MH-CET-2014
Subjects : Physics, Chemistry & Biology

Question Booklet Version	MH-CET-2014 Roll No.	Question Booklet Sr. No.
22 (Write this number on your Answer Sheet)		(Write this number on your Answer Sheet)

Answer Sheet No.

Day and Date : Thursday, 08th May, 2014 Duration: 3.00 hours

Total Marks : 720

This is to certify that, the entries of MH-CET Roll No. and Answer Sheet No. have been correctly written and verified.

Candidate's Signature *Invigilator's Signature*

Instructions to Candidates

1. This question booklet contains 180 Objective Type Questions in the subjects of Physics (45), Chemistry (45) and Biology (90).
2. The question paper and OMR (Optical Mark Reader) Answer Sheet is issued separately at the start of the examination.
3. Choice and sequence for attempting questions will be as per the convenience of the candidate.
4. Candidate should carefully read the instructions printed on the Question Booklet and Answer Sheet and make the correct entries on the Answer Sheet. As Answer Sheets are designed to suit the OPTICAL MARK READER (OMR) SYSTEM, special care should be taken to mark the entries correctly. Special care should be taken to fill QUESTION BOOKLET VERSION, SERIAL No. and MH-CET Roll No. accurately. The correctness of entries has to be cross-checked by the invigilators. **The candidate must sign on the Answer Sheet and Question Booklet.**
5. Read each question carefully.
6. Select the correct answer from the four available options given for each question.
7. Mark the appropriate circle completely like this ● , for answering a particular question. Mark with Black ink ball point pen only.
8. **Each question with correct response shall be awarded four (4) marks. There shall be negative marking. For wrong answers there will be deduction of one mark per question. One mark shall be deducted for marking two or more answers of same question, scratching or overwriting.**
9. **Use of whitener or any other material to erase/hide the circle once filled is not permitted.**
10. Avoid overwriting and/or striking of answers once marked.
11. Rough work should be done only on the blank space provided on the Question Booklet. **Rough work should not be done on the Answer Sheet.**
12. The required Log-Antilog table will be provided along with the Question Booklet.
13. Immediately after the prescribed examination time is over, the Question Booklet and Answer sheet is to be returned to the Invigilator. Confirm that both the Candidate and Invigilator have signed on question booklet and answer sheet.
14. No candidate is allowed to leave the examination hall till the end of examination.
15. No marks will be deducted if a particular question is not attempted.

PHYSICS

1. The velocity of water in river is 9 $\frac{km}{hr}$ of the upper surface. The river is 10 m deep. If the coefficient of viscosity of water is 10^{-2} poise then the shearing stress between horizontal layers of water is

   A) $0.25\times10^{-2}\ \frac{N}{m^2}$ B) $0.25\times10^{-3}\ \frac{N}{m^2}$

   C) $0.5\times10^{-3}\ \frac{N}{m^2}$ D) $0.75\times10^{-3}\ \frac{N}{m^2}$

2. A sphere 'P' of mass 'm' moving with velocity 'u' collides head-on with another sphere 'Q' of mass 'm' which is at rest. The ratio of final velocity of 'Q' to initial velocity of 'P' is (e = coefficient of restitution)

   A) $\frac{e-1}{2}$ B) $\left[\frac{e+1}{2}\right]^{1/2}$ C) $\frac{e+1}{2}$ D) $\left[\frac{e+1}{2}\right]^2$

3. Magnetic induction produced at the centre of a circular loop carrying current is 'B'. The magnetic moment of the loop of radius 'R' is

   (μ_0 = permeability of free space)

   A) $\frac{BR^3}{2\pi\mu_0}$ B) $\frac{2\pi BR^3}{\mu_0}$ C) $\frac{BR^2}{2\pi\mu_0}$ D) $\frac{2\pi BR^2}{\mu_0}$

4. In air, a charged soap bubble of radius 'r' is in equilibrium having outside and inside pressures being equal. The charge on the drop is ($\in_0$ = permittivity of free space, T = surface tension of soap solution)

   A) $4\pi r^2\sqrt{\frac{2T\in_0}{r}}$ B) $4\pi r^2\sqrt{\frac{4T\in_0}{r}}$

   C) $4\pi r^2\sqrt{\frac{6T\in_0}{r}}$ D) $4\pi r^2\sqrt{\frac{8T\in_0}{r}}$

SPACE FOR ROUGH WORK

5. A block is pushed momentarily on a horizontal surface with initial velocity 'v'. If 'μ' is the coefficient of sliding friction between the block and surface, the block will come to rest after time ('g' = acceleration due to gravity)

A) $\frac{v}{\mu g}$ B) $\frac{vg}{\mu}$ C) $\frac{v\mu}{g}$ D) $\frac{\mu g}{v}$

6. The masses of three copper wires are in the ratio 1 : 3 : 5 and their lengths are in the ratio 5 : 3 : 1. The ratio of their resistance is

A) 25 : 1: 125 B) 1 : 125 : 25

C) 125 : 1 : 25 D) 125 : 25 : 1

7. A body of mass 'm' is raised to a height '10 R' from the surface of earth, where 'R' is the radius of earth. The increase in potential energy is (G = universal constant of gravitation, M = mass of earth and g = acceleration due to gravity)

A) $\frac{GMm}{11R}$ B) $\frac{GMm}{10R}$ C) $\frac{mgR}{11G}$ D) $\frac{10GMm}{11R}$

8. The angle θ between the vector $\vec{p} = \hat{i} + \hat{j} + \hat{k}$ and unit vector along x-axis is

A) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ B) $\cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$ C) $\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$ D) $\cos^{-1}\left(\frac{1}{2}\right)$

9. A small metal ball of mass 'm' is dropped in a liquid contained in a vessel, attains a terminal velocity 'v'. If a metal ball of same material but of mass '8m' is dropped in same liquid then the terminal velocity will be

A) V B) 2V C) 4V D) 8V

SPACE FOR ROUGH WORK

10. A wooden block of mass 8 kg slides down an inclined plane of inclination 30° to the horizontal with constant acceleration 0.4 m/s^2. The force of friction between the block and inclined plane is ($g = 10\ m/s^2$)

    A) 12.2 N B) 24.4 N C) 36.8 N D) 48.8 N

11. In cyclotron, for a given magnet, radius of the semicircle traced by positive ion is directly proportional to

    (v = velocity of positive ion)

    A) v^{-2} B) v^{-1} C) v D) v^2

12. A particle at rest is moved along a straight line by a machine giving constant power. The distance moved by the particle in time 't' is proportional to

    A) $t^{1/2}$ B) $t^{2/3}$ C) t D) $t^{3/2}$

13. In insulators (C.B. is conduction band and V.B. is valence band)

    A) V.B. is partially filled with electrons

    B) C.B. is partially filled with electrons

    C) C.B. is empty and V.B. is filled with electrons

    D) C.B. is filled with electrons and V.B. is empty

14. An object of radius 'R' and mass 'M' is rolling horizontally without slipping with speed 'V'. It then rolls up the hill to a maximum height $h = 3v^2/4g$. The moment of inertia of the object is (g = acceleration due to gravity)

    A) $\frac{2}{5}MR^2$ B) $\frac{MR^2}{2}$ C) MR^2 D) $\frac{3}{2}MR^2$

SPACE FOR ROUGH WORK

15. In Wheatstone's bridge, three resistors P, Q, R are connected in three arms in order and 4th arm s is formed by two resistors s_1 and s_2 connected in parallel. The condition for bridge to be balanced is $\frac{P}{Q} =$

A) $\frac{R(s_1 + s_2)}{s_1 s_2}$ B) $\frac{s_1 s_2}{R(s_1 + s_2)}$ C) $\frac{R s_1 s_2}{(s_1 + s_2)}$ D) $\frac{(s_1 + s_2)}{R s_1 s_2}$

16. The moment of inertia of a thin uniform rod rotating about the perpendicular axis passing through one end is 'I'. The same rod is bent into a ring and its moment of inertia about the diameter is 'I_1'. The ratio $\frac{I}{I_1}$ is

A) $\frac{4\pi}{3}$ B) $\frac{8\pi^2}{3}$ C) $\frac{5\pi}{3}$ D) $\frac{8\pi^2}{5}$

17. Three identical spheres each of mass 1 kg are placed touching one another with their centres in a straight line. Their centres are marked as A, B, C respectively. The distance of centre of mass of the system from A is

