MOCK MHT - CET EXAM - 2018
QUESTION BOOKLET
Subjects : Physics & Chemistry

		Roll No.				

Question Booklet No.

9	9	8	3

(Write this number on
your Answer Sheet)

Duration : 1 Hour 30 Minutes

Total Marks: 100

Candidate's Signature

*Invigilator's Signature*

Instructions to Candidates

1. This Question Booklet contains 100 Objective Type Questions (Single Best Response Type) in the subjects of Physics (50) and Chemistry (50).
2. The Question Booklet and Answer Sheets are issued to examinees separately at the beginning of the examination session.
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. Special care should be taken to fill Question Booklet No. and 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. Determine the correct answer from out of the four available options given for each question.
7. Fill the appropriate circle completely like this ●, for answering the particular question, with Black ink ball point pen only, in the Answer Sheet.
8. Each answer with correct response shall be awarded **one (1) mark.** There is **no Negative Marking**. If the examinee has marked two or more answers or has done scratching and overwriting in the Answer Sheet in response to any question, or has marked the circles inappropriately e.g. half circle, dot, tick mark, cross etc, mark/s shall NOT be awarded for such answer/s, as these may not be read by the scanner. Answer sheet of each candidate will be evaluated by computerized scanning method only and there will not be any manual checking during evaluation or verification.
9. Use of whitener or any other material to erase/hide the circle once filled is not permitted. Avoid overwriting and/or striking of answers once marked.
10. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your Roll No. anywhere else except in the specified space in the Question Booklet/ Answer Sheet.
11. **Rough work should not be done on the Answer Sheet.**
12. Use of Electronic/Manual Calculator is prohibited.
13. Immediately after the prescribed examination time is over, the Answer sheet is to be returned to the Invigilator.
14. No candidate is allowed to leave the examination hall till the examination session is over.

1. A compound microscope consists of an objective of focal length 2.0 cm and an eyepiece of focal length 6.0 cm separated by 15 cm. At what distance from the objective should an object be placed so that the final image is formed at the least distance of distinct vision?
   (A) −1.1 cm
   (B) −2.1 cm
   (C) −1.5 cm
   (D) −2.5 cm

2. A parallel plate capacitor is charged by connecting its plates to the terminal of a battery. Now a glass plate is introduced between the plates of the charged capacitor with battery connected across the plates, then
   (A) the charge on the plates will reduce.
   (B) the potential difference between the plates will reduce.
   (C) the charge on the plates will increase.
   (D) the potential difference between the plates will increase.

3. The anode voltage of a photocell is kept fixed. The wavelength λ of the light falling on the cathode is gradually changed. The plate current I of the photocell varies as follows:

   (A)

   (B)

   (C)

   (D)
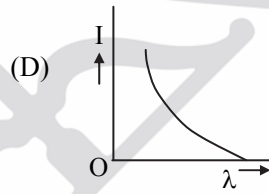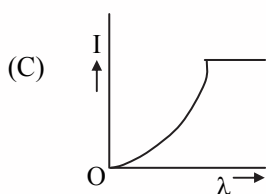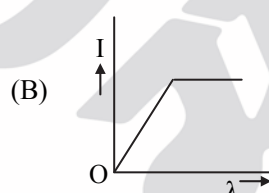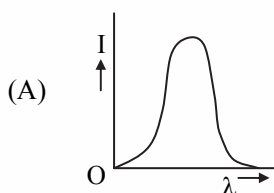
4. When angle of incidence for a ray of light at a refracting surface of a prism is θ, the ray suffers minimum deviation through the prism. If the angle of prism is 60° and refractive index of the material of the prism is $\sqrt{2}$, then value of θ is
   (A) 20.5°
   (B) 30°
   (C) 45°
   (D) 60°

5. Two particles of mass m and M are moving in a circle of radii r and R respectively. If their angular velocities are same, what will be the ratio of their linear velocities?
   (A) mr : MR
   (B) R : r
   (C) r : R
   (D) 1 : 1

6. Two wires of same length are shaped into a square and a two looped coil. If they exhibit same magnetic moment when current flows through them, then ratio of current flowing through them is
   (A) 2 : π
   (B) π : $\sqrt{2}$
   (C) π : 4
   (D) 4 : π

7. A metallic sphere (A) is at rest. Another metallic sphere (B) hits sphere (A) and comes to rest as the first sphere (A) starts moving. If mass of sphere (A) is 20 kg, then mass of second sphere (B) will be (Considering collision to be elastic)
   (A) 40 kg
   (B) 5 kg
   (C) 20 kg
   (D) 10 kg

8. As the switch S is closed in the circuit shown in figure, current passed through it is
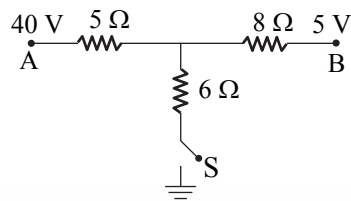
(A)   4.4 A   (B)   6.0 A   (C)   3.0 A   (D)   zero

9. The image of an object, formed by a plano-convex lens at a distance of 1 m behind the lens, is real and is one-third the size of the object. The wavelength of light inside the lens is $\dfrac{4}{5}$ times the wavelength in free space. The radius of the curved surface of the lens is
(A)   0.9 m   (B)   0.19 m
(C)   0.75 m   (D)   0.38 m

10. Six condensers each of capacity 5 μF are connected as shown in the figure. The total energy stored in the system is 64×10^{-6} J. The voltage across AB will be
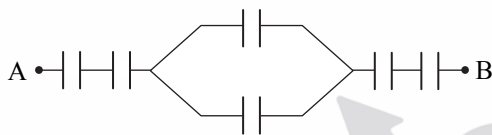
(A)   25 V   (B)   8 V   (C)   15 V   (D)   11 V

11. A magnet suspended at angle x with magnetic meridian makes an angle of $\dfrac{3x}{2}$ with the horizontal. The actual value of the angle of dip is

(A) $\dfrac{3x}{2} \tan^{-1} (\cos x)$ (B) $\tan^{-1} \dfrac{3x}{2} \cos x$

(C) $\tan^{-1} \left(\tan \dfrac{3x}{2} \cos x \right)$ (D) $\dfrac{3x}{2} \cos x$

12. Considering wavelengths associated with spectral lines of hydrogen atom, ratio of two wavelengths λ_1 and λ_2 is found to be $\dfrac{1}{3}$, then λ_1 and λ_2 respectively denote

(A)   Lyman limit and maximum wavelength of Balmer series.
(B)   Paschen limit and maximum wavelength of Pfund series.
(C)   Maximum wavelength of Lyman series and Balmer limit.
(D)   Paschen limit and Balmer limit.

13. Particle A moves along X-axis with a uniform velocity of magnitude 20 m/s. Particle B moves with uniform velocity 40 m/s along a direction making an angle of 60° with the positive direction of X-axis. The relative velocity of B with respect to that of A is
(A)   20 m/s along X-axis.
(B) $20\sqrt{3}$ m/s along Y-axis (perpendicular to X-axis).
(C) $20\sqrt{5}$ along the bisection of the velocities of A and B.
(D)   30 m/s along negative X-axis.

14. A particle starts oscillating simple harmonically from its equilibrium position with time period T. Then the ratio of kinetic and potential energies of the particle at time $\dfrac{T}{6}$ is

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

15. For a given body at a given temperature, if coefficient of transmission is 0.16 and coefficient of reflection is 0.53, then its coefficient of emission is

   (A)   0.69
   (B)   0.31
   (C)   0.53
   (D)   0.16

16. The following four wires are made of the same material. Which of these will have the smallest extension when the same tension is applied?

   (A)   Length = 50 cm, diameter = 0.5 mm
   (B)   Length = 100 cm, diameter = 1 mm
   (C)   Length = 200 cm, diameter = 2 mm
   (D)   Length = 300 cm, diameter = 3 mm

17. Light is incident from medium M at an angle of incidence i and is refracted into medium air at an angle of refraction r. Considering various values of i and r, the graph of sin i versus sin r is plotted as shown below. Then speed of light in medium M is

   (A) 3×10^8 m/s
   (B) 10^8 m/s
   (C) 1.73×10^8 m/s
   (D) 2.45×10^8 m/s
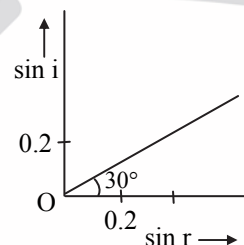
18. There is some change in magnetic flux associated with a coil of resistance 15 Ω. As a result, an induced current is developed in it which varies with time as shown in the graph. The magnitude of change in flux through the coil in weber is
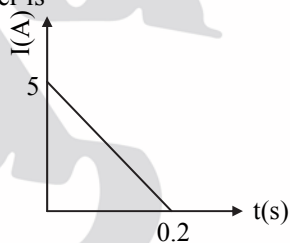
   (A)   7.5
   (B)   4.8
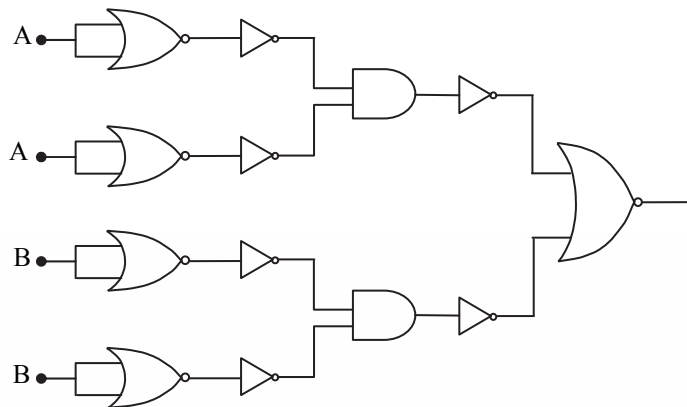   (C)   6.2
   (D)   8.5

19. A mass 1 kg is suspended by a thread. It is

   i.   lifted up with an acceleration 2.45 m/s^2.
   ii.   lowered with an acceleration 4.9 m/s^2.

   The ratio of the tensions is

   (A)   5 : 2
   (B)   2 : 3
   (C)   1 : 2
   (D)   4 : 5

20. For the given digital circuit, identify the logic gate it represents.

(A) NAND Gate (B) NOR Gate
(C) AND Gate (D) OR Gate

21. Broadcast band in which FM lies is
(A) UHF (B) VHF
(C) SHF (D) none of these

22. A 90 kg cupboard is to be shifted to the right as shown in the figure. If coefficient of friction between cupboard and floor is 0.4 then the force required to move the cupboard will be, (Take $g = 10$ m/s^2)
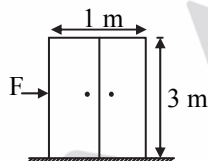
(A) < 294 N (B) > 300 N
(C) > 360 N (D) > 250 N

23. Energy required to move a body of mass m from an orbit of radius 4R to 5R is

(A) $\dfrac{GMm}{R}$ (B) $\dfrac{GMm}{5R}$

(C) $\dfrac{GMm}{4R}$ (D) $\dfrac{GMm}{20R}$

24. The displacement of a particle performing simple harmonic motion is given by, $x = 3 \cos \omega t + 4 \sin \omega t$, where distance is in centimetre and time is in second. What is the amplitude of motion?
(A) 5 cm (B) 7 cm
(C) 4 cm (D) 3 cm

25. The length of vibrating wire is 120 cm and frequency is 110 Hz. When the length is decreased by 10 cm, the number of beats produced is
(A) 8 (B) 2
(C) 10 (D) 5

26. A square frame of length l is immersed in soap solution and taken out. The force experienced by the square plate is
(A) Tl (B) 2Tl
(C) 4Tl (D) 8Tl

27. A beam of light travelling through water strikes a glass plate, which is also immersed in water. When the angle of incidence is 49°, the reflected beam is found to be plane polarised. What is the refractive index of glass if the refractive index of water is $\frac{4}{3}$? (cot 41° = 1.1503)

   (A) 1.53
   (B) 1.67
   (C) 1.98
   (D) 2.23

28. A voltmeter reads 5 V at full scale deflection and is graded as 2000 Ω/V. What resistance should be connected in series with it so that it reads 12 V at full-scale deflection?

   (A) $2.8 \times 10^4\,\Omega$
   (B) $3.6 \times 10^4\,\Omega$
   (C) $1.4 \times 10^4\,\Omega$
   (D) $7.2 \times 10^4\,\Omega$

29. An ac source is connected to a parallel combination of inductor and capacitor having reactance of 20 Ω and 40 Ω respectively. The impedance of the entire circuit will be

   (A) 40 Ω
   (B) 60 Ω
   (C) 50 Ω
   (D) 30 Ω

30. Threshold wavelength for a metal having work function W_0 is λ. What is the threshold wavelength for the metal having work function $2W_0$?

   (A) 4λ
   (B) 2λ
   (C) $\lambda/2$
   (D) $\lambda/4$

31. Ratio of K.E. of rolling to rotational K.E. of a solid sphere is

   (A) 3/2
   (B) 5/2
   (C) 7/2
   (D) 1

32. The rms velocity of a gas at T °C is thrice the value at 27 °C. The temperature T of the gas in °C is (assume that the pressure remains constant)

   (A) 2427
   (B) 2700
   (C) 1000
   (D) 900

33. A thin wire of 66 cm is fixed at both ends as shown in figure. The wire is kept under a tension and is divided into three segments of lengths l_1, l_2 and l_3 as shown in figure. When the wire is made to vibrate, the segments vibrate respectively with their fundamental frequencies in the ratio 1: 2 : 3. Then the lengths l_1, l_2, l_3 of the segments respectively are (in cm)
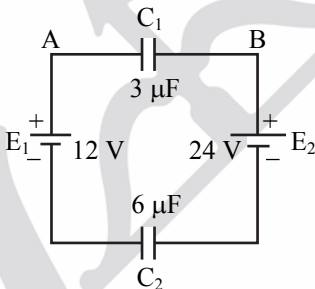

   (A) 18, 12, 36
   (B) 12, 18, 36
   (C) 36, 18, 12
   (D) 36, 12, 18

34. Young's modulus of wire is calculated in CGS. The conversion factor to change it from CGS to MKS system is

    (A) 1
    (B) 10
    (C) 0.1
    (D) 0.01

35. A variable capacitor and an inductive coil along with resistance of negligible value are connected in series to an a.c source having voltage of 70 V. The current in the circuit is 7 A. When the capacity of capacitor decreases to half its value, the current becomes 14 A. The voltage across the capacitor, in first case is

    (A) 40 V
    (B) 45 V
    (C) 35 V
    (D) 30 V

36. In a Young's double slit experiment, slits are separated by 0.2 mm, and the screen is placed 120 cm away. A beam of light consisting of two wavelengths, 720 nm and 480 nm, is used to obtain interference fringes on the screen. The least distance at which the bright fringes due to both the wavelengths coincide is

    (A) 9.75 mm
    (B) 15.6 mm
    (C) 3.56 mm
    (D) 8.64 mm

37. A bar magnet made from paramagnetic substance has dipole moment 0.34 Am^2 at 31 °C. When temperature increases by 40 °C, the new dipole moment is

    (A) 0.6 Am^2
    (B) 0.15 Am^2
    (C) 0.3 Am^2
    (D) 0.04 Am^2

38. What is the reading of ammeter shown in the figure below?
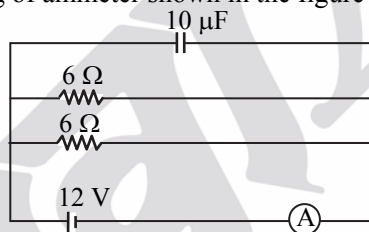
    (A) 3 A
    (B) 4 A
    (C) 1.5 A
    (D) 6 A

39. A particle A of mass m and initial velocity v collides with a particle B of mass $\frac{m}{7}$ which is at rest. The collision is head on, and elastic. The ratio of the de-Broglie wavelengths λ_A to λ_B after the collision is

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

40. If density of the earth is tripled keeping radius constant, the new acceleration due to gravity is

    (A) 9.8 m/s^2
    (B) 19.6 m/s^2
    (C) 4.9 m/s^2
    (D) 29.4 m/s^2

41. Radius of gyration of a circular ring about an axis passing through its centre of gravity and perpendicular to its plane is

    (A) R

    (B) $\dfrac{R}{2}$

    (C) $\sqrt{2}\,R$

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

42. A steel rod 100 cm long is clamped at its mid-point. The fundamental frequency of longitudinal vibrations of the rod is given to be 2.9 kHz. What is the speed of sound in steel?

    (A) 5.8 km/s

    (B) 4.25 km/s

    (C) 11.6 km/s

    (D) 5.4 km/s

43. Equation of a simple harmonic progressive wave is $y = 0.05 \sin 8\pi \left(\dfrac{t}{0.032} - \dfrac{x}{3.2} \right)$, where all the quantities are in S.I. units. The velocity of wave is

    (A) 0.010 m/s

    (B) 1.0 m/s

    (C) 10 m/s

    (D) 100 m/s

44. Two capacitors C_1 and C_2 are connected in a circuit as shown in the figure. The potential difference $(V_A - V_B)$ is

    (A) 8 V

    (B) − 8 V

    (C) 12 V

    (D) − 12 V

45. Moment of inertia of ring about the tangent parallel to plane is I. The moment of inertia of ring about tangent and perpendicular to its plane is

    (A) 6I

    (B) 3I

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

    (D) $\dfrac{I}{3}$

46. In a wire, when elongation is 3 cm, energy stored is E. If it is stretched by 15 cm, then the energy stored will be (Assume stretching of wire in both cases lies within elastic limit of wire)

    (A) E

    (B) 2E

    (C) 25E

    (D) 4E

47. When sound is reflected from a denser medium,

    (A) crest is reflected as a trough.

