvin

26. 'Iludin', an antibiotic is produced by
(A) Fusarium oxysporium
(B) Penicillium illudens
(C) Clitocybe illudens
(D) Ustilago illudens.

27. A description of the wavelengths absorbed by a pigment is called its?
(A) Electromagnetic properties.
(B) Electromagnetic spectrum
(C) Absorption spectrum
(D) Action spectrum.

28. The pigment molecules of a chloroplast are located?
(A) Within its thylakoid membranes.
(B) Within its intrathylakoid spaces.
(C) Within its inner membrane.
(D) Within the space between its inner and outer membranes.

29. Which of the following statement about facilitated diffusion is incorrect ?
(A) The rate of transport is greater than simple diffusion.
(B) The process is specific
(C) The rate of transport is directly proportional to concentration gradient
(D) The process is not accompanied by permeases.

30. Which of the following are aerobic bacteria?

(A) Nitrosomonas

(B) Nitrobacter

(C) Thiobacillus

(D) All of these

31. Energy and nutrients enter a community by way of the

(A) Producers.

(B) Consumers.

(C) Scavengers.

(D) Detrivores.

32. A sequence of species through which the organic molecules in a community pass is called a

(A) Pyramid of energy.

(B) Food chain.

(C) Food web.

(D) Nutrient cycle.

33. On which of the following does aldosterone exert its greatest effect?

(A) Glomerulus

(B) Cortical collecting duct

(C) Thin portion of the loop of Henle

(D) Thick portion of the loop of Henle

34. The original function of the vertebrate stomach was

(A) Storage

(B) Digestion

(C) Enzyme secretion

(D) Absorption

35. Slit-pores are present in the walls of

(A) Glomerular capillaries

(B) Inner layer of Bowman's capsule

(C) Peritubular capillaries

(D) Vasa recta

36. In the human female, menstruation can be deferred by the administration of

(A) Combination of FSH and LH

(B) Combination of estrogen and progesterone

(C) FSH only

(D) LH only

37. If a person shows production of interferon's in his body, the chances are that he has got an infection of –

(A) Typhoid

(B) Measles

(C) Malaria

(D) Tetanus

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

(A) Carcinoma

(B) Sarcoma

(C) Leukemia

(D) Lymphoma

39. One of the most remarkable features of evolution is the formation of amnion & the allantoids which appeared for the first time in:-

(A) Amphibians

(B) Fishes

(C) Birds

(D) Reptiles

40. Evolution is often referred to as speciation. Which in the most correct statement with respect to speciation:-

(A) Inheritance of gene pool from one generation to another,

(B) Origin of new character in a group of geographically isolated individuals.

(C) Origin of distinct physical identities amongst races which are located in different geographical location.

(D) Origin of reproductive isolation amongst the races of a given species.

41. Cardiac muscles are striped muscles with fibers being

(A) Syncytial and voluntary

(B) Multinucleated, involuntary

(C) Nucleated, voluntary

(D) Nucleated, involuntary

42. Which one illustrates a reflex are;

(A) Brain → Spinal cord → Muscles.

(B) Receptor → Spinal cord → Muscles

(C) Muscle → Spiral cord → Brain

(D) Spinal cord → Effector → Receptor

43. Which of the following normally has the most prominent prepotential?

(A) Sinoatrial node

(B) Atrial muscle cells

(C) Bundle of His

(D) Purkinje

44. Which one is common feature of *Amphioxus*, frog, sea horse and crocodile?

(A) Skeleton of cartilage and bone

(B) Three chambered heart

(C) Pharyngeal gill slits at least in developmental stages

(D) Dorsal solid nerve cord

45. The ratio between root mean square velocity of H_2 at 50 K and that of O_2 at 800 K is –

(A) 4

(B) 2

(C) 1

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

46. The maximum number of 3d - electrons that can have s = + 1/2 are;

(A) 10

(B) 3

(C) 5

(D) 7

47. The radius of second stationary orbit in Bohr's atom is R. The radius of third orbit will be:

(A) 3R

(B) 9R

(C) 2.25 R

(D) R/3

48. To get 2, 4, 6 tribromobenzoic acids from aniline the correct sequence of reagents is:

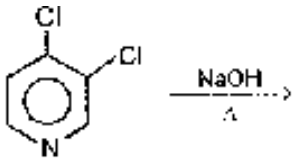
(A) $\xrightarrow[AlCl_3]{Br_2}$ $\xrightarrow[H_2O]{H_3O^{\oplus}}$ $\xrightarrow[(II)\ CuCN]{(I)\ NaNO_2/HCl}$

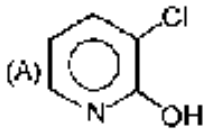
(B) $\xrightarrow[\Delta]{H_3O^{\oplus}/H_2O}$ $\xrightarrow[AlCl_3]{Br_2}$ $\xrightarrow[(II)\ CuCN]{(I)\ NaNO_2/HCl}$

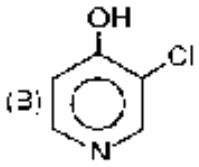
(C) $\xrightarrow[(II)\ CuCN]{(I)\ NaNO_2/HCl}$ $\xrightarrow[\Delta]{H_3O^{\oplus}/H_2O}$ $\xrightarrow[AlCl_3]{Br_2}$

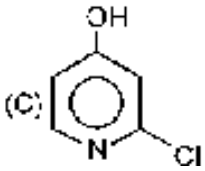
(D) $\xrightarrow[AlCl_3]{Br_2}$ $\xrightarrow[(II)\ CuCN]{(I)\ NaNO_2/HCl}$ $\xrightarrow[\Delta]{H_3O^{\oplus}/H_2O}$

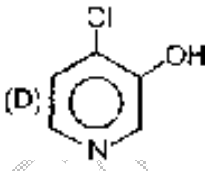
49.



