Manipal
Medical Entrance Exam
Solved Paper 2010

Physics

1. A beam of light composed of red and green rays is incident obliquely at a point on the face of a rectangular glass slab. When coming out on the opposite parallel face, the red and green rays emerge from
   (a) two points propagating in two different non-parallel directions
   (b) two points propagating in two different parallel directions
   (c) one point propagating in two different directions
   (d) one point propagating in the same direction

2. A photon moves to energy level E_1 from E_2 to find more stable nucleus, then the frequency will be
   (a) exactly $\dfrac{(E_2 - E_1)}{h}$
   (b) slightly greater than $\dfrac{(E_2 - E_1)}{h}$
   (c) slightly less than $\dfrac{(E_2 - E_1)}{h}$
   (d) $h\nu$

3. At 273°C, the emissive power of a perfect black body is R. What is its value at 0°C?
   (a) $\dfrac{R}{4}$
   (b) $\dfrac{R}{16}$
   (c) $\dfrac{R}{2}$
   (d) None of the above

4. Among two discs A and B, first has radius 10 cm and charge 10^{-6}C and second has radius 30 cm and charge 10^{-5}C. When they are touched, charges on both are, q_A and q_B respectively, will be
   (a) $q_A = 2.75\,\mu C,\ q_B = 3.15\,\mu C$
   (b) $q_A = 1.09\,\mu C,\ q_B = 1.53\,\mu C$
   (c) $q_A = q_B = 5.5\,\mu C$
   (d) None of the above

5. The potential difference between the cathode and the target electrode in a coolidge tube is 24.75 kV. The minimum wavelength of the emitted X-rays is
   (a) 0.1 Å
   (b) 0.5 Å
   (c) 1 Å
   (d) 5 Å

6. A torque of 10^{-5} Nm is required to hold a magnet at 90° with the horizontal component of the earth's magnetic field. The torque required to hold it at 30° will be
   (a) 5×10^{-6} Nm
   (b) $\dfrac{1}{2} \times 10^{-5}$ Nm
   (c) $5\sqrt{3} \times 10^{-6}$ Nm
   (d) Data is insufficient

7. A 220 V, 100 W bulb is joined with a 110 V supply. The power consumed by the bulb is
   (a) 50 W
   (b) 25 W
   (c) 80 W
   (d) 100 W

8. A sample of an ideal gas occupies a volume V at pressure p and absolute temperature T. The mass of each molecule is m, then the density of the gas is

(c) $\dfrac{p}{km}$ (d) $\dfrac{p}{kT}$

9. An air column in a pipe which is closed at one end, will be in resonance with the vibrating body of frequency 166 Hz, if the length of the air column is
   (a) 0.5 m   (b) 1.0 m
   (c) 1.5 m   (d) 2.0 m

10. A wave equation which gives the displacement along the direction is given by
    $$y = 0.001 \sin(100t + x)$$
    where, x and y are in metre and t in second. This equation represents a wave
    (a) travelling with a velocity of 100 m/s in the negative x-direction
    (b) travelling with a velocity of $\dfrac{50}{\pi}$ m/s in the positive x-direction
    (c) of wavelength 1 m
    (d) of frequency $\dfrac{100}{\pi}$ Hz

11. The essential distinction between X-rays and γ-rays is that
    (a) γ-rays have smaller wavelength than X-rays
    (b) γ-rays emanate from nucleus while X-rays emanate from outer part of the atom
    (c) γ-rays have greater ionizing power than X-rays
    (d) γ-rays are more penetrating than X-rays

12. Two particles, initially at rest move towards each other under the effect of gravitational force of attraction. At the instant when their relative velocity is $3v$ where, v is the velocity of the slower particle, then the speed of the centre of mass of two given particles is
    (a) $1v$ (b) $2v$
    (c) $3v$ (d) zero

13. A body of mass 10 kg moves with a velocity v of 2 m/s along a circular path of radius 8 m. The power produced by the body will be
    (a) 10 J/s   (b) 98 J/s
    (c) 49 J/s   (d) zero

of x newton in 2 s. Because of this force, the ball moves with velocity of 3 m/s. The value of x is
(a) 5 N   (b) 8.25 N
(c) 0.25 N   (d) 1.0 N

15. A thin prism P_1 with angle 4° and made from glass of refractive index 1.54 is combined with another prism P_2 made of glass of refractive index 1.72 to produce dispersion without deviation. The angle of prism P_2 is
    (a) 5.33°   (b) 4°
    (c) 2.6°   (d) 3°

16. In a reaction $_{92}Be^{234} \longrightarrow {}_{88}Y^{218}$, the number of α and β-particles emitted respectively, are
    (a) 4, 4   (b) 4, 6
    (c) 4, 8   (d) 4, 2

17. In the following transitions, which one has higher frequency?
    (a) $3 \rightarrow 1$ (b) $4 \rightarrow 2$
    (c) $4 \rightarrow 3$ (d) $3 \rightarrow 2$

18. If increase in linear momentum of a body is 50%, then change in its kinetic energy is
    (a) 25%   (b) 125%
    (c) 150%   (d) 50%

19. The current gain α of a transistor in common-base mode is 0.995. Its current gain β in the common-emitter mode is
    (a) 200   (b) 90.5
    (c) 100   (d) 1.005

20. A photocell is illuminated by a small bright source placed 2 m away. When the same source of light is placed 4 m away, the electrons emitted by photo-cathode in one second
    (a) carry one quarter of their previous energy
    (b) carry one quarter of their previous momentum
    (c) are half numerous
    (d) are one quarter numerous

21. Two thin long parallel wires separated by a distance b are carrying a current i ampere each. The magnitude of the force per unit length exerted by one wire on the other, is
    (a) $\dfrac{\mu_0 i^2}{b^2}$
    (b) $\dfrac{\mu_0 i}{2\pi b^2}$
    (c) $\dfrac{\mu_0 i}{2\pi b}$
    (d) $\dfrac{\mu_0 i^2}{2\pi b}$

22. A conducting wire of cross-sectional area 1 cm^2 has 3×10^{23} charge carriers per metre^3. If wire carries a current 24 mA, then drift velocity of carriers is
    (a) 5×10^{-2} m/s
    (b) 0.5 m/s
    (c) 5×10^{-3} m/s
    (d) 5×10^{-6} m/s

23. The capacitance of a metallic sphere is 1 μF, then its radius is nearly
    (a) 1.11 m
    (b) 10 m
    (c) 9 km
    (d) 1.11 cm

24. For a projectile (range)^2 is 48 times of (maximum height)^2 obtained. Find the angle of projection.
    (a) 60°
    (b) 30°
    (c) 45°
    (d) 75°

25. At room temperature, the rms speed of the molecules of a certain diatomic gas is found to be 1933 m/s. The gas is
    (a) H_2
    (b) F_2
    (c) Cl_2
    (d) O_2

26. The equation of longitudinal wave is represented as $y = 20 \cos \pi (50t - x)$ cm. Then its wavelength is
    (a) 120 cm
    (b) 50 cm
    (c) 2 cm
    (d) 5 cm

27. With the increase of temperature, the surface tension of the liquid
    (a) may increase or decrease depending on the density of the liquid
    (b) remains the same
    (c) always increases
    (d) always decreases

28. A force of 6×10^6 Nm^{-2} required for breaking a material. The density ρ of the material is 3×10^3 kg m^{-3}. If the wire is to break under its own weight, the length of the wire made of that material should be (take $g = 10$ ms^{-2})
    (a) 20 m
    (b) 200 m
    (c) 100 m
    (d) 2000 m

29. A ball falls from 20 m height on floor and rebounds to 5 m. Time of contact is 0.02 s. Find acceleration during impact.
    (a) 1200 m/s^2
    (b) 1000 m/s^2
    (c) 2000 m/s^2
    (d) 1500 m/s^2

30. Two charges are at a distance d apart. If a copper plate of thickness $\dfrac{d}{2}$ is kept between them, the effective force will be
    (a) $\dfrac{F}{2}$
    (b) zero
    (c) $2F$
    (d) $\sqrt{2F}$

31. Two mirrors are placed at right angle to each other. A man is standing between them combing his hair. How many images will he see?
    (a) 2
    (b) 3
    (c) 1
    (d) zero

32. 15 g of ice melts to form water at 0° C. What is the change in entropy?
    (a) 18.5
    (b) 15
    (c) zero
    (d) None of these

33. A small magnet kept in a non-uniform magnetic field experiences
    (a) neither a force nor a torque
    (b) a force and a torque
    (c) a torque but not a force
    (d) a force but not a torque

34. A particle is executing SHM at mid point of mean position and extremity. What is the potential energy in terms of total energy (E)?
    (a) $\dfrac{E}{4}$
    (b) $\dfrac{E}{16}$
    (c) $\dfrac{E}{2}$
    (d) $\dfrac{E}{8}$

35. In case of steel wire or a metal wire, the elastic limit is reached when
    (a) the wire just break
    (b) the load is more than the weight of wire
    (c) elongation is inversely proportional to the tension
    (d) None of the above

36. An eraser weighing 1 N is pressed against a vertical black board with a normal force of 5 N. The coefficient of friction μ between eraser and blackboard is approximately 0.4.