    (B) crest is reflected as a crest.

    (C) rarefaction is reflected as a rarefaction.

    (D) rarefaction is reflected as a compression.

48. In Fraunhoffer diffraction pattern, slit width is 0.4 mm and screen is at 180 cm away from the lens. If wavelength of light used is 5000 Å, then the distance between the first minimum on either side of the central maximum is (θ is small and measured in radian)

(A) 10^{-2} m

(B) 0.225×10^{-2} m

(C) 0.45×10^{-2} m

(D) 4.5×10^{-2} m

49. An iron rod is placed parallel to magnetic field of intensity 1600 A/m. The magnetic flux through the rod is 4×10^{-4} Wb and its cross-sectional area is 8 cm^2. The magnetic permeability of the rod in Wb/A−m is

(A) 0.62×10^{-3}

(B) 0.31×10^{-2}

(C) 0.31×10^{-3}

(D) 0.62×10^{-2}

50. Two soap bubbles have radii in the ratio of 5 : 3. What is the ratio of work done to blow these bubbles?

(A) 5 : 3

(B) 25 : 9

(C) 9 : 25

(D) 3 : 5

51. The decomposition of a substance 'X' takes place according to the first order kinetics. Its initial concentration is reduced to one sixteenth in 64 s. The rate constant of the reaction is _____ s^{-1}.

(A) $\dfrac{0.693}{64}$

(B) $\dfrac{0.693}{16}$

(C) $\dfrac{0.693}{8}$

(D) $\dfrac{0.693}{4}$

52. For a reaction, the values of ΔH and ΔS are 40.2 kJ mol^{-1} and 0.201 kJ K^{-1} mol^{-1}, respectively. At what temperature will the change in free energy be zero?

(A) 250 K

(B) 225 K

(C) 200 K

(D) 170 K

53. While assigning R, S configuration, the CORRECT order of priority of groups attached to chiral carbon atom is _____.

(A) $CONH_2 > COOCH_3 > CN > CH_2OH$

(B) $COOCH_3 > CONH_2 > CH_2OH > CN$

(C) $CH_2OH > CONH_2 > CN > COOCH_3$

(D) $CN > CH_2OH > COOCH_3 > CONH_2$

54. Identify the addition polymers from the following.

i. Dacron   ii. Teflon   iii. Orlon   iv. Melamine

v. Neoprene

(A) ii, iii, v

(B) i, iii

(C) i, iii, iv

(D) ii, iv

55. Which of the following is an example of giant solid?

(A) Dry ice

(B) Iodine crystal

(C) Graphite

(D) Common salt

56. Which of the following gases has the lowest root mean square velocity at the same temperature?

    (A) H_2 (B) He   (C) N_2 (D) O_2

57. Identify an INCORRECT statement from the following.

    (A) In maltose, C-1 of one α-D-glucopyranose is linked with C-4 of another α-D-glucopyranose.

    (B) In cellobiose, C-1 of one β-D-glucopyranose is linked with C-4 of another β-D-glucopyranose.

    (C) In sucrose, C-1 of one α-D-glucopyranose is linked with C-4 of another α-D-glucopyranose.

    (D) In cellulose, C-1 of one β-D-glucopyranose is linked with C-4 of another β-D-glucopyranose.

58. What is the oxidation number of I in $NaIO_3$?

    (A) +6   (B) +5

    (C) −1   (D) −5

59. Which one of the following statements is TRUE?

    (A) Codeine is a diacetyl derivative of morphine.

    (B) Arsphenamine, the drug used to treat syphilis, contains – N = N – linkage.

    (C) In human body, prontosil gets converted into sulphanilamide.

    (D) Antihistamines are a mixture of synthetic estrogen and progesterone derivatives.

60. Magnesium chloride may be electrolysed at 1000 °C to furnish magnesium metal. The cathode reaction is,

    $Mg^{2+} + 2e^- \longrightarrow Mg$.

    The quantity of electricity required to prepare 5 kg of magnesium metal by this method is _____.

    (Atomic mass of Mg = 24 amu; 1 Faraday = 96,500 Coulombs).

    (A) 2.01×10^4 C   (B) 1.80×10^7 C

    (C) 4.02×10^7 C   (D) 5.19×10^4 C

61. Which of the following is NOT formed in the reaction between bromobenzene and bromomethane carried out in the presence of sodium in dry ether?

    (A) Ethane   (B) Toluene

    (C) Methane   (D) Diphenyl

62. XY crystallizes in body-centred cubic lattice. Which of the following expressions is CORRECT for XY crystal?

    (A) $r_{X^+} + r_{Y^-} = \dfrac{1}{\sqrt{2}} \times$ edge length   (B) $r_{X^+} + r_{Y^-} = \dfrac{3}{2} \times$ edge length

    (C) $r_{X^+} + r_{Y^-} = \dfrac{\sqrt{3}}{2} \times$ edge length   (D) $r_{X^+} + r_{Y^-} = \dfrac{\sqrt{3}}{2} \times$ body diagonal

63. Dow's process is used for manufacture of _____.

    (A) phenol   (B) diethyl ether

    (C) benzaldehyde   (D) ethanol

64. The standard reduction potentials at 25 °C of Li^+/Li, Zn^{2+}/Zn, Na^+/Na and Al^{3+}/Al are -3.05, -0.76, -2.71 and -1.66 volts, respectively. Which one of the following is the strongest oxidizing agent?

(A) Na^+ (B) Li^+ (C) Zn^{2+} (D) Al^{3+}

65. Find the INCORRECT match.

(A) Acidic oxides $\rightarrow Cl_2O_7$, B_2O_3 (B) Neutral oxides $\rightarrow N_2O$, N_2O_5

(C) Basic oxides $\rightarrow MgO$, K_2O (D) Amphoteric oxides $\rightarrow Al_2O_3$, ZnO

66. Calculate the amount of work done when two moles of an ideal gas is compressed from a volume of $2\ m^3$ to $20\ dm^3$ at 298 K against a constant external pressure of 100 kPa.

(A) 198 kJ   (B) -19.8 kJ   (C) 180 kJ   (D) 1800 kJ

67. The CORRECT decreasing order of reactivity of the following carbonyl compounds towards nucleophilic addition reactions is _____ .
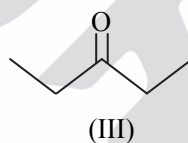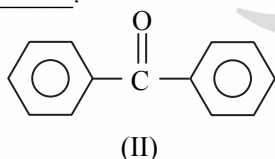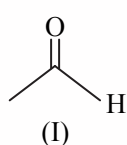
(A) II > I > III   (B) I > III > II   (C) III > I > II   (D) II > III > I

68. Which of the following solutions is one molar solution? ($C = 12$, $H = 1$, $O = 16$, $Ca = 40$, $Cl = 35.5$, $Na = 23$)

(A) 0.92 g of C_2H_5OH in 100 mL of solution

(B) 11.1 g of $CaCl_2$ in 1000 mL of solution

(C) 3.2 g of CH_3OH in 100 mL of solution

(D) 5.85 g of $NaCl$ in 1000 mL of solution

69. In which oxyacids of phosphorus, one $P–O–P$ bond and two $P = O$ bonds are present?

(A) Hypophosphoric acid   (B) Orthophosphorus acid

(C) Orthophosphoric acid   (D) Pyrophosphoric acid

70. Identify the most stable carbocation amongst the following.
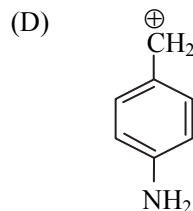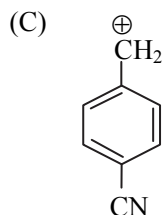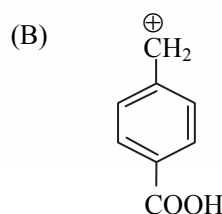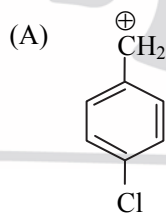
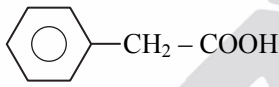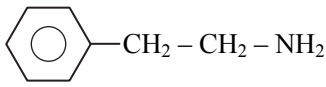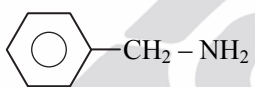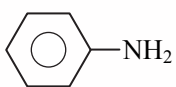71. Identify an INCORRECT statement from the following.

    (A) The oil in water emulsion can be diluted with water.

    (B) Addition of small amount of an electrolyte can effect the coagulation of sol particles in lyophobic sols.

    (C) Whipped cream is a colloidal dispersion of gas in liquid.

    (D) A catalytic promoter has very high catalytic power.

72. The molecular formula of an alkane with molecular weight 100 is _____.

    (A) C_5H_{12} (B) C_6H_{14}

    (C) C_7H_{16} (D) C_8H_{18}

73. According to Arrhenius equation, the graph of $\log_{10}k$ against the reciprocal of temperature (T) is a straight line with slope _____.

    (A) $\dfrac{-E_a}{2.303R}$ (B) $\dfrac{E_a}{2.303R}$

    (C) $\dfrac{-E_a}{R}$ (D) $\dfrac{-2.303E_a}{R}$

74. Test-tube A + $HNO_2 \longrightarrow$ blue solution $\xrightarrow{NaOH}$ red solution.

    Test-tube B + $HNO_2 \longrightarrow$ No reaction.

    Test-tube C + $HNO_2 \longrightarrow$ blue solution $\xrightarrow{NaOH}$ No reaction.

    Test-tubes A, B and C contain _____ respectively.

    (A) primary, secondary and tertiary nitroalkanes   (B) primary, tertiary and secondary nitroalkanes

    (C) secondary, tertiary and primary nitroalkanes   (D) tertiary, secondary and primary nitroalkanes

75. Which of the following statements is INCORRECT?

    (A) In calcination, hydrated ore loses its water of hydration.

    (B) Blast furnace works on a counter current principle.

    (C) Slag prevents the oxidation of metal by air.

    (D) Froth floatation method is used for concentration of siderite.

76. In which case, tert-butyl methyl ether is formed as major product?

    (A) $(C_2H_5)_3CONa + CH_3Cl$ (B) $(CH_3)_3CONa + CH_3Cl$

    (C) $(CH_3)_3CONa + C_2H_5Br$ (D) $C_2H_5ONa + (CH_3)_3CBr$

77. The bond angle in ammonia is $107°18'$ which is slightly less than the expected bond angle of $109°28'$ for a regular tetrahedral geometry. This is due to_____.

    (A) attraction between lone pair and bond pair of electrons

    (B) repulsion between lone pair and bond pair of electrons

    (C) sp^3 hybridisation of nitrogen

    (D) higher electronegativity of nitrogen

78. The freezing point of 0.5 mol kg^{-1} solution of X in water is lesser than equimolal solution of Y in water. Which one of the following statements is TRUE based on the given information?

   (A) X is undergoing dissociation in water.

   (B) Molecular mass of X is greater than the molecular mass of Y.

   (C) Molecular mass of X is less than the molecular mass of Y.

   (D) Y is undergoing dissociation in water while X undergoes no change.

79. Which of the following reactions is used for the preparation of α-bromoacetic acid?

   (A) Kolbe's reaction   (B) Reimer-Tiemann reaction

   (C) Hell-Volhard-Zelinsky reaction   (D) Etard reaction

80. In qualitative analysis of organic compounds, the presence of _____ CANNOT be detected by Lassaigne's test.

   (A) nitrogen   (B) sulphur

   (C) iodine   (D) oxygen

81. At a certain temperature, the value of the slope of the plot of osmotic pressure (π) against concentration (C in molarity) of a protein solution is 295 R. The osmotic pressure of the solution was measured at temperature = _____. [Here, R is gas constant.]

   (A) 22 °C   (B) 24 °C

   (C) 35 °C   (D) 295 °C

82. _____ will give immediate turbidity on shaking with HCl at room temperature.

   (A) 2-Ethylbutan-1-ol   (B) 3-Methylbutan-2-ol

   (C) 2-Methylpropan-2-ol   (D) 2-Methylpropan-1-ol

83. At a particular temperature, the value of molar conductivity of a 0.01 M NaCl solution is given by _____. (where k is conductivity)

   (A) $k \times 10^5 \ \Omega^{-1} \, cm^2 \, mol^{-1}$ (B) $k \times 10^3 \ \Omega^{-1} \, cm^3 \, mol^{-1}$

   (C) $k \times 100 \ \Omega^{-1} \, cm^3 \, mol^{-1}$ (D) $k \times 10^4 \ \Omega^{-1} \, cm^2 \, mol^{-1}$

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

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

   (C) 3-Bromopentane   (D) 1-Iodopropane

85. Which of the following ions has highest magnetic moment?

   (A) Ti^{3+} (B) Ni^{2+} (C) Co^{2+} (D) Mn^{3+}

86. Among the hydrides of group 15 elements, _____.

   (A) NH_3 is least soluble in water   (B) BiH_3 is the strongest reducing agent

   (C) BiH_3 is thermally very stable   (D) NH_3 is least basic

87. Which of the following is NOT true for an isochoric process?

   (A) $\Delta V = 0$
   (B) $W = 0$
   (C) $W = \Delta U$
   (D) $\Delta U = q_v$

88. In aldol reaction between ethanal and propanal, the crossed aldol products are _____.

   (A)   but-2-enal and pent-2-enal
   (B)   but-2-enal and 2-methylpent-2-enal
   (C)   2-methylbut-2-enal and pent-2-enal
   (D)   prop-2-enal and 2-methylbut-2-enal

89. Which of the following is used in research laboratories for the detection of gamma photons?

   (A)   Xe
   (B)   Ar
   (C)   Kr
   (D)   Ne

90. Select the CORRECT statement with respect to $[CoF_6]^{3-}$.

   (A)   It is a low spin complex.
   (B)   Cobalt undergoes d^2sp^3 hybridisation and the complex has octahedral geometry.
   (C)   Cobalt is in +3 oxidation state and the complex has five unpaired electrons.
   (D)   It is an outer orbital complex and shows paramagnetic behaviour.

91. If 10^{21} molecules are removed from 180 mg of H_2O, then the number of molecules of H_2O left are _____.

   (A) 5.022×10^{22}
   (B) 5.022×10^{21}
   (C) 6.022×10^{21}
   (D) 5.022×10^{23}

92. Identify the product formed when phenylacetonitrile undergoes Mendius reduction.

   (A)
   (B)
   (C)
   (D)

93. Arrange Ce^{3+}, La^{3+}, Pm^{3+} and Gd^{3+} in the increasing order of their ionic radii.

   (A) $Gd^{3+} < Pm^{3+} < Ce^{3+} < La^{3+}$
   (B) $Ce^{3+} < Gd^{3+} < Pm^{3+} < La^{3+}$
   (C) $Gd^{3+} < Pm^{3+} < La^{3+} < Ce^{3+}$
   (D) $Pm^{3+} < La^{3+} < Ce^{3+} < Gd^{3+}$

94. The standard enthalpy of combustion of ethyne is -1300 kJ mol^{-1}. How much heat will be evolved in the formation of 8.8 g of CO_2?

   (A)   65 kJ
   (B)   130 kJ
   (C)   260 kJ
   (D)   650 kJ

95. The reagents required for the preparation of milk of sulphur are _____.

   (A) H_2S and HNO_3
   (B) $Na_2S_2O_3$ and HCl
   (C) $Ca(OH)_2$, S and HCl
   (D) H_2S and SO_2

96. In the nitration of aniline considerable amount of m-nitroaniline is formed along with p-nitroaniline and o-nitroaniline. This is because _____.

(A) in electrophilic substitution reaction, amino group is meta directing

(B) inspite of substituents, nitro group always goes to m-position

(C) in strongly acidic medium, nitration of aniline is a nucleophilic substitution reaction

(D) in strongly acidic medium, aniline is converted to anilinium ion

97. The electronic configuration of the least electropositive alkali metal is _____.

(A) $[Ne]3s^1$ (B) $[He]2s^1$

(C) $[Ar]4s^1$ (D) $[Xe]6s^1$

98. How many ions per molecule are produced in the solution when potassium ferrocyanide is dissolved in water?

(A) 2   (B) 4

(C) 5   (D) 11

99. Which of the following forms a polynuclear hydride?

(A) N   (B) C

(C) B   (D) Cr

100. The number of stereoisomers that can exist for the complex $[Co(en)_2Cl_2]^+$ is _____.

(A) 2   (B) 3

(C) 4   (D) 6

MOCK MHT - CET EXAM - 2018
QUESTION BOOKLET
Subject : Biology

Roll No.						

Question Booklet No.