(A) 

(B) 

(C) 

(D) 

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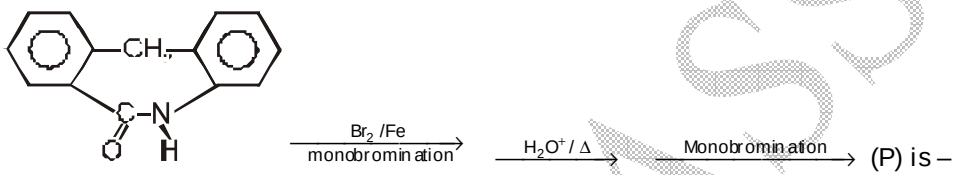
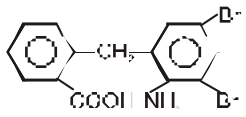
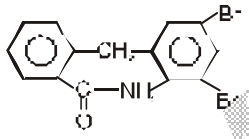
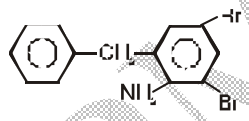
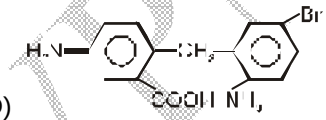


(P) is –

(A) 

(B) 

(C) 

(D) 

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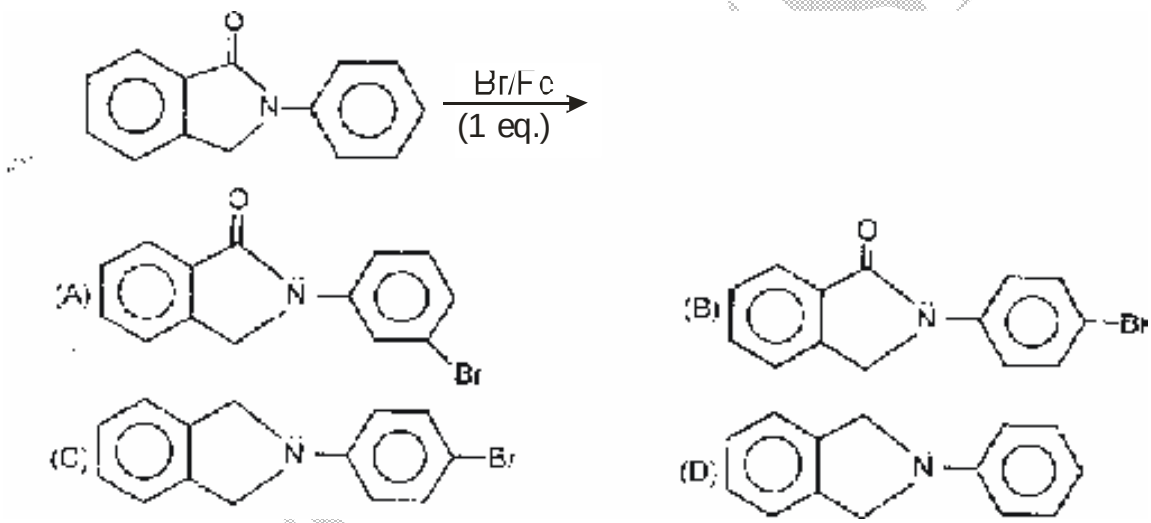

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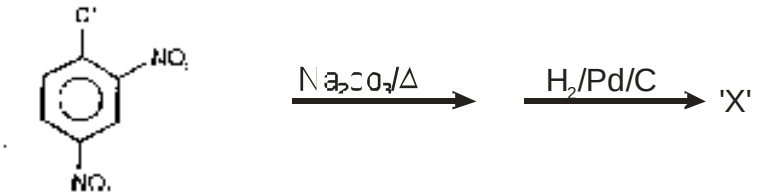
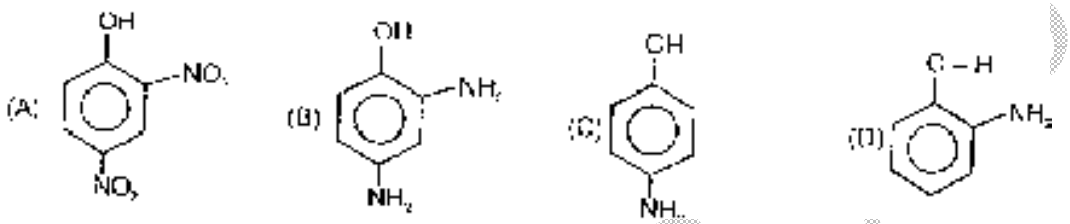


The product 'X' is



53. Secondary amine can be produced by
(A) Reduction amine can be produced by
(B) Reduction of amides
(C) Reduction of aldehydes
(D) Reduction of nitrobenzene

54. Identify S in the following sequence of reactions

(A) benzoic acid
(B) Phenyl acetic acid
(C) benzyl alcohol
(D) Benzamide

55. The pOH of a 0.02 M KOH solution is:
(A) 3.2
(B) 1.7
(C) 1.69
(D) None

56. The half-life of a first-order reaction is $6.00 \times 10^{-2}\ s^{-1}$. What is the rate constant for the reaction?