37. A ball of mass 0.12 kg is being whirled in a horizontal circle at the end of string 0.5 m long. It is capable of making 231 revolutions in one minute. The breaking tension of the string is
    (a) 3 N   (b) 15.1 N
    (c) 31.5 N   (d) 35.1 N

38. A wire of length l and resistance R is stretched to get the radius of cross-section $\frac{r}{2}$. Then the new value of R is
    (a) $16R$ (b) $4R$
    (c) $8R$ (d) $5R$

39. Calcium plate has maximum possible radiation of wavelength λ of 400 nm to eject electrons. Its work function is
    (a) 2.3 eV   (b) 3.1 eV
    (c) 4.5 eV   (d) None of these

40. If one face of prism is silvered having prism angle 30° and $\mu = \sqrt{2}$. What will be the angle of incidence, so that the incident ray retraces its path?
    (a) 30°   (b) 60°
    (c) 90°   (d) 45°

41. A 1 μF capacitor is charged to 50 V potential difference and then discharged through a 10 mH inductor of negligible resistance. The maximum current in the inductor will be
    (a) 0.5 A   (b) 1.6 A
    (c) 0.16 A   (d) 1.0 A

42. Dimensions of capacitance is
    (a) $[M^{-1}L^{-2}T^4A^2]$
    (b) $[MLT^{-3}A^{-1}]$
    (c) $[ML^2T^{-3}A^{-1}]$
    (d) $[M^{-1}L^{-2}T^3A^{-1}]$

43. In a mechanical refrigerator, the low temperature coils are at a temperature of $-23°C$ and the compressed gas in the condenser has a temperature of $27°C$. The theoretical coefficient of performance is
    (a) 5   (b) 8
    (c) 6   (d) 10

upper levels of X and Y are same. What is the density of Y?
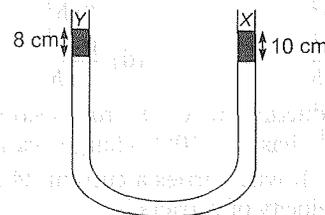
    (a) 0.8 g/cc   (b) 1.2 g/cc
    (c) 1.4 g/cc   (d) 1.6 g/cc

45. For a given material, the Young's modulus is 2.4 times that of rigidity modulus, then Poisson's ratio is
    (a) 0.2   (b) 0.4
    (c) 1.2   (d) 2.4

46. A ball thrown vertically upwards with an initial velocity 1.4 ms^{-1} returns in 2 s. The total displacement of the ball is
    (a) 22.4 cm   (b) zero
    (c) 44.8 m   (d) 33.6 m

47. In double slit experiment, the angular width of the fringes is 0.20° for the sodium light ($\lambda = 5890\,\text{Å}$). In order to increase the angular width of the fringes by 10%, the necessary change in wavelength is
    (a) zero
    (b) increased by 6479 Å
    (c) decreased by 589 Å
    (d) increased by 589 Å

48. A convex lens has mean focal length of 20 cm. The dispersive power of the material of the lens is 0.02. The longitudinal chromatic aberration for an object at infinity is
    (a) 10^3 (b) 0.80
    (c) 0.40   (d) 0.20

49. 1 mg gold undergoes decay with 2.7 days half-life period, amount left after 8.1 days is
    (a) 0.125 mg   (b) 0.5 mg
    (c) 0.25 mg   (d) 0.91 mg

50. A planet has same density and same acceleration due to gravity as of earth and universal gravitational constant G is twice of earth. The ratio of their radii is
   (a) 1 : 4
   (b) 1 : 5
   (c) 1 : 2
   (d) 3 : 2

51. If refractive index of glass is 1.50 and of water is 1.33, then critical angle is

   (a) $\sin^{-1}\left(\dfrac{8}{9}\right)$
   (b) $\sin^{-1}\left(\dfrac{2}{3}\right)$

   (c) $\cos^{-1}\left(\dfrac{8}{9}\right)$
   (d) None of these

52. The ionisation potential of mercury is 10.39 V. How far an electron must travel in an electric field of 1.5×10^6 V/m to gain sufficient energy to ionise mercury?
   (a) $\dfrac{10.39}{1.6 \times 10^{-19}}$ m

   (b) $\dfrac{10.39}{2 \times 1.6 \times 10^{-19}}$ m

   (c) $10.39 \times 1.6 \times 10^{-19}$ m

   (d) $\dfrac{10.39}{1.5 \times 10^6}$ m

53. A straight wire conductor of length l of 0.4 m is moving with a speed v of 7 m/s perpendicular to a magnetic field B of intensity 0.9 Wb/m^2. The induced emf across the conductor is
   (a) 2.52 V
   (b) 25.2 V
   (c) 5.26 V
   (d) 1.26 V

54. A cylindrical tube closed at one end contains air. It produces the fundamental note of frequency 512 Hz. If the tube is opened at both ends, the fundamental frequency that can be excited is

   (a) 256 Hz
   (b) 512 Hz
   (c) 1024 Hz
   (d) 128 Hz

55. A block of steel of size 5 cm × 5cm × 5 cm is weighed in water. If the relative density of steel is 7, its apparent weight is
   (a) $4 \times 4 \times 4 \times 6$ g
   (b) $5 \times 5 \times 5 \times 9$ g
   (c) $4 \times 4 \times 4 \times 7$ g
   (d) $6 \times 5 \times 5 \times 5$ g

56. A coin is of mass 4.8 kg and radius 1 m rolling on a horizontal surface without sliding with angular velocity 600 rot/min. What is total kinetic energy of the coin?
   (a) 360 J
   (b) $1440\pi^2$ J
   (c) $4000 \, \pi^2$ J
   (d) $600 \, \pi^2$ J

57. 1 N/m is equal to
   (a) 1 Jm^{-2}
   (b) 1 Jm^3
   (c) 1 Jm^2
   (d) None of these

58. A force F_1 of 500 N is required to push a car of mass 1000 kg slowly at constant speed on a levelled road. If a force F_2 of 1000 N is applied, the acceleration of the car will be
   (a) zero
   (b) 1.5 m/s^2
   (c) 1.0 m/s^2
   (d) 0.5 m/s^2

59. A particle of mass 0.2 kg tied at the end of a spring is being rotated along a vertical circle of radius 0.5 m at critical speed of 5 m/s. The tension T in the string at the highest point of its path is
   (a) 8.04 N
   (b) 11.96 N
   (c) 10 N
   (d) 1.96 N

60. The current gain in the common-emitter mode of a transistor is 10. The input impedance is 20 kΩ and load of resistance is 100 kΩ. The power gain is
   (a) 300
   (b) 500
   (c) 200
   (d) 100

The number of molecules in it is

(a) 3.01×10^{12} (b) 3.01×10^{24}

(c) 3.01×10^{23} (d) 3.01×10^{20}

2. 74.5 g of a metallic chloride contain 35.5 g of chlorine. The equivalent weight of the metal is

(a) 19.5   (b) 35.5

(c) 39.0   (d) 78.0

3. Electron affinity is maximum for

(a) Cl   (b) F

(c) Br   (d) I

4. Which of the following is paramagnetic with bond order 0.5?

(a) F_2 (b) H_2^+

(c) N_2 (d) O_2^-

5. Metallic bond is

(a) similar to ionic bond

(b) similar to covalent bond

(c) neither similar to ionic nor covalent bond

(d) formed by movement of positive charged spheres in a sea of electrons

6. The correct order of magnetic moments (spin only values in BM) among the following is

(Atomic numbers : Mn = 25, Fe = 26, Co = 27)

(a) $[MnCl_4]^{2-} > [CoCl_4]^{2-} > [Fe(CN)_6]^{4-}$

(b) $[MnCl_4]^{2-} > [Fe(CN)_6]^{4-} > [CoCl_4]^{2-}$

(c) $[Fe(CN)_6]^{4-} > [MnCl_4]^{2-} > [CoCl_4]^{2-}$

(d) $[Fe(CN)_6]^{4-} > [CoCl_4]^{2-} > [MnCl_4]^{2-}$

7. The effective electrophile in aromatic sulphonation is

(a) HSO_4^- (b) SO_2

(c) SO_2^+ (d) SO_3

8. Reaction of chloroform with KOH in the presence of a primary aromatic amine is called

(a) carbylamine reaction

(b) reduction

(c) hydrolysis

(d) Wurtz reaction

(c) NH_3 (d) $(C_2H_5)_2NH$

10. Acetamide and ethylamine can be distinguished by reacting with

(a) aqueous HCl and heat

(b) aqueous NaOH and heat

(c) acidified $KMnO_4$

(d) bromine water

11. Aldol condensation would not occur in

(a) CH_3COCH_3 (b) CH_3CH_2CHO

(c) HCHO   (d) CH_3CHO

12. The most suitable reagent for the conversion of

$$RCH_2OH \longrightarrow RCHO \text{ is}$$

(a) $KMnO_4$

(b) $K_2Cr_2O_7$

(c) CrO_3

(d) PCC (pyridine chloro chromate)

13.
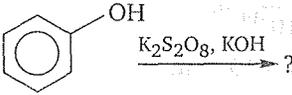
The major product in the above reaction is

(a) *p*-benzoquinone

(b) *p*-benzenediol

(c) benzenesulphonic acid

(d) diphenyl ether

14. The number of isomers for the compound with the molecular formula $C_2BrClFI$ is

(a) 3   (b) 4

(c) 5   (d) 6

15. The pH of an acidic buffer mixture is

(a) 6.8

(b) 7

(c) 7.5

(d) depends upon K_a of the acid

16. Which of the following is optically active?

(a)

(b) $CH_3 - CHOH - CH_3$

(c)
$$CH_3-\underset{\underset{O}{\|}}{C}-\underset{\underset{Br}{|}}{C}-COOH$$

(d) $CH_3-CH_2-\underset{\underset{OH}{|}}{C}=O$

17. The $E^\circ_{M^{3+}/M^{2+}}$ values for Cr, Mn, Fe and Co are -0.41, $+1.57$, $+0.77$ and $+1.97$ V respectively. For which one of these metals the change in oxidation state from $+2$ to $+3$ is easiest?
(a) Cr
(b) Mn
(c) Fe
(d) Co

18. Crystals can be classified into basic crystal habits equal to
(a) 7
(b) 4
(c) 14
(d) 2

19. According to second law of thermodynamics, a process (reaction) is spontaneous, if during the process
(a) $\Delta S_{universe} > 0$
(b) $\Delta S_{universe} = 0$
(c) $\Delta H_{system} > 0$
(d) $\Delta S_{universe} = \Delta S_{system}$

20. Insulin, a hormone, chemically is
(a) fat
(b) steroid
(c) protein
(d) carbohydrate

21. These are the extraction processes of silver except
(a) as a side product in electolytic refining of copper
(b) Parke's process in which Zn is used to extract silver by solvent extraction from molten lead
(c) by reaction of silver sulphide with KCN and then reaction of soluble complex with Zn
(d) by heating $Na[Ag(CN)_2]$

22. The noble gas was first time discovered by
(a) Cavendish
(b) William Ramsay
(c) Rayleigh
(d) Frankland

23. Which one of the following ions is colourless ?
(a) Cu^+
(b) Cr^{2+}
(c) Ni^{2+}
(d) Fe^{2+}

24. If the elevation in boiling point of a solution of 10g of solute (mol. wt. $=100$) in 100g of water is ΔT_b, the ebullioscopic constant of water is
(a) 10
(b) $100 T_b$
(c) ΔT_b
(d) $\dfrac{\Delta T_b}{10}$

25. Which substance is not used for preparing lyophilic sols?
(a) Starch
(b) Gum
(c) Gelatin
(d) Metal sulphide

26. Excess of KI reacts with $CuSO_4$ solution and then $Na_2S_2O_3$ solution is added to it. Which of the statements is incorrect for this reaction?
(a) Cu_2I_2 is formed
(b) CuI_2 is formed
(c) $Na_2S_2O_3$ is oxidised
(d) Evolved I_2 is reduced