A) $\frac{AB + AC}{2}$ B) $\frac{AB + BC}{2}$ C) $\frac{AC - AB}{3}$ D) $\frac{AB + AC}{3}$

18. The relation between force 'F' and density 'd' is $F = \frac{x}{\sqrt{d}}$. The dimensions of x are

A) $[L^{-1/2} M^{3/2} T^{-2}]$ B) $[L^{-1/2} M^{1/2} T^{-2}]$

C) $[L^{-1} M^{3/2} T^{-2}]$ D) $[L^{-1} M^{1/2} T^{-2}]$

19. When a wave travels in a medium, displacement of a particle is given by $y = a \sin 2\pi (bt - cx)$ where 'a', 'b', 'c' are constants. The maximum particle velocity will be twice the wave velocity if

A) $b = ac$ B) $b = \frac{1}{ac}$ C) $c = \pi a$ D) $c = \frac{1}{\pi a}$

SPACE FOR ROUGH WORK

20. Electromagnets are made of soft iron because soft iron has
    A) high susceptibility and low retentivity
    B) low susceptibility and high retentivity
    C) low susceptibility and low retentivity
    D) high susceptibility and high retentivity

21. If 'N' is the number of turns in a circular coil then the value of self inductance varies as
    A) N^0 B) N C) N^2 D) N^{-2}

22. Surface density of charge on a sphere of radius 'R' in terms of electric intensity 'E' at a distance 'r' in free space is
    ($\in_0$ = permittivity of free space)
    A) $\in_0 E\left(\frac{R}{r}\right)^2$ B) $\frac{\in_0 ER}{r^2}$ C) $\in_0 E\left(\frac{r}{R}\right)^2$ D) $\frac{\in_0 Er}{R^2}$

23. A body at rest starts sliding from top of a smooth inclined plane and requires 4 second to reach bottom. How much time does it take, starting from rest at top, to cover one-fourth of a distance ?
    A) 1 second B) 2 second C) 3 second D) 4 second

24. In vacuum, to travel distance 'd', light takes time 't' and in medium to travel distance '5d', it takes time 'T'. The critical angle of the medium is
    A) $\sin^{-1}\left(\frac{5T}{t}\right)$ B) $\sin^{-1}\left(\frac{5t}{3T}\right)$ C) $\sin^{-1}\left(\frac{5t}{T}\right)$ D) $\sin^{-1}\left(\frac{3t}{5T}\right)$

25. In electromagnetic spectrum, the frequencies of γ -rays, X-rays and ultraviolet rays are denoted by n_1, n_2 and n_3 respectively then
    A) $n_1 > n_2 > n_3$ B) $n_1 < n_2 < n_3$ C) $n_1 > n_2 < n_3$ D) $n_1 < n_2 > n_3$

SPACE FOR ROUGH WORK

26. Two charges of equal magnitude 'q' are placed in air at a distance '2a' apart and third charge '–2q' is placed at midpoint. The potential energy of the system is ($\in_0$ = permittivity of free space)

A) $-\frac{q^2}{8\pi\in_0 a}$ B) $-\frac{3q^2}{8\pi\in_0 a}$ C) $-\frac{5q^2}{8\pi\in_0 a}$ D) $-\frac{7q^2}{8\pi\in_0 a}$

27. An electron in potentiometer wire experiences a force 2.4×10^{-19} N. The length of potentiometer wire is 6m. The e.m.f. of the battery connected across the wire is (electronic charge = 1.6×10^{-19}C)

A) 6 V B) 9 V C) 12 V D) 15 V

28. The dimensional formula for Reynold's number is

A) $[L^0 M^0 T^0]$ B) $[L^1 M^1 T^1]$

C) $[L^{-1} M^1 T^1]$ D) $[L^1 M^1 T^{-1}]$

29. Calculate angular velocity of earth so that acceleration due to gravity at 60° latitude becomes zero. (Radius of earth = 6400 km, gravitational acceleration at poles = $10\ m/s^2$, cos 60° = 0.5)

A) 7.8×10^{-2} rad/s B) 0.5×10^{-3} rad/s

C) 1×10^{-3} rad/s D) 2.5×10^{-3} rad/s

30. A stationary object explodes into masses m_1 and m_2. They move in opposite directions with velocities V_1 and V_2. The ratio of kinetic energy E_1 to kinetic energy E_2 is

A) $\frac{m_2}{m_1}$ B) $\frac{m_1}{m_2}$ C) $\frac{2m_2}{m_1}$ D) $\frac{2m_1}{m_2}$

31. In LCR series circuit, an alternating e.m.f. 'e' and current 'i' are given by the equations

e = 100 sin (100 t) volt,

$i = 100 \sin\left(100t + \frac{\pi}{3}\right)$ mA.

The average power dissipated in the circuit will be

A) 100 W B) 10 W C) 5 W D) 2.5 W

SPACE FOR ROUGH WORK

32. A block resting on the horizontal surface executes S.H.M. in horizontal plane with amplitude 'A'. The frequency of oscillation for which the block just starts to slip is (μ = coefficient of friction, g = gravitational acceleration)

A) $\frac{1}{2\pi}\sqrt{\frac{\mu g}{A}}$ B) $\frac{1}{4\pi}\sqrt{\frac{\mu g}{A}}$ C) $2\pi\sqrt{\frac{A}{\mu g}}$ D) $4\pi\sqrt{\frac{A}{\mu g}}$

33. A plane sound wave travelling with velocity 'v' in a medium A reaches a point on the interface of medium A and medium B. If velocity of sound in medium B is 2v, the angle of incidence for total internal reflection of the wave will be greater than ($\sin 30° = 0.5$ and $\sin 90° = 1$)

A) 15° B) 30° C) 45° D) 90°

34. A gas is compressed isothermally. The r.m.s. velocity of its molecules

A) increases B) decreases

C) first increases and then decreases D) remains the same

35. Two concentric spheres kept in air have radii 'R' and 'r'. They have similar charge and equal surface charge density 'σ'. The electric potential at their common centre is

($\in_0$ = permittivity of free space)

A) $\frac{\sigma(R+r)}{\in_0}$ B) $\frac{\sigma(R-r)}{\in_0}$ C) $\frac{\sigma(R+r)}{2\in_0}$ D) $\frac{\sigma(R+r)}{4\in_0}$

36. If an electron in hydrogen atom jumps from an orbit of level n = 3 to an orbit of level n = 2, emitted radiation has a frequency (R = Rydberg's constant, C = velocity of light)

A) $\frac{3RC}{27}$ B) $\frac{RC}{25}$ C) $\frac{8RC}{9}$ D) $\frac{5RC}{36}$

37. In electromagnetic wave, according to Maxwell, changing electric field gives

A) stationary magnetic field B) conduction current

C) eddy current D) displacement current

38. The de-Broglie wavelength of an electron in 4^{th} orbit is (r = radius of 1^{st} orbit)

A) $2\pi r$ B) $4\pi r$ C) $8\pi r$ D) $16\pi r$

SPACE FOR ROUGH WORK

39. A string of length 'L' and force constant 'K' is stretched to obtain extension 'l'. It is further stretched to obtain extension 'l_1'. The work done in second stretching is

A) $\frac{1}{2} K l_1 (2l + l_1)$ B) $\frac{1}{2} K l_1^2$ C) $\frac{1}{2} K (l^2 + l_1^2)$ D) $\frac{1}{2} K (l_1^2 - l^2)$

40. The equiconvex lens has focal length 'f'. If it is cut perpendicular to the principal axis passing through optical centre, then focal length of each half is

A) $f/2$ B) f C) $3f/2$ D) 2f

41. In common base circuit of a transistor, current amplification factor is 0.95. Calculate the emitter current if base current is 0.2 mA

A) 2 mA B) 4 mA C) 6 mA D) 8 mA

42. The ratio of magnetic dipole moment of an electron of charge 'e' and mass 'm' in Bohr's orbit in hydrogen atom to its angular momentum is

A) $\frac{e}{m}$ B) $\frac{m}{e}$ C) $\frac{2m}{e}$ D) $\frac{e}{2m}$

43. Gases exert pressure on the walls of the container because the gas molecules

A) have finite volume B) obey Boyle's law
C) possess momentum D) collide with one another

44. Two coherent sources of intensity ratio 'α' interfere. In interference pattern $\frac{I_{max} - I_{min}}{I_{max} + I_{min}} =$