(A) 4.16/sec

(B) 1.16/sec

(C) 11.6/sec

(D) None

57. How many signals do you expect in the 1H NMR spectrum to $(CH_3CH_2)_3PO$?
(A) one (B) two (C) three (D) four

58. 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

59. For which of the following processes, enthalpy change is positive

(A) $F_{(g)} + e^- \rightarrow F^-_{(g)}$

(B) $Cl_{(g)} + e^- \rightarrow Cl^-_{(g)}$

(C) $O_{(g)} + 2e^- \rightarrow O^{2-}_{(g)}$

(D) $H_{(g)} + e^- \rightarrow H^-_{(g)}$

60. Identify the least stable amongst the following

(A) Li^-

(B) Be^-

(C) B^-

(D) C^-

61. Which of the following pairs are isomers?

(A) C_5H_{10} and $C_{10}H_{20}$

(B) $CH_3.(CH_2)_4.CH_3$ and $CH_3.(CH_2)_3.CH_3$

(C) $CH_3.CH(CH_3).(CH_2).CH_3$ and $CH_3.(CH_2)_2.CH(CH_3)_2$

(D) $(CH_3)_3.CH$ and $CH_3.CH_2.CH_2.CH_3$

62. In the UV spectrum of cyclohexanone, the absorption at λ_{max} ~ 215 nm is due to the transition

(A) $\sigma \rightarrow \sigma^*$

(B) $\sigma \rightarrow n$

(C) $\pi \rightarrow n$

(D) $\pi \rightarrow \pi^*$

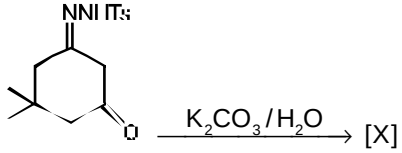
63. Which of the following amino acid have 2 chiral centres?

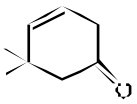
(A) Lysine

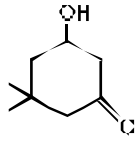
(B) Phenyl alanine

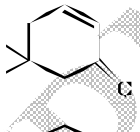
(C) Threonine

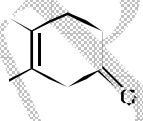
(D) Valine

64. 

(A) 

(B) 

(C) 

(D) 

65. 1, 1-Dibromoethane when heated with zinc dust produces

(A) Ethyl bromide

(B) Ethene

(C) Vinyl bromide

(D) 2-Butene

66. 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) $\frac{1}{6}$.

67. ${}^{n}P_{r} \div {}^{n}C_{r}$ =

(A) n!

(B) (n - r)!

(C) $\frac{1}{r!}$

(D) r!

68. If ${}^{n}C_{r-1} = 36$, ${}^{n}C_{r} = 84$ and ${}^{n}C_{r+1} = 126$ then value of r is

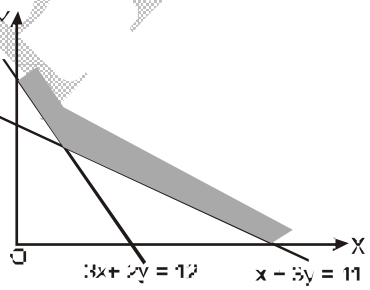
(A) 1

(B) 2

(C) 3

(D) 4

69. For the following feasible region, the linear constraints are



(A) $x \geq 0, y \geq 0, 3x + 2y \geq 12, x + 3y \geq 11$

(B) $x \geq 0, y \geq 0, 3x + 2y \leq 12, x + 3y \geq 11$

(C) $x \geq 0, y \geq 0, 3x + 2y \leq 12, x + 3y \leq 11$

(D) None of these

70. Odds 8 to 5 against a person who is 40 years old living till he is 70 and 4 to 3 against person now 50 till he will be living 80. Probability that one of them will be alive next 30 years.

(A) $\frac{59}{91}$

(B) $\frac{44}{91}$

(C) $\frac{51}{91}$

(D) $\frac{32}{91}$

71. Which one of the following is false?

(A) If n (A) = 20, n (B) = 25 and $n(A \cap B) = 10$, then $n(A \cup B) = 35$

(B) If n (A) = 15, n (B) = 20 and $n(A \cup B) = 30$, then $n(A \cap B') = 10$

(C) $n(A \cap B') = n(A) - n(A \cup B)$

(D) At least one of the above is false

72. $f(x) = x^2[x]$

(A) Increases in (0, 1)

(B) Decreases in (0, 1)

(C) increases in (-1, 0)

(D) None of these

73. There are four machines and it is known that exactly two of them are faulty. They are tested, one by one, in a random order till both the faulty machines are identified. Then the probability that only two tests are needed is

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

(B) $\frac{1}{6}$

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

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

74. Let f(x) = (x – 3) (x – 4) (x – 5) (x – 6), then

(A) f '(x) = 0 has four roots

(B) Three roots of f'(x) = 0 lie in $(3,4) \cup (4,5) \cup (5,6)$

(C) The equation f'(x) = 0 has only one root

(D) Three roots of f'(x) = 0 lie in $(2,3) \cup (3,4) \cup (4,5)$

75. 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!)

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

(A) ae^{x^2}

(B) ae^{-x^2}

(C) ae^{2x}

(D) ae^{-2x}

77. 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

78. Area between the curve y = cos x and x–axis when $0 \le x \le 2\pi$ is

(A) 2

(B) 4

(C) 0

(D) 3

79. Area under the curve $y=\sqrt{3x+4}$ between x = 0 and x = 4, is

(A) $\frac{56}{9}$ sq. unit

(B) $\frac{64}{9}$ sq unit

(C) 8 sq. unit

(D) None of these

80. Area bounded by the curve y = sin x between x = 0 and $x = 2\pi$ is

(A) 2 sq. unit

(B) 4 sq. unit

(C) 8 sq. unit

(D) None of these

81. 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) $\frac{\alpha\beta-1}{\alpha+\beta}$

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

(A) π - x

(B) $2\pi - x$

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

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

83. A closed compartment containing as is moving with some acceleration in horizontal direction. Neglect effect of gravity. Then the pressure in the compartment is:

(A) Same everywhere

(B) Lower in the front side

(C) Lower in the rear side

(D) Lower in the upper side

84. 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

85. A smooth sphere A is moving on a frictionless horizontal plane with angular speed ω and centre of mass velocity v. It collides elastically and head on with an identical sphere B at rest. Neglect friction everywhere. After the collision, their angular speeds are ω_A and ω_B, respectively. The

(A) $\omega_A < \omega_B$

(B) $\omega_A = \omega_B$

(C) $\omega_A = \omega$

(D) $\omega_B = \omega$

86. In hydrogen spectrum the wavelength of H_α line is 656 nm, whereas in the spectrum of a distance galaxy, H_α line wavelength is 706 nm. Estimated speed of the galaxy with respect to earth is:

(A) 2×10^8 m/s

(B) 2×10^7 m/s

(C) 2×10^6 m/s

(D) 2×10^5 m/s

87. A particle free to move along the x-axis has potential energy given by $U(x) = k[1 - \exp(-x^2)]$ for $-\infty \leq x \leq +\infty$, where k is a positive constant of appropriate dimensions. Then :

(A) At points away from the origin, the particle is in unstable equilibrium

(B) For any finite non-zero value of x, there is a force directed away from origin

(C) If its total mechanical energy is k/2, it has its minimum kinetic energy at the origin

(D) For small displacements from $x = 0$, the motion is simple harmonic

88. 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

89. A particle of charge q and mass m moves in a circular orbit of radius r with angular speed ω. The ratio of the magnitude of its magnetic moment to that of its angular momentum depends on:

(A) ω and q

(B) ω, q and m

(C) q and m

(D) ω and m

90. A large open tank has two holes in the wall. One is square hole of side L at a depth y from the top and the other is a circular hole of radius R at a depth 4y from the top. When the tank is completely filled with water, the quantities of water flowing out per second from both holes are the same. Then, R is equal to:

(A) $\frac{L}{\sqrt{2\pi}}$

(B) $2\pi L$

(C) L

(D) $\frac{L}{2\pi}$

91. An ionized gas contains both positive and negative ions. If it is subjected simultaneously to an electric field along the +x direction and a magnetic field along the + z direction, then:

(A) Positive ions deflect towards + y direction and negative ions towards – y direction

(B) All ions deflect towards + y direction

(C) All ions deflect towards – y direction

(D) Positive ions deflect towards – x direction and negative ions towards + x direction

92. A long horizontal rod has a bead which can slide along its length, and initially placed at a distance L from one end A of the rod. The rod is set in angular motion about A with constant angular acceleration α. It the coefficient of friction between the rod and the bead is μ, and gravity is neglected, then the time after which the bead starts slipping is:

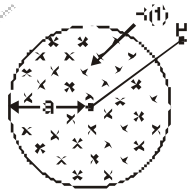
(A) $\sqrt{\frac{\mu}{\alpha}}$

(B) $\frac{\mu}{\sqrt{\alpha}}$

(C) $\frac{1}{\sqrt{\mu\alpha}}$

(D) Infinitesimal

93. A uniform but time-varying magnetic field B (t) exists in a circular region of radius a and is directed into the plane of the paper, as shown. The magnitude of the induced electric field at point P at a distance r from the centre of the circular region:



(A) i zero

(B) Decreases as 1/r

(C) Increases as r

(D) Decreases as $1/r^2$

94. In a double slit experiment, instead of taking slits of equal widths, one slit is made twice as wide as the other. Then, in the interference pattern:
(A) The intensities of both these maxima and the minima increase
(B) The intensity of the maxima increases and the minima has zero intensity
(C) The intensity of the maxima decreases and that of the minima increases
(D) The intensity of the maxima decreases and the minima has zero intensity

95. In a compound microscope, the intermediate image is:
(A) Virtual, erect and magnified
(B) Real, erect and magnified
(C) Real, inverted and magnified
(D) Virtual, erect and reduced

96. The temperatures T_1 and T_2 of heat reservoirs in the ideal cannot engine are 1500°C and 500°C respectively. If T_1 increases by 100°C, what will be the efficiency of the engine?
(A) 62%
(B) 59%
(C) 95%
(D) 100%

97. 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

98. Three moles of oxygen are mixed with two moles of helium. What will be the ratio of specific heats at constant pressure and constant volume for the mixture?
(A) 6·7
(B) 1·5

(C) 4

(D) None of the above

99. A T.V. tower has a height of 100 m. How much population is covered by the T.V. broadcast if the average population density around the tower is 1500 km^{-2}? (Radius of earth = $6{\cdot}37 \times 10^6$ m).

(A) 15×10^6

(B) 8×10^6

(C) 6×10^6

(D) 6×10^{11}

100. 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

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

HINTS AND SOLUTION

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

2. (C) In Metabolism, during reduction reaction electrons are added to a substrate molecule.

3. (B) If in an m-RNA at a particular point, one base pair is replaced by another without any deletion or addition the meaning of one codon containing this altered base will change. The mechanism involved is silent mutation. For example, 5' UUU → UUC.

4. (D) Horizontal polyacrylamide gels polymerized on ultra-thin films are used to separate low molecular weight compounds e.g. dye with molecular cuts. Of 500 daltons. It is also used for analysis of nucleic acids e.g. DNA sequencing, for viroid tests and to detect mutations as well as for analysis of proteins.

5. (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.

6. (A) The self-splicing introns and the RNA component of RNase-P (the enzyme that cleaves the 5' end of t-RNA precursors) belong to a class of biological catalysts called ribozymes.

7. (B) The mRNA triplet oligomer that occurs by nonenzymatic reaction is pyrimidine-purine-pyrimidine.

8.(D) Genetic imprinting is a phenomenon, which involves differences in the expression of genes inherited from mother and father.