9	9	8	7

(Write this number on
your Answer Sheet)

Duration : 1 Hour 30 Minutes

Total Marks: 100

Candidate's Signature

Invigilator's Signature

Instructions to Candidates

1. This Question Booklet contains 100 Objective Type Questions (Single Best Response Type) in the subjects of Biology.
2. The Question Booklet and Answer Sheets are issued to examinees separately at the beginning of the examination session.
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. Special care should be taken to fill Question Booklet No. and 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. Determine the correct answer from out of the four available options given for each question.
7. Fill the appropriate circle completely like this ●, for answering the particular question, with Black ink ball point pen only, in the Answer Sheet.
8. Each answer with correct response shall be awarded **one (1) mark.** There is **no Negative Marking**. If the examinee has marked two or more answers or has done scratching and overwriting in the Answer Sheet in response to any question, or has marked the circles inappropriately e.g. half circle, dot, tick mark, cross etc, mark/s shall NOT be awarded for such answer/s, as these may not be read by the scanner. Answer sheet of each candidate will be evaluated by computerized scanning method only and there will not be any manual checking during evaluation or verification.
9. Use of whitener or any other material to erase/hide the circle once filled is not permitted. Avoid overwriting and/or striking of answers once marked.
10. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your Roll No. anywhere else except in the specified space in the Question Booklet/ Answer Sheet.
11. **Rough work should not be done on the Answer Sheet.**
12. Immediately after the prescribed examination time is over, the Answer sheet is to be returned to the Invigilator.
13. No candidate is allowed to leave the examination hall till the examination session is over.

1. Where are the enzymes required for electron transport system located?
   (A) endoplasmic reticulum
   (B) cytoplasm
   (C) outer mitochondrial membrane
   (D) inner mitochondrial membrane

2. Which of the following plant shows double fertilization?
   (A) *Pinus*
   (B) *Parmelia*
   (C) *Pteris*
   (D) *Pisum sativum*

3. Which of the following enzyme unwinds the DNA during its replication process?
   (A) DNA Polymerase
   (B) RNA Primase
   (C) Ligase
   (D) Helicase

4. In HSK pathway, oxalo-acetic acid is converted to aspartic acid in the presence of $NADPH_2$ and the enzyme _____.
   (A) oxalo-succinate decarboxylase
   (B) PEP carboxylase
   (C) transaminase
   (D) RUBP carboxylase

5. Which of the following are micro-consumers?
   (A) Fungi
   (B) Plants
   (C) Caterpillars
   (D) Birds

6. The roots of plants can absorb _____ water from the soil.
   (A) Hygroscopic
   (B) Combined
   (C) Capillary
   (D) Gravitational

7. Polygonum type of embryo sac in angiosperm is
   (A) tetrasporic, 8 celled and 8 nucleate
   (B) monosporic, 7 celled and 8 nucleate
   (C) monosporic, 4 celled and 4 nucleate
   (D) bisporic, 2 celled and 8 nucleate

8. Which of the following process is absent in prokaryotes?
   (A) Aminoacylation of tRNA
   (B) RNA splicing
   (C) DNA replication
   (D) Transcription 3

9. In the given pyramid of energy, what would be the amount of energy (in Joules) that reaches the secondary consumers?
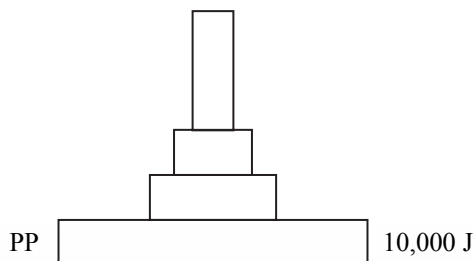
PP ─ 10,000 J

(A) 1,000 J   (B) 10 J

(C) 100 J   (D) 10,000 J

10. Which of the following is NOT a derived lipid?

(A) Oestrogen   (B) Cholic acid

(C) Xanthophyll   (D) Zein

11. How many non-parental combinations in terms of phenotypes would be produced in F_2 generation of a cross between TTRR and ttrr?

(A) 2   (B) 9

(C) 3   (D) 1

12. The sticky or cohesive ends of a double stranded linear DNA in lambda phage are called

(A) recon   (B) cos sites

(C) YAC   (D) blunt sites

13. Which of the following is a protogynous flower?

(A) Sunflower   (B) Primrose

(C) Cucumber   (D) *Michelia*

14. In which of the following epigeal germination takes place?

(A) Gram   (B) Groundnut

(C) Mango   (D) Castor

15. Which of the following plant hormone is used to produce seedless grapes?

(A) Ethylene   (B) ABA

(C) Gibberellins   (D) Florigen

16. In the plant *Mirabilis jalapa*, the inheritance of flower colour is an example of

(A) complete dominance   (B) incomplete dominance

(C) pleiotropy   (D) co-dominance

17. In Krebs cycle, how many ATP molecules are produced by substrate level phosphorylation?

(A) 38   (B) 2

(C) 40   (D) 8

18. If the number of chromosomes in root cell of an angiospermic plant is 42, the number of chromosomes in the antipodal cells, endosperm and microspores mother cell of an anther will be _____ respectively.

    (A) 42, 42, 21   (B) 21, 63, 21
    (C) 21, 63, 42   (D) 42, 63, 42

19. The fatty acid which does not contain double bonds between their carbon atoms is

    (A) Oleic acid   (B) Linolenic acid
    (C) Palmitoleic acid   (D) Stearic acid

20. In which of the following steps of glycolysis is ATP utilized?

    (A) Conversion of 1, 3- diphosphoglyceric acid to 3PGA
    (B) Conversion of phosphoenolpyruvic acid to pyruvic acid
    (C) Conversion of Fructose 6-PO_4 to Fructose 1, 6-diPO_4
    (D) Conversion of 3-PGAL to 1, 3- diphosphoglyceric acid

21. The enzyme permease produced in lactose metabolism

    (A) acts as a repressor   (B) acts as a inducer
    (C) transports lactose into the cell (D) brings out hydrolysis of lactose

22. _____ is the transfer of pollen grains from anthers of one flower to stigma of another flower produced on the same plant.

    (A) Autogamy   (B) Xenogamy
    (C) Geitonogamy   (D) Allogamy

23. Which of the following steps of PCR correctly represents the step of attachment of RNA primers to the respective ends of a DNA strand?

    (A) Annealing at 72^oC   (B) Denaturation at 65^oC
    (C) Annealing at 55^oC   (D) Polymerisation at 72^oC

24. Which of the following is an example of a biofortified crop?

    (A) Himgiri   (B) Pusa Sawni
    (C) Atlas-66   (D) Lerma Rojo 64-A

25. _____ is an enzyme that catalyzes the joining of two molecules.

    (A) Succinate thiokinase   (B) Isomerase
    (C) Fumarase   (D) Transaminase

26. The active site of which enzyme can bind to both CO_2 and O_2 depending on the environmental conditions?

   (A) Ribulose bisphosphate dehydrogenase

   (B) Ribulose bisphosphate anhydrase

   (C) Ribulose bisphosphate carboxylase

   (D) Ribulose triphosphate carboxylase

27. Primary succession of plants occurs after

   (A) harvesting of crops

   (B) cooling of lava

   (C) wild-fire in forest

   (D) hurricane and floods

28. Identify the CORRECT match with respect to animal diseases caused by viruses.

   (A) Measles – Variola virus

   (B) Influenza – Morbilli virus

   (C) Yellow fever – Flavi virus

   (D) Mumps – Myxo virus

29. Which of the following would have respiratory quotient of 0.9?

   (A) Cheese and nut butters

   (B) Soybeans and red lentils

   (C) Banana and sweet potato

   (D) Apples and grapes

30. Which one of the following statements is INCORRECT with reference to emasculation of flowers?

   (A) It is used for selective breeding of plants by hybridization.

   (B) It helps avoid self pollination.

   (C) It is used when the selected plant to be used as female parent bears unisexual flowers.

   (D) It involves removal of anthers from young buds.

31. Identify the CORRECT match.

   (A) Vitamin B_2 – *Pseudomonas denitrificans*

   (B) Citric acid – *Acetobacer aceti*

   (C) Erythromycin – *Streptomyces venezuelae*

   (D) Pectinase – *Sclerotinia libertine*

32. Stomatal opening is caused due to accumulation of _____ element in the guard cells.

   (A) Magnesium   (B) Potassium

   (C) Iron   (D) Zinc

33. What would be the possible genotypes of parents having children with blood groups A, O and AB?

   (A) I^AI^A and I^BI^B (B) I^AI^B and I^AI^B

   (C) I^AI^B and I^Bi (D) I^Ai and I^Bi

34. ATG is a sequence present on the coding strand of DNA. What would be the anti-codon sequence on the anti-codon loop of the tRNA?

   (A) AUG   (B) UAC

   (C) UAG   (D) TAG

35. Following are the events occurring in non-cyclic photophosphorylation. Arrange them sequentially and select the correct option.

   i. Excitation of electrons.

   ii. Electrons pass on to the pigments of PS I.

   iii. Absorption of 680 nm wavelength of red light by chlorophyll-a.

   iv. Electrons are accepted by $cyt.b_6$.

   (A) iv, ii, i, iii   (B) i, iii, iv, ii

   (C) iii, i, iv, ii   (D) iii, ii, iv, i

36. How many stop codons are required to be present on mRNA to terminate the process of translation of one mRNA strand?

   (A) 3   (B) 1

   (C) 2   (D) 4

37. From which of the following bacterium are *cry* genes isolated?

   (A) *Agrobacterium tumefaciens*

   (B) *Escherichia coli*

   (C) *Bacillus subtilis*

   (D) *Bacillus thuringiensis*

38. Which hormone is released through cut coleoptile tips of the oat used in the *Avena* curvature test?

   (A) Gibberellins

   (B) Indole-3-acetic acid

   (C) Cytokinin

   (D) Abscisic acid

39. Arrange the following compounds in the CORRECT order of their formation in TCA cycle.

   i.   Succinic acid

   ii. Oxalosuccinic acid

   iii. Fumaric acid

   iv. Citric acid

   v.   Malic acid

   (A) ii, iv, i, iii, v   (B) iii, iv, ii, i, v

   (C) v, iv, i, ii, iii   (D) iv, ii, i, iii, v

40. Which of the following codon does NOT have a specific tRNA?

   (A) UUU   (B) AUG

   (C) GUC   (D) UAG

41. Which of the following is true with respect to triple fusion?

   (A) It is the fusion of female gamete with haploid secondary nucleus.

   (B) It is the fusion of second male gamete with diploid secondary nucleus.

   (C) It is the fusion of two male gametes with egg.

   (D) It is the fusion of second male gamete with egg.

42. Which of the following is INCORRECT with respect to the requirements of tissue culture technique?

   (A) 1% sodium hypochlorite for sterilization.

   (B) Nutrient medium with pH 4.0 – 4.8.

   (C) Agitation of cell culture at 100 – 250 rpm for aeration.

   (D) Excision of parenchyma or meristem for using as explants.

43. Select the CORRECT match.

	Column A		Column B
i.	Rhamnose	a.	CH_3CHOH
ii.	Lactic acid	b.	$C_6H_{12}O_5$
iii.	Formaldehyde	c.	$C_6H_{12}O_4$
iv.	Digitoxose	d.	HCHO

   (A) i – b   (B) ii – c

   (C) iii – a   (D) iv – d

44. Identify the molecular formulae of chlorophyll-a and chlorophyll-b and choose the correct option.

	Chlorophyll-a	Chlorophyll-b
(A)	$C_{50}H_{72}O_5N_4Mg$	$C_{55}H_{70}O_6N_4Mg$
(B)	$C_{55}H_{72}O_5N_4Mg$	$C_{50}H_{70}O_6N_4Mg$
(C)	$C_{55}H_{72}O_5N_4Mg$	$C_{55}H_{70}O_6N_4Mg$
(D)	$C_{55}H_{72}O_5N_4Mg$	$C_{55}H_{72}O_6N_2Mg$

45. Which of the following pathogenic bacteria is used as a herbicide?

    (A) *Beauveria* sp.
    (B) *Nosema* sp.
    (C) *Xanthomona*s sp.
    (D) *Alternaria* sp.

46. Along with co-dominance which other concept can also be explained with the example of ABO blood groups?

    (A) Sex linked inheritance
    (B) Multiple alleles
    (C) Incomplete dominance
    (D) Pleiotropy

47. Which of the following is NOT a free-living cyanobacterial biofertilizer?

    (A) *Tolypothrix*
    (B) *Azotobacter*
    (C) *Nostoc*
    (D) *Aulosira*

48. When pollination occurs on the surface of water it is referred to as

    (A) hypohydrophily
    (B) epihydrophily
    (C) chiropterophily
    (D) ornithophily

49. Which of the following bacteria performs denitrification?

    (A) *Nitrosomonas*
    (B) *Nitrococcus*
    (C) *Nitrobacter*
    (D) *Pseudomonas*

50. In photorespiration, which of the following compound is NOT formed in the chloroplast?

    (A) Glycolate
    (B) Phosphoglycolate
    (C) PGA
    (D) Glycine

51. Identify the INCORRECT match.

    (A) Forelimbs of lizard and bat – Homologous organs

    (B) Wings of birds and insects – Divergent evolution

    (C) Wings of Pterodactyl and parrot – Analogous organs

    (D) Wings of bat and pigeon – Convergent evolution

52. Accessory sex gland in males is
    (A) Bulbourethral gland
    (B) Bartholin's gland
    (C) Vestibular gland
    (D) Pineal gland

53. _____ prevent(s) the regurgitation of food.
    (A) Pyloric sphincter
    (B) Papillae
    (C) Cardiac sphincter
    (D) Epiglottis

54. Identify the pair of hormones synthesized by the hypothalamus but are released from the posterior pituitary.
    (A) Melatonin and Prolactin
    (B) Vasopressin and Melatonin
    (C) Oxytocin and Vasopressin
    (D) Oxytocin and Prolactin

55. Which of the following process occurs during the pachytene stage of prophase-I of meiosis?
    (A) Crossing over
    (B) Terminalisation
    (C) Synapsis
    (D) Tetrad formation

56. Which of the following is NOT a marine fish?
    (A) *Rastrelliger*
    (B) *Labeo*
    (C) *Sardinella*
    (D) *Stromateus*

57. Genome of any organisms is the total number of genes present on a _____ set of chromosomes.
    (A) triploid
    (B) haploid
    (C) diploid
    (D) polyploid

58. Which of the following is true for glyoxysomes?
    (A) They contain enzymes for oxidation of fatty acids.
    (B) They are a type of sphaerosomes.
    (C) They are double membranous structures.
    (D) They play a role in detoxification.

59. Oral contraceptive pills check pregnancy by preventing
    (A) fertilization
    (B) implantation
    (C) ovulation
    (D) conception

60. Severe malaria is caused exclusively by
    (A) *P. vivax*
    (B) *P. malariae*
    (C) *P. falciparum*
    (D) *P. ovale*

61. Bacterial poultry diseases include the following, EXCEPT

(A) CRD (B) Favus

(C) Pullorum (D) Cholera

62. Blastocyst stage is reached about _____ days after fertilization.

(A) 3 (B) 5

(C) 8 (D) 10

63. The nasal chamber is divided into right and left parts by the

(A) internal nare (B) vestibule

(C) mesethmoid (D) naso-pharynx

64. Select the CORRECT match.

	Column A		Column B
a.	Endangered species	i.	Three banded Armadillo
b.	Rare species	ii.	Asiatic wild ass
c.	Indeterminate species	iii.	Hawaiian monk seal
d.	Vulnerable species	iv.	Antelope

(A) a – ii (B) b – iv

(C) c – iii (D) d – i

65. Which of the following is NOT the function of ADH?

(A) Increases the permeability of renal tubules for absorption of water

(B) Constricts blood vessels

(C) Increases blood pressure

(D) Vasodilation

66. The rise of first primates occurred in which epoch?

(A) Holocene (B) Eocene

(C) Oligocene (D) Palaeocene

67. Which of the following correctly represents the II, IV and VII cranial nerves respectively?

(A) Oculomotor, Facial and Optic (B) Optic, Trochlear and Facial

(C) Vagus, Oculomotor and Trochlear (D) Hypoglossal, Optic and Olfactory

68. Sarcomere is a

(A) portion between two adjacent Z-lines.

(B) fibrous membrane present in the middle of 'A' band.

(C) dark band that does not allow light to pass.

(D) narrow dark line seen in light band.

69. Banting and Best purified insulin from

    (A) transgenic mice
    (B) Banded krait
    (C) *Escherichia coli*
    (D) dog

70. Symptoms of Amoebiasis include the following EXCEPT,

    (A) Colitis
    (B) Dysentery
    (C) Arthralgia
    (D) Liver abscess

71. *Neisseria gonorrhoeae* is a _____ bacterium.

    (A) rod-shaped
    (B) diplococci
    (C) spirochaete
    (D) streptococci

72. Interspecific hybridization is

    (A) mating of animals within the same breed, which have no ancestors in common.
    (B) mating between male and female animals of two different related species.
    (C) mating of superior males of one breed with superior females of another breed.
    (D) mating between closely related individuals of the same breed.

73. _____ are required to form microtubules during mitotic division.

    (A) Centromeres
    (B) Centrioles
    (C) Nucleosomes
    (D) Mesosomes

74. Which of the following change occurs to prevent polyspermy?

    (A) Hydrolytic activity of hyaluronidase.
    (B) Conversion of vitelline membrane into fertilization membrane.
    (C) Secretion of viscous fluid in the internal lining of fallopian tube.
    (D) Secretion of anti-fertilizin by sperm head.