27. The change in optical rotation of freshly prepared solution of cane sugar with time is known as
(a) mutarotation
(b) inversion
(c) specific rotation
(d) rotatory motion

28. The S_N1 reactivity of the following halides will be in the order
(i) $(CH_3)_3CBr$
(ii) $(C_6H_5)_2CHBr$
(iii) $(C_6H_5)_2C(CH_3)Br$
(iv) $(CH_3)_2CHBr$
(v) C_2H_5Br
(a) (ii) > (i) > (iii) > (v) > (iv)
(b) (i) > (iii) > (v) > (ii) > (iv)
(c) (v) > (i) > (ii) > (iv) > (iii)
(d) (iii) > (ii) > (i) > (iv) > (v)

29. Oxidation number of N is HNO_3 is
(a) -3.5
(b) $+3.5$
(c) $-3, +5$
(d) $+5$

30. Two gram of hydrogen diffuse from a container in 10 min. How many gram of oxygen would diffuse through the same container in the same time under similar conditions?
(a) 0.5 g
(b) 4 g
(c) 2 g
(d) 8 g

(i) $n = 4, l = 1$ (ii) $n = 4, l = 0$
(iii) $n = 3, l = 2$ (iv) $n = 3, l = 1$
can be placed in order of increasing energy from the lowest to highest as
(a) (iv) < (ii) < (iii) < (i)
(b) (ii) < (iv) < (i) < (iii)
(c) (i) < (iii) < (ii) < (iv)
(d) (iii) < (i) < (iv) < (ii)

32. Catalytic poisons act by
(a) making the products chemically inactive
(b) increasing the rate of the backward reaction
(c) chemical combination with any one of the reactants
(d) preferential adsorption on the catalyst surface

33. van der Waals' equation of state is obeyed by real gases. For n moles of a real gas, the expression will be

(a) $\left(\dfrac{p}{n} + \dfrac{na}{V^2} \right)\left(\dfrac{V}{n-b} \right) = RT$

(b) $\left(p + \dfrac{a}{V^2} \right)(V - b) = nRT$

(c) $\left(p + \dfrac{na}{V^2} \right)(nV - b) = nRT$

(d) $\left(p + \dfrac{n^2 a}{V^2} \right)(V - nb) = nRT$

34. The effective atomic number of Cr (atomic no. 24) in $[Cr(NH_3)_6]Cl_3$ is

(a) 35   (b) 27
(c) 33   (d) 36

35. The IUPAC name of the compound having the molecular formula $Cl_3C \cdot CH_2CHO$ is
(a) 3, 3, 3-trichloropropanal
(b) 1, 1 ,1-trichloropropanal
(c) 2, 2, 2-trichloropropanal
(d) chloral

36. Methyl acetate will be obtained by reacting CH_3OH with
(a) CH_3COOH
(b) CH_3COCl
(c) $(CH_3CO)_2O$
(d) All the above three

(a) aldehydes   (b) ketones
(c) ethers   (d) fatty acids

38. When vapours of *iso*-propyl alcohol are passed over heated copper, the major product obtained is
(a) propane   (b) propylene
(c) acetaldehyde   (d) acetone

39. Drying oil invariably contains
(a) linoleic acid   (b) lauric acid
(c) stearic acid   (d) butyric acid

40. Iodine value is related to
(a) fats and oils   (b) alcohols
(c) esters   (d) hydrocarbons

41. 4.0 g of NaOH is dissolved in 100 mL solution. The normality of the solution is
(a) 0.1 N   (b) 0.5 N
(c) 4.0 N   (d) 1.0 N

42. Which one of the following is correctly matched?
(a) Emulsion-Curd   (b) Foam-Mist
(c) Aerosol-Smoke   (d) Solid sol-Cake

43. Which of the following statements concerning transition elements is false?
(a) They are all metals
(b) They easily form complex coordination compounds
(c) Compounds containing unpaired electrons and their ions are mostly coloured
(d) They show multiple oxidation states always differing by units of two

44. Which of the following is not attacked by hat sodium hydroxide solution?
(a) Silicon   (b) Carbon
(c) Tin   (d) Lead

45. Sulphuric acid reacts with PCl_5 to give
(a) thionyl chloride
(b) sulphur monochloride
(c) sulphuryl chloride
(d) sulphur tetrachloride

46. Reduction by excess carbon at high temperature can be successfully applied in the case of
(a) BeO and Al_2O_3
(b) ZnO and Fe_2O_3
(c) CaO and Cr_2O_3
(d) BaO and U_3O_8

47. Which of the following has minimum-I-effect?
    (a) $-NO_2$
    (b) $-COOH$
    (c) $-F$
    (d) $-\overset{+}{N}R_3$

48. The most stable carbonium ion among the following is
    (a) $C_6H_5\overset{+}{C}HC_6H_5$
    (b) $C_6H_5\overset{+}{C}H_2$
    (c) $CH_3\overset{+}{C}H_2$
    (d) $C_6H_5CH_2\overset{+}{C}H_2$

49. The conjugate base of $H_2PO_4^-$ is
    (a) PO_4^{3-}
    (b) P_2O_5
    (c) H_3PO_4
    (d) HPO_4^{2-}

50. The concentration of Ag^+ ion in a given saturated solution of AgCl at $25°C$ is 1.06×10^{-5} g-ion per litre. Thus, the solubility product of AgCl is
    (a) 0.353×10^{-10}
    (b) 0.530×10^{-10}
    (c) 1.12×10^{-10}
    (d) 2.12×10^{-10}

51. Which of the following statements is true for the electrochemical Daniell cell?
    (a) Electrons flow from copper electrode to zinc electrode
    (b) Current flows from zinc electrode to copper electrode
    (c) Cations move toward copper electrode
    (d) Cations move toward zinc electrode

52. Calculate the free energy change for the following reaction at 300 K.
    $$2CuO(s) \longrightarrow Cu_2O(s) + \frac{1}{2}O_2(g)$$
    Given, $\Delta H = 145.6 \text{ kJ mol}^{-1}$
    and $\Delta S = 116 \text{ JK}^{-1} \text{ mol}^{-1}$
    (a) $110.8 \text{ kJ mol}^{-1}$
    (b) $221.5 \text{ kJ mol}^{-1}$
    (c) 55.4 kJ mol^{-1}
    (d) $145.6 \text{ kJ mol}^{-1}$

53. $[Co(NH_3)_4Cl_2]NO_2$ and $[Co(NH_3)_4ClNO_2]Cl$ exhibit which type of isomerism?
    (a) Geometrical
    (b) Optical
    (c) Linkage
    (d) Ionisation

54. The name of the complex $[Pt(NH_3)_6]Cl_4$ is
    (a) hexammineplatinum (IV) chloride
    (b) hexammineplatinum (II) chloride
    (c) tetrachloro hexammineplatinum (IV)
    (d) tetrachloro hexammineplatinum (II)

55. $S_N 1$ reaction of alkyl halides leads to
    (a) retention of configuration
    (b) racemisation
    (c) inversion of configuration
    (d) None of the above

56. Phenol reacts with PCl_5 to give mainly
    (a) p-chlorophenol
    (b) chlorobenzene
    (c) o-and p-chlorophenols
    (d) triphenylphosphate

57. Rate of a reaction
    (a) decreases with increase in temperature
    (b) increases with increase in temperature
    (c) may increase or decrease with increase in temperature
    (d) does not depend on temperature

58. Which one of the following reactions involves oxidation reduction?
    (a) $H_2 + Br_2 \longrightarrow 2HBr$
    (b) $NaBr + HCl \longrightarrow NaCl + HBr$
    (c) $HBr + AgNO_3 \longrightarrow AgBr + HNO_3$
    (d) $2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$

59. Element the electronic configuration of which is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2 5p^3$ belongs to the following group of the Periodic Table
    (a) 2nd
    (b) 5th
    (c) 3rd
    (d) 7th

60. Correct electronic configuration of Cr $(Z = 24)$ is
    (a) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^7 4s^1$
    (b) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$
    (c) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^7 4s^2$
    (d) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$

(a) *Ramapithecus*
(b) *Australopithecus*
(c) *Pithecanthropus*
(d) *Neanderthalensis*

2. Passive immunity can be obtained by injecting
(a) antibodies
(b) antigen
(c) antibiotic
(d) vaccination

3. In pteridophytes, phloem is without
(a) sieve cells
(b) sieve tubes
(c) companion cells
(d) bast fibres

4. In which plant, Calvin experimented by radioactive isotopy to discover the stable product of C_3-cycle?
(a) *Chlorella*
(b) *Cycas*
(c) Carrot
(d) Tobacco

5. Which of the following inhibits protein synthesis by binding to 50S ribosome?
(a) Tetracyclin
(b) Streptomycin
(c) Erythromycin
(d) Penicillin

6. Zygospore formation occurs in
(a) *Mucor*
(b) *Plasmodium*
(c) *Lentinum*
(d) *Peziza*

7. Which structure of man is similar to spiracle of cockroach?
(a) Nostril
(b) Bronchiole
(c) Lungs
(d) Alveoli

8. Vagina, oesophagus, urethra contain which type of tissue?
(a) Stratified squamous epithelium
(b) Simple squamous epithelium
(c) Ciliated epithelium
(d) Columnar epithelium

9. Dominant generation in bryophytes is
(a) capsule
(b) sporophyte
(c) gametophyte
(d) seta

10. The radiation energy of light is converted to chemical energy and stored as
(a) AMP
(b) ADP
(c) ATP
(d) APP

(a) insects
(b) herbicides
(c) salt resistant
(d) drought resistant

12. Which pteridophyte is called as horse tail?
(a) *Equisetum*
(b) *Lycopodium*
(c) *Marsilea*
(d) *Selaginella*

13. Parts of two plants were observed. Structure-A develops aerially and produces roots when comes in contact with the soil. Structure-B develops from underground part of the stem, grows obliquely becomes aerial and produces roots on its lower surface. Identify, respectively the structure of A and B.
(a) Sucker, stolon
(b) Stolon, runner
(c) Stolon, sucker
(d) Runner, stolon

14. Which are of the following has epiphytic features and aerial and flattened photosynthetic roots, without formal organisation of stem and leaves?
(a) *Tinospora*
(b) *Trapa*
(c) *Taeniophyllum*
(d) *Vanda*