9. (A) Split genes sequences containing actual information of the genes (axons) are interrupted by other sequences (introns) which are spliced out after transcription.

10.(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.

11. (A) A nucleotide is derived from a nucleoside by addition of a molecule of phosphonic acid. A typical animal cell contains 3×10^9 nucleotides.

12. (B) The secretary Ig A antibody can block bacteria attachment to mucosal epithelial cells, which is the first line of defense against is the first line of defense against host infection.

13. (B) Systemic lupus erythematosus (SLE) is prevalent in females between 20 and 40 years of age characterized by butterfly rash on face, whole body rash and arthritis and kidney dysfunction.

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

15. (C) Retroviruses have two copies of plus ss RNA.

16. (D) Rubivirus is not a retrovirus.

17. (C) Preen gland is found in birds and helps in keeping feathers oily. Osphridium is not an organ of olfaction in molluscs. Tentades are not statocyst sensory organs of echinoderms are the balancing organ of invertebrates.

18. (D) Oxaloacetate must leave the mitochondria and enter the cytosol. Since the inner mitochondrial membrane is impermeable to ozalocetate. It is converted to malate by mitochondrial malate dehydrogenase.

19. (C) Once the Cyclin B and Cdk1 is activated by Thr 161; it then enters into M - phase by dephosphorylation of Tyr 15 and Thr 14.

20. (B) Cdk 1 is cell cycle regulator in eukaryotes

21. (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.

22. (A) Thermophiles live in very hot places, typically from 60° to 80° C. Many thermophiles (some eubacteria and archaebacteria) are autotrophs and have metabolisms based on sulphur. Some thermophilic archaebacteria form the basis of food webs around deep-sea thermal vents, where they must withstand extreme temperature and pressures. Archaebacteria can grow in highly acidic (pH = 0.7) and very basic (pH = 11) environments.

23. (B) Substitution of usual sexual reproduction by a form of reproduction which does not involve meiosis and syngamy is called apomixis. In Citrus, apomictic embryos arise from diploid cells (maternal sporophytic tissue) of the ovule occurring outside the embryo sac.

24. (B) Geitonogamy (Greek geiton = neighbout and gameiu = to marry) involves the transfer of pollen grains from a male flower to the stigma of another female flower originating on the same plant. Thus, geitonogamy operates only in monoecious plants, i.e., plants having male and female flowers on different places but on the same plant, e.g., maize (Zea mays). In animal pollinated system, this is accomplished by a pollinator visiting multiple flowers on the same plant. It is also possible within species that are wind pollinated.

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

26. (C) The antibiotic Iludin is produced by clitocybe illudens.

27. (C) The description of the wavelengths absorbed by pigment is called its absorption spectrum.

28. (A) Thylakoids of chloroplast are double-membrane bound structure. The pigment molecules of a chloroplast are located with in its thylakoid membranes.

29. (D) Facilitated diffusion is a special type of passive transport in which ions or molecules cross the membrane rapidly because specific permeases in the membrane facilitate their crossing.

30. (D) Examples of aerobic bacteria (who require oxygen for their respiration) are Nitrosomonas, Nitrobacter and Thiobacillus.

31. (A) Energy and nutrients enter community by way of green plant which is also known as producers.

32. (B) The transfer of food energy from source in plants through a series of organisms with repeated eating and being eaten is called food chain in an ecosystem.

33. (D) Aldosterone exerts its greatest effect on thick portion of loop of Henle.

34. (A) the original function of vertebrate stomach was storage because it shows greatest modifications and ancestral traits.

35. (B) Slit pores are present in the inner layer of Bowman's capsule. They are required for filtration of blood.

36. (B) Combination of estrogen & progesterone is usually given to delay the process of ovulation.

37. (B) a person suffering from measles his body shows production of interferons.

38. (D) Lymphoma cancer affects lymph nodes and spleen.

39. (D) During development, in reptiles, birds and mammals, embryo becomes invested with four embryonic membranes – amnion, chorion, yolk sac and allantois.

40. (D) the process of splitting a genetically homogeneous population into two or more populations that undergo genetic differentiation and eventual reproductive isolation is called speciation.

41. (D) structurally, cardiac muscles resemble striated muscles but functioning independently of the conscious control of brain, these are involuntary like smooth muscles. Cardiac muscle cells or fibers are cylindrical and mostly uninucleate.

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

43. (A) S - A node has most prominent prepotential. Fibers of this node are continues with the normal cardiac muscle fibers of right atrium. These spontaneously generate contraction impulses of cardiac cycles at short intervals. The S-A node is therefore "pacemaker" or "contraction centre".

44. (D) Amphioxus, Frog, Sea house and crocodile has dorsal solid nerve cord.

45. (C) $u_{rms(H_2)} = \sqrt{\frac{3 \times 50 \times R}{2}}$

And $u_{rms(O_2)} = \sqrt{\frac{3 \times 800 \times R}{32}}$

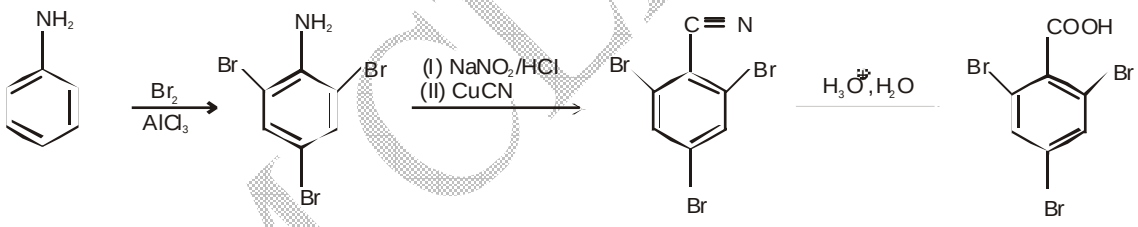
$\therefore \quad \frac{u_{rms(H_2)}}{u_{rms(O_2)}} = 1$

46. (C) Follow Pauli's exclusion principle.