75. The first wave in ECG represents

    (A) ventricular repolarization
    (B) atrial depolarization
    (C) ventricular depolarization
    (D) atrial repolarization

76. Ape-men include all of the following EXCEPT,

    (A) *Kenyapithecus*
    (B) *Australopithecus*
    (C) *Propliopithecus*
    (D) *Ramapithecus*

77. Total volume of air expired after maximum inspiration is termed as

    (A) residual volume
    (B) expiratory reserve volume
    (C) tidal volume
    (D) vital capacity

78. The heavy metal whose accumulation in humans causes testicular atrophy, growth retardation and bone deformation is

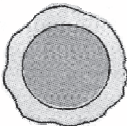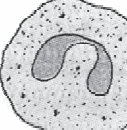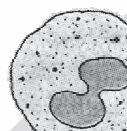(A) selenium   (B) cadmium   (C) mercury   (D) lead

79. Antigen presenting cells include all the following EXCEPT,

(A) T lymphocytes   (B) Monocytes

(C) B lymphocytes   (D) Langerhans cells

80. The following are X-linked traits that are more frequent in males than females EXCEPT,

(A) Hypertrichosis   (B) Haemophilia

(C) Myopia   (D) Muscular dystrophy

81. Find the CORRECT match.

	Column A		Column B
a.		i.	Phagocytic
b.		ii.	Release heparin
c.		iii.	Produce antibodies
d.		iv.	Anti-histamine property

(A) a – ii   (B) b – i

(C) c – iii   (D) d – iv

82. Ciliated columnar epithelium is found in

(A) kidney   (B) fallopian tubes

(C) thyroid gland   (D) stomach

83. Bright's disease involves the following, EXCEPT

(A) Haematuria   (B) Oliguria

(C) Hypertension   (D) Urolithiasis

84. _____ is known as Wernicke's area.

   (A)   Auditory area   (B)   Sensory speech area

   (C)   Motor speech area   (D)   Association area

85. Which of the following is a CORRECT match for the genes used in gene therapy?

   (A)   TPA – Treat haemophiliacs

   (B)   BGH – Treat Cystic fibrosis

   (C)   DNase – Treat pituitary dwarfism

   (D)   TGF-β – Treat wounds and burns

86. _____ prevents valves from turning back into the atria, during the contraction of ventricles.

   (A)   Interventricular septum   (B)   Chordae tendinae

   (C)   Columnae carnae   (D)   Trabeculae carnae

87. Proliferative phase extends from _____ day of menstrual cycle.

   (A) 1st to 4th (B) 5th to 13th

   (C) 14th to 20th (D) 15th to 28th

88. Normal value of serum bilirubin ranges from

   (A)   3 to 13 μmol/l   (B)   10 to 20 μmol/l

   (C)   30 to 40 μmol/l   (D)   40 to 50 μmol/l

89. Which of the following drug is derived from ergot fungus?

   (A)   Lysergic acid diethyl amide (B)   Diacetylmorphine

   (C)   Marijuana   (D)   Cocaine

90. Water is reabsorbed by osmosis in the following, EXCEPT

   (A)   PCT

   (B)   DCT

   (C)   Descending limb of loop of Henle

   (D)   Ascending limb of loop of Henle

91. Which of the following is NOT true with respect to Down's syndrome?

   (A)   It is caused due by aneuploidy.

   (B)   Common symptoms include epicanthal fold and simian crease.

   (C)   Genotype is 44 + XO.

   (D)   It occurs due to non-disjunction during meiosis.

92. The endoderm gives rise to the following, EXCEPT

    (A) Tongue   (B) Intestine

    (C) Adrenal cortex   (D) Pancreas

93. In the following steps of digestion (i and ii), identify the enzymes (X and Y).

    i. Peptones $\xrightarrow{\text{'X'}}$ Polypeptides

    ii. Trypsinogen $\xrightarrow{\text{'Y'}}$ Trypsin

    (A) X − Trypsin, Y − Chymotrypsinogen

    (B) X − Trypsinogen, Y − Enterokinase

    (C) X − Trypsinogen,   Y − Chymotrypsinogen

    (D) X − Trypsin, Y − Enterokinase

94. Glucosuria is indicated when the blood glucose level rises above

    (A) 45 mg/ml   (B) 100 mg/ml

    (C) 160 mg/ml   (D) 200 mg/ml

95. Complete the analogy and select the correct option.

    Addison's disease : Hyposecretion of ACTH :: _____ : Hypersecretion of GH

    (A) Myxoedema

    (B) Acromegaly

    (C) Graves' disease

    (D) Cretinism

96. If tactile receptors : touch, then frigid receptors : _____

    (A) pressure   (B) cold

    (C) taste   (D) pain

97. Which of the following is NOT a method of *in-situ* conservation of endangered species?

    (A) Culture collections

    (B) Hot spots

    (C) Biosphere reserves

    (D) National parks

98. Which of the following is CORRECT with respect to steps in DNA fingerprinting?

    (A) DNA fragments are separated based on difference in charge between them.

    (B) The DNA bands are blotted on parchment paper.

    (C) DNA bands are flooded with single stranded radioactive RNA probes.

    (D) dsDNA is split into ssDNA by alkaline chemicals.

99. Which of the following condition is NOT associated with asthma?

    (A)   dyspnea   (B)   hypoxia

    (C)   wheezing   (D)   dyspepsia

100. The orchid growing as an epiphyte on a tree is an example of

    (A)   commensalism   (B)   mutualism

    (C)   parasitism   (D)   competition

ANSWER KEY & HINTS
TO
MOCK MHT - CET EXAM - 2018

Subjects : Physics & Chemistry

1. Answer key is provided to all the questions.

2. Hints are provided below the Answer Key, wherever needed.

3. Additionally, Video Solutions to interpretative/challenging type questions are provided. You can view them by scanning the QR Code given along with the answer key. The QR Code can be scanned by using any 'QR Scanner' app.

1. (D)
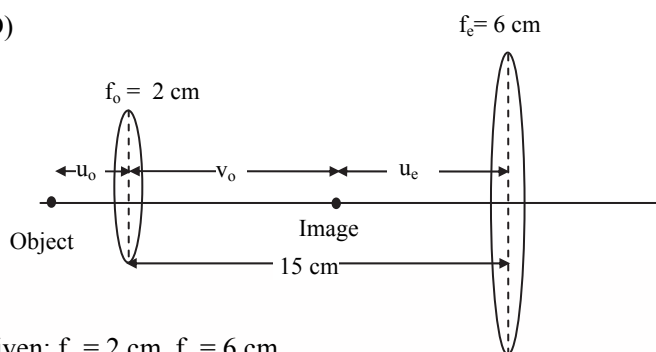
Given: $f_o = 2$ cm, $f_e = 6$ cm,
$\qquad L = v_o + u_e = 15$ cm,

As image is formed at the least distance of distinct vision, $v_e = -25$ cm

For eyepiece,

$$\frac{1}{v_e} - \frac{1}{u_e} = \frac{1}{f_e} \qquad \ldots.(i)$$

$\therefore \quad \dfrac{1}{u_e} = \dfrac{1}{v_e} - \dfrac{1}{f_e} = \dfrac{1}{-25} - \dfrac{1}{6} = \dfrac{-31}{150}$

$\therefore \quad u_e = \dfrac{-150}{31}$ cm

As u_e is on left side of eyepiece, according to sign conventions, u_e is negative. Hence, neglecting negative sign,

$u_e = \dfrac{150}{31}$ cm

As, $L = v_0 + u_e = 15$ cm

$\therefore \quad v_o = 15 - \dfrac{150}{31} = \dfrac{315}{31}$ cm

For objective,

$$\frac{1}{v_o} = \frac{1}{f_o} + \frac{1}{u_o}$$

$\therefore \quad \dfrac{1}{u_o} = \dfrac{1}{v_o} - \dfrac{1}{f_o} = \dfrac{1}{\frac{315}{31}} - \dfrac{1}{2} = \dfrac{-253}{630}$

$\therefore \quad u_o = -\dfrac{630}{253} = -2.49$ cm

Approximating to nearest answer, option (D) is correct choice.

2. (C)
Potential across capacitor,
$V = Q / C$
As capacitor is connected to battery throughout, $V =$ constant

$\therefore \quad \dfrac{Q_o}{C_o} = \dfrac{Q_g}{C_g} \Rightarrow \dfrac{Q_g}{Q_o} = \dfrac{C_g}{C_o}$ where, C_o is the original capacitance and Q_o is original charge on capacitor. C_g is the

new capacitance and Q_g is new charge.
As capacitance of capacitor increases after inserting a dielectric plate,
$C_g > C_o \Rightarrow Q_g > Q_o$

$\therefore \quad$ The charge on the plates will increase.

3. (D)
The plate current reduces with increasing wavelength. When wavelength exceeds threshold value, photoelectric effect ceases, reducing current to zero. This is best represented by graph (D).

4. **(C)**

As ray suffers minimum deviation, $i = e = \theta$

$\therefore$ $\delta_m = (i + e) - A = 2\theta - A$

$$\mu = \frac{\sin\left(\dfrac{A + \delta_m}{2}\right)}{\sin\left(\dfrac{A}{2}\right)} = \frac{\sin\left(\dfrac{A + \delta_m}{2}\right)}{\sin\left(\dfrac{60}{2}\right)}$$

$\therefore$ $\sqrt{2} = \dfrac{\sin\left(\dfrac{A + \delta_m}{2}\right)}{\sin 30°}$

$\therefore$ $\sin 30° \times \sqrt{2} = \sin\left(\dfrac{A + 2\theta - A}{2}\right) = \sin\theta$

$\therefore$ $\dfrac{\sqrt{2}}{2} = \sin\theta$

$\therefore$ $\dfrac{1}{\sqrt{2}} = \sin\theta$

$\therefore$ $\theta = \sin^{-1}\left(\dfrac{1}{\sqrt{2}}\right) = 45°$

5. **(C)**

Given: $\omega_1 = \omega_2$, But, $\omega = \dfrac{v}{r}$

$\therefore$ $\dfrac{v_1}{r_1} = \dfrac{v_2}{r_2} \Rightarrow \dfrac{v_1}{v_2} = \dfrac{r_1}{r_2} = \dfrac{r}{R}$

6. **(A)**

Suppose length of each wire is l,

then side of square $= \dfrac{l}{4}$

$\therefore$ $A_{square} = \left(\dfrac{l}{4}\right)^2 = \dfrac{l^2}{16}$

Also, for two looped coil,

circumference of each coil $= \dfrac{l}{2}$

$\therefore$ radius of each coil, $r = \dfrac{\dfrac{l}{2}}{2\pi}$

$\therefore$ Area of each coil $= \pi r^2 = \pi\left(\dfrac{\dfrac{l}{2}}{2\pi}\right)^2 = \dfrac{l^2}{16\pi}$

Given: $M_{square} = M_{coil}$

$I_{square}\, A_{square} = n\, I_{coil}\, A_{coil}$

$\therefore$ $\dfrac{I_{square}}{I_{coil}} = \dfrac{nA_{coil}}{A_{square}}$

$= \dfrac{2 \times \left(l^2/16\pi\right)}{l^2/16}$ ....($\because$ n = 2)

$= \dfrac{2}{\pi}$
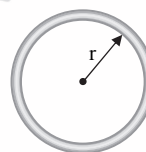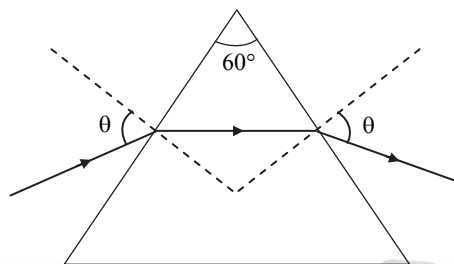
7. **(C)**

Velocity of sphere (B) after elastic collision,

$$v_B = \left(\frac{2m_A}{m_A + m_B}\right)u_A + \left(\frac{m_B - m_A}{m_A + m_B}\right)u_B$$

∴ $\quad 0 = \frac{(m_B - m_A)u_B}{m_A + m_B} \quad\quad ....(\because u_A = 0)$

∴ $\quad m_B - m_A = 0$

∴ $\quad m_A = m_B$

∴ $\quad m_B = 20$ kg

8. **(C)**

Let V be the potential of the junction as shown in figure. Applying junction law, we have
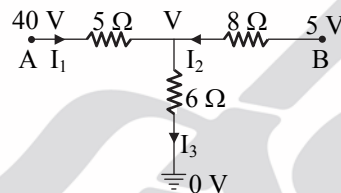
$I_1 + I_2 = I_3$

∴ $\quad \dfrac{40 - V}{5} + \dfrac{5 - V}{8} = \dfrac{V - 0}{6}$

∴ $\quad \dfrac{320 - 8V + 25 - 5V}{40} = \dfrac{V}{6}$

∴ $\quad \dfrac{345 - 13V}{40} = \dfrac{V}{6}$

∴ $\quad V = 17.54$ V

∴ $\quad I_3 = \dfrac{V}{R} = \dfrac{17.54}{6} = 2.9$ A ≈ 3A

9. **(B)**

$$\mu = \frac{c}{v} = \frac{f\lambda_{air}}{f\lambda_{med}} = \frac{5}{4}$$

Given, v = +1 m,

$$m = \frac{-1}{3} = \frac{v}{u}$$

∴ $\quad u = -3$ m.

Using formula, $\dfrac{1}{f} = \dfrac{1}{v} - \dfrac{1}{u} = \dfrac{1}{1} - \left(\dfrac{-1}{3}\right)$

$$\frac{1}{f} = \frac{4}{3}$$

$$f = \frac{3}{4} \text{ m}$$

Using lens maker's equation,

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

For plano-convex lens, $R_1 = \infty$, $R_2 = -R$.

∴ $\quad \dfrac{1}{f} = (\mu - 1)\dfrac{1}{R}$

$\Rightarrow R = f(\mu - 1) = \dfrac{3}{4}\left(\dfrac{5}{4} - 1\right) = \dfrac{3}{16}$ m = 0.19 m

10. **(D)**

Total capacitance of the system is given by,

$$\frac{1}{C_{eq}} = \frac{1}{5} + \frac{1}{5} + \frac{1}{(5+5)} + \frac{1}{5} + \frac{1}{5} = \frac{2}{5} + \frac{1}{10} + \frac{2}{5} = \frac{4}{5} + \frac{1}{10}$$

$\therefore$ $\quad \dfrac{1}{C_{eq}} = \dfrac{40+5}{50} = \dfrac{45}{50} = \dfrac{9}{10}$

$\therefore$ $\quad C_{eq} = 1.11 \ \mu F$

Energy stored in the system,

$U = \dfrac{1}{2} \ C_{eq} \ V^2$

$\therefore$ $\quad 64 \times 10^{-6} = \dfrac{1}{2} \times 1.11 \times 10^{-6} \times V^2$

$\therefore$ $\quad V = \sqrt{\dfrac{64 \times 10^{-6} \times 2}{1.11 \times 10^{-6}}}$

$\therefore$ $\quad V = 10.74 \ V$

$\therefore$ $\quad V \approx 11 \ V$

11. **(C)**

If B_H is the horizontal component of earth's magnetic field in magnetic meridian, then

$\tan \delta = \dfrac{B_V}{B_H}$

Let B_H' be component of B_H at angle x to magnetic meridian, then

$\tan \delta' = \dfrac{B_V}{B_H'} = \dfrac{B_V}{B_H \cos x} = \dfrac{\tan \delta}{\cos x}$

$\Rightarrow \tan \delta = \tan \delta' \times \cos x$

$\qquad = \tan \dfrac{3}{2} x \times \cos x \qquad$ ….(Given $\delta' = \dfrac{3x}{2}$)

$\therefore$ $\quad \delta = \tan^{-1} \left(\tan \dfrac{3x}{2} \cos x \right)$
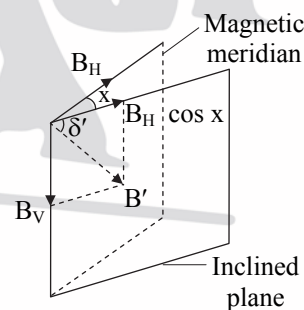
12. **(C)**

Wavelength of spectral line,

$\lambda = \left[R \left(\dfrac{1}{n_1^2} - \dfrac{1}{n_2^2} \right) \right]^{-1}$

For maximum wavelength of Lyman series
$n_1 = 1$ and $n_2 = 2$

$\therefore$ $\quad \lambda_1 = \left[R \left(\dfrac{1}{1^2} - \dfrac{1}{2^2} \right) \right]^{-1} = \dfrac{4}{3R}$

and for Balmer limit, $n_1 = 2$ and $n_2 = \infty$

$\therefore$ $\quad \lambda_2 = \left[R \left(\dfrac{1}{2^2} - \dfrac{1}{\infty} \right) \right]^{-1} = \dfrac{4}{R}$

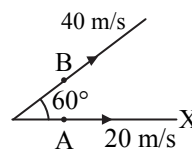$\therefore$ $\quad \dfrac{\lambda_1}{\lambda_2} = \dfrac{1}{3}$

Hence, λ_1 and λ_2 denote maximum wavelength of Lyman series and Balmer limit respectively.