15. Identify the correct chronological sequence periods of Mesozoic era.
(a) Carboniferous $\rightarrow$ Permian $\rightarrow$ Triassic $\rightarrow$ Jurassic $\rightarrow$ Cretaceous
(b) Cretaceous $\rightarrow$ Permian $\rightarrow$ Jurassic $\rightarrow$ Carboniferous $\rightarrow$ Triassic
(c) Cretaceous $\rightarrow$ Carboniferous $\rightarrow$ Permian $\rightarrow$ Triassic $\rightarrow$ Jurassic
(d) Carboniferous $\rightarrow$ Jurassic $\rightarrow$ Permian $\rightarrow$ Triassic $\rightarrow$ Cretaceous

16. In *E. coli*, a finished polypeptide has 162 amino acids of which the first amino acid is not a methionine compound. How many nucleotides of DNA are required to code this polypeptide?
(a) 486
(b) 54
(c) 489
(d) 492

17. Which of the following substances induces mobilisation of carboxylation during germination of barley seeds?
(a) Auxin
(b) Gibberellin
(c) Cytokinin
(d) Abscisic acid

18. Bundle of His is a network of
    (a) nerve fibres distributed in ventricles
    (b) nerve fibres found throughout the heart
    (c) muscle fibres distributed throughout the heart walls
    (d) muscle fibres found only in the ventricle wall

19. What type of cell division takes place in the functional megaspore initially in angiosperms?
    (a) Homeotypic without cytokinesis
    (b) Reductional without cytokinesis
    (c) Somatic followed by cytokinesis
    (d) Meiotic followed by cytokinesis

20. In the fully organised *Polygonum* type of embryo sac, what is the ratio of haploid, diploid and triploid nuclei?
    (a) 3 : 1 : 3   (b) 6 : 0 : 1
    (c) 6 : 1 : 0   (d) 3 : 2 : 3

21. The anaphase promoting complex is activated by
    (a) M cdk cyclin
    (b) G_1 cdk cyclin
    (c) S cdk cyclin
    (d) Transcription factor

22. *Triticale* is a hybrid formed from the members belonging to the following families
    (a) Brassicaceae and Poaceae
    (b) Poaceae and Poaceae
    (c) Poaceae and Fabaceae
    (d) Alismaceae and Poaceae

23. The juice containing sodium glycocholate is released under the influence
    (a) secretin   (b) cholecystokinin
    (c) enterogastrone   (d) enterocrinin

24. The enzyme employed for amplification of DNA during PCR is commercially obtained from
    (a) *Streptococcus pyrogenes*
    (b) *Bacillus licheniformis*
    (c) *Trichoderma reesi*
    (d) *Thermus aquaticus*

25. In five kingdom system of classification of RH Whittaker, how many kingdoms contain eukaryotes?
    (a) Four kingdoms   (b) One kingdom
    (c) Two kingdoms   (d) Three kingdoms

26. Average kilocalorie of energy needed by woman is
    (a) less than man
    (b) more than man
    (c) equal to man
    (d) can not be predicted

27. Which one is not correctly matched?
    (a) Mollusca   – Pseudocoel
    (b) Cnidaria   – Nematocyst
    (c) Annelida   – Chloragogen cells
    (d) Echinodermata   – Water vascular system

28. Improvement of human race is called
    (a) euthenics
    (b) human heredity
    (c) human demography
    (d) eugenics

29. Blood of earthworm is
    (a) red in colour, due to dissolved haemoglobin in corpuscle
    (b) red in colour, due to dissolved haemoglobin in plasma
    (c) blue in colour, due to dissolved haemocyanin in plasma
    (d) blue in colour, due to dissolved haemocyanin in corpuscles

30. Agranulocytes are
    (a) lymphocytes and monocytes
    (b) eosinophils and basophils
    (c) lymphocytes and eosinophils
    (d) basophils and monocytes

31. The 'wish-bone' or Merry though bone of birds is
    (a) sternum   (b) scapula
    (c) coracoid   (d) clavicle

32. Symmetry in Cnidaria is
    (a) radial   (b) bilateral
    (c) pentamerous   (d) spherical

33. *Taenia solium* is asociated with
    (a) apolysis   (b) strobilisation
    (c) premunition   (d) All of these

34. Sexual mode of reproduction in Protozoa
    (a) anisogamy
    (b) plasmogamy
    (c) plasmotomy
    (d) schizogony

(c) Cuttle fish – Mollusca
(d) Star fish – Echinodermata

36. Trochophore larva is found in
(a) Annelida and Mollusca
(b) Annelida and Cnidaria
(c) Annelida and Ctenophora
(d) Annelida and Arthropoda

37. Match the following lists and choose the correct option.

	List I		List II
A.	Columnar epithelium	1.	Larynx
B.	Ligaments	2.	Eosinopaenia
C.	Chondrioblast	3.	Elastic tissue
D.	Acidophils	4.	Urinary bladder
E.	Uninucleated spindle-shaped muscle fibres	5.	Microvilli

	A	B	C	D	E
(a)	5	3	1	2	4
(b)	5	1	3	2	4
(c)	1	5	3	2	4
(d)	5	3	1	4	2

38. **Statement (S)** : Linnaeus system of animal classification is essentially an artificial system, yet it has become a natural system.
Reason (R) : Similarities forming the basis in Linnaeus system are indicative of genetic relationship.
(a) Both (S) and (R) are true and (R) is the correct explanation to (S)
(b) Both (S) and (R) are true, but (R) cannot explain (S)
(c) Only (S) is true and (R) is not true
(d) (S) is not correct and (R) cannot explain (S)

39. The following statements are given about plant growth hormones.
I. Kinetin is a degradative substance from DNA molecule.
II. ABA is present, in all the plants.
III. Low ratio of cytokinins to auxins favours root formation only.
IV. ABA is synthesised catabolically through mevalonate pathway.

40. Which organism forms perithecia in its life cycle?
(a) *Colletotrichum*
(b) *Pyricularia*
(c) *Helminthosporium*
(d) *Sphaerotheca*

41. Which phytohormone has viral inhibitory property?
(a) IAA (b) GA_3
(c) ABA (d) 2, 4-D

42. Study the following lists.

	List I		List II
A.	Zacharias Janssen	1.	Sexual reproduction
B.	Camerarius	2.	Conduction of water
C.	Stephen Hales	3.	Compound microscope
D.	Knoll and Ruska	4.	Crystallisation of urease
		5.	Electron microscope

	A	B	C	D
(a)	5	2	4	3
(b)	3	1	2	5
(c)	2	4	1	3
(d)	5	2	3	1

43. **Assertion** : Clonal selection is a method of breeding in sugarcane.
Reason : Sugarcane is propagated through suckers.
(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion
(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion
(c) Assertion is true but Reason is false
(d) Assertion is false but Reason is true

44. By which mechanism, the salt resistant plants can get rid off excess Na^+ ions to the outer side, through the roots?
(a) H^+–ATPase uniport system
(b) Na^+–ATPase uniport system
(c) $H^+ - Cl^-$ symport system
(d) $Na^+ - H^+$ antiport system

45. The animal as an adult secondarily acquires radial symmetry when its bilaterally symmetrical larva metamorphosis, is
    (a) *Polygordius*   (b) *Gorgonia*
    (c) *Gorgonocephalus* (d) *Pila*

46. The natural selection that acts against change in the form and keeps the population constant though the time is
    (a) directional   (b) disruptive
    (c) not acting   (d) stabilising

47. Euploidy is best explained by
    (a) exact multiple of a haploid set of chromosomes
    (b) one chromosome less than the haploid set of chromosomes
    (c) one chromosome more than the haploid set of chromosomes
    (d) one chromosome more than the diploid set of chromosomes

48. In DNA helix, cytosine is paired with guanine by
    (a) three hydrogen bonds
    (b) two hydrogen bonds
    (c) single hydrogen bond
    (d) covalent bond

49. Stalk with which ovules remain attached to the placenta is called
    (a) funicle   (b) raphe
    (c) hilum   (d) chalaza

50. Family–Gramineae is closely related to
    (a) Cannaceae   (b) Cyperaceae
    (c) Arecaceae   (d) Apicaceae

51. Edward, Patau and Down's syndromes are
    (a) change in autosomes
    (b) changes in sex chromosomes
    (c) mutation due to malnutrition
    (d) both change in sex chromosome and autosomes

52. Biosphere reserve programme started in India?
    (a) 1986   (b) 1984
    (c) 1982   (d) 1988

53. Peroxisomes are found in
    (a) bundle sheath
    (b) endosperm
    (c) mesophyll cells
    (d) vascular bundles

54. Low calorie and low cholesterol is found in
    (a) soyabean oil   (b) peanut oil
    (c) sesame oil   (d) sunflower oil

55. Algae, which form motile colony, is
    (a) *Volvox*   (b) *Nostoc*
    (c) *Spirogyra*   (d) *Chlamydomonas*

56. Short day plant is
    (a) *Xanthium*   (b) *Pisum*
    (c) *Cucumis*   (d) *Avena*

57. A patient of diabetes mellitus excretes glucose in urine even when he is kept in a carbohydrate free diet. It is because
    (a) fats are catabolised to form glucose
    (b) amino acids are catabolised in liver
    (c) amino acids are discharged in blood stream from liver
    (d) glycogen from muscles are released in the blood stream

58. Diphtheria is characterised by
    (a) suffocation
    (b) hydrophobia
    (c) dehydration
    (d) gum bleeding

59. The triploid number of chromosomes of the first taxon is ten times more than the haploid number of chromosomes of the second taxon while the diploid number of the third taxon is six time more than the haploid number of the fourth taxon. Which one of the following shows the ascending order of the number of chromosomes in their respective endosperm?
    (a) *Oryza–Allium–Saccharum–Nicotiana*
    (b) *Allium–Oryza–Nicotiana–Saccharum*
    (c) *Nicotiana–Saccharum–Oryza–Allium*
    (d) *Saccharum–Oryza–Nicotiana–Allium*

60. Match the following lists.

	List I		List II
A.	Basophils	1.	Phagocytosis
B.	Neutrophils	2.	Inflammation
C.	Plasma cells	3.	Blood clotting
D.	Thrombocytes	4.	Antibodies

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

(a) Both Assertion and Reason are true and Reason is the explanation of Assertion

(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion

(c) Assertion is true but Reason is false

(d) Assertion is false but Reason is true

62. The following are the branches of dorsal aorta.
   I. Intercostal
   II. Phrenic
   III. Coeliac
   IV. Anterior mesenteric
   V. Posterior mesenteric
   Of these, which set of arteries supply the blood to the glands of digestive system?
   (a) I and II   (b) III and IV
   (c) IV and V   (d) II and III