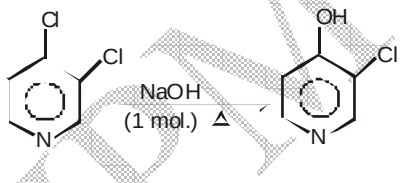
47. (A) $r_n = r_1 \times n^2$

$\therefore \frac{r_3}{r_2} = \frac{9}{3}$

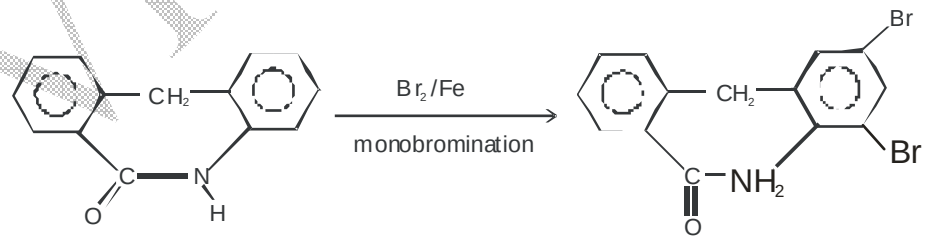
48. (D)

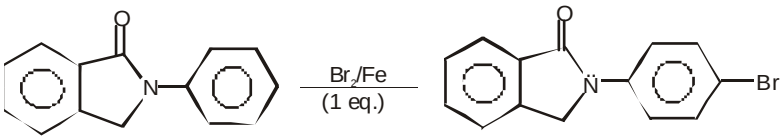


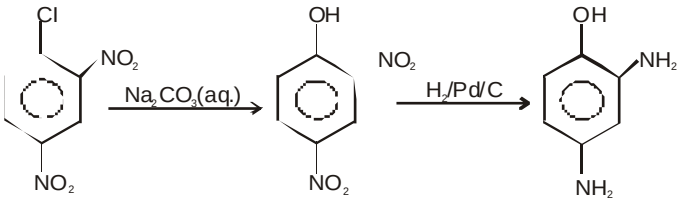
49. (B)



50. (B)



51. (B) 

52. (B) 

53. (A) $R-N\overset{+}{\equiv}C \xrightarrow{\text{reduction}} R-N-CH_3$

54. (C) $C_2H_5N_2\overset{-}{Cl} \xrightarrow{CuCN} C_6H_5CN \xrightarrow{LiAlH_4} C_6H_5CH_2NH_2 \xrightarrow{HNO_2} C_6H_5CH_2OH$

(Benzyl alcohol)

55. (B) The problem-solving approach is the same as in Exercise 4 :

	$KOH \rightarrow$	K^+	+	OH^-
Initial (M) :	0.02	0		0
Ionization (M) :	–0.02	+0.02		+0.02
Final (M) :	0	0.02		0.02

The KOH ionizes 100 percent and 0 M KOH remains after it ionizes.

$pOH = -\log[OH^-] = -\log(0.02) = 1.7$

56.(C) The rate constant is calculated by using the reaction $k = 0.693/t_{1/2}$. Substituting 6.00×10^{-2} s for $t_{1/2}$ yields

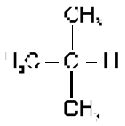
$$k = \frac{0.693}{6.00\times10^{-2}\text{s}} = 11.6/\text{sec}$$

57.(B) Two signals, due to CH_3^- and CH_2^-

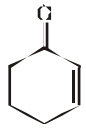
58.(B) The unit of rate constant suggests it to be I order.

59.(C) Gaining of an electron by a gaseous atom is usually an exothermic process. Gain of second electron by negatively charged species feels a strong repulsion and the energy of the system increases.

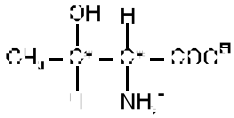
60.(B) Adding an electron to a full subshell ($2s^2$ configuration of Be) is not favorable energetically.

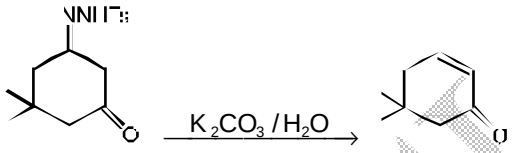
61.(D)  $CH_3 - CH_2 - CH_2 - CH_3$

Both are chain isomers.

62.(D) 
Cyclohexenone $\lambda_{max} \approx 215$ nm

The absorption at $\lambda_{max} \sim 215$ nm is due to the transition $\pi \rightarrow \pi^*$.

63.(C) Threonine — 
2 Chiral Centre

64.(C) 

65. (D) $H_3C - CHBr_2 \xrightarrow[\Delta]{Zn} H_3C - CH = CH - CH_3$

66.(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

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

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

67.(A) ${}^nP_r = \frac{n!}{(n-r)!}, {}^nC_r = \frac{n!}{r!(n-r)!}$

On simplification we get required result.