13. **(B)**

Particle B moves making an angle of 60° with X-axis. Hence resolving it into components,

$\vec{v}_B = 40 \cos 60° \hat{i} + 40 \sin 60° \hat{j}$

Relative velocity, $\vec{v}_{BA} = \vec{v}_B - \vec{v}_A = \left(40 \cos 60° \hat{i} + 40 \sin 60° \hat{j} \right) - 20 \hat{i}$

$\qquad\qquad\qquad = \left(20 \hat{i} + 20\sqrt{3} \hat{j} \right) - 20 \hat{i} = 20\sqrt{3} \ \hat{j}$

$\therefore$ $\quad$ Relative velocity is $20\sqrt{3}$ m/s along Y-axis.

14. (A)

At time $t = \dfrac{T}{6}$, displacement of particle from the mean position would be

$x = A \sin \omega t = A \sin \left(\dfrac{2\pi}{T} \times \dfrac{T}{6} \right) = A \sin \dfrac{\pi}{3}$

$\therefore \quad x = \dfrac{\sqrt{3}A}{2}$

Now, K.E. $= \dfrac{1}{2} m\omega^2 (A^2 - x^2)$

$\qquad = \dfrac{1}{2} m\omega^2 \left(A^2 - \dfrac{3A^2}{4} \right) = \dfrac{1}{8} (m\omega^2 A^2)$

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

$\qquad = \dfrac{1}{2} m\omega^2 \left(\dfrac{3A^2}{4} \right) = \dfrac{3}{8} m\omega^2 A^2$

$\therefore \quad \dfrac{\text{K.E.}}{\text{P.E.}} = \dfrac{\dfrac{1}{8}\left(m\omega^2 A^2\right)}{\dfrac{3}{8}\left(m\omega^2 A^2\right)} = \dfrac{1}{3}$

15. (B)

Using, $a + r + t = 1$,
$a + 0.53 + 0.16 = 1 \Rightarrow a = 0.31$
According to Kirchhoff's law of radiation,
$a = e \Rightarrow e = 0.31$

16. (D)

Young's Modulus for a wire is given as,

$Y = \dfrac{MgL}{l\,A} \Rightarrow l = \dfrac{MgL}{YA}$

$\therefore \quad l \propto \dfrac{L}{A} \qquad$ i.e., $l \propto \dfrac{L}{\pi r^2}$

Considering option (A),

$\dfrac{L}{\pi r^2} = \dfrac{50 \times 10^{-2}}{\pi \times \left(\dfrac{0.5 \times 10^{-1}}{2} \right)^2} = \dfrac{800}{\pi}$ cm^{-1}

Considering option (B),

$\dfrac{L}{\pi r^2} = \dfrac{100 \times 10^{-2}}{\pi \times \left(\dfrac{1 \times 10^{-1}}{2} \right)^2} = \dfrac{400}{\pi}$ cm^{-1}

Considering option (C),

$\dfrac{L}{\pi r^2} = \dfrac{200 \times 10^{-2}}{\pi \times \left(\dfrac{2 \times 10^{-1}}{2} \right)^2} = \dfrac{200}{\pi}$ cm^{-1}

Considering option (D),

$$\frac{L}{\pi r^2} = \frac{300 \times 10^{-2}}{\pi \times \left(\frac{3 \times 10^{-1}}{2}\right)^2} = \frac{133.33}{\pi} \text{ cm}^{-1}$$

Amongst the given options, $\left(\frac{L}{\pi r^2}\right)$ is minimum for wire of length 300 cm and diameter 3 mm.

Hence, option (D) is correct.

17. (C)

For the given graph,

$$\text{slope} = \frac{\sin i}{\sin r} = \tan 30° = \frac{1}{\sqrt{3}}$$

but, $\dfrac{\sin i}{\sin r} = \dfrac{c_M}{c_{air}}$

∴ $c_M = \dfrac{c_{air}}{\sqrt{3}} = \dfrac{3 \times 10^8}{\sqrt{3}} = \sqrt{3} \times 10^8$

$= 1.73 \times 10^8$ m/s

18. (A)

Induced current, $I = \dfrac{d\phi}{Rdt}$

∴ $\dfrac{d\phi}{R} = I \, dt = $ Area under I – t graph

∴ $d\phi = R \times$ (Area under I – t graph)

∴ $d\phi = 15 \times \dfrac{1}{2} \times 5 \times 0.2 = 7.5$ weber

19. (A)

Let T_1 be the tension in the string when mass is lifted up and T_2 be the tension in the string when mass is lowered.

$T_1 = m(g + a) = 1 \times \left(g + \dfrac{g}{4}\right) = \dfrac{5g}{4}$ ....$(\because 2.45 \times 4 = g)$

$T_2 = m(g - a) = 1 \times \left(g - \dfrac{g}{2}\right) = \dfrac{g}{2}$ ....$(\because 4.9 \times 2 = g)$

∴ $\dfrac{T_1}{T_2} = \dfrac{5}{2}$

20. (C)
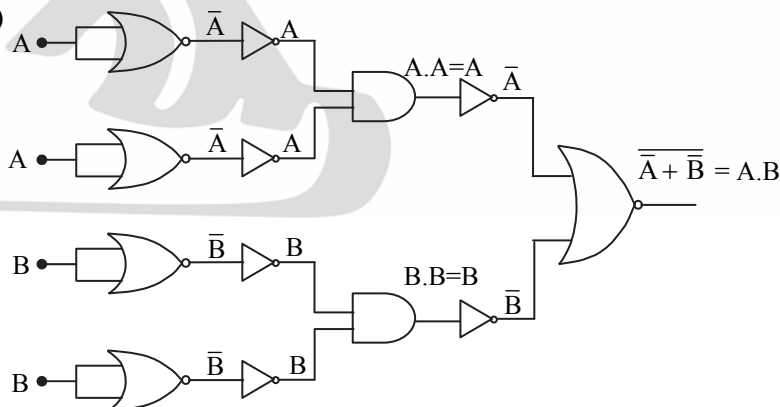
Hence, the given circuit represents AND gate.

21. (B)

22. (C)
As the weight of the cupboard is,
W = 90 × 10 = 900 N
Normal reaction N_1 = 900 N

∴ for moving the cupboard,
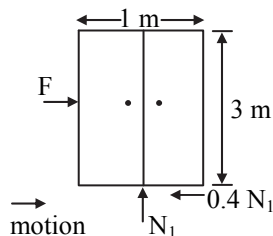F – 0.4 N_1 = 0
F – 0.4 × 900 = 0
F = 360 N

Thus, the cupboard will move only if the frictional force is overcome.
i.e., the force required to move the cupboard should be slightly greater than 360 N.

23. (D)
Change in potential energy in displacing a body from r_1 to r_2 is given by

$$\Delta U = GMm\left(\frac{1}{r_1} - \frac{1}{r_2}\right) = GMm\left(\frac{1}{4R} - \frac{1}{5R}\right) = \frac{GMm}{20R}$$

24. (A)
x = 3 cosωt + 4 sinωt

$$= 3 \sin\left(\omega t + \frac{\pi}{2}\right) + 4 \sin \omega t$$

∴ R = $\sqrt{3^2 + 4^2}$ = 5 cm

25. (C)
According to law of length for a vibrating string, nl = constant

∴ $n_1 l_1 = n_2 l_2$ ⇒ 110 (l_1 × 120) = (120 – 10) n_2

∴ $n_2 = \frac{110 \times 120}{110}$ ⇒ n_2 = 120 Hz

∴ Number of beats = 120 – 110 = 10

26. (D)
F = T × 2(length of loop)
   = T × 2 (4l)
   = 8 Tl

27. (A)
According to Brewster's law,
$_w\mu_g$ = tan i_p
   = tan 49°
   = cot(90° – 49°)   ….[∵ tan θ = cot(90° – θ)]
   = cot 41°
   = 1.1503

$_w\mu_g = \dfrac{_a\mu_g}{_a\mu_w}$

∴ $_a\mu_g = {}_w\mu_g \times {}_a\mu_w = 1.1503 \times \frac{4}{3} = 1.53$

28. (C)
As the voltmeter has full scale deflection of 5 V and is graded as 2000 Ω/V, hence
total resistance of voltmeter is G = 5 × 2000 Ω
⇒ G = 10000 Ω
The full scale deflection current of voltmeter is

$$I_g = \frac{5}{10000} = \frac{1}{2000} A$$

The resistance in series that must be connected for 12 V full scale deflection is

$R_S = \dfrac{V}{I_g} - G = \dfrac{12}{\dfrac{1}{2000}} - 10000$

$\therefore \quad R_S = 24000 - 10000 = 14000\ \Omega = 1.4 \times 10^4\ \Omega$

29. (A)

$\dfrac{1}{Z} = \dfrac{1}{X_L} - \dfrac{1}{X_C} = \dfrac{1}{20} - \dfrac{1}{40}$

$\therefore \quad \dfrac{1}{Z} = \dfrac{40-20}{20 \times 40} = \dfrac{1}{40}\ \Omega$

$\therefore \quad Z = 40\ \Omega$

30. (C)

Work function is given by,

$W_0 = h\nu_0$

$W_0 = \dfrac{hc}{\lambda_0}$

$\therefore \quad \lambda = \dfrac{hc}{W_0}$

$\therefore \quad \lambda' = \dfrac{hc}{2W_0} = \dfrac{\lambda}{2}$

31. (C)

For a solid sphere,

$(K.E)_{Rolling} = \dfrac{1}{2}Mv^2\left(1 + \dfrac{K^2}{R^2}\right)$

$(K.E)_{Rotation} = \dfrac{1}{2}Mv^2\left(\dfrac{K^2}{R^2}\right)$

$\dfrac{(K.E)_{Rolling}}{(K.E)_{Rotation}} = \dfrac{1 + \dfrac{2}{5}}{\dfrac{2}{5}}$ .... $\left[\because \left(\dfrac{K^2}{R^2}\right)_{sphere} = \dfrac{2}{5}\right]$

$= \dfrac{7}{2}$

32. (A)

According to kinetic theory of gases,

$\left(\dfrac{c_1}{c_2}\right)_{rms} = \sqrt{\dfrac{T_1}{T_2}}$

But $(c_2)_{rms} = 3(c_1)_{rms}$ ....(given)

$\therefore \quad \left(\dfrac{c_1}{3c_1}\right)_{rms} = \sqrt{\dfrac{27 + 273}{T}} \Rightarrow \dfrac{1}{9} = \dfrac{300}{T}$

$\Rightarrow T = 2700\ K = 2427\ °C$

33. (C)

Using law of length for a vibrating string,

$l_1 : l_2 : l_3 = \dfrac{1}{n_1} : \dfrac{1}{n_2} : \dfrac{1}{n_3}$

$= 6 : 3 : 2$

$\therefore \quad l_1 = \dfrac{6}{11} \times 66 = 36$ cm

$l_2 = \dfrac{3}{11} \times 66 = 18$ cm

$l_3 = \dfrac{2}{11} \times 66 = 12$ cm

34. (C)

$Y = \dfrac{F}{A}\dfrac{L}{\Delta L} = \dfrac{dyne}{cm^2} = \dfrac{10^{-5}\,N}{10^{-4}\,m^2} = 0.1$ N/m^2

35. (C)

Given circuit is series LCR circuit. Current through circuit is given by,

$I = \dfrac{V}{Z} = \dfrac{V}{\sqrt{R^2 + \left(\omega L - \dfrac{1}{\omega C}\right)^2}}$

Neglecting resistance value,

$I = \dfrac{V}{\omega L - \dfrac{1}{\omega C}}$

$\omega L - \dfrac{1}{\omega C} = \dfrac{V}{I} = \dfrac{70}{7} = 10\ \Omega$ ….(i)

If the value of capacitance is decreased to half then,

$\omega L - \dfrac{1}{\omega \dfrac{C}{2}} = \dfrac{70}{14} = 5\ \Omega$

$\therefore \quad \omega L - \dfrac{2}{\omega C} = 5\ \Omega$ ….(ii)

Subtracting equation (ii) from equation (i),

$\dfrac{1}{\omega C} = 5\ \Omega$

Voltage across capacitor $= I \times$ capacitive reactance
$\qquad = 7 \times 5 = 35$ V

36. (D)

For $y_1 = y_2$

$n_1\lambda_1 = n_2\lambda_2$

$\therefore \quad \dfrac{n_1}{n_2} = \dfrac{\lambda_2}{\lambda_1} = \dfrac{480}{720} = \dfrac{2}{3}$

$\therefore \quad y_1 = \dfrac{n_1\lambda_1 D}{d} = \dfrac{2 \times 720 \times 10^{-9} \times 1.2}{0.2 \times 10^{-3}} = 8.64 \times 10^{-3}$ m $= 8.64$ mm.

37. (C)

Intensity of magnetisation $(I) = \dfrac{\text{Dipole moment}\,(M)}{\text{Volume}\,(V)}$

Also, $I \propto \dfrac{1}{T}$

As the bar magnet is same in both cases,
$V = $ constant

$\therefore \quad I \propto M$

$\therefore \quad M \propto \dfrac{1}{T}$

$\therefore \quad \dfrac{M_1}{M_2} = \dfrac{T_2}{T_1}$

$\therefore \quad M_2 = \dfrac{T_1}{T_2} \times M_1 = \dfrac{(31+273)}{(31+273+40)} \times 0.34 = 0.3 \ Am^2$
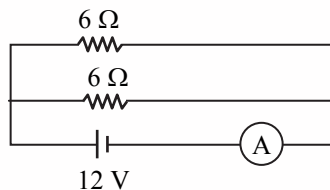
38. **(B)**
Since capacitor does not allow dc current to flow through it, the circuit diagram can be modified as shown below.

$\therefore$ Resistance of circuit,

$R = \dfrac{6 \times 6}{6+6} = 3 \Omega$

Current through circuit,

$I = \dfrac{E}{R} = \dfrac{12}{3} = 4 \ A$

39. **(C)**
By conservation of linear momentum,
$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$

In this case, $m_1 = m$, $m_2 = \dfrac{m}{7}$, $u_1 = v$ and $u_2 = 0$.

$\therefore \quad mv = mv_1 + \dfrac{m}{7} v_2$

where, v_1 and v_2 are velocities of particles A and B after collision.

$\therefore \quad 7v = 7v_1 + v_2 \qquad \dots(i)$
As collision is head on and elastic,

$e = \dfrac{v_2 - v_1}{u_1 - u_2} = 1$

As, $u_1 = v$ and $u_2 = 0$

$\therefore \quad v = v_2 - v_1$
$\therefore \quad v_1 = v_2 - v \qquad \dots(ii)$
Substituting equation (ii) in equation (i),
$7v = 7(v_2 - v) + v_2$

$\therefore \quad 14v = 8v_2$

$\therefore \quad v_2 = \dfrac{14}{8} v = \dfrac{7}{4} v$

$\therefore \quad v_1 = \dfrac{7}{4} v - v = \dfrac{3}{4} v$

As, $\lambda \propto \dfrac{1}{p}$

$\therefore \quad \dfrac{\lambda_A}{\lambda_B} = \dfrac{p_2}{p_1} = \dfrac{\dfrac{m}{7} v_2}{mv_1} = \dfrac{v_2}{7v_1} = \dfrac{\dfrac{7}{4} v}{7\left(\dfrac{3}{4}\right) v} = \dfrac{1}{3}$

40. **(D)**
Given: $\rho_2 = 3\rho_1$, $R_1 = R_2$
$g \propto \rho R \Rightarrow g_1 \propto \rho_1 R_1$ and $g_2 \propto \rho_2 R_2$

$\therefore \quad \dfrac{g_1}{g_2} = \dfrac{\rho_1}{\rho_2} \times \dfrac{R_1}{R_2} = \dfrac{1}{3} \times 1 = \dfrac{1}{3}$

$\therefore \quad g_2 = 3 \times 9.8 = 29.4 \ m/s^2$

41. (A)

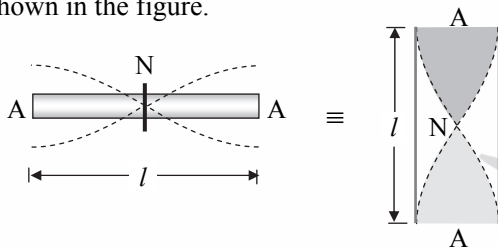Radius of gyration, $K = \sqrt{\dfrac{I}{M}}$

M.I. of circular ring, $I = MR^2$

$\therefore \quad K = \sqrt{\dfrac{MR^2}{M}}$

$\therefore \quad K = \sqrt{R^2}$

$K = R$

42. (A)

If a rod clamped in the middle, then it vibrates similar to an open organ pipe as shown in the figure.

$\therefore$ Fundamental frequency of vibrating rod is, given by $n_1 = \dfrac{v}{2l} \Rightarrow 2.9 \times 10^3 = \dfrac{v}{2 \times 1}$

$\therefore \quad v = 5.8 \times 10^3$ m/s $= 5.8$ km/s.