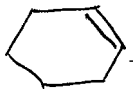
A) $\frac{2\alpha}{1+\alpha}$ B) $\frac{2\sqrt{\alpha}}{1+\alpha}$ C) $\frac{2\alpha}{1+\sqrt{\alpha}}$ D) $\frac{1+\alpha}{2\alpha}$

45. Light of wavelength λ_A and λ_B falls on two identical metal plates A and B respectively. The maximum kinetic energy of photoelectrons in K_A and K_B respectively, then which one of the following relations is true ? ($\lambda_A = 2\lambda_B$)

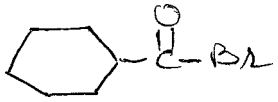
A) $K_A < \frac{K_B}{2}$ B) $2 K_A = K_B$ C) $K_A = 2 K_B$ D) $K_A > 2 K_B$

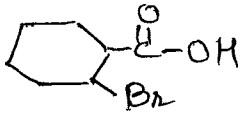
SPACE FOR ROUGH WORK

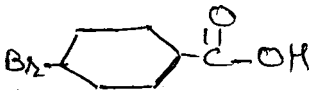
CHEMISTRY

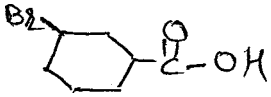
46.  $\xrightarrow{HBr}$ 'A' $\xrightarrow{KCN}$ 'B' $\xrightarrow{H_3O^+}$ 'C' $\xrightarrow[(ii)\ H_2O]{(i)Br_2\ /\ red\ P}$ 'D'

Identify the compound 'D' in above mentioned series of reactions.

A) 

B) 

C) 

D) 

47. Which among the following gases can be liquified easily ?

A) Chlorine B) Nitrogen C) Oxygen D) Hydrogen

48. What is the mass of one molecule of yellow phosphorus ? (Atomic mass, P = 30)

A) 1.993×10^{-22} kg B) 1.993×10^{-19} mg

C) 4.983×10^{-20} mg D) 4.983×10^{-23} kg

49. Ozone is present as a chief constituent in which region of the atmosphere ?

A) Troposphere B) Stratosphere

C) Mesosphere D) Thermosphere

50. The plot of square root of frequency of X-ray emitted against atomic number led to suggestion of which law/rule ?

A) Periodic law B) Modern periodic law

C) Hund's rule D) Newland's law

51. Benzene can be conveniently converted into n-propyl benzene by

A) Friedel – Craft alkylation with n-propyl chloride

B) Friedel – Craft acylation with propionyl chloride followed by Wolff – Kishner reduction

C) Friedel – Craft acylation with propionyl chloride followed by catalytic hydrogenation

D) Friedel – Craft acylation with propionyl chloride followed by reduction with $LiAlH_4$

SPACE FOR ROUGH WORK

52. Select the diamagnetic complex ion amongst the following complexes

(Atomic No. Fe = 26, Co = 27)

A) $K_3[Fe(CN)_6]$ B) $[Co(NH_3)_6]Cl_3$

C) $K_3[FeF_6]$ D) $K_3[CoF_6]$

53. One mole of stachyose on hydrolysis yields

A) 1 mole of glucose + 1 mole of fructose + 2 mole of galactose

B) 2 mole of glucose + 1 mole of fructose + 1 mole of galactose

C) 1 mole of glucose + 2 mole of fructose + 1 mole of galactose

D) 2 mole of glucose + 2 mole of fructose

54. An organic compound 'X' having molecular formula $C_4H_{11}N$ reacts with p-toluene sulphonyl chloride to form a compound 'Y' that is soluble in aqueous KOH. Compound 'X' is optically active and reacts with acetyl chloride to form compound 'Z'. Identify the compound 'Z'

A) $CH_3CH_2CH_2CH_2NHCOCH_3$ B) $CH_3CH_2\underset{\displaystyle CH_3}{\underset{|}{C}}HNHCOCH_3$

C) $CH_3\underset{\displaystyle CH_3}{\underset{|}{C}}HCH_2NHCOCH_3$ D) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-NHCOCH_3$

55. If average velocity of a sample of gas molecules at 300 K is 5 cm s^{-1}, what is RMS velocity of same sample of gas molecules at the same temperature ? (Given, $\alpha : u : v = 1 : 1.224 : 1.127$)

A) 6.112 cm/s B) 4.605 cm/s C) 4.085 cm/s D) 5.430 cm/s

SPACE FOR ROUGH WORK

56. Which of the following complexes has lowest molar conductance ?

A) $CoCl_3 . 3NH_3$ B) $CoCl_3 . 4NH_3$

C) $CoCl_3 . 5NH_3$ D) $CoCl_3 . 6NH_3$

57. The volume of oxygen evolved at STP, by decomposition of 0.68 g '20 volume' hydrogen peroxide solution, is

A) 2.24 mL B) 22.4 mL C) 224 mL D) 2240 mL

58. What is the molality of a solution containing 200 mg of urea (molar mass 60 g mol^{-1}) dissolved in 40 g of water ?

A) 0.0825 B) 0.825 C) 0.498 D) 0.0013

59. Alkaline hydrolysis of which among the following compounds leads to the formation of a racemate ?

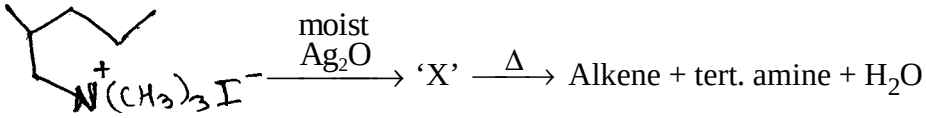
A) 1-Bromo-1-phenylethane B) 1-Chloro-3-methylbutane

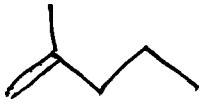
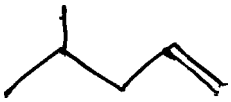
C) Bromoethane D) 1-Chloropropane

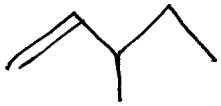
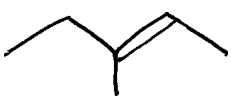
60. The work done when two mole of an ideal gas is compressed from a volume of 5 m^3 to 1 dm^3 at 300 K, under a pressure of 100 kPa is

A) 499.9 kJ B) – 499.9 kJ C) –99.5 kJ D) 42495 kJ

61. Identify the alkene that is produced in the following series of reactions



A)  B) 

C)  D) 

SPACE FOR ROUGH WORK

62. 'X' is an optically active alkane having lowest molecular mass. Predict the structure of the major product obtained on monochlorination of 'X'

A) $CH_3 - CH_2 - CH_2 - \underset{\displaystyle Cl}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}} - CH_2 - CH_3$

B) $CH_3 - CH_2 - CH_2 - \overset{\displaystyle CH_3}{\overset{|}{CH}} - \underset{\displaystyle Cl}{\overset{|}{CH}} - CH_3$

C) $CH_3 - CH_2 - CH_2 - \overset{\displaystyle CH_3}{\overset{|}{CH}} - CH_2 - CH_2 - Cl$

D) $Cl - CH_2 - CH_2 - CH_2 - \overset{\displaystyle CH_3}{\overset{|}{CH}} - CH_2 - CH_3$

63. Butylated hydroxy toluene is used in

A) preventing oxidative rancidity of fats B) preserving food grains

C) killing bacteria in living tissues D) reducing stress and anxiety

64. Deficiency of which vitamin causes degeneration of spinal cord ?

A) E B) K C) B_{12} D) A

65. Bond order of which among the following molecules is zero ?

A) F_2 B) O_2 C) Be_2 D) Li_2

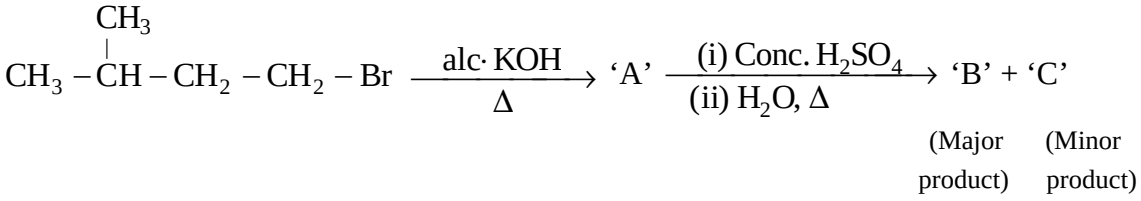
66. What is the geometry of molecule of bromine penta fluoride ?