63. The water soluble protein associated with silk thread is
   (a) fibroin   (b) serecin
   (c) chitin   (d) mucin

64. Consider the following sentences
   I. Dentition is heterodont.
   II. Canines are poorly developed.
   III. Incisors are chisel like and poorly developed.
   IV. Herbivorous and diastema is present.
   V. The dental formula is, I 2/1; C 0/0; Pm 3/2; M 3/3.
   Which of the above are true for *Oryctolagus*?
   (a) I, II, IV   (b) I, IV, V
   (c) I, II, IV, V   (d) II, IV, V

65. If sexual reproduction takes place between the filaments of *Rhizopus* of different strains, one with 80 nuclei and another with 24 nuclei, what would be the total number of spores of different strains put together?
   (a) 24   (b) 48
   (c) 96   (d) 114

66. Which of the following is indicative of the term alburnum?
   (a) Spring wood
   (b) Autumn wood
   (c) Heart wood
   (d) Sap wood

(c) VII   (d) VI

68. A student collected a hydrophyte with swollen and with a single vascular bundle in the root. The plant which he collected was
   (a) *Jussiaea*   (b) *Trapa*
   (c) *Ceratophyllum* (d) *Potamogeton*

69. A snake is identified to be having large hexagonal vertebral and the dorsal surface bluish with narrow white streaks, it is
   (a) *Echis carinata*
   (b) *Bungarus coeruleus*
   (c) *Vipera russelli*
   (d) *Hemibungarus*

70. The raw material obtained from which one of the following plants is used in paper making?
   (a) *Jerusalem artichoke*
   (b) *Oryza sativa*
   (c) *Sorghum vulgare*
   (d) *Butea monosperma*

71. Binomial nomenclatures is first mentioned in the book
   (a) Systema Naturae
   (b) Historia Animalium
   (c) Historia Plantarum
   (d) Philosophie Zoologique

72. Hugo de Vries observed mutation in
   (a) *Pisum sativum*
   (b) *Arabidopsis thaliana*
   (c) *Oenothera lamarckiana*
   (d) *Datura stramonium*

73. Bacterium which reduces nitrates in soil to nitrogen is
   (a) *Nitrosomonas*   (b) *Pseudomonas*
   (c) *Rhizobium*   (d) *Clostridium*

74. If position of ovary is below sepals, petals, stamens, the flower is called
   (a) epigynous   (b) perigynous
   (c) mesogynous   (d) metagynous

75. Study of ticks and mites is
   (a) Acarology
   (b) Entomology
   (c) Malacology
   (d) Carcinology

76. Asiatic lion (*Panthera leo persica*) is now
   (a) endangered
   (b) extinct in wild
   (c) vulnerable
   (d) critically endangered

77. Muscles which bend the joint
   (a) flexor
   (b) extensor
   (c) involution
   (d) twitch

78. Fungal flagellum originates from
   (a) dictyosomes   (b) kinetosomes
   (c) glyoxysomes   (d) oxysomes

79. Sucking roots are present in the plant
   (a) betel   (b) *Cuscuta*
   (c) *Mangifera*   (d) *Solanum*

80. In acid rain, SO_2 accounts for
   (a) 70%   (b) 100%
   (c) 50%   (d) 30%

General English and Aptitude

Directions (Q. 1-5) : *Read the following passage carefully and answer the questions given below it.*

Most of us use the products of science-railways, aeroplanes, electricity, wireless and thousands of others-without thinking how they came into existence. We take them for granted, as if we were entitled to them as a matter of right. And we are very proud of the fact that we live in an advanced age and are ourselves so very 'advanced'. Now, there is no doubt that our age is a very different one from previous ages and I think it is perfectly correct to say that is it far more advanced. But that is a different thing from saying that we as individuals or groups are more advanced. It would be the height of absurdity to say that because an engine-driver can run an engine and Plato or Socrates could not, the engine-driver is more advanced than or is superior to Plato or Socrates. But it would be perfectly correct to say that the engine itself is a more advanced method of locomotion than Plato's chariot was.

1. Which one of the following statements is true?
   (a) An engine-driver is cleverer than Plato or Socrates
   (b) Plato or Socrates is in no way inferior to the engine-driver
   (c) Plato and Socrates surpassed the engine-driver in every respect
   (d) The engine-driver cannot be compared to Plato or Aristotle

2. In this passage, the author mentions Plato and/or Socrates to emphasise that
   (a) they are/were men of great scholarship
   (b) people as individuals in the modern age are not more advanced than their predecessors
   (c) the engine is a better mode of locomotion than Plato's chariot
   (d) Plato and Aristotle had greater respect for learning

3. According to the author, the present age is far more advanced than
   (a) all the previous ages in some respect
   (b) the age of Socrates and Aristotle in some respects
   (c) some of the previous ages in all respects
   (d) all the previous ages in all respects

4. Many of us make use of machines
   (a) with very little knowledge of their mechanism
   (b) without any knowledge of their historical significance
   (c) with full knowing of their genesis
   (d) without knowing how they were invented

5. People today are very proud because they live
   (a) in a philosophically advanced age
   (b) in a materially advanced age
   (c) in a scientifically advanced age
   (d) in a spiritually advanced age

Directions (Q. 6-9) *In each of the following questions, choose the alternative which best expresses the meaning of the word given in capital letters.*

6. RARE
   (a) common   (b) usual
   (c) chance   (d) few

8. VICARIOUS
   (a) ambitious
   (b) not experienced personally
   (c) nostalgic
   (d) vindictive

9. TRANSITION
   (a) position   (b) translation
   (c) change   (d) movement

Directions (Q. 10-13) *In each of the following questions, find out the part which has an error. If there is no error, your answer is (d).*

10. The train come/(a) at 2 O'clock/(b) in the next morning./(c) No error/(d)

11. I have not been to/(a) New york before/(b) and neither my sister/(c) No error/(d)

12. A major contribution of Mathura sculptors/(a) of that period were the creation and popularization/(b) of the Buddha's image in human form./(c) No error/(d)

13. I had hoped that/(a) I would see you the other day/(b) but unfortunately/(c) I fell ill./(d)

Directions (Q. 14-15) *In each of the following questions, choose the alternative which can be substituted for the given words/sentence.*

14. An allowance paid to wife on divorce
    (a) Alimony   (b) Bigamy
    (c) Celibacy   (d) Matrimony

15. The study of human races
    (a) Botany   (b) Biology
    (c) Ethnology   (d) Geology

Directions (Q. 16-20) *In the following passage, there are blanks each of which has been numbered. These numbers are printed below the passage and against each, some words are suggested, one of which fits the blank appropriately. Find the appropriate word for each blank.*

One's body can be kept healthy by adopting breathing programmes that use the respiratory system to its maximum potential,

effective is the total Breath Control. Practice it....19... it becomes second nature. When that happens, you....20... find that you are less tired.

16. (a) as much   (b) as little as
    (c) into   (d) onto

17. (a) in   (b) through
    (c) into   (d) onto

18. (a) useful   (b) necessary
    (c) waste   (d) need

19. (a) as soon as   (b) until
    (c) after   (d) till

20. (a) can   (b) should
    (c) must   (d) ought

Directions (Q. 21-25) *In the following questions, choose the option which shows common feature in the relationship gives in each question.*

21. Nissan : Toyota : Isuzu
    (a) These are cities in Japan
    (b) These are ports in Japan
    (c) These are cars from Japan
    (d) These are tele-programmes

22. Yenisei : Orinoco : Makenzie
    (a) These are small round hills
    (b) These are sea ports
    (c) These are names of rivers
    (d) These are rich agricultural lands

23. Vinci : Angelo : Raphael
    (a) They were Italian engineers
    (b) They were European painters
    (c) They were dictators
    (d) They were famous politicians

24. Patna : Mumbai : Dispur
    (a) Cochin : Trombay : Chennai
    (b) Delhi : Udaipur : Jammu and Kashmir
    (c) Coal : Ebony : Soot
    (d) Botany : Zoology : Mathematics

25. Theta : Phi : Omega
    (a) These are Latin alphabets
    (b) These are signs of algebra
    (c) These are Greek letters
    (d) These are used in physical derivations

Directions (Q. 26-30) *In each of the following questions, there occurs a specific relations. Fill the vacant space according to that relation.*

26. Homicide : Human : : Fratricide : ?
    (a) Mother   (b) Father
    (c) Brother   (d) Enemy

27. Horse : Jockey : : Car :?
    (a) Mechanic   (b) Chauffer
    (c) Steering   (d) Brake

28. Wool : Sheep : : Mohair : ?
    (a) Deer   (b) Goat
    (c) Bear   (d) Camel

29. Cunning : Fox : : Timid : ?
    (a) Horse   (b) Ant
    (c) Ass   (d) Panther

30. Mars : Planet : Moon : ?
    (a) Earth   (b) Sun
    (c) Saturn   (d) Satellite

31. Who was the writer of the book 'Arthashastra'?
    (a) Vatsyayana   (b) Kautilya
    (c) Painin   (d) Kalidas

32. 19th Commonwealth Game was held in India at
    (a) New Delhi   (b) Hyderabad
    (c) Bengaluru   (d) Chennai

33. The headquarter of SAARC is located at
    (a) New Delhi
    (b) Islamabad
    (c) Kathmandu
    (d) Colombo

34. The first Indian woman who became IPS officer, is
    (a) Santosh Yadav   (b) Arati Saha
    (c) Reeta Faria   (d) Kiran Bedi

35. Who among the following Sikh Gurus started the Gurumukhi Script?
    (a) Guru Arjun
    (b) Guru Ramdas
    (c) Guru Tegh Bahadur
    (d) Guru Angad

36. Which was the first metal used by Man?
    (a) Copper   (b) Silver
    (c) Bronze   (d) Brass

37. Who founded the Banaras Hindu University?
    (a) Mahatma Gandhi
    (b) Madan Mohan Malviya
    (c) Jawaharlal Nehru
    (d) Motilal Nehru

38. Niagara falls are in
    (a) Australia   (b) UK
    (c) South Africa   (d) USA

39. Folk painting 'Madhubani' is famous in
    (a) West Bengal   (b) Orissa
    (c) Bihar   (d) Assam

40. Who is the proponent and propagandist of the 'Art of Living'?
    (a) Mahesh Yogi
    (b) Ram Dev
    (c) Sri Ravi Shankar
    (d) Chinmayananda