43. (D)

Given equation is,

$y = 0.05 \sin 8\pi \left(\dfrac{t}{0.032} - \dfrac{x}{3.2} \right)$

$\quad = 0.05 \sin 2\pi \left(\dfrac{t}{0.008} - \dfrac{x}{0.8} \right)$

Comparing with the standard form,

$y = A \sin 2\pi \left(\dfrac{t}{T} - \dfrac{x}{\lambda} \right)$ we get,

$T = 0.008$ s; $n = \dfrac{1}{T} = \dfrac{1}{0.008} = \dfrac{1000}{8} = 125$ Hz,

$\lambda = 0.8$ m

Using, $v = n\lambda = 125 \times 0.8 = 100$ m/s

44. (B)

Potential difference across the series combination of capacitors $= E_2 - E_1 = 24 - 12 = 12$ volt. This potential difference is divided among two capacitors C_1 and C_2 in the inverse ratio of their capacities as they are joined in series.

$\therefore \quad V_1 = \dfrac{C_2}{C_1 + C_2} \, V = \dfrac{6}{3+6} \times 12 = 8$ volt

As plate of capacitor C_1 towards point B will be at higher positive potential than plate towards point A, hence

$V_B - V_A = 8$ volt

$\therefore \quad V_A - V_B = -8$ V

45. **(D)**

M.I. of ring about tangent in plane, $I = \dfrac{3}{2} MR^2$

$\therefore$ $\quad MR^2 = \dfrac{2}{3} I$ $\qquad$ ....(i)

M.I. of ring about tangent perpendicular to plane, $I' = \dfrac{1}{2} MR^2$

Substituting the value of MR^2 from equation (i), we get

$I' = \dfrac{1}{2}\left(\dfrac{2}{3} I\right) = \dfrac{I}{3}$

46. **(C)**

Elastic potential energy of stretched wire, $E = \dfrac{YAl^2}{2L}$

For a given wire, $E \propto l^2$

$\therefore$ $\quad E_1 \propto l_1^2$ and $E_2 \propto l_2^2$

$\therefore$ $\quad \dfrac{E_2}{E_1} = \dfrac{l_2^2}{l_1^2}$

$\Rightarrow E_2 = \dfrac{E_1 l_2^2}{l_1^2}$

$\qquad = E \times \left(\dfrac{15}{3}\right)^2 = 25E$

47. **(C)**

48. **(C)**

Distance of 1st minima from central maxima

$x_1 = \dfrac{\lambda D}{a}$

Distance between two minima on either side of the central maxima is

$2x_1 = \dfrac{2\lambda D}{a} = \dfrac{2 \times 5000 \times 10^{-10} \times 180 \times 10^{-2}}{0.4 \times 10^{-3}}$

$\qquad = 4.5 \times 10^{-3} = 0.45 \times 10^{-2}$ m

49. **(C)**

Magnetic permeability is given by,

$\mu = \dfrac{B}{H} = \dfrac{(\phi / A)}{H} = \dfrac{\phi}{HA}$

$\quad = \dfrac{4 \times 10^{-4}}{1600 \times 8 \times 10^{-4}}$

$\therefore$ $\quad \mu = 0.31 \times 10^{-3}$ Wb/A–m

50. **(B)**

$W \propto r^2$

$\therefore$ $\quad W_1 \propto r_1^2$ and $W_2 \propto r_2^2$

$\therefore$ $\quad \dfrac{W_1}{W_2} = \left(\dfrac{r_1}{r_2}\right)^2 = \left(\dfrac{5}{3}\right)^2 = 25 : 9$

51. (B)
Method 1:
Assuming initial concentration to be 1M,

$$1 \xrightarrow{t_{1/2}} \frac{1}{2} \xrightarrow{t_{1/2}} \frac{1}{4} \xrightarrow{t_{1/2}} \frac{1}{8} \xrightarrow{t_{1/2}} \frac{1}{16}$$

∴ The time required for initial concentration to reduce to $1/16^{th}$ is $4 \times t_{1/2}$.

$4 \times t_{1/2} = 64$ s (given)

$t_{1/2} = 16$ s

$k = \dfrac{0.693}{t_{1/2}} = \dfrac{0.693}{16}$ s^{-1}

Method 2:
Integrated rate law for first order reaction is:

$k = \dfrac{2.303}{t} \log_{10} \dfrac{[A]_0}{[A]_t}$

$= \dfrac{2.303}{64} \log_{10} \left(\dfrac{1}{1/16} \right)$

$= \dfrac{2.303}{64} \log_{10} (16)$

$= \dfrac{2.303}{64} \log_{10} (2^4)$

$= \dfrac{2.303}{64} \times 4 \log_{10} 2$

$= \dfrac{2.303}{16} \times 0.3010$

$= \dfrac{0.693}{16}$ s^{-1}

Alternate method to find $t_{1/2}$:
Amount of the substance left after 'n' half lives is given as,

$[A]_t = \dfrac{[A]_0}{2^n}$

∴ $\dfrac{1}{16} = \dfrac{1}{2^n}$ ∴   n = 4,

$4 \times t_{1/2} = 64$ s (given)   ∴ $t_{1/2} = 16$ s

52. (C)
$\Delta G = \Delta H - T\Delta S$
If $\Delta G = 0$; then, $\Delta H = T\Delta S$

∴ $T = \dfrac{\Delta H}{\Delta S} = \dfrac{40.2}{0.201} = 200$ K

53. (B)

54. (A)
Teflon, orlon (polyacrylonitrile) and neoprene are addition polymers. Dacron and melamine are condensation polymers. Hence, option (A) is correct.

55. (C)
Dry ice → Non-polar molecular solid
Iodine crystal → Non-polar molecular solid
Graphite → Covalent solid or giant solid
Common salt → Ionic solid

56. (D)

The root mean square velocity is given as $u = \sqrt{\dfrac{3RT}{M}}$.

Thus, $u \propto \sqrt{\dfrac{1}{M}}$ ($\because$ R, T = constant)

This implies that heavier molecules move with lower velocities.
Among the given gases, O_2 has the maximum molar mass and therefore, O_2 has the lowest root mean square velocity.

57. (C)

In sucrose, glycosidic linkage is formed between C-1 of α-D-glucopyranose and C-2 of β-D-fructofuranose units.

58. (B)

Oxidation number of Na = +1
Oxidation number of O = –2
Sum of the oxidation states of all atoms = 0

$\therefore$ For $NaIO_3$:

(Oxidation number of Na) + (Oxidation number of I) + 3 × (Oxidation number of O) = 0

$\therefore$ (+1) + (Oxidation number of I) + 3 × (–2) = 0

$\therefore$ (Oxidation number of I) + 1 – 6 = 0

$\therefore$ Oxidation number of I = +5

59. (C)

(A) Heroin is a diacetyl derivative of morphine.
(B) Arsphenamine, the drug used to treat syphilis, contains – As = As – linkage.
(D) Antifertility drugs are a mixture of synthetic estrogen and progesterone derivatives.
Thus, statement (C) is true.

60. (C)

24 g of Mg is obtained by passing a current of 2 Faradays = 2 × 96,500 C

$\therefore$ 1 g of Mg is obtained by passing a current of $2 \times \dfrac{96{,}500}{24}$ C

$\therefore$ 5×10^3 g of Mg is obtained by passing a current of $\dfrac{2 \times 96{,}500}{24} \times 5 \times 10^3 = 4.02 \times 10^7$ C

61. (C)

Bromobenzene reacts with bromomethane in the presence of sodium in dry ether to form toluene as the major product. This reaction is called Wurtz-Fittig reaction. Besides, the reaction also forms diphenyl and ethane as minor products due to self coupling of bromobenzene and bromomethane, respectively.

$2CH_3 - Br + 2Na \xrightarrow[\text{ether}]{\text{dry}} CH_3 - CH_3 + 2NaBr$

Bromomethane   Ethane
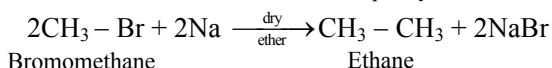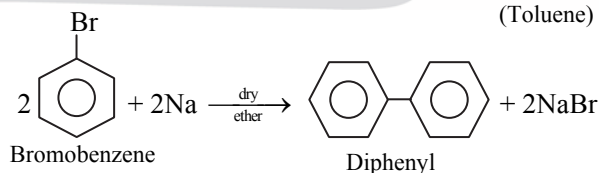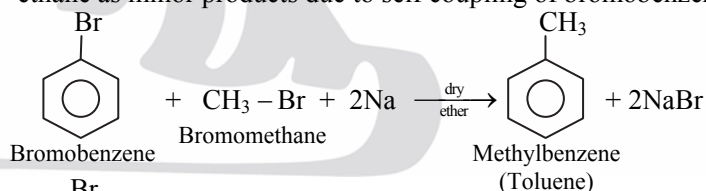
Hence, methane is not formed in the given reactions.

62. (C)
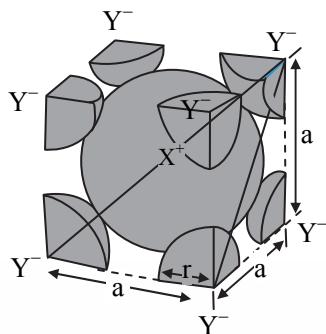
Body-centred unit cell of XY crystal

For a body-centred cubic lattice of XY with edge length 'a',

the length of body diagonal = $\sqrt{3}$ a.

However, the length of the body diagonal is also equal to $2\left(r_{X^+} + r_{Y^-}\right)$.

$\therefore \quad 2\left(r_{X^+} + r_{Y^-}\right) = \sqrt{3}\,a \quad$ or $\quad r_{X^+} + r_{Y^-} = \dfrac{\sqrt{3}}{2}a$

i.e., $r_{X^+} + r_{Y^-} = \dfrac{\sqrt{3}}{2} \times$ edge length

63. (A)

64. (C)

The species with the least negative value of standard reduction potential is the strongest oxidizing agent. Among the given species, Zn^{2+} has least negative value of standard reduction potential. Thus, it is the strongest oxidizing agent.

65. (B)

N_2O – Neutral oxide

N_2O_5 – Acidic oxide

66. (A)

If pressure is expressed in Pa and volume is expressed in m^3, work is directly derived in J.

$1\ Pa \times 1\ m^3 = 1\ J$

$V_1 = 2\ m^3$, $V_2 = 20\ dm^3 = 20 \times 10^{-3}\ m^3 = 0.02\ m^3 \quad [\because 1\ dm^3 = 1 \times 10^{-3}\ m^3]$

$p_{ex} = 100\ kPa$

$\quad = 100 \times 10^3\ Pa$

$W = -p_{ex} \times \Delta V = -p_{ex} \times (V_2 - V_1)$

$\quad = -100 \times 10^3 \times (0.02 - 2)$

$\quad = -10^5 \times (-1.98)$

$\quad = 198000\ J = 198\ kJ$

67. (B)

Alkyl groups exert +I effect and this effect decreases the positive charge on carbonyl carbon making it less susceptible for nucleophilic attack. Hence, ketones are less reactive than aldehydes towards nucleophilic addition reactions. Further, aromatic aldehydes and ketones are less reactive than aliphatic aldehydes and ketones due to steric effect. Hence, the correct decreasing order of reactivity towards nucleophilic addition reactions is,
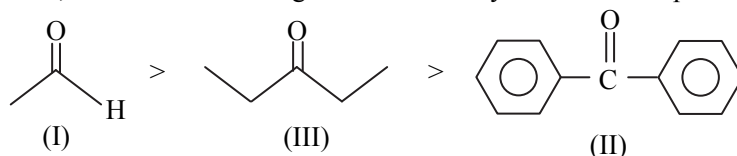
68. (C)

$$\text{Molarity} = \frac{\text{Number of moles of solute}(n)}{\text{Volume of solution in litre}(L)} \qquad \text{where, } n = \frac{\text{Mass of solute}}{\text{Molar mass of solute}}$$

The value of molarity should be 1 for one molar solution.

(A) Molar mass of $C_2H_5OH = (2\times12) + (5\times1) + (1\times16) + (1 \times 1) = 46$ g

$$n_{C_2H_5OH} = \frac{\text{Mass of } C_2H_5OH}{\text{Molar mass of } C_2H_5OH}$$

$$= \frac{0.92}{46} = 0.02 \text{ mol}$$

Molarity of C_2H_5OH solution

$$= \frac{n_{C_2H_5OH}}{\text{Volume of solution in L}}$$

$$= \frac{0.02}{0.1} = 0.2 \text{ M}$$

(B) Molar mass of $CaCl_2 = (1 \times 40) + (2 \times 35.5) = 111$ g

$$n_{CaCl_2} = \frac{\text{Mass of } CaCl_2}{\text{Molar Mass of } CaCl_2}$$

$$= \frac{11.1}{111} = 0.1 \text{ mol}$$

Molarity of $CaCl_2$ solution

$$= \frac{n_{CaCl_2}}{\text{Volume of solution in L}} = \frac{0.1}{1} = 0.1 \text{ M}$$

(C) Molar mass of $CH_3OH = (1\times12)+ (3\times1) + (1\times16) +(1\times1) = 32$ g

$$n_{CH_3OH} = \frac{\text{Mass of } CH_3OH}{\text{Molar mass of } CH_3OH}$$

$$= \frac{3.2}{32} = 0.1 \text{ mol}$$

Molarity of CH_3OH solution

$$= \frac{n_{CH_3OH}}{\text{Volume of solution in L}} = \frac{0.1}{0.1} = 1 \text{ M}$$

(D) Molar mass of $NaCl = (1 \times 23) + (1 \times 35.5) = 58.5$ g

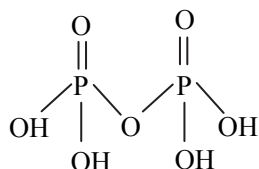$$n_{NaCl} = \frac{\text{Mass of NaCl}}{\text{Molar mass of NaCl}} = \frac{5.85}{58.5} = 0.1 \text{ mol}$$

Molarity of NaCl solution

$$= \frac{n_{NaCl}}{\text{Volume of solution in L}} = \frac{0.1}{1} = 0.1 \text{ M}$$
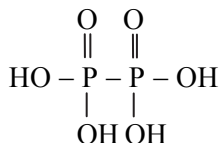
Hence, option (C) is correct.

69. (D)

In pyrophosphoric acid ($H_4P_2O_7$), phosphorus atom has +5 oxidation state. Four P–OH bonds, two P = O bonds and one P–O–P bond are present.
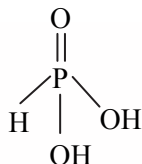

Pyrophosphoric acid ($H_4P_2O_7$)

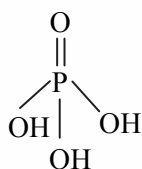The other given oxyacids of phosphorus do not have P – O – P bond.

$$\underset{\substack{| \\ \text{OH}}}{\overset{\substack{\text{O} \\ ||}}{\text{HO} - \text{P}}} - \underset{\substack{| \\ \text{OH}}}{\overset{\substack{\text{O} \\ ||}}{\text{P}}} - \text{OH}$$

Hypophosphoric acid ($H_4P_2O_6$)

Orthophosphorus acid (H_3PO_3)

Orthophosphoric acid (H_3PO_4)

70. **(D)**

The presence of electron donating groups such as $-CH_3$, $-NH_2$, etc., in benzene increases the stability of carbocation whereas the presence of electron withdrawing groups such as $-COOH$, $-CN$, $-Cl$, etc., decreases the stability of carbocation.

71. **(D)**

A promoter is defined as a substance which itself has little or no catalytic power but which on addition to a catalyst significantly increases its activity.

72. **(C)**

The general formula of alkanes C_nH_{2n+2}.

For the given alkane, molecular weight is 100.

∴ $(n \times 12) + [(2 \times n)] \times 1 + 2 = 100$

∴ $12n + 2n + 2 = 100$

∴ $14n = 98$

∴ $n = 7$
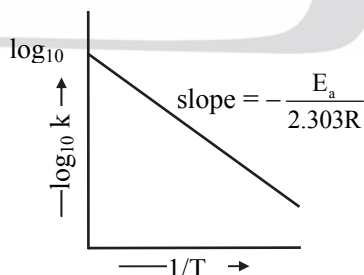
Therefore, $C_7H_{(2 \times 7+2)} = C_7H_{16}$

73. **(A)**

Arrhenius equation can be given as:

$$\log_{10}k = \frac{-E_a}{2.303RT} + \log_{10}A$$

A graph of $\log_{10}k$ against $1/T$ gives a straight line with slope = $\frac{-E_a}{2.303R}$ and y-intercept = $\log_{10}A$.
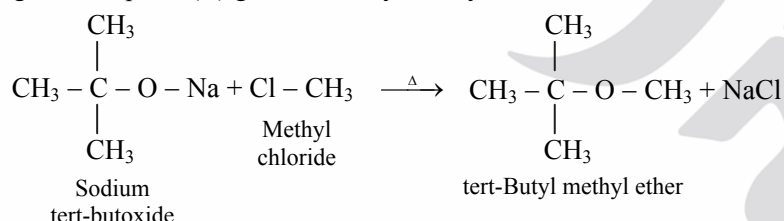

Graph of $\log_{10}$ k versus l/T
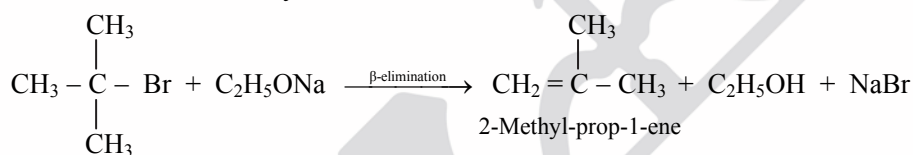**(Arrhenius equation)**

74. (B)

Primary nitroalkanes react with nitrous acid (HNO_2) to form blue coloured nitroso-nitroalkanes (aci form) which dissolve in sodium hydroxide to give red solution.