A) square planar B) trigonal bipyramidal

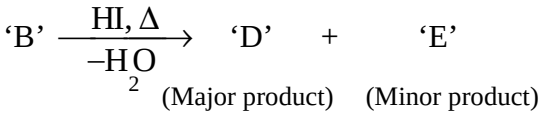
C) square pyramidal D) octahedral

SPACE FOR ROUGH WORK

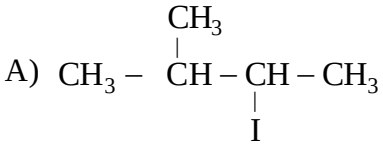
67. Identify the compound 'D' in the following series of reactions

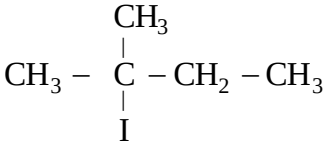


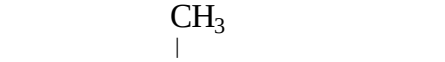
'B' (Major product) + 'C' (Minor product)



'D' (Major product) + 'E' (Minor product)

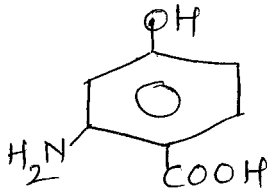
A) 

B) 

C) 

D) 

68. Write IUPAC name of following compound



A) 2-Amino-4-hydroxybenzoic acid
B) 6-Amino-4-hydroxybenzoic acid
C) 3-Amino-4-carboxyphenol
D) 2-Carboxy-5-hydroxyaniline

69. Which among the following metals is employed to provide cathodic protection to iron ?

A) Zinc B) Nickel C) Tin D) Lead

SPACE FOR ROUGH WORK

70. Oxidation number of nitrogen in which among the oxides of nitrogen is the lowest ?
    A) Nitric oxide B) Nitrous oxide
    C) Nitrogen dioxide D) Nitrogen trioxide

71. The compound that yields only ketonic compound/s on ozonolysis is
    A) But-2-ene B) Pent-2-ene
    C) 2, 3-Dimethylbut-2-ene D) 2-Methylbut-2-ene

72. Which among the following metals is refined by electrolytic method ?
    A) Aluminium B) Bismuth C) Tin D) Lead

73. The two monomers used in the preparation of dextron are
    A) 3-hydroxy butanoic acid and 3-hydroxy pentanoic acid
    B) $\in$ amino caproic acid and glycine
    C) Isobutylene and isoprene
    D) Lactic acid and glycolic acid

74. Which oxyacid of sulphur contains S-S single bond ?
    A) Oleum B) Marshall's acid
    C) Dithionic acid D) Thiosulphuric acid

75. Amongst the followings, select the element having highest ionization enthalpy
    A) Sodium B) Potassium C) Beryllium D) Magnesium

76. Select the ether among following that yields methanol as one of the products on reaction with cold hydroiodic acid
    A) 1-Methoxybutane B) 1-Methoxy-2-methylpropane
    C) 2-Methoxy-2-methylpropane D) Methoxybenzene

SPACE FOR ROUGH WORK

77. Rate law for the reaction A + B $\rightarrow$ product is rate = k $[A]^2$ [B]. What is the rate constant, if rate of reaction at a given temperature is 0.22 Ms^{-1}, when [A] = 1 M and [B] = 0.25 M.

A) 3.52 M^{-2} s^{-1} B) 0.88 M^{-2} s^{-1}

C) 1.136 M^{-2} s^{-1} D) 0.05 M^{-2} s^{-1}

78. Presence of nitrogen in which among the following compounds can NOT be detected by Lassaigne method ?

A) Hydrazine B) Aniline C) p-Toluidine D) Picric acid

79. 20 ml solution of 0.1 M ferrous sulphate was completely oxidised using a suitable oxidising agent. What is the number of electrons exchanged ?

A) 1.204×10^{22} B) 193 C) 1930 D) 1.204×10^{21}

80. Among the following select the alkane that is expected to have lowest boiling point

A) Hexane B) 2-Methylpentane

C) 3-Methylpentane D) 2, 2-Dimethylbutane

81. Which statement is NOT correct about fullerene C_{60} ?

A) It contains 20 six membered rings and 12 five membered rings

B) All carbon atoms undergo SP^2 hybridization

C) A six membered ring is fused with six membered rings only

D) A five membered ring is fused with six membered ring only

82. The product of molar concentrations of hydrogen ions and hydroxide ions in a 0.01 M aqueous solution of sodium chloride is known as

A) Hydrolysis constant of salt B) Dissociation constant of acid

C) Dissociation constant of base D) Ionic product of water

SPACE FOR ROUGH WORK

83. Select the coloured compound amongst the following :

(Atomic no. Ti = 22, Cr = 24, Cu = 29, Zn = 30)

A) $TiCl_4$ B) $CrCl_3$ C) $ZnCl_2$ D) CuCl

84. Which among the following solids crystalises as a face centred cube ?

A) Iron B) Rubidium C) Uranium D) Platinum

85. What is the pH of millimolar solution of ammonium hydroxide which is 20% dissociated ?

A) 3.699 B) 10.301 C) 4.691 D) 9.301

86. Which among the following group 16 elements exists in more than two allotropic states ?

A) Polonium B) Tellurium C) Selenium D) Oxygen

87. Solubility of which among the following substances in water increases slightly with rise in temperature ?

A) Potassium bromide B) Potassium chloride

C) Potassium nitrate D) Sodium nitrate

88. Assuming enthalpy of combustion of hydrogen at 273 K, –286 kJ and enthalpy of fusion of ice at the same temperature to be + 6.0 kJ, calculate enthalpy change during formation of 100 g of ice

A) + 1622 kJ B) – 1622 kJ C) +292 kJ D) –292 kJ

89. How is electrical conductance of a conductor related with length and area of cross section of the conductor ?

A) $G = l \,.\, a.\, k^{-1}$ B) $G = k \,.\, l.\, a^{-1}$

C) $G = k.\, a.\, l^{-1}$ D) $G = k.\, l.\, a^{-2}$

90. What is the orbital angular momentum of an electron in 'f' orbital ?

A) $\frac{1.5h}{\pi}$ B) $\frac{\sqrt{6}h}{\pi}$ C) $\frac{\sqrt{3}h}{\pi}$ D) $\frac{\sqrt{3}h}{2\pi}$

SPACE FOR ROUGH WORK

BIOLOGY

91. The inactive protoxin is activated in the gut of the insect by
    A) acidic pH B) alkaline pH
    C) low temperature D) high temperature

92. In angiosperms, the formation of two male gametes from a pollen grain involves _____ divisions.
    A) one meiotic and one mitotic B) two meiotic and two mitotic
    C) only two mitotic D) only two meiotic

93. In a plant cell the Diffusion Pressure Deficit is zero when it is_____
    A) plasmolysed B) turgid C) flaccid D) incipient

94. The life cycle of algae such as *Spirogyra* is
    A) haplontic B) diplontic
    C) haplo-diplontic D) diplo-haplontic

95. During which stage of Prophase I, genetic recombination of parental characters, takes place ?
    A) Zygotene B) Pachytene C) Diplotene D) Diakinesis

96. Gross primary productivity is the rate of production of _____ during photosynthesis.
    A) organic matter B) oxygen
    C) carbon di-oxide D) Chlorophyll

97. Flowers showing basipetal succession are observed in
    A) *Caesalpinia* and *Clerodendron* B) Jasmine and Gold mohar
    C) Gold mohar and *Caesalpinia* D) *Clerodendron* and Jasmine

98. The total number of types of gametes produced in a cross between a negro and albino parent is
    A) 64 B) 16 C) 08 D) 04

99. Enzymes required for phosphorylation are located in _____ of chloroplast.
    A) Peristromium B) Plastidome C) Stroma D) Quantosome

100. Afforestation is
    A) restoring a forest B) plantation in barren lands
    C) cultivation under agriculture D) jhum cultivation

101. Animals obtain all their carbon through
    A) plants B) soil C) air D) water

102. Which one of the following is NOT true about monocotyledonae ?
   A) embryo has single cotyledon
   B) leaves show parallel venation
   C) flowers are generally trimerous
   D) vascular bundles are conjoint, collateral and open

103. How many NAD molecules get reduced in complete oxidation of one glucose molecule ?
   A) 2 B) 5 C) 10 D) 12

104. Which one of the following is used in the production of citric acid ?
   A) *Aspergillus niger* B) *Rhizopus arrhizus*
   C) *Acetobacter aceti* D) *Saccharomyces cerevisiae*