Physics

1.	(b)	2.	(b)	3.	(b)	4.	(c)	5.	(b)	6.	(a)	7.	(b)	8.	(b)	9.	(a)	10.	(a)
11.	(b)	12.	(d)	13.	(d)	14.	(c)	15.	(d)	16.	(a)	17.	(a)	18.	(b)	19.	(a)	20.	(d)
21.	(d)	22.	(c)	23.	(c)	24.	(b)	25.	(a)	26.	(c)	27.	(d)	28.	(b)	29.	(d)	30.	(b)
31.	(b)	32.	(a)	33.	(b)	34.	(a)	35.	(d)	36.	(a)	37.	(d)	38.	(a)	39.	(b)	40.	(d)
41.	(a)	42.	(a)	43.	(a)	44.	(a)	45.	(a)	46.	(b)	47.	(d)	48.	(c)	49.	(a)	50.	(c)
51.	(a)	52.	(d)	53.	(a)	54.	(c)	55.	(d)	56.	(b)	57.	(a)	58.	(d)	59.	(a)	60.	(b)

Chemistry

1.	(a)	2.	(c)	3.	(a)	4.	(b)	5.	(c)	6.	(a)	7.	(d)	8.	(a)	9.	(d)	10.	(b)
11.	(c)	12.	(d)	13.	(b)	14.	(d)	15.	(d)	16.	(a)	17.	(a)	18.	(a)	19.	(a)	20.	(c)
21.	(d)	22.	(b)	23.	(a)	24.	(c)	25.	(d)	26.	(b)	27.	(a)	28.	(d)	29.	(d)	30.	(d)
31.	(a)	32.	(d)	33.	(d)	34.	(c)	35.	(a)	36.	(d)	37.	(a)	38.	(d)	39.	(a)	40.	(a)
41.	(d)	42.	(c)	43.	(d)	44.	(b)	45.	(c)	46.	(b)	47.	(c)	48.	(a)	49.	(d)	50.	(c)
51.	(c)	52.	(a)	53.	(d)	54.	(a)	55.	(b)	56.	(d)	57.	(c)	58.	(a)	59.	(b)	60.	(b)

Biology

1.	(a)	2.	(a)	3.	(c)	4.	(a)	5.	(c)	6.	(a)	7.	(a)	8.	(a)	9.	(c)	10.	(c)
11.	(a)	12.	(a)	13.	(c)	14.	(c)	15.	(a)	16.	(c)	17.	(b)	18.	(d)	19.	(a)	20.	(c)
21.	(a)	22.	(b)	23.	(b)	24.	(d)	25.	(a)	26.	(a)	27.	(a)	28.	(a)	29.	(b)	30.	(a)
31.	(d)	32.	(a)	33.	(d)	34.	(a)	35.	(a)	36.	(a)	37.	(a)	38.	(a)	39.	(c)	40.	(a)
41.	(d)	42.	(b)	43.	(c)	44.	(d)	45.	(c)	46.	(d)	47.	(a)	48.	(a)	49.	(a)	50.	(b)
51.	(a)	52.	(a)	53.	(c)	54.	(a)	55.	(b)	56.	(a)	57.	(a)	58.	(a)	59.	(b)	60.	(a)
61.	(c)	62.	(b)	63.	(b)	64.	(b)	65.	(c)	66.	(a)	67.	(d)	68.	(b)	69.	(b)	70.	(b)
71.	(a)	72.	(c)	73.	(b)	74.	(a)	75.	(a)	76.	(a)	77.	(a)	78.	(b)	79.	(b)	80.	(a)

General English and Aptitude

1.	(b)	2.	(b)	3.	(a)	4.	(d)	5.	(c)	6.	(c)	7.	(a)	8.	(b)	9.	(c)	10.	(c)
11.	(c)	12.	(b)	13.	(d)	14.	(a)	15.	(c)	16.	(a)	17.	(c)	18.	(c)	19.	(b)	20.	(a)
21.	(c)	22.	(c)	23.	(b)	24.	(c)	25.	(c)	26.	(c)	27.	(b)	28.	(b)	29.	(c)	30.	(d)
31.	(b)	32.	(a)	33.	(c)	34.	(d)	35.	(d)	36.	(a)	37.	(b)	38.	(d)	39.	(c)	40.	(c)

Hints & Solutions

Physics

1. In any medium other than air or vacuum, the velocities of different colours are different. Therefore, both red and green colours are refracted at different angles of refractions. Hence, after emerging from glass slab through opposite parallel face, they appear at two different points and move in the two different parallel directions.

2. If the kinetic energy of photoelectrons emitted from the metal surface is E_k and W is the work function of the metal, then from Einstein's equation of photoelectric effect, we have

$$E_k = h\nu - W \qquad \ldots(i)$$

Also, $\qquad E_k = E_2 - E_1 \qquad \ldots(ii)$

Hence, Eq. (i) is

$$\frac{E_2 - E_1}{h} + \frac{W}{h} = \nu$$

Hence, frequency (ν) is greater than $\dfrac{E_2 - E_1}{h}$.

3. From Stefan's law, the total radiant energy emitted per second per unit surface area of a black body is proportional to the fourth power of the absolute temperature (T) of the body.

$$\therefore \qquad E = \sigma T^4$$

where, σ is Stefan's constant.

Given, $\qquad E_1 = R, T_1 = 273° \text{C}$

$$= 273 + 273 = 546 \text{ K}$$

$$T_2 = 0°\text{C} = 273 \text{ K}$$

$$\therefore \qquad \frac{E_1}{E_2} = \frac{T_1^4}{T_2^4}$$

$$\Rightarrow \qquad E_2 = \frac{T_2^4}{T_1^4} E_1$$

$$\Rightarrow \qquad E_2 = \frac{(273)^4}{(546)^4} R$$

$$\therefore \qquad E_2 = \frac{R}{16}$$

4. When touched charge flows from higher potential to lower potential till it equalizes on the two discs.

Given, $\qquad q_1 = 10^{-6}\text{C}, q_2 = 10^{-5}\text{C}$

$$\therefore \quad q = \frac{q_1 + q_2}{2} = \frac{10^{-6} + 10^{-5}}{2} = 5.5\,\mu\text{C}$$

5. When electrons accelerated through a potential difference V strike a target, the maximum frequency of the emitted X-rays is given by

$$eV = h\nu_{max}$$

where, e is charge of the electron and h the Planck's constant.

But $\nu_{max} = \dfrac{c}{\lambda_{min}}$, where c is the speed of light and λ_{min} the minimum wavelength.

$$\therefore \qquad eV = \frac{hc}{\lambda_{min}}$$

$$\Rightarrow \qquad \lambda_{min} = \frac{hc}{eV}$$

Given, $V = 24.75\,\text{kV} = 24.75 \times 10^3 \text{ V}$,

$$h = 6.6 \times 10^{-34} \text{ Js}, c = 3 \times 10^8 \text{ ms}^{-1},$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

$$\therefore \quad \lambda_{min} = \frac{6.6 \times 10^{-34} \times 3 \times 10^8}{1.6 \times 10^{-19} \times 24.75 \times 10^3}$$

$$= 0.5 \times 10^{-10}$$

$$= 0.5 \,\text{Å}$$

6. The magnet in a magnetic field experiences a torque which rotates the magnet to a position in which the axis of the magnet is parallel to the field.

$$\tau = MB \sin\theta$$

where, M is magnetic dipole moment, B the magnetic field and θ the angle between the two.

Given, $\tau_1 = 10^{-5}\text{ Nm}, \theta_1 = 90°, \theta_2 = 30°.$

$$\tau_1 = MB \sin 90° \qquad \ldots(i)$$

$$\tau_2 = MB \sin 30° \qquad \ldots(ii)$$

Dividing Eq. (i) by Eq. (ii), we get

$$\frac{\tau_1}{\tau_2} = \frac{10^{-5}}{\tau_2} = \frac{1}{1/2}$$

$$\Rightarrow \qquad \tau_2 = \frac{10^{-5}}{2}$$

$$= \frac{10}{2} \times 10^{-6}$$

$$= 5 \times 10^{-6}\text{ Nm}$$

where, V is potential difference and R the resistance.

Given, $P_1 = 100\,W$, $V_1 = 220\,V$

$\therefore \qquad R = \dfrac{V_1^2}{P_1} = \dfrac{(220)^2}{100}$

$\qquad = 484\,\Omega$

Hence, power dissipated when potential difference is 110 V is

$$P = \dfrac{(110)^2}{484} = 25\,W$$

8. The equation which relates the pressure (p), volume (V) and temperature of the given state of an ideal gas is known as ideal gas equation

$$pV = kT$$

$$p\left(\dfrac{m}{\rho}\right) = kT \qquad \left[\because V = \dfrac{m}{\rho}\right]$$

Density of gas, $\rho = \dfrac{pm}{kT}$

9. When air is blown at the open end of a closed pipe a longitudinal wave travels in the air of the pipe from closed end to open end. When λ is wavelength and l the length of pipe and n the frequency of note emitted and v the velocity of sound in air, then
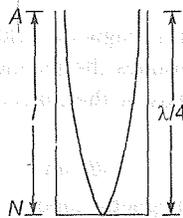
$$n = \dfrac{v}{\lambda}, \text{ (fundamental note)}$$

Given, $n = 166\,Hz$, $v = 332\,m/s$

$\therefore \qquad \lambda = \dfrac{332}{166} = 2\,m$

But, $\qquad \lambda = 4l$

$\therefore \qquad l = \dfrac{\lambda}{4} = \dfrac{2}{4} = 0.5\,m$

10. The standard equation of a wave, travelling with amplitude a in the negative x-direction with angular velocity ω is given by

$$y = a\sin(\omega t + kx) \qquad \ldots(i)$$

where, k is wave number.

$$v = \dfrac{\omega}{k} = \dfrac{100}{1}$$

$$= 100\,m/s$$

11. The wavelength of the γ-rays is shorter. However the main distinguishing feature is the nature of emission.

12. According to Newton' law of universal gravitation, every point mass attracts every other point mass by a force directed along the line connecting the two. The gravitational force is an internal force. Since, the two particles are initially at rest, their centre of mass is also initially at rest under the effect of internal forces, so the centre of mass remains in the state of rest.
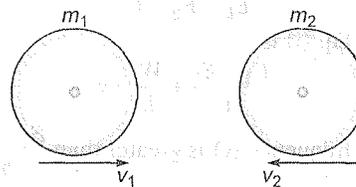
13. Power is defined as rate of change of energy in a system or the time rate of doing work.

$$P = \dfrac{dE}{dt}$$

$$= \dfrac{dW}{dt}$$

Also work = force $\times$ displacement = $F \times d$

In a circular motion, displacement is zero, therefore,

$$P = \dfrac{d}{dt}(F \times d)$$

$$= \dfrac{d}{dt}(0) = 0$$

14. If a constant force F is applied on a body for a short interval of time Δt, then the impulse of this force is $F\Delta t$.