${}^nP_r \div {}^nC_r = r!$

68.(C) Dividing first two relations

$$\frac{36}{84}=\frac{3}{7}=\frac{n!}{(r-1)!(n-r+1)!}\times\frac{r!(n-r)!}{n!}=\frac{r}{n-r+1} \quad \Rightarrow 3(n-r+1)=7r \Rightarrow n=\frac{10r-3}{3} \quad \ldots (i)$$

Dividing 2nd and 3rd relations,

$$\frac{84}{126}=\frac{14}{21}=\frac{n!}{r!(n-r)!}\times\frac{(r+1)!(n-r-1)!}{n!}=\frac{r+1}{n-r}\Rightarrow n=(5r+3)/2 \quad \ldots (ii)$$

Solving (i) and (ii), r = 3

69.(A) For the given graph $x\geq 0,\ y\geq 0,\ 3x+2y\geq 12,\ x+3y\geq 11$ are suitable constraint

70.(B) Probability [Person A will die in 30 years] $=\frac{8}{8+5}$

$$P(A)=\frac{8}{13}\Rightarrow P(\bar{A})=\frac{5}{13}$$

Similarly, $P(B)=\frac{4}{7}\Rightarrow P(\bar{B})=\frac{3}{7}$

There are two ways in which one person is alive after 30 years $\bar{A}B$ and $A\bar{B}$ and event are independent.

So, required probability

$$=P(\bar{A}).P(B)+P(A).P(\bar{B})=\frac{5}{13}\times\frac{4}{7}+\frac{8}{13}\times\frac{3}{7}=\frac{44}{91}.$$

71.(D) Statement (A) is true

Again $n(A\cap B)=n(A)+n(B)-n(A\cup B)$

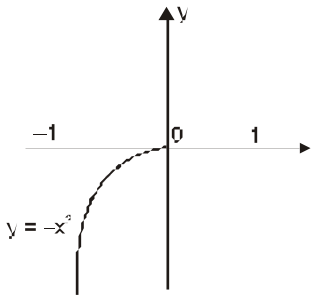
$$n(A\cap B)=15+20-30$$
$$=5$$

$\therefore\ n(A\cap B')=n(A)-n(A\cap B)$

$=15-5=10$

Hence, the statement (B) and (C) both are true.

72.(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).

73.(B) This is a problem of without replacement.

$$P=\frac{\text{one def. from 2 def}}{\text{any one from 4}}\times\frac{\text{1 def. from remaining 1 def.}}{\text{any one from remaining 3}}$$

Hence required probability $=\frac{2}{4}\times\frac{1}{3}=\frac{1}{6}$

Alter: number of ways in which two faulty machines may be detected (depending upon the test done to identify the faulty machines) $= {}^4C_2 = 6$

Number of favourable cases = 1

[When the faulty machines are identified in the first and the second test]

Hence required probability $=\frac{1}{6}$.

74.(B) If $f(x) = (x-3)(x-4)(x-5)(x-6) \Rightarrow f(3) = f(4) = f(5) = f(6) = 0$

$\therefore$ by Roll's theorem, there exist

$\alpha_1 \in (3,4), \alpha_2 \in (4,5)$ and $\alpha_3 \in (5,6)$ such that $f'(\alpha_i) = 0, i = 1,2,3.$

Since f'(x) is a cubic polynomial therefore $\alpha_1, \alpha_2, \alpha_3$ are the roots of f'(x) = 0.

75.(C) $$\begin{vmatrix} 10! & 11! & 12! \\ 11! & 12! & 13! \\ 12! & 13! & 14! \end{vmatrix} = 10!\,11!\,12! \begin{vmatrix} 1 & 11 & 11\times12 \\ 1 & 12 & 12\times13 \\ 1 & 13 & 13\times14 \end{vmatrix}$$

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

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

76.(A) $\frac{dy}{dx} = 2xy$

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

$\log y = x^2 + c$

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

77.(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.

78.(B) $y = \cos x$, When $x \in \left[0, \frac{\pi}{2}\right]$, $\cos x \geq 0$

When $x \in \left[\frac{\pi}{2}, \frac{3\pi}{2}\right]$, $\cos x \leq 0$

When $x \in \left[\frac{3\pi}{2}, 2\pi\right]$, $\cos x \geq 0$

Thus required area is given by

$$\int_0^{\pi/2} y\,dx = \int_0^{\pi/2} \cos x\,dx + \int_{\pi/2}^{3\pi/2} (-\cos x)\,dx + \int_{3\pi/2}^{2\pi} \cos x\,dx = 4$$

79.(D) Area = $\int_0^4 \sqrt{3x+4}\,dx = \left|\frac{(3x+4)^{3/2}}{3.(3/2)}\right|_0^4$

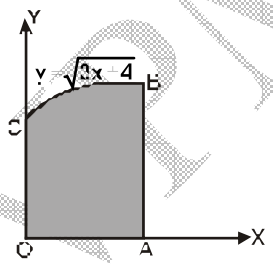


Fig.4

$= \frac{2}{9}\times 56 = \frac{112}{9}$ sq.unit

80.(B) We have y = sin x

x	0	π/6	π/2	π	3π/2	2π
y	0	0.5	1	0	–1	0

Join these points with a free hand to obtain a rough sketch

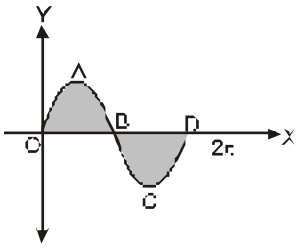


Fig.1

Required area = (area of OAB) + (area of BCD)

$= \int_0^{\pi} y\,dx + \int_{\pi}^{2\pi} (-y)\,dx$

(Area BCD is below x–axis)

$= \int_0^{\pi} \sin x\,dx - \int_{\pi}^{2\pi} \sin x\,dx = 4$ sq.unit

81.(D) Given that $\cot^{-1}\alpha + \cot^{-1}\beta = \cot^{-1} x$

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

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

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

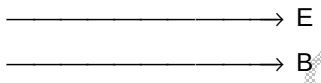
$$= \cot^{-1}\left[\frac{(1-\sin x) + (1+\sin x) + 2\sqrt{1-\sin^2 x}}{(1-\sin x) - (1+\sin x)}\right]$$

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

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

83.(B) Due to pseudo force acting on a gas molecule in opposite direction of acceleration, the pressure on rear side will be more.