105. What will be the number of histone molecules in a chromatin fibre having 50 nucleosomes ?
   A) 400 B) 450 C) 500 D) 1000

106. In India, research in genetic modification of organisms and safety issues are controlled by
   A) DBT B) IARI C) CSIR D) GEAC

107. Guttation occurs through_____
   A) roots B) hydathode C) trichome D) stomata

108. A couple, both carriers for the gene sickle cell anaemia planning to get married, wants to know the chances of having anaemic progeny ?
   A) 100% B) 75% C) 50% D) 25%

109. A simple, living permanent tissue which is absent in roots is_____
   A) Collenchyma B) Chlorenchyma
   C) Aerenchyma D) Parenchyma

110. Which of the following show dimorphic chloroplast ?
   A) Mango B) Castor C) Banyan D) Amaranthus

111. In *Albizzia*, vegetative propagation takes place with the help of
   A) fasciculated tuberous roots B) epiphyllous buds
   C) subaerial branches D) nonfleshy roots

112. Which of the following cross will give recessive progeny in F_1 generation ?
   A) TT × tt B) Tt × TT C) tt × tt D) TT × TT

113. Select the correct statements from the following :

I. Endosperm is generally triploid in angiosperms.

II. All angiosperms have monosporic and endosporic embryo sac.

III. Angiosperms are characterised by double-fertilization.

IV. All angiosperms show-indirect pollination and siphonogamy.

A) I, II and III B) II, III and IV C) I, III and IV D) I, II, III and IV

114. The structure producing basidium in Basidiomycetes is formed by the fusion of

A) two vegetative cells B) two male gametes

C) two female gametes D) male and female gametes

115. The sequence of nucleotides AUGCUUCUC indicates that it is a segment of

A) sense strand of DNA B) anti sense strand of DNA

C) RNA D) polypeptide chain

116. Multicostate divergent reticulate venation is seen in _____ leaf.

A) *Zizyphus* B) Bamboo C) Castor D) Mango

117. Synthesis of one glucose molecule requires _____ reduced NADP molecules.

A) 6 B) 12 C) 18 D) 24

118. The arrangement of vascular tissue in hadrocentric vascular bundle is_____

A) concentric B) radial C) collateral D) bicollateral

119. 'Cry' gene is obtained from

A) *Agrobacterium tumefaciens* B) *Bacillus thuringiensis*

C) *Rhizobium leguminosarum* D) *Rhizobium phaseoli*

120. Identify the incorrect match between the protein and its role.

A) Keratin – structural component of hair

B) Immunoglobulins – protection of body against diseases

C) Haemoglobin – transport of O_2 in muscles

D) Thrombin – blood clotting

121. The largest collection of herbarium in India is

A) Central National Herbarium, Kolkata

B) Southern Circle Herbarium, Coimbatore

C) Central Circle Herbarium, Allahabad

D) Blatter Herbarium, Mumbai

122. Enzyme enolase catalyses the conversion of 2 PGA to phosphoenol Pyruvic acid in presence of _____ which is the cofactor.
A) Mn^{++} B) Fe^{++} C) Mg^{++} D) Zn^{++}

123. Excess of Manganese inhibits the translocation of _____ to the shoot apex.
A) Calcium B) Potassium C) Iron D) Magnesium

124. The correct sequence of the substages of Prophase I is
A) Diakinesis → Pachytene → Diplotene → Zygotene → Leptotene
B) Leptotene → Zygotene → Pachytene → Diplotene → Diakinesis
C) Pachytene → Zygotene → Leptotene → Diplotene → Diakinesis
D) Leptotene → Zygotene → Diplotene → Diakinesis → Pachytene

125. Capsule is a kind of _____ fruit.
A) simple, dry and dehiscent B) simple, dry and indehiscent
C) an aggregate D) simple and fleshy

126. In plant breeding, the entire collection of plants/seeds having the diverse alleles of all genes in a particular organism is called
A) gene bank B) cDNA library C) genomic library D) germ plasm

127. Acetylation of Pyruvate takes place in the _____
A) perimitochondrial space B) mitochondrial matrix
C) cristae D) F_1 particles

128. Cross pollination does not occur in
A) allogamous flowers B) geitonogamous flowers
C) cleistogamous flowers D) chasmogamous flowers

129. Which one of the following is a dicot weedicide ?
A) 2, 4-D B) NAA C) IBA D) IAA

130. Senescense in plants leads into _____ of cells.
A) increase in size B) increase in number
C) death D) differentiation

131. Which one of the following is the first group of vascular plants ?
A) Thallophyta B) Bryophyta
C) Pteridophyta D) Spermatophyta

132. An angiospermic male plant with 24 chromosomes in its pollen mother cells is crossed with female plant bearing 24 chromosomes in its root cells. What would be the ploidy of embryo and endosperm respectively formed after this cross ?
A) 24 and 48 B) 24 and 24 C) 48 and 72 D) 24 and 36

133. Which one of the following has bast fibres ?
A) parenchyma B) sclerenchyma C) phloem D) xylem

134. In how many interlocking rings are the carbon atoms arranged in a steroid molecule ?
A) 1 B) 2 C) 3 D) 4

135. What are the spindle fibres that connect the centromere of chromosome to the respective poles called ?
A) Astral rays B) Interpolar fibres
C) Chromosomal fibres D) Inter chromosomal fibres

136. Which of the following produces erythropoietin ?
A) Kidney B) Pancreas C) Pineal gland D) Thyroid gland

137. Identify the correct match from the Columns I, II and III.

I	II	III
1. Interstitial cells	a. Cortex of ovary	i. Follicular fluid
2. Sertoli cells	b. Ovarian follicle	ii. Progesterone
3. Granulosa cells	c. Testis	iii. Attachment of sperm bundle
4. Cells of corpus luteum	d. Seminiferous tubules	iv. Testosterone

A) 2-a-iii, 1-c-iv, 3-b-i, 4-d-ii B) 1-c-iv, 2-d-iii, 3-b-i, 4-a-ii
C) 1-d-iii, 2-a-iv, 3-b-i, 4-c-ii D) 2-d-iii, 1-c-iv, 3-a-ii, 4-b-iv

138. Which of the following is correct match ?

I	II	III
A) Thalassemia	a) XO	i) Flat nose, simian crease
B) Down's syndrome	b) 42 AA + XY	ii) Webbing of neck
C) Turner's syndrome	c) 44 AA + XXX	iii) Anaemia, jaundice
D) Klinefelter's syndrome	d) 44 AA + XXY	iv) Tall thin eunuchoid

139. Which is CORRECT regarding genetically engineered insulin using *E. coli* ?
A) Difficult to purify
B) Obtained in large unlimited quantities
C) Possibility of transmission of animal diseases
D) Insulin obtained varies in chemical structure

140. Dobson unit is used in measurement of _____ level.
A) Chlorofluoro carbons B) Nitrous oxide
C) Ozone D) UV – B radiation

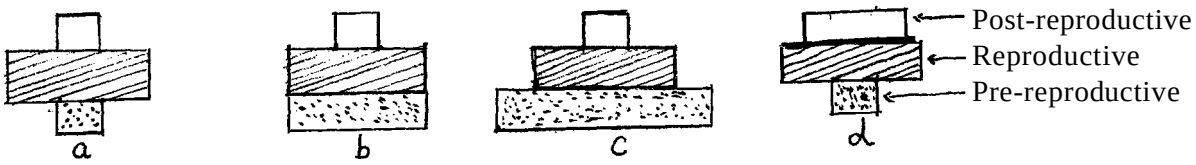
141. Which of the following store proteins ?
A) Chromoplasts B) Aleuroplasts C) Amyloplasts D) Elaioplasts

142. Pneumotaxic centre is located in_____
A) Medulla oblongata B) Pons
C) Cerebrum D) Diencephalon

143. In case of a couple where a man is having very low sperm count, which of the following technique will be suitable for fertilization ?
A) Infra uterine transfer
B) Gamete intra cytoplasmic fallopian transfer
C) Artificial insemination
D) Intra cytoplasmic sperm injection

144. The rise of 1st primates occurred in _____ epoch.
A) Palaeocene B) Oligocene C) Miocene D) Eocene

145. Which of the following statements correctly correlates with the diagrams ?



A) a and b are steady population B) a and d are declining population
C) c and d are growing population D) b and d are declining population