When mass of body is m, an applying force F, for a time interval Δt, the body suffers a velocity change Δv, then

$$F = ma = m\dfrac{\Delta v}{\Delta t} \Rightarrow F\Delta t = m\Delta v$$

Given, $F = x$ newton, $\Delta t = 2\,s$, $v_1 = 2\,m/s$,

$\qquad v_2 = 3\,m/s$, $m = 0.5\,kg$

$\therefore \qquad x \times 2 = 0.5 \times 1$

$\Rightarrow \qquad x = \dfrac{0.5}{2} = 0.25\,N$

15. For a thin prism, angle of minimum deviation is given by $\delta = (\mu - 1)\,A$

where, μ is refractive index of the prism and A the angle of prism.

For dispersion without deviation

$$\delta_1 = \delta_2$$

$$\Rightarrow \qquad (\mu_1 - 1)\,A_1 = (\mu_2 - 1)A_2$$

$$\Rightarrow \qquad A_2 = \frac{(\mu_1 - 1)}{(\mu_2 - 1)}\,A_1$$

Given, $\mu_1 = 1.54$, $A_1 = 4°$, $\mu_2 = 1.72$

$$\Rightarrow \qquad A_2 = \frac{(1.54 - 1)}{(1.72 - 1)} \times 4 = 3°$$

16. When α-particle is emitted, the mass number decreases by 4 units and atomic number decreases by 2 units and for β-particle, atomic number is increased by 1 and mass number remains the same.

Given reaction is $_{92}Be^{234} \longrightarrow {}_{88}Y^{218}$
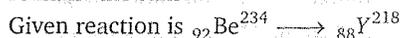
Number of α-particles

$$= \frac{234 - 218}{4}$$

$$= \frac{16}{4} = 4$$

Decrease in atomic number $= 4 \times 2 = 8$

ie., $\qquad 92 - 8 = 84$

From atomic number 88, number of β-particles emitted $= \dfrac{88 - 84}{1} = 4$

Hence, 4 α and 4 β-particles are emitted.

17. From Bohr's postulate, energy of electron in nth orbit is given by

$$E = -\frac{MZ^2 e^4}{8\,\varepsilon_0^2\,h^2}\left(\frac{1}{n^2}\right)$$

When electron jumps from some higher energy state n_2 to a lower energy state n_1, the energy difference between these states is

$$E_2 - E_1 \propto \left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

From Bohr's third postulate, the frequency ν of the electromagnetic wave is

$$\nu = \frac{E_2 - E_1}{h} \propto \left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

First case $\qquad n_1 = 1, n_2 = 3$

$$\therefore \qquad \nu_1 \propto \left(1 - \frac{1}{9}\right) \propto \frac{8}{9}$$

Second case $\ n_1 = 2, n_2 = 4$

$$\therefore \qquad \nu_2 \propto \left(\frac{1}{4} - \frac{1}{16}\right) \propto \frac{3}{16}$$

Third case $\quad n_1 = 3, n_2 = 4$

$$\therefore \qquad \nu_3 \propto \left(\frac{1}{9} - \frac{1}{16}\right) \propto \frac{7}{144}$$

Fourth case $\quad n_1 = 2, n_2 = 3$

$$\therefore \qquad \nu_4 \propto \left(\frac{1}{4} - \frac{1}{9}\right) \propto \frac{5}{36}$$

$$\nu_1 > \nu_2 > \nu_4 > \nu_3$$

Hence, transition $3 \to 1$ has higher frequency.

18. The relation between kinetic energy K, and momentum p, is

$$p = \sqrt{2mK}$$

where, m is mass.

Given, $\quad p_1 = p$, $p_2 = p_1 + 50\%$ of p_1

$$p_2 = p_1 + \frac{p_1}{2} = \frac{3}{2}\,p_1 = 1.5 p_1$$

$$\therefore \qquad \frac{K_1}{K_2} = \frac{p_1^2}{p_2^2}$$

$$\Rightarrow \qquad K_2 = \frac{p_2^2}{p_1^2}\,K_1$$

$$\Rightarrow \qquad K_2 = \frac{(1.5)^2}{1} \times K = 2.25\,K$$

$\therefore$ Change in KE $= 2.25 - 1$

$$= 1.25 = 125\%$$

19. The relation between current gain of a common-base transistor (α) to that of current gain between a common-emitter transistor (β) is

$$\beta = \frac{\alpha}{1 - \alpha}$$

Given, $\quad \alpha = 0.995$

$$\therefore \qquad \beta = \frac{0.995}{1 - 0.995} = 199 \approx 200$$

20. When light falls normally on a surface, the illuminance is maximum. If from a light source of luminous intensity (I), light is falling normally on a surface distant r from the source, then illuminance is

$$E = \frac{I}{r^2}$$

Given, $r_1 = 2\,m$, $r_2 = 4\,m$

$$\therefore \qquad \frac{E_1}{E_2} = \frac{r_2^2}{r_1^2}$$

$$\frac{E_1}{E_2} = \frac{(4)^2}{(2)^2} = 4 \Rightarrow E_2 = \frac{E_1}{4}$$

Hence, electrons emitted by photo cathode in one second are one quarter numerous.

The magnitude of magnetic field **B** at any point on Y due to current i_1 in X is given by
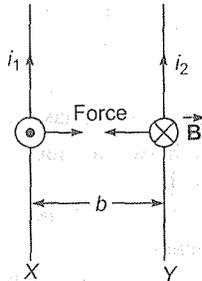
$$B = \frac{\mu_0}{2\pi} \frac{i_1}{b}$$

The magnitude of force acting on length l of Y is

$$F = i_2 B l = i_2 \left(\frac{\mu_0}{2\pi} \frac{i_1}{b} \right) l$$

Force per unit length is

$$\frac{F}{l} = \frac{\mu_0}{2\pi} \frac{i_1 i_2}{b}$$

Given, $i_1 = i_2 = i$, therefore,

$$\frac{F}{l} = \frac{\mu_0}{2\pi} \frac{i^2}{b}$$

22. The current i crossing area of cross-section A, can be expressed in terms of drift velocity v_d and the moving charges as

$$i = ne\, v_d A$$

where, n is number of charge carriers per unit volume and e the charge on the carrier.

$$\therefore v_d = \frac{i}{neA} = \frac{24 \times 10^{-3}}{(3 \times 10^{23})(1.6 \times 10^{-19})(10^{-4})}$$

$$= 5 \times 10^{-3} \,\text{m/s}$$

23. For a spherical capacitor of radius R, the capacitance is given by

$$C = 4\pi\varepsilon_0 R$$

Given, $C = 1\,\mu\text{F} = 1 \times 10^{-6}\,\text{F}$

$$\Rightarrow \quad R = \frac{C}{4\pi\varepsilon_0}$$

$$= 9 \times 10^9 \times 1 \times 10^{-6}\,\text{m}$$

$$\Rightarrow \quad R = 9 \times 10^3\,\text{m}$$

$$= 9\,\text{km}$$
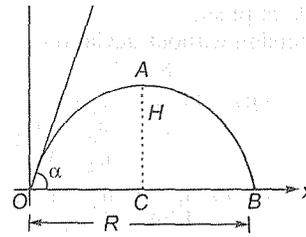
Maximum height of projectle

$$H = \frac{u^2 \sin^2 \alpha}{2g}$$

Now, it is given that

$$(\text{Range})^2 = 48\ (\text{maximum height})^2$$

$$\therefore \quad \left(\frac{u^2 \sin 2\alpha}{g} \right)^2 = 48 \left(\frac{u^2 \sin^2 2\alpha}{2g} \right)^2$$

or $$\frac{u^2 \sin 2\alpha}{g} = 4\sqrt{3} \left(\frac{u^2 \sin^2 \alpha}{2g} \right)$$

or $$\frac{2 \sin \alpha \cos \alpha}{4\sqrt{3}} = \frac{\sin^2 \alpha}{2}$$

or $$\tan \alpha = \frac{4}{4\sqrt{3}} = \frac{1}{\sqrt{3}}$$

$$\therefore \quad \alpha = 30°$$

25. The velocity of gas at temperature T is given by

$$v = \frac{\sqrt{3RT}}{M}$$

where, R is gas constant and M the molecular weight.

Given, $R = 8.3\,\text{J/mol-K}$,

$$T = 27°\,\text{C} + 273° = 300\,\text{K}$$

$$v = 1933\,\text{m/s}$$

$$\therefore \quad M = \frac{3RT}{v^2} = \frac{3 \times 8.3 \times 300}{(1933)^2}$$

$$\therefore \quad = \frac{7470}{3736489}$$

$$\approx 0.001999$$

$$\therefore \quad M \approx 2 \times 10^{-3}\,\text{kg}$$

which is molecular weight of H_2.

26. The standard equation of a wave of amplitude a is given by

$$y = a \cos (\omega t - kx) \qquad \ldots(i)$$

where, ω is angular velocity, k the wave number and t the time.

Given equation is
$$y = 20 \cos \pi(50t - x) \qquad \ldots(ii)$$
Comparing Eq. (i) with Eq. (ii), we get
$$k = \frac{2\pi}{\lambda} = \pi$$
$$\Rightarrow \qquad \lambda = 2\,\text{cm}$$

27. Surface tension is the energy that is required to stretch the surface of liquid one incremental amount of area. This requires an input of energy, that is surface tension is positive, It is easier to stretch the surface of a liquid the warmer it gets, because the molecules at the surface are "hopping around" more, the higher the temperature is. Hence, surface tension always decreases with rise in temperature.