84.(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.



85.(C) During head-on collision of a A and B, the interaction force is passing through the centre of mass of both sphere. So torque on sphere A = 0 and by conservation of angular momentum, its angular velocity remains unchanged.

86.(B) In case of Doppler effect in light,

$$\lambda' - \lambda = \Delta\lambda = \frac{\lambda v}{c}$$

Here, $\lambda' = 706$ nm, $\lambda = 656$ nm, $c = 3 \times 10^8$ m/s

Substituting and solving, $v \simeq 2 \times 10^7$ m/s.

87.(D) $U(x) = k[1 - e^{-x^2}]$

So, $F = -\frac{dU}{dx} = -2kxe^{-x^2}$

For small values of x, $e^{-x^2} \simeq 1$

$\therefore$ $F = -2kx$.

As force $\propto$ (–displacement), motion is S.H.M.

88.(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.

89.(C) As magnetic moment of current loop = iA with $i = q\omega/2\pi$

and angular momentum = $mr^2\omega$

So, $\frac{\text{magnetic moment}}{\text{angular momentum}} = \frac{q\,\omega\,\pi r^2}{2\pi \times mr^2\omega} = \frac{q}{2\pi}$

90.(A) The velocity of efflux at distance y below free surface of liquid $v = \sqrt{2gy}$ and, volume of liquid coming out of surface per sec = Av, where A : cross-sectional area of office.

$\therefore \quad \sqrt{2gy} \cdot L^2 = \sqrt{2g \times 4y} \cdot \pi R^2$

$$L^2 = 2\pi R^2, \quad \text{i.e.,} \quad R = \frac{L}{\sqrt{2\pi}}$$

91.(C) We can write $\vec{E} = E.\hat{i}$ and $\vec{B} = B\hat{k}$

Velocity of the particle will be along q. $\vec{E}$ direction.

Therefore, we can write

$\vec{V} = AqE\hat{i}$

In , and , A , E and B are positive constants while q can be positive ornegative.

$$\vec{F}_m = q\left(\vec{v} \times \vec{B}\right) = q\left\{AqE\hat{i}\right\} \times \left\{B\hat{K}\right\}$$

$$= q^2 AEB\left(\hat{i} \times \hat{k}\right)$$

$$\vec{F}_m = q^2 AEB\left(-\hat{j}\right)$$

Since, $\vec{F}_m$ is along negative y-axis, no matter what is the sign of charge q. Therefore, all ions will deflect towards negative y-direction.

92.(A) The frictional force balances the centrifugal force, i.e.,

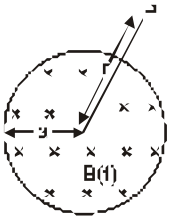
$$\mu m\omega L = m\omega^2 L, \quad \text{i.e.,} \quad \omega = \sqrt{\alpha\mu}$$

Further, $\omega = \omega_0 + \alpha t, \quad \alpha t = \omega = \sqrt{\alpha\mu}$

$$t = \sqrt{\frac{\mu}{\alpha}}$$

93.(B) From Faraday's law,

$$\oint \vec{E} \cdot \vec{dl} = -\frac{d\phi_B}{dt} = -\frac{d}{dt}(\pi a^2 B)$$



or $$E \times 2\pi r = -\pi a^2 \frac{dB}{dt}$$

$$E \propto \frac{1}{r}$$

94.(A) In Interference $I_{max} = (a_1 + a_2)$ and $I_{min} = (a_1 \sim a_2)^2$

In slits of equal widths, $a_1 = a_2 = a$ (say)

$\therefore$ $I_{max} = 4a^2$ and $I_{min} = 0$

Due to broadening of one slit, the amplitude $a_2 = Ka$ with $K > 1$

So, $I_{max} = (a + Ka)^2 > 4a^2$ and $I_{min} = (Ka - a)^2 > 0$ as $K > 1$

Thus, intensity of both maxima and minima increases.

95.(C) It compound microscope, the intermediate image is formed by objective and is real, inverted, magnified and is formed between the lenses.

96.(B) $T_1 = 1500 + 100 = 1600°C = 1600 + 273\,K$

$= 1873\,K$

$T_2 = 500°C = 500 + 273 = 773\,K$

$$\eta = 1 - \frac{T_2}{T_1} = 1 - \frac{773}{1873} = \frac{1100}{1873}$$

$$= \frac{1100}{1873} \times 100\% = 59\%.$$

97.(D) $E = C_v 1\,.\,T = RT$

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

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

98.(B) For a diatomic gas like oxygen $\gamma_0 = 7/5$

For a monatomic gas like helium $\gamma_{He} = 5/3$.

For γ of the mixture, we have to take weighted average of the two gases,

i.e., $$\gamma_{mix} = \frac{3 \times \gamma_0 + 2 \times \gamma_{He}}{(3+2)}$$

$$= \frac{3 \times 7/5 + 2 \times 5/3}{5} = \frac{\frac{21}{5} + \frac{10}{3}}{5}$$

$$\gamma_{min.} = \frac{113}{15 \times 5} = 1{\cdot}5.$$

99.(C) Here, h= 100 m ;

$R = 6{\cdot}37 \times 10^6 m$;

population density, $\rho = 1500\ km^{-2}$

$= 1500 \times 10^{-6}\ m^{-2}$

Population covered $= \rho \times \pi\ d^2 = \rho\ \pi\ 2hR$

$= 1500 \times 10^{-6} \times \frac{22}{7} \times 2 \times 100 \times 6{\cdot}37 \times 10^6 = 6 \times 10^6.$

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

Charge number of X = 92—90 = 2

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