146. Cellular organization of body is present in
A) Annelida B) Platyhelminthes
C) Porifera D) Urochordata

147. In the following process of digestion, the enzymes at location 'X' and 'Y' are respectively

proteins $\xrightarrow{X}$ proteoses and peptones $\xrightarrow{Y}$ Dipeptides

A) Chymotrypsin and pepsin B) Pepsin and trypsin
C) Ptyalin and pepsin D) Trypsin and di-peptidase

148. Find out the correct match from the following table :

	Column I	Column II	Column III
i.	Corpus luteum	Progesteron	Degeneration of endometrium
ii.	Pineal gland	Vasopressin	Intracellular transport
iii.	Pars nervosa	Coherin	Induces contraction of jejunum

A) i only B) i and ii
C) iii only D) ii and iii

149. The colostrum provides_____
A) Naturally acquired active immunity B) Naturally acquired passive immunity
C) Artificially acquired active immunity D) Artificially acquired passive immunity

150. Identify and select the correct Match in the Columns I, II and III.

	I		II		III
A)	Earthworm	–	Annelida	–	Superclass
B)	Frog	–	*Rana*	–	Species
C)	Lancelet	–	Vertebrata	–	Division
D)	Walrus	–	Mammalia	–	Class

151. The structure which prevents the entry of food particles into the respiratory passage is ____
A) Epiglottis B) Glottis C) Larynx D) Pharynx

152. Identify vertebrochondral ribs from the following :
A) All 12 pairs of ribs B) 1^{st} to 7^{th} pairs of ribs
C) 8^{th}, 9^{th} and 10^{th} pairs of ribs D) 11^{th} and 12^{th} pairs of ribs

153. "Testis are extraabdominal in position". Which of the following is most appropriate reason ?
A) Narrow pelvis in male
B) Special protection for testis
C) Prostate gland and seminal vesicles occupy maximum space
D) 2.0 – 2.5° C lower than the normal body temperature

154. The Malignant malaria is caused by _____
A) *Plasmodium vivax* B) *Plasmodium malariae*
C) *Plasmodium ovale* D) *Plasmodium falciparum*

155. The total number of podomeres in each leg of cockroach is_____
A) 5 B) 6 C) 7 D) 8

156. The correct match is
I. DCT – Secretion of H^+ and K^+ ions
II. Henle's loop – Reabsorption of glucose, water and Na^+ ions
III. Podocytes – Attached to parietal layer of Bowman's capsule
IV. JGA – Rise in glomerular blood pressure activates it to release rennin
A) III B) II C) I D) IV

157. The diurnal rhythms are regulated by_____
A) Adrenalin B) Melatonin C) Serotonin D) Vasopressin

158. In DNA fingerprinting technique, _____ probe is used for hybridization of DNA fragments.
A) Double stranded RNA B) Double stranded non-radio active DNA
C) Single stranded radio active DNA D) Single stranded radio active RNA

159. Find the Odd one out :
A) *Adamsia* B) *Astraea* C) *Physalia* D) *Pleurobrachia*

160. The totipotent cell can form a _____
A) Bud B) Cell membrane
C) Cell organelle D) Complete new organism

161. In cockroach, the common duct of salivary reservoir opens at the base of the _____
A) Pharynx B) Maxilla C) Mandible D) Hypopharynx

162. The wall of urinary bladder in humans shows a thick layer of smooth muscle called_____
A) Dartos B) Detrusor C) Deltoid D) Depressor

163. Identify the correct match :

Accessory glands	**Functions**
i. Seminal vesicles	a. Lubricates vagina
ii. Prostate gland	b. Provide energy, coagulation of sperm
iii. Cowper's gland	c. Neutralizes acidity of vagina

A) i-b, ii-c, iii-a B) i-c, ii-b, iii-a
C) i-a, ii-c, iii-b D) i-c, ii-a, iii-b

164. The technique used to block the passage of sperm in male_____
A) Tubectomy B) Vasectomy
C) Coitus interruptus D) Rhythm method

165. Find the incorrect match :

I	**II**	**III**
i. Crab	Sacculina	Interaction + +
ii. Human being	Mosquito	Interaction – +
iii. Sea anemone	Hermit crab	Interaction + 0

A) i only B) ii and iii C) iii and i D) ii only

166. The nodal tissue located in the lower left corner of the right atrium is _____
A) SA node B) AV node C) AV bundle D) Purkinje fibres

167. Which of the following hormones initiate the parturition ?
A) ACTH, HCG, Oxytocin
B) ACTH, Corticosteroid, Oxytocin
C) Corticosteroid, ACTH, Prostaglandin
D) ACTH, Progesteron, HCG

168. The primary lymphoid organ is_____
A) Tonsils B) Payer's patches
C) Lymph nodes D) Thymus

169. Synapse is_____
A) Crossing over between non-homologous chromosomes
B) Pairing of homologous chromosomes
C) Junction between axon and dendrites of two different neurons
D) Zig zag junctions in cardiac muscle fibres

170. Which of the following animal has enucleated erythrocytes ?
A) Earthworm B) Sepia C) Frog D) Rat

171. The salivary amylase shows maximum digestive action at pH_____
A) 3.6 B) 6.8 C) 7.5 D) 8.5

172. The central hollow portion of the vertebra is called_____
A) Neural canal B) Central canal
C) Auditory canal D) Vertebro-arterial canal

173. The depolarization of nerve membrane takes place through influx of _____ ions.
A) Calcium B) Potassium C) Sodium D) Magnesium

174. Which of the following is used to promote growth of new blood vessels, thus helping in wound healing ?
A) HUMULIN B) TPA
C) TGF – B D) α – 1 antitrypsin

175. Select the correct statement regarding the Schwann cells
A) Surround axon of myelinated nerve fibre
B) Support muscle fibres
C) Found in Haversian system of bones
D) Form basement membrane of epithelium

176. The structural unit of bone is_____
A) chondrin B) cyton C) osteon D) ossein

177. The stato-acoustic receptor responds to changes in the_____
A) Light and pressure B) Pressure and touch
C) Pain and pressure D) Sound and equilibrium

178. The chromosome with centromere near the end is called_____
A) Acrocentric B) Metacentric
C) Sub-metacentric D) Telocentric

179. One of the following is NOT a possible reason for use of CNG in automobiles
A) It can be adulterated B) It is cheaper than petrol
C) It burns more efficiently D) It reduces pollution

180. Oviparous mammal is_____
A) *Equus* B) *Macropus*
C) *Ornithorhynchus* D) *Pteropus*

SPACE FOR ROUGH WORK

LOGARITHMS

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
10	0000	0043	0086	0128	0170						5	9	13	17	21	26	30	34	38
						0212	0253	0294	0334	0374	4	8	12	16	20	24	28	32	36
11	0414	0453	0492	0531	0569						4	8	12	16	20	23	27	31	35
						0607	0645	0682	0719	0755	4	7	11	15	18	22	26	29	33
12	0792	0828	0864	0899	0934						3	7	11	14	18	21	25	28	32
						0969	1004	1038	1072	1106	3	7	10	14	17	20	24	27	31
13	1139	1173	1206	1239	1271						3	6	10	13	16	19	23	26	29
						1303	1335	1367	1399	1430	3	6	10	13	16	19	22	25	29
14	1461	1492	1523	1553	1584						3	6	9	12	15	19	22	25	28
						1614	1644	1673	1703	1732	3	6	9	12	14	17	20	23	26
15	1761	1790	1818	1847	1875						3	6	9	11	14	17	20	23	26
						1903	1931	1959	1987	2014	3	6	8	11	14	17	19	22	25
16	2041	2068	2095	2122	2148						3	6	8	11	14	16	19	22	24
						2175	2201	2227	2253	2279	3	5	8	10	13	16	18	21	23
17	2304	2330	2355	2380	2405						3	5	8	10	13	15	18	20	23
						2430	2455	2480	2504	2529	3	5	8	10	12	15	17	20	22
18	2553	2577	2601	2625	2648						2	5	7	9	12	14	17	19	21
						2672	2695	2718	2742	2765	2	4	7	9	11	14	16	18	21
19	2788	2810	2833	2856	2878						2	4	7	9	11	13	16	18	20
						2900	2923	2945	2967	2989	2	4	6	8	11	13	15	17	19
20	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201	2	4	6	8	11	13	15	17	19
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404	2	4	6	8	10	12	14	16	18
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598	2	4	6	8	10	12	14	15	17
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	2	4	6	7	9	11	13	15	17
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962	2	4	5	7	9	11	12	14	16
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133	2	3	5	7	9	10	12	14	15
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	2	3	5	7	8	10	11	14	15
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456	2	3	5	6	8	9	11	13	14
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609	2	3	5	6	8	9	11	12	14
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757	1	3	4	6	7	9	10	12	13
30	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900	1	3	4	6	7	9	10	11	13
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038	1	3	4	6	7	8	10	11	12
32	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172	1	3	4	5	7	8	9	11	12
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302	1	3	4	5	6	8	9	10	12
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428	1	3	4	5	6	8	9	10	11
35	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551	1	2	4	5	6	7	9	10	11
36	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670	1	2	4	5	6	7	8	10	11
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	1	2	3	5	6	7	8	9	10
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899	1	2	3	5	6	7	8	9	10
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010	1	2	3	4	5	7	8	9	10
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117	1	2	3	4	5	6	8	9	10
41	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222	1	2	3	4	5	6	7	8	9
42	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325	1	2	3	4	5	6	7	8	9
43	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425	1	2	3	4	5	6	7	8	9
44	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522	1	2	3	4	5	6	7	8	9
45	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618	1	2	3	4	5	6	7	8	9
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712	1	2	3	4	5	6	7	7	8
47	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803	1	2	3	4	5	5	6	7	8
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893	1	2	3	4	4	5	6	7	8
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981	1	2	3	4	4	5	6	7	8