Secondary nitroalkanes react with nitrous acid to give blue coloured nitroso-nitroalkanes, which no more contain replaceable α-hydrogen atom, thereby are insoluble in sodium hydroxide.

Tertiary nitroalkanes do not react with nitrous acid because there is no replaceable α-hydrogen atom on the carbon atom carrying the $-NO_2$ group.

Hence, test-tubes A, B and C contain primary, tertiary and secondary nitroalkanes respectively.

75. (D)

Froth floatation method is used for the concentration of sulphide ores. Siderite ($FeCO_3$) is an example of carbonate ore.

76. (B)

When an alkyl halide is heated with alcoholic sodium or potassium alkoxide, corresponding ethers are formed. This reaction is known as Williamson synthesis. Among the given options, only the combination given in option (B) gives tert-butyl methyl ether.

$$CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-O-Na + \underset{\text{Methyl}}{Cl-CH_3} \xrightarrow{\Delta} CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-O-CH_3 + NaCl$$

Sodium tert-butoxide   chloride   tert-Butyl methyl ether

When alkyl halide is tertiary (as in option D), β-elimination dominates as the nucleophilic attack on α-carbon atom is sterically difficult.

$$CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-Br + C_2H_5ONa \xrightarrow{\beta\text{-elimination}} CH_2=\underset{}{\overset{\overset{CH_3}{|}}{C}}-CH_3 + C_2H_5OH + NaBr$$

2-Methyl-prop-1-ene

77. (B)

According to VSEPR theory, repulsive interaction of electron pairs decreases in the order:

Lone pair-lone pair > lone pair-bond pair > bond pair-bond pair

NH_3 molecule has three bond pairs and one lone pair of electrons.

Lone pair-bond pair repulsions are greater than bond pair-bond pair repulsions and hence result in deviation from ideal tetrahedral angle $109°28'$.
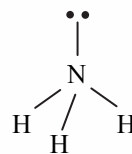
78. (A)

Depression in freezing point, ΔT_f is a colligative property, which is directly proportional to the number of solute particles in the solution. Lower freezing point of solution of X, inspite being equimolal with that of Y, indicates an increase in number of solute particles i.e., X is undergoing dissociation in water. Based on the given information, the molecular masses cannot be compared.

79. (C)

(A) Phenol reacts with sodium hydroxide to give sodium phenoxide, which undergoes electrophilic substitution with carbon dioxide which is a weak electrophile (because phenoxide ion is more reactive than phenol), to form salicylic acid as a major product. This reaction is known as Kolbe's reaction.

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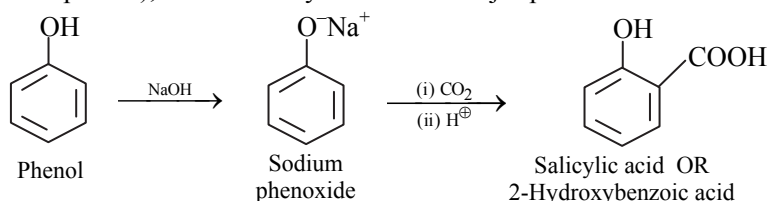
(B) Phenol in the presence of sodium hydroxide reacts with chloroform to give salicylaldehyde. This reaction is known as Reimer-Tiemann reaction.
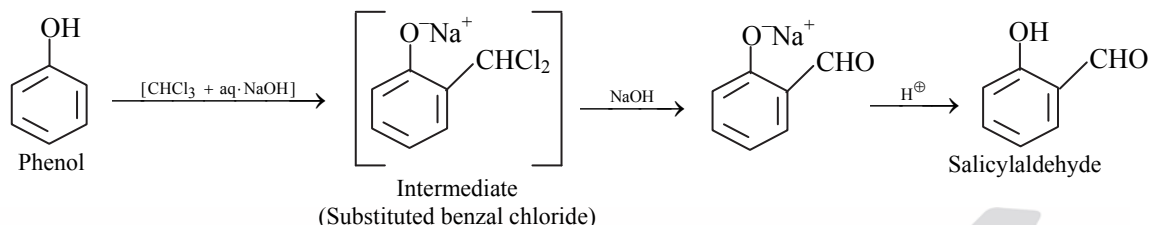
(C) When Cl_2 or Br_2 reacts with a carboxylic acid (Example: acetic acid) in the presence of red phosphorus, then α-hydrogen of carboxylic acid is replaced by Cl or Br. This reaction is known as Hell-Volhard-Zelinsky reaction.

$$CH_3COOH \xrightarrow[\text{red P}]{Br_2} BrCH_2COOH$$

Acetic acid α-Bromoacetic acid
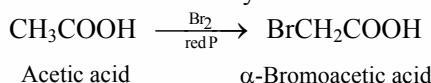
(D) Chromyl chloride (CrO_2Cl_2) in CCl_4 or CS_2 converts methyl group on benzene ring to a chromium complex, which on acid hydrolysis gives corresponding aldehyde. This reaction is known as Etard reaction.
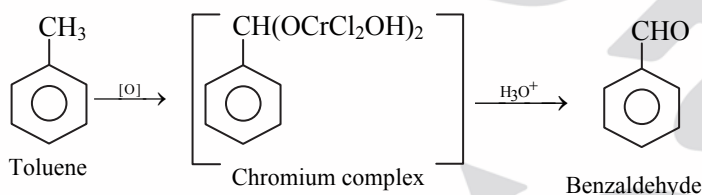
Hence, reaction in option (C) is used for the preparation of α-bromoacetic acid.

80. (D)

In qualitative analysis of organic compounds, Lassaigne's test is used for the detection of nitrogen, sulphur and halogens (Cl, Br and I). Hence, oxygen cannot be detected using this test.

81. (A)

At constant temperature, osmotic pressure (π) is directly proportional to concentration (C in mol L^{-1}).

$\pi = (RT)\,C$

$\therefore \quad \dfrac{\pi}{C} = RT$

On plotting a graph of π against C, a straight line with slope = RT is obtained.

$\therefore \quad 295\,R = RT$

$\therefore \quad T = 295\ K$

     $= 295 - 273 = 22\ °C$

82. (C)

Tertiary alcohols give immediate turbidity on shaking with HCl at room temperature.

83. (A)

$\wedge = \dfrac{k \times 1000}{C}$

$\therefore \quad \wedge = \dfrac{k\left(\Omega^{-1} cm^{-1}\right) \times 1000\left(cm^{3}\,L^{-1}\right)}{0.01\left(mol\,L^{-1}\right)}$

     $= k \times 10^{5}\ \Omega^{-1}\ cm^{2}\ mol^{-1}$

84. (A)

When the compound (alkyl halide) is optically active, the resulting mixture contains equimolar quantities of dextro and laevo isomers. This optically inactive mixture is known as racemate or racemic mixture.

Among the given options, 1-Bromo-1-phenylethane is optically active (it has a chiral carbon atom), thus, resulting in the formation a racemate.

1-Bromo-1-phenylethane → (KOH / H₂O) → 1-Phenylethanol (Racemic mixture) + KBr
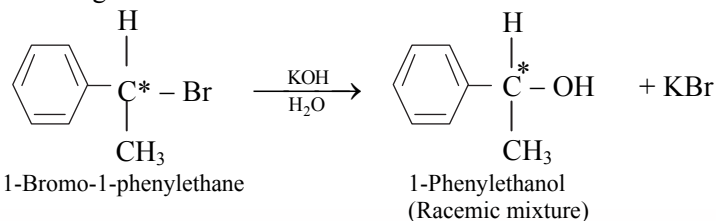
85. **(D)**

Magnetic moment $(\mu) = \sqrt{n(n+2)}$ B.M.

Where, n = number of unpaired electrons

Ion	Outer electronic configuration	Number of unpaired electrons	Calculated value of magnetic moment in (B.M.)
Ti^{3+}	$3d^1$	1	1.73
Ni^{2+}	$3d^8$	2	2.82
Co^{2+}	$3d^7$	3	3.87
Mn^{3+}	$3d^4$	4	4.90

86. **(B)**

As we move down in the group, the size of the group 15 elements (E) increases and therefore, the length of the E−H bond increases and its bond dissociation enthalpy decreases. In other words, as we move down the group, the E−H bond can break more easily to evolve H_2 gas which acts as the reducing agent. Thus, Bi−H bond is the weakest amongst the hydrides of elements of group 15 and hence, BiH_3 is the strongest reducing agent.

The solubility of hydrides of group 15 elements decreases on moving down the group. NH_3 is highly soluble in water.

The thermal stability of hydrides of group 15 elements decreases on moving down the group. BiH_3 is highly unstable.

The basicity also decreases down the group. NH_3 is distinctly basic.

87. **(C)**

The mathematical expression of first law of thermodynamics is:

$\Delta U = q + W$ …(1)

For isochoric process, $\Delta V = 0$ and $W = 0$ $(\because W = -p_{ex} \times \Delta V)$

Therefore, options (A) and (B) are true.

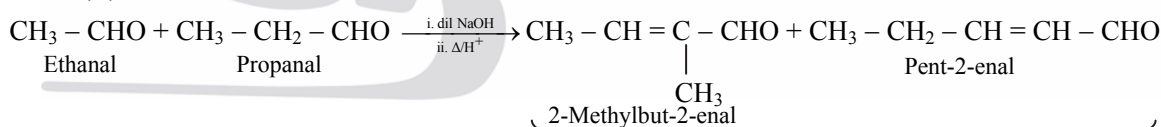Now, equation (1) becomes

$\Delta U = q_v + 0$ $[\because$ V is constant, $q = q_v]$

$\therefore$ $\Delta U = q_v$

Therefore, option (D) is true. Thus, only option (C) is not true for isochoric process.

88. **(C)**

$$CH_3 - CHO + CH_3 - CH_2 - CHO \xrightarrow[\text{ii. } \Delta/H^+]{\text{i. dil NaOH}} CH_3 - CH = C - CHO + CH_3 - CH_2 - CH = CH - CHO$$

Ethanal   Propanal

|
CH_3
2-Methylbut-2-enal   Pent-2-enal

Crossed aldol condensation products

89. **(A)**

Liquid Xe (Xenon) is used in research laboratories for the detection of mesons and gamma photons.
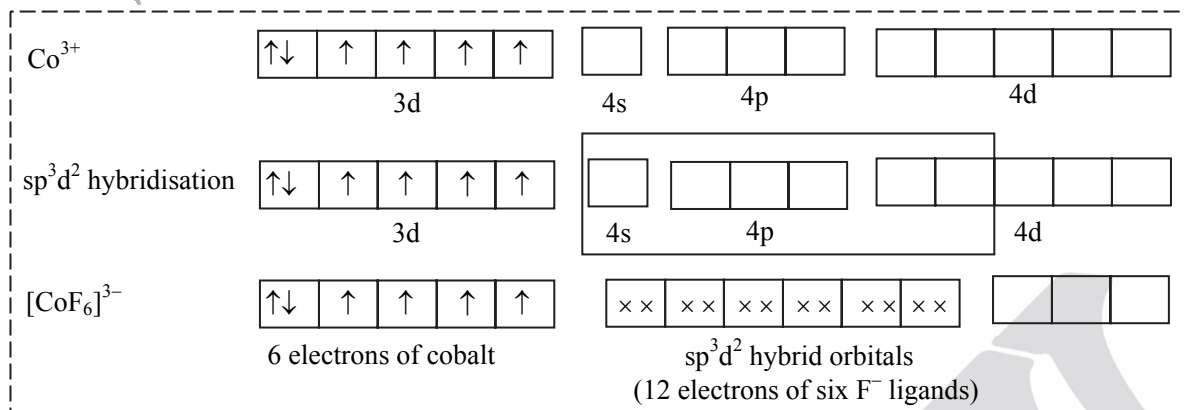
90. **(D)**

Structure of $[CoF_6]^{3-}$:

i. The oxidation state of Co is +3. The outer electronic configuration of Co^{3+} is $3d^6$.

ii. sp^3d^2 hybridisation of one s, three p and two d orbitals results in octahedral geometry.

Co^{3+}	↑↓	↑	↑	↑	↑										

3d   4s   4p   4d

sp^3d^2 hybridisation

3d   4s   4p   4d

$[CoF_6]^{3-}$

6 electrons of cobalt sp^3d^2 hybrid orbitals
(12 electrons of six F^- ligands)

iii. Due to presence of unpaired 3d electrons, $[CoF_6]^{3-}$ is paramagnetic.

iv. $[CoF_6]^{3-}$ is also known as outer orbital or high spin or spin free complex due to utilization of outer 4d orbitals in sp^3d^2 hybridisation.

91. (B)

180 mg of H_2O = 180 × 10⁻³ g of H_2O = 0.18 g of H_2O

18 g of H_2O = 6.022 × 10²³ molecules

∴ 0.18 g of H_2O = $\dfrac{6.022 \times 10^{23}}{18} \times 0.18$ molecules = 6.022 × 10²¹ molecules

Now 10²¹ molecules are removed,

So, remaining molecules = 6.022 × 10²¹ – 10²¹ = 10²¹(6.022 – 1) = 5.022 × 10²¹ molecules

92. (B)

Primary amine is obtained from corresponding alkyl cyanide by reduction using sodium and ethanol. This reaction is called Mendius reduction.
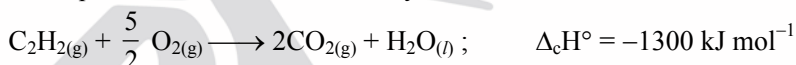
$$\langle\bigcirc\rangle - CH_2 - C \equiv N \ + \ 4[H] \ \xrightarrow{Na/ethanol} \ \langle\bigcirc\rangle - CH_2 - CH_2 - NH_2$$

Phenylacetonitrile   β-Phenylethylamine
(2-Phenylethan-1-amine)
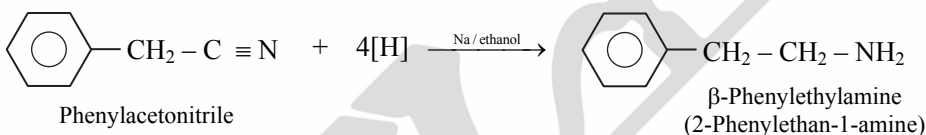
93. (A)

Due to lanthanoid contraction, the ionic radii of lanthanoids decrease with increase in atomic number. Hence, ionic radii increases from Gd^{3+} to La^{3+}.

Gd^{3+} (Z = 64) < Pm^{3+} (Z = 61) < Ce^{3+} (Z = 58) < La^{3+} (Z = 57).

94. (B)

The equation for combustion of ethyne is:

$$C_2H_{2(g)} + \frac{5}{2} O_{2(g)} \longrightarrow 2CO_{2(g)} + H_2O_{(l)} ; \qquad \Delta_cH° = -1300 \text{ kJ mol}^{-1}$$

According to the reaction, 1300 kJ of heat is evolved per 2 moles of CO_2.

∴ $\dfrac{1300}{2}$ kJ of heat is evolved per mole of CO_2.

Number of moles of CO_2 = $\dfrac{\text{Mass of } CO_2}{\text{Molar mass of } CO_2}$ = $\dfrac{8.8}{44}$ = 0.2 mol

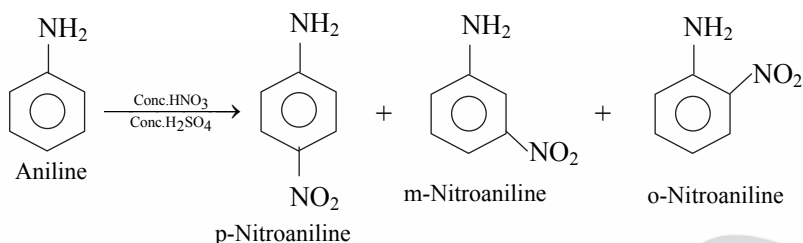∴ Heat evolved in the formation of 0.2 moles of CO_2 = $\dfrac{1300}{2} \times 0.2$ = 130 kJ

95. (C)

i. Sulphur is boiled with calcium hydroxide (milk of lime) to obtain a mixture of calcium pentasulphide (CaS_5) and calcium thiosulphate (CaS_2O_3).

$$3Ca(OH)_2 \ + \ 12S \ \longrightarrow \ 2CaS_5 \ + \ CaS_2O_3 \ + \ 3H_2O$$

Calcium hydroxide   Sulphur   Calcium pentasulphide   Calcium thiosulphate   Water
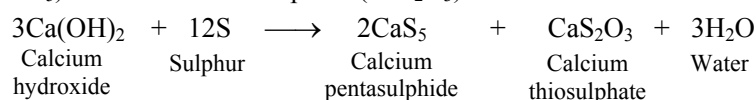
ii. This mixture is treated with hydrochloric acid to obtain a white amorphous precipitate of milk of sulphur.
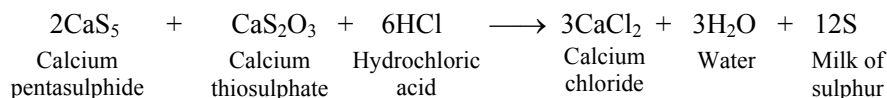
$$2CaS_5 + CaS_2O_3 + 6HCl \longrightarrow 3CaCl_2 + 3H_2O + 12S$$

Calcium pentasulphide   Calcium thiosulphate   Hydrochloric acid   Calcium chloride   Water   Milk of sulphur

96. (D)

Aniline $\xrightarrow{\text{Conc.HNO}_3 / \text{Conc.H}_2\text{SO}_4}$ p-Nitroaniline + m-Nitroaniline + o-Nitroaniline

In the nitration of aniline considerable amount of m-nitroaniline is formed along with p-nitroaniline and

o-nitroaniline. This is because in acidic condition, protonation of $-NH_2$ group gives anilinium ion $(Ar - \overset{+}{N}H_3)$, which is deactivating and m-directing in nature.