LOGARITHMS

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	1	2	3	3	4	5	6	7	8
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	1	2	3	3	4	5	6	7	8
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	1	2	2	3	4	5	6	7	7
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	1	2	2	3	4	5	6	6	7
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	1	2	2	3	4	5	6	6	7
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	1	2	2	3	4	5	5	6	7
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551	1	2	2	3	4	5	5	6	7
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627	1	2	2	3	4	5	5	6	7
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701	1	1	2	3	4	4	5	6	7
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774	1	1	2	3	4	4	5	6	7
60	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846	1	1	2	3	4	4	5	6	6
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917	1	1	2	3	4	4	5	6	6
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987	1	1	2	3	3	4	5	6	6
63	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055	1	1	2	3	3	4	5	5	6
64	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122	1	1	2	3	3	4	5	5	6
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189	1	1	2	3	3	4	5	5	6
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	1	1	2	3	3	4	5	5	6
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	1	1	2	3	3	4	5	5	6
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	1	1	2	3	3	4	4	5	6
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445	1	1	2	2	3	4	4	5	6
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506	1	1	2	2	3	4	4	5	6
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	1	1	2	2	3	4	4	5	5
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	1	1	2	2	3	4	4	5	5
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	1	1	2	2	3	4	4	5	5
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	1	1	2	2	3	4	4	5	5
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	1	1	2	2	3	3	4	5	5
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	1	1	2	2	3	3	4	5	5
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	1	1	2	2	3	3	4	4	5
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	1	1	2	2	3	3	4	4	5
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025	1	1	2	2	3	3	4	4	5
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	1	1	2	2	3	3	4	4	5
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	1	1	2	2	3	3	4	4	5
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	1	1	2	2	3	3	4	4	5
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	1	1	2	2	3	3	4	4	5
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	1	1	2	2	3	3	4	4	5
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	1	1	2	2	3	3	4	4	5
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	1	1	2	2	3	3	4	4	5
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	0	1	1	2	2	3	3	4	4
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	0	1	1	2	2	3	3	4	4
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	0	1	1	2	2	3	3	4	4
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	0	1	1	2	2	3	3	4	4
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	0	1	1	2	2	3	3	4	4
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	0	1	1	2	2	3	3	4	4
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	0	1	1	2	2	3	3	4	4
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	0	1	1	2	2	3	3	4	4
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	0	1	1	2	2	3	3	4	4
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	0	1	1	2	2	3	3	4	4
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	0	1	1	2	2	3	3	4	4
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	0	1	1	2	2	3	3	4	4
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	0	1	1	2	2	3	3	3	4

ANTILOGARITHMS

	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
0.00	1000	1002	1005	1007	1009	1012	1014	1016	1019	1021	0	0	1	1	1	1	2	2	2
0.01	1023	1026	1028	1030	1033	1035	1038	1040	1042	1045	0	0	1	1	1	1	2	2	2
0.02	1047	1050	1052	1054	1057	1059	1062	1064	1067	1069	0	0	1	1	1	1	2	2	2
0.03	1072	1074	1076	1079	1081	1084	1086	1089	1091	1094	0	0	1	1	1	1	2	2	2
0.04	1096	1099	1102	1104	1107	1109	1112	1114	1117	1119	0	1	1	1	1	2	2	2	2
0.05	1122	1125	1127	1130	1132	1135	1138	1140	1143	1146	0	1	1	1	1	2	2	2	2
0.06	1148	1151	1153	1156	1159	1161	1164	1167	1169	1172	0	1	1	1	1	2	2	2	2
0.07	1175	1178	1180	1183	1186	1189	1191	1194	1197	1199	0	1	1	1	1	2	2	2	2
0.08	1202	1205	1208	1211	1213	1216	1219	1222	1225	1227	0	1	1	1	1	2	2	2	3
0.09	1230	1233	1236	1239	1242	1245	1247	1250	1253	1256	0	1	1	1	1	2	2	2	3
0.10	1259	1262	1265	1268	1271	1274	1276	1279	1282	1285	0	1	1	1	1	2	2	2	3
0.11	1288	1291	1294	1297	1300	1303	1306	1309	1312	1315	0	1	1	1	2	2	2	2	3
0.12	1318	1321	1324	1327	1330	1334	1337	1340	1343	1346	0	1	1	1	2	2	2	2	3
0.13	1349	1352	1355	1358	1361	1365	1368	1371	1374	1377	0	1	1	1	2	2	2	3	3
0.14	1380	1384	1387	1390	1393	1396	1400	1403	1406	1409	0	1	1	1	2	2	2	3	3
0.15	1413	1416	1419	1422	1426	1429	1432	1435	1439	1442	0	1	1	1	2	2	2	3	3
0.16	1445	1449	1452	1455	1459	1462	1466	1469	1472	1476	0	1	1	1	2	2	2	3	3
0.17	1479	1483	1486	1489	1493	1496	1500	1503	1507	1510	0	1	1	1	2	2	2	3	3
0.18	1514	1517	1521	1524	1528	1531	1535	1538	1542	1545	0	1	1	1	2	2	2	3	3
0.19	1549	1552	1556	1560	1563	1567	1570	1574	1578	1581	0	1	1	1	2	2	3	3	3
0.20	1585	1589	1592	1596	1600	1603	1607	1611	1614	1618	0	1	1	1	2	2	3	3	3
0.21	1622	1626	1629	1633	1637	1641	1644	1648	1652	1656	0	1	1	2	2	2	3	3	3
0.22	1660	1663	1667	1671	1675	1679	1683	1687	1690	1694	0	1	1	2	2	2	3	3	3
0.23	1698	1702	1706	1710	1714	1718	1722	1726	1730	1734	0	1	1	2	2	2	3	3	4
0.24	1738	1742	1746	1750	1754	1758	1762	1766	1770	1774	0	1	1	2	2	2	3	3	4
0.25	1778	1782	1786	1791	1795	1799	1803	1807	1811	1816	0	1	1	2	2	2	3	3	4
0.26	1820	1824	1828	1832	1837	1841	1845	1849	1854	1858	0	1	1	2	2	3	3	3	4
0.27	1862	1866	1871	1875	1879	1884	1888	1892	1897	1901	0	1	1	2	2	3	3	3	4
0.28	1905	1910	1914	1919	1923	1928	1932	1936	1941	1945	0	1	1	2	2	3	3	4	4
0.29	1950	1954	1959	1963	1968	1972	1977	1982	1986	1991	0	1	1	2	2	3	3	4	4
0.30	1995	2000	2004	2009	2014	2018	2023	2028	2032	2037	0	1	1	2	2	3	3	4	4
0.31	2042	2046	2051	2056	2061	2065	2070	2075	2080	2084	0	1	1	2	2	3	3	4	4
0.32	2089	2094	2099	2104	2109	2113	2118	2123	2128	2133	0	1	1	2	2	3	3	4	4
0.33	2138	2143	2148	2153	2158	2163	2168	2173	2178	2183	0	1	1	2	2	3	3	4	4
0.34	2188	2193	2198	2203	2208	2213	2218	2223	2228	2234	1	1	2	2	3	3	4	4	5
0.35	2239	2244	2249	2254	2259	2265	2270	2275	2280	2286	1	1	2	2	3	3	4	4	5
0.36	2291	2296	2301	2307	2312	2317	2323	2328	2333	2339	1	1	2	2	3	3	4	4	5
0.37	2344	2350	2355	2360	2366	2371	2377	2382	2388	2393	1	1	2	2	3	3	4	4	5
0.38	2399	2404	2410	2415	2421	2427	2432	2438	2443	2449	1	1	2	2	3	3	4	4	5
0.39	2455	2460	2466	2472	2477	2483	2489	2495	2500	2506	1	1	2	2	3	3	4	5	5
0.40	2512	2518	2523	2529	2535	2541	2547	2553	2559	2564	1	1	2	2	3	4	4	5	5
0.41	2570	2576	2582	2588	2594	2600	2606	2612	2618	2624	1	1	2	2	3	4	4	5	5
0.42	2630	2636	2642	2649	2655	2661	2667	2673	2679	2685	1	1	2	2	3	4	4	5	6
0.43	2692	2698	2704	2710	2716	2723	2729	2735	2742	2748	1	1	2	3	3	4	4	5	6
0.44	2754	2761	2767	2773	2780	2786	2793	2799	2805	2812	1	1	2	3	3	4	4	5	6
0.45	2818	2825	2831	2838	2844	2851	2858	2864	2871	2877	1	1	2	3	3	4	5	5	6
0.46	2884	2891	2897	2904	2911	2917	2924	2931	2938	2944	1	1	2	3	3	4	5	5	6
0.47	2951	2958	2965	2972	2979	2985	2992	2999	3006	3013	1	1	2	3	3	4	5	5	6
0.48	3020	3027	3034	3041	3048	3055	3062	3069	3076	3083	1	1	2	3	4	4	5	6	6
0.49	3090	3097	3105	3112	3119	3126	3133	3141	3148	3155	1	1	2	3	4	4	5	6	6