97. (B)
Among alkali metals, the electropositive character of the metal increases as:

$$Li < Na < K < Rb < Cs$$
$[He]2s^1$ $[Ne]3s^1$ $[Ar]4s^1$ $[Kr]5s^1$ $[Xe]6s^1$
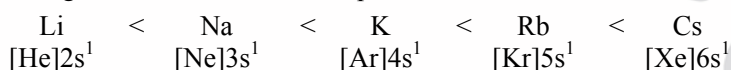
Hence, the least electropositive alkali metal is Li with electronic configuration $[He]2s^1$.

98. (C)
Potassium ferrocyanide is $K_4[Fe(CN)_6]$. When it is dissolved in water, one molecule forms four K^+ ions and one $[Fe(CN)_6]^{4-}$ ion. So, total five ions per molecule are produced in the solution.
$$K_4[Fe(CN)_6] \rightleftharpoons 4K^+ + [Fe(CN)_6]^{4-}$$
Complex ion
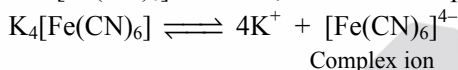
99. (C)
Elements like B, Al, Si and Ga form polynuclear hydrides. **Example:** B_2H_6.

100. (B)
$[Co(en)_2Cl_2]^+$ shows both geometrical as well as optical isomerism. This complex exists in cis and trans forms and thus, shows geometrical isomerism.
Cis isomer is optically active. The resolution of cis isomer in d and *l* form is possible.
Trans isomer contains a plane of symmetry and is optically inactive. Thus, the complex has three stereoisomers.

Optically active forms and meso form of the complex $[Co(en)_2Cl_2]^+$
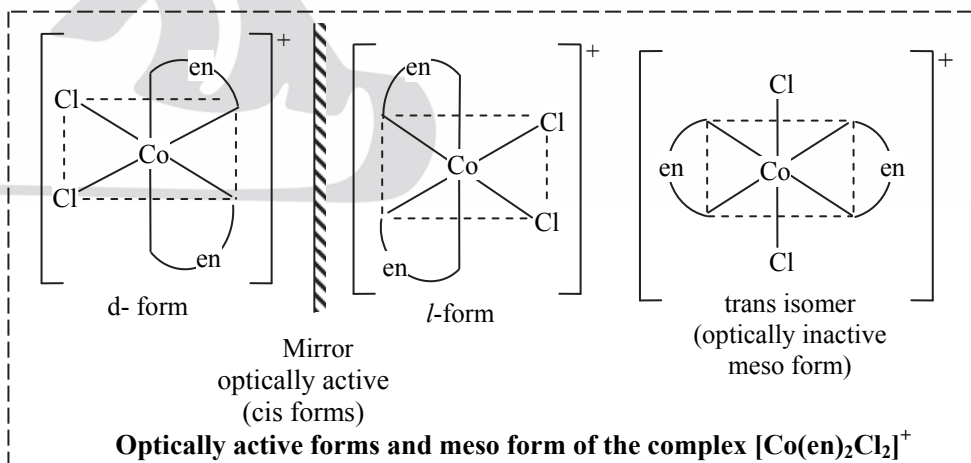
ANSWER KEY & HINTS
TO
MOCK MHT - CET EXAM - 2018
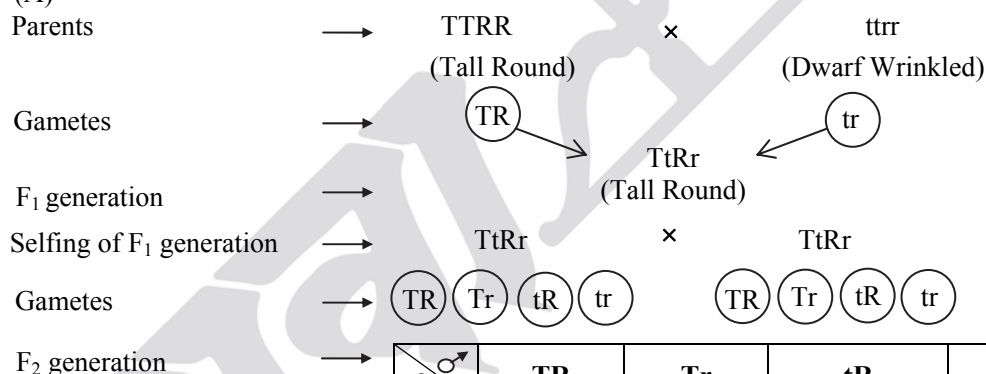
Subject : Biology

1. Answer key is provided to all the questions.

2. Hints are provided below the Answer Key, wherever needed.

3. Additionally, Video Solutions to interpretative/challenging type questions are provided. You can view them by scanning the QR Code given along with the answer key. The QR Code can be scanned by using any 'QR Scanner' app.

1. (D)
   Enzymes required for electron transport system are located on the body of oxysomes that are present on the inner mitochondrial membrane.

2. (D)
   Double fertilization is a characteristic of angiosperms.

3. (D)

   Q. 3

4. (C)

5. (A)
   Micro-consumers are decomposers like fungi, bacteria, actinomycetes.

6. (C)

7. (B)

   Q. 7

8. (B)

9. (C)
   When energy flows from a particular trophic level to the next, only 10% of the energy is available to the next trophic level.

10. (D)
    Zein is a simple protein.

11. (A)

Parents ⟶ TTRR × ttrr
(Tall Round) (Dwarf Wrinkled)

Gametes ⟶ (TR) (tr)

F$_1$ generation ⟶ TtRr
(Tall Round)

Selfing of F$_1$ generation ⟶ TtRr × TtRr

Gametes ⟶ (TR)(Tr)(tR)(tr) (TR)(Tr)(tR)(tr)

F$_2$ generation ⟶

♀\♂	**TR**	**Tr**	**tR**	**tr**
TR	TTRR Tall Round	TTRr Tall Round	TtRR Tall Round	TtRr Tall Round
Tr	TTRr Tall Round	TTrr Tall Wrinkled	TtRr Tall Round	Ttrr Tall Wrinkled
tR	TtRR Tall Round	TtRr Tall Round	ttRR Dwarf Round	ttRr Dwarf Round
tr	TtRr Tall Round	Ttrr Tall Wrinkled	ttRr Dwarf Round	ttrr Dwarf Wrinkled

The non-parental combinations produced in the F$_2$ generation of cross between TTRR and ttrr would be tall wrinkled and dwarf round.
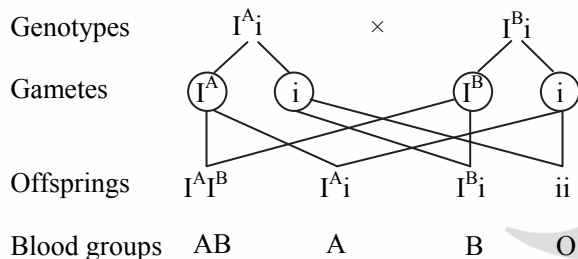
12. (B)

13. (D)
Michelia – Protogyny, Sunflower – Protandry
Primrose – Heterostyly, Cucurbits – Geitonogamy (Self pollination)

14. (D)
Gram, groundnut and mango show hypogeal germination.

Q. 14

15. (C)

16. (B)

17. (B)
During substrate level phosphorylation i.e. from conversion of succinyl – CoA to succinate, 2 molecules of ATP are formed.

18. (C)
Antipodal cells (Haploid): 21
Endosperm (Triploid): 63
Microspore mother cell (Diploid): 42

19. (D)
Stearic acid is a saturated fatty acid and does not have double bond between carbon atoms of its chain.

Q. 19

20. (C)

21. (C)

22. (C)

23. (C)

24. (C)
Crops bred to increase their nutritional value are known as biofortified crops.
Atlas-66 is a variety of wheat with high protein content.
Himgiri and Pusa Sawni are disease/pest resistant varieties of wheat and okra respectively, whereas, Lerma Rojo 64-A is a high yielding variety of wheat.

25. (A)
Succinate thiokinase is classified as a ligase.
Isomerase catalyzes the interconversions of geometric, optical and positional isomers.
Fumarase is classified as lyase. It catalyzes non-hydrolytic cleavage. Transaminase is classified as transferase and helps in transfer of chemical groups between a pair of substrate.

26. (C)
Ribulose bisphosphate carboxylase (RuBisCO) has both oxygenase and carboxylase activity. It sometimes fixes O_2 to RUBP instead of CO_2. The oxygenase activity occurs at low CO_2, high O_2 conditions and becomes prominent at high temperatures.

27. (B)
Primary succession occurs only where no living organism ever existed.

28. (C)

29. (B)
The ratio of the volume of CO_2 evolved to the volume of O_2 consumed in respiration is called respiratory quotient/respiratory ratio.
The respiratory quotient of proteins is 0.9. Soybeans and red lentils are rich in protein content.

Q. 29

30. (C)
Emasculation is used when the selected plant to be used as female parent bears bisexual flowers.

31. (D)
Vitamin B$_2$ – i. *Neurospora gossypii*
ii. *Eremothecium ashbyi*
Citric acid – *Aspergillus niger*
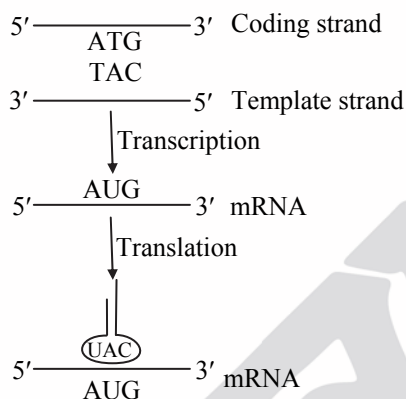Erythromycin – *Streptomyces erythreus*

32. (B)

33. (D)

Genotypes $\quad$ I^{A}i $\quad\quad\times\quad\quad$ I^{B}i

Gametes $\quad$ (I^A) $\quad$ (i) $\quad\quad$ (I^B) $\quad$ (i)

Offsprings $\quad$ I^{A}I^B $\quad\quad$ I^{A}i $\quad\quad$ I^{B}i $\quad\quad$ ii

Blood groups $\quad$ AB $\quad\quad$ A $\quad\quad$ B $\quad\quad$ O

Q. 33

Therefore, the possible genotypes of parents having children with blood groups A, O and AB is I^{A}i and I^{B}i.

34. (B)

5′ ——— 3′ Coding strand
$\quad$ ATG
$\quad$ TAC
3′ ——— 5′ Template strand
$\quad\quad$ | Transcription
5′ ——— 3′ mRNA
$\quad$ AUG
$\quad\quad$ | Translation

5′ ——— 3′ mRNA
$\quad$ (UAC)
$\quad$ AUG

Q. 34

35. (C)
36. (B)
37. (D)
38. (B)
39. (D)

Q. 39

40. (D)
UAG is a stop codon and hence does not have a specific tRNA.

41. (B)
42. (B)
The pH of the nutrient medium is adjusted between 5.0 – 5.8 for tissue culture technique.

43. (A)
Rhamnose: $C_6H_{12}O_5$ $\quad\quad\quad\quad\quad\quad\quad\quad$ Lactic acid: CH_3CHOH
Formaldehyde: $HCHO$ $\quad\quad\quad\quad\quad\quad\quad$ Digitoxose: $C_6H_{12}O_4$

44. (C)
45. (C)
    Beauveria sp. and *Alternaria* sp. are pathogenic fungi, whereas *Nosema* sp. is a pathogenic protozoan.
46. (B)
47. (B)
    Cyanobacteria are autotrophic microbes. *Azotobacter* is a heterotrophic, free-living bacterial biofertilizer.
48. (B)
    Hypohydrophily: Pollination with the help of water, below the water surface.
    Chiropterophily: Pollination carried out by bats.
    Ornithophily: Pollination carried out by birds.
49. (D)
    Nitrosomanas, *Nitrococcus* and *Nitrobacter* are nitrifying bacteria.
50. (D)
    In photorespiration, glycine (2C) is produced in the peroxisome whereas glycolate, phosphoglycolate and PGA are produced in the chloroplast. Q. 50
51. (B)
    Wings of birds and insects are an example of convergent evolution.
52. (A)
    Bartholin's gland or vestibular gland are accessory sex glands in females. Pineal gland is a part of the endocrine system.
53. (C)
    Pyloric sphincter regulates the passage of food into the duodenum of intestine.
    Epiglottis prevents the entry of food into respiratory system.
    Papillae are the projections present on the upper surface of tongue. They contain sensory receptors which detect the taste of food.
54. (C)
55. (A)
    Synapsis and tetrad formation occur during the zygotene stage of prophase-I of meiosis and terminalisation occurs during diakinesis.
56. (B)
    Labeo is a freshwater fish.
57. (B)
58. (A)
59. (C)
    Oral contraceptive pills check ovulation by inhibiting the secretion of hormones − FSH and LH. These hormones are essential for ovulation.
60. (C)
61. (B)
    Favus is a fungal poultry disease.
62. (B)
    Day 3: Morula stage, Day 7 − 10: Implantation
63. (C)
64. (A)
    Endangered species − Asiatic wild ass; Rare species − Hawaiian monk seal
    Indeterminate species − Three banded Armadillo; Vulnerable species − Antelope

65. (D)
Vasodilation is the function of ANF.

66. (D)

Q. 66

67. (B)

68. (A)
The 'M' line is a fibrous membrane present in the middle of the 'A' band. The dark band that does not allow light to pass is the 'A' band.
The narrow dark like seen in the light band is called the 'Z'-line.

Q. 68

69. (D)

70. (C)
Arthralgia refers to joint pain which is the symptom of malaria.

71. (B)

72. (B)
Mating of animals within the same breed, which have no ancestors in common – Out-crossing
Mating of superior males of one breed with superior females of another breed – Cross-breeding
Mating between closely related individuals of the same breed – Inbreeding

73. (B)

74. (B)
Viscous fluid is secreted by internal lining of fallopian tube for the activation of sperms.
Hyaluronidase, an enzyme of the acrosome hydrolyzes the hyaluronic acid of follicular cells to allow the sperm to reach the plasma membrane of the oocyte.
Secretion of anti-fertilizin by the sperm head is essential for adhesion of the sperm to the oocyte.

Q. 74

75. (B)
P wave: Atrial depolarization
QRS complex: Ventricular depolarization
T wave: Ventricular repolarization

Q. 75

76. (C)
Ape-men stage is an intermediate between apes and men. *Propliopithecus* was a primitive ancestral ape-like primate.

77. (D)

78. (B)

79. (A)

Q. 79

80. (A)
Hypertrichosis is a Y-linked trait expressed only in males.

81. (B)
    a.   Lymphocyte – Produce antibodies and cellular immune response.
    b.   Monocyte – Phagocytic
    c.   Eosinophil – Anti-histamine property
    d.   Basophil – Release heparin

Q. 81

82. (B)

Kidney and thyroid gland are made up of cuboidal epithelium, whereas the inner lining of the stomach is made up of non-ciliated columnar epithelium.

83. (D)

Urolithiasis refers to having calculi in the urinary tract.

84. (B)

Q. 84

85. (D)

TPA – Prevents or reverses blood clot; BGH – Increases cattle and dairy yield
DNase – Treats cystic fibrosis

86. (B)

87. (B)

1st to 4th day – Menstrual phase; 14th to 25th day – Secretory phase

88. (A)

89. (A)

Diacetylmorphine – Poppy plant (*Papaver somniferum*)
Marijuana – *Cannabis sativa*
Cocaine – Coca plant (*Erythroxylum coca*)

90. (D)

The ascending limb of loop of Henle is impermeable to water but permeable to electrolytes.

Q. 90

91. (C)

The person with Down's syndrome has genetic constitution 2n + 1. It is also known as trisomy 21. Genotype of a person suffering from Turner's syndrome has genetic constitution 44 + XO.

92. (C)

Mesoderm gives rise to adrenal cortex.

93. (D)

94. (C)

95. (B)

Myxoedema : Hyposecretion of thyroxine in adults
Graves' disease : Hypersecretion of thyroxine
Cretinism : Hyposecretion of thyroxine in children

96. (B)

Tango receptors – Pressure Gustatoreceptors – Taste Enteroceptros – Pain

97. (A)

Culture collection is a method of conserving endangered species *ex-situ*.

98. (D)

DNA fragments are separated based on the length of these fragments.
DNA bands are blotted on nitrocellulose paper.
DNA bands are flooded with single stranded radioactive DNA probe.

99. (D)

Dyspepsia refers to upper abdominal discomfort or pain usually experienced during indigestion.

100. (A)