ANTILOGARITHMS

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0.50	3162	3170	3177	3184	3192	3199	3206	3214	3221	3228	1	1	2	3	4	4	5	6	7
0.51	3236	3243	3251	3258	3266	3273	3281	3289	3296	3304	1	2	2	3	4	5	5	6	7
0.52	3311	3319	3327	3334	3342	3350	3357	3365	3373	3381	1	2	2	3	4	5	5	6	7
0.53	3388	3396	3404	3412	3420	3428	3436	3443	3451	3459	1	2	2	3	4	5	6	6	7
0.54	3467	3475	3483	3491	3499	3508	3516	3524	3532	3540	1	2	2	3	4	5	6	6	7
0.55	3548	3556	3565	3573	3581	3589	3597	3606	3614	3622	1	2	2	3	4	5	6	7	7
0.56	3631	3639	3648	3656	3664	3673	3681	3690	3698	3707	1	2	3	3	4	5	6	7	8
0.57	3715	3724	3733	3741	3750	3758	3767	3776	3784	3793	1	2	3	3	4	5	6	7	8
0.58	3802	3811	3819	3828	3837	3846	3855	3864	3873	3882	1	2	3	4	4	5	6	7	8
0.59	3890	3899	3908	3917	3926	3936	3945	3954	3963	3972	1	2	3	4	5	5	6	7	8
0.60	3981	3990	3999	4009	4018	4027	4036	4046	4055	4064	1	2	3	4	5	6	6	7	8
0.61	4074	4083	4093	4102	4111	4121	4130	4140	4150	4159	1	2	3	4	5	6	7	8	9
0.62	4169	4178	4188	4198	4207	4217	4227	4236	4246	4256	1	2	3	4	5	6	7	8	9
0.63	4266	4276	4285	4295	4305	4315	4325	4335	4345	4355	1	2	3	4	5	6	7	8	9
0.64	4365	4375	4385	4396	4406	4416	4426	4436	4446	4457	1	2	3	4	5	6	7	8	9
0.65	4467	4477	4487	4498	4508	4519	4529	4539	4550	4560	1	2	3	4	5	6	7	8	9
0.66	4571	4581	4592	4603	4613	4624	4634	4645	4656	4667	1	2	3	4	5	6	7	9	10
0.67	4677	4688	4699	4710	4721	4732	4742	4753	4764	4775	1	2	3	4	5	7	8	9	10
0.68	4786	4797	4808	4819	4831	4842	4853	4864	4875	4887	1	2	3	4	6	7	8	9	10
0.69	4898	4909	4920	4932	4943	4955	4966	4977	4989	5000	1	2	3	5	6	7	8	9	10
0.70	5012	5023	5035	5047	5058	5070	5082	5093	5105	5117	1	2	4	5	6	7	8	9	11
0.71	5129	5140	5152	5164	5176	5188	5200	5212	5224	5236	1	2	4	5	6	7	8	10	11
0.72	5248	5260	5272	5284	5297	5309	5321	5333	5346	5348	1	2	4	5	6	7	9	10	11
0.73	5370	5383	5395	5408	5420	5433	5445	5458	5470	5483	1	3	4	5	6	8	9	10	11
0.74	5495	5508	5521	5534	5546	5559	5572	5585	5598	5610	1	3	4	5	6	8	9	10	12
0.75	5623	5636	5649	5662	5675	5689	5702	5715	5728	5741	1	3	4	5	7	8	9	10	12
0.76	5754	5768	5781	5794	5808	5821	5834	5848	5861	5875	1	3	4	5	7	8	9	11	12
0.77	5888	5902	5916	5929	5943	5957	5970	5984	5998	6012	1	3	4	5	7	8	10	11	12
0.78	6026	6039	6053	6067	6081	6095	6109	6124	6138	6152	1	3	4	6	7	8	10	11	13
0.79	6166	6180	6194	6209	6223	6237	6252	6266	6281	6295	1	3	4	6	7	8	10	11	13
0.80	6310	6324	6339	6353	6368	6383	6397	6412	6427	6442	1	3	4	6	7	9	10	12	13
0.81	6457	6471	6486	6501	6516	6531	6546	6561	6577	6592	2	3	5	6	8	9	11	12	14
0.82	6607	6622	6637	6653	6668	6683	6699	6714	6730	6745	2	3	5	6	8	9	11	12	14
0.83	6761	6776	6792	6808	6823	6839	6855	6871	6887	6902	2	3	5	6	8	9	11	13	14
0.84	6918	6934	6950	6966	6982	6998	7015	7031	7047	7063	2	3	5	6	8	10	11	13	15
0.85	7079	7096	7112	7129	7145	7161	7178	7194	7211	7228	2	3	5	7	8	10	12	13	15
0.86	7244	7261	7278	7295	7311	7328	7345	7362	7379	7396	2	3	5	7	8	10	12	13	15
0.87	7413	7430	7447	7464	7482	7499	7516	7534	7551	7568	2	3	5	7	9	10	12	14	16
0.88	7586	7603	7621	7638	7656	7674	7691	7709	7727	7745	2	4	5	7	8	11	12	14	16
0.89	7762	7780	7798	7816	7834	7852	7870	7889	7907	7925	2	4	5	7	9	11	13	14	16
0.90	7943	7962	7980	7998	8017	8035	8054	8072	8091	8110	2	4	6	7	9	11	13	15	17
0.91	8128	8147	8166	8185	8204	8222	8241	8260	8279	8299	2	4	6	8	9	11	13	15	17
0.92	8318	8337	8356	8375	8395	8414	8433	8453	8472	8492	2	4	6	8	10	12	14	15	17
0.93	8511	8531	8551	8570	8590	8610	8630	8650	8670	8690	2	4	6	8	10	12	14	16	18
0.94	8710	8730	8750	8770	8790	8810	8831	8851	8872	8892	2	4	6	8	10	12	14	16	18
0.95	8913	8933	8954	8974	8995	9016	9036	9057	9078	9099	2	4	6	8	10	12	15	17	19
0.96	9120	9141	9162	9183	9204	9220	9247	9268	9290	9311	2	4	6	8	11	13	15	17	19
0.97	9333	9354	9376	9397	9419	9441	9462	9484	9506	9528	2	4	7	9	11	13	15	17	20
0.98	9550	9572	9594	9616	9638	9661	9683	9705	9727	9750	2	4	7	9	11	13	16	18	20
0.99	9772	9795	9817	9840	9863	9886	9908	9931	9954	9977	2	5	7	9	11	14	16	18	20