28. When a wire is pulled it stretches (undergoes strain) upto a certain limit the amount it stretches is proportional to the load divided by the cross–sectional area of the wire.
$$\text{Stress} = \frac{\text{Force}}{\text{Area}} = \frac{mg}{A} = \frac{V\rho g}{A} = \frac{LA\rho g}{A}$$
$$\therefore \qquad \text{Stress} = L\rho g$$
Given, stress = $6 \times 10^6\,\text{Nm}^{-2}$
$$\rho = 3 \times 10^3\,\text{kg m}^{-3}$$
$$g = 10\,\text{ms}^{-2}$$
$$L = \frac{\text{stress}}{\rho g}$$
$$= \frac{6 \times 10^6}{3 \times 10^3 \times 10}$$
$$= 2 \times 10^2 = 200\,\text{m}$$

29. According to Newton's second law of motion force acting on a body is equal to the rate of change of momentum during impact.
$$F = \frac{\Delta p}{\Delta t}$$
Also, $\qquad F = ma$
$$\therefore \qquad ma = \frac{p_2 - p_1}{\Delta t}$$
or $\qquad a = \frac{mv_2 - (-mv_1)}{m\Delta t}$
or $\qquad a = \frac{v_2 + v_1}{\Delta t}$
$$\therefore \qquad a = \frac{\sqrt{2 \times 10 \times 20} + \sqrt{2 \times 10 \times 5}}{0.02}$$
or $\qquad a = \frac{20 + 10}{0.02}$
$$= 1500\,\text{m/s}^2$$

30. From Coulomb's law, electric force between two charges is directly proportional to product of charges and inversely proportional to square of distance between them. That is
$$F = k\frac{q_1 q_2}{d^2}$$
where, $k = \dfrac{1}{4\pi\varepsilon_0}$ = proportionality constant. If a medium is placed between the charges, then
$$F' = \frac{1}{4\pi\varepsilon_0 K}\frac{q_1 q_2}{d^2}$$
Since, medium placed between the charges is a metallic plate, so for it $K = \infty$
Hence, $\qquad F' = 0$ (zero)

31. The number of images formed depends upon the angle between the mirrors. If two mirrors make an angle θ with each other, the number of images formed is
$$n = \frac{360}{\theta} - 1$$
when mirrors are kept mutually perpendicular to each other, then $\theta = 90°$.
$$n = \frac{360}{90} - 1 = 3$$

32. Entropy of a system is a measure of its molecular disorder. The greater the disorder, greater is the entropy. The charge in entropy is given by
$$dS = \frac{dQ}{T}$$
$$= \frac{\text{Heat absorbed}}{\text{Absolute temperature}}$$
Also, $dQ = mL$ where, m is mass and L the latent heat.
Given, $m = 15\,\text{g}$, $L = 80\,\text{cal/g}$
$$\therefore \qquad dQ = 15 \times 80 = 1200\,\text{cal}$$
$$\therefore \qquad dQ = 1200 \times 4.2 = 5040\,\text{J}$$
Hence, change in entropy is
$$dS = \frac{5040}{273} = 18.46$$
$$\approx 18.5$$

33. If the magnet is placed in a non-uniform magnetic field, the force acting on the north and south poles of the magnet are not equal in magnitude (although they are opposite in direction). Thus, on the magnet, in addition to

direction of magnetic field, but the resultant force will have a tendency to produce a linear displacement of the magnet.

34. If a particle executes SHM, its kinetic energy is given by

$$KE = \frac{1}{2} m\omega^2 (A^2 - x^2)$$

or

$$KE = \frac{1}{2} k (A^2 - x^2)$$

where, $k = m\omega^2 = $ constant

Its potential energy is given by

$$PE = \frac{1}{2} m\omega^2 x^2$$

$$= \frac{1}{2} kx^2$$

Thus, total energy of particle

$$E = KE + PE$$

$$= \frac{1}{2} k (A^2 - x^2) + \frac{1}{2} kx^2$$

$$= \frac{1}{2} kA^2$$

Hence,

$$PE = \frac{1}{2} kx^2 = \frac{1}{2} k \left(\frac{A}{2}\right)^2 \quad (\because x = A/2)$$

$$= \frac{1}{4} \left(\frac{1}{2} kA^2\right)$$

$$= \frac{1}{4} E$$

Hence, potential energy is one-fourth of total energy.

35. According to Hooke's law, the stress produced in a body is proportional to the strain. But this proportionality exists for small strains only. When a load is applied to a damped wire, the length of wire goes on increasing part *OA* of the graph is straight line, indicating that upto point *A*, increase in length is directly proportional to load. After point *A* on further increasing the load, the increase in length is no longer proportional to load, however till point *B* the elastic property exists in the wire. The stress at point *B* is called elastic limit. Beyond *B* is the wire does not return to its original position, but its length is permanently increased.
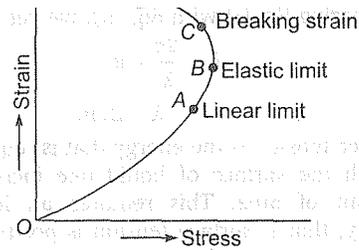
Hence, none of the given statements is true.

36. The eraser is pressed against the black board. Taking the vertical and horizontal components of forces, we have
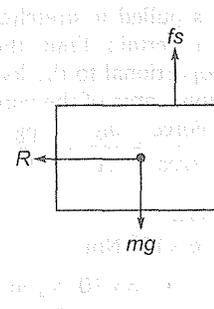
$$F = \mu R$$

where, R is reaction of the board on the rubber.

Given, $\qquad R = 5\,N, \mu = 0.4$

$\therefore \qquad\qquad F = 0.4 \times 5 = 2\,N$

37. When body performs circular motion, it is acted upon by a centripetal force the magnitude of which is given by $F = \dfrac{mv^2}{r}$

where, m is mass, v the velocity and r the radius.
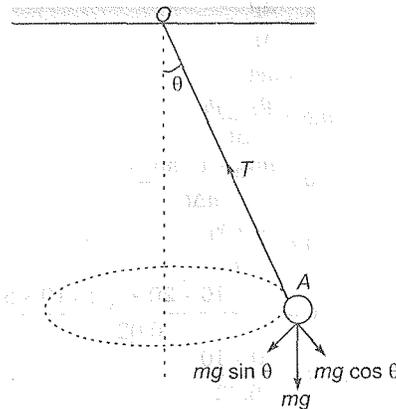
Since, $v = r\omega$

$\therefore$ $F = mr\omega^2$

Given, $m = 0.12\,\text{kg}, r = 0.5\,\text{m}$,

$\omega = 231\,\text{rpm} = \dfrac{2\pi \times 231}{60}\,\text{rad/s} = 24.2\,\text{rad/s}$

$\therefore$ $F = 0.12 \times 0.5 \times (24.2)^2 = 35.1\,\text{N}$

38. $R = \dfrac{\rho\, l}{\pi\, r^2}$

Since, $V_1 = V_2$

$\Rightarrow$ $l' \times \pi \left(\dfrac{r}{2}\right)^2 = l \times \pi\, r^2$

$\Rightarrow$ $\dfrac{l'}{4} = l \text{ or } l' = 4l$

$\therefore$ $R' = \dfrac{\rho\, 4l}{\pi r^2} \times 4 = 16R$

39. The minimum energy required for the emission of photoelectron from a metal is called the work function W of that metal. If v_0 is threshold frequency, then

$$W = h v_0$$

but frequency $(v_0) = \dfrac{\text{velocity } (c)}{\text{wavelength } (\lambda)}$

$\therefore$ $W = \dfrac{hc}{\lambda}$

where, h is Planck's constant and c the speed of light.

Given, $h = 6.6 \times 10^{-34}\,\text{Js}, c = 3 \times 10^8\,\text{m/s}$,

$\lambda = 400\,\text{nm} = 400 \times 10^{-9}\,\text{m}$

$\therefore$ $W = \dfrac{6.6 \times 10^{-34} \times 3 \times 10^8}{400 \times 10^{-9}}\,\text{J}$

$W = 4.95 \times 10^{-19}\,\text{J}$

$W = \dfrac{4.95 \times 10^{-19}}{1.6 \times 10^{-19}} = 3.1\,\text{eV}$

40. The ray retraces its path after reflection from the silvered face AC. Therefore, $\angle ARQ = 90°$. As is clear from the figure, the angle of reflection RQN at face AB is 30°.
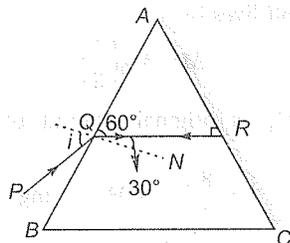
Therefore, by Snell's law, we have

$$n = \dfrac{\sin i}{\sin r}$$

Given, $n = \sqrt{2}, r = 30°$

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

$\Rightarrow$ $i = 45°$

41. When a charged capacitor is allowed to discharge through a resistance inductor electrical oscillations of constant amplitude are produced in the circuit. These are called L-C oscillations.
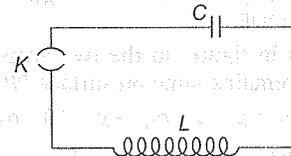
The energy stored in charged capacitor is

$$U = \dfrac{1}{2}CV^2 = \dfrac{1}{2}Li^2$$

where, i is current in the circuit and V the potential difference.

$\therefore$ $i = \sqrt{\dfrac{C}{L}}\,V$

Given, $C = 1\,\mu\text{F} = 1 \times 10^{-6}\,\text{F}$,

$L = 10\,\text{mH} = 10 \times 10^{-3}\,\text{H}$

$V = 50\,\text{V}$

$\therefore$ $i = \sqrt{\dfrac{1 \times 10^{-6}}{10 \times 10^{-3}}} \times 50 = 0.5\,\text{A}$

42. The capacitance (C) of a conductor is defined as the ratio of charge (q) given to the rise in potential (V) of the conductor. That is

$$C = \dfrac{q}{V}$$

$\therefore$ Farad $= \dfrac{\text{coulomb}}{\text{volt}} = \dfrac{\text{coulomb}}{\text{joule}\,/\,\text{coulomb}}$

$= \dfrac{\text{coulomb}^2}{\text{joule}}$

$= \dfrac{(\text{ampere-sec})^2}{\text{newton-metre}} = \dfrac{\text{ampere}^2\text{-sec}^2}{(\text{kg-m sec}^{-2}) \times \text{metre}}$

$= \dfrac{\text{ampere}^2\text{-sec}^4}{\text{kg-metre}^2}$

$= \text{kg}^{-1}\text{-metre}^{-2}\text{-sec}^4\text{-ampere}^2$

Hence, dimensions of capacitance are

$[\text{M}^{-1}\text{L}^{-2}\text{T}^4\text{A}^2]$

$$= \frac{T_2/T_1}{1 - T_1/T_2} = \frac{T_2}{T_1 - T_2}$$

where, T_1 is temperature of source, T_2 of sink.

Given, $T_1 = 273 + 27 = 300\,K$

$T_2 = 273 + (-23) = 250\,K$

$\therefore \quad \beta = \frac{250}{300 - 250} = \frac{250}{50} = 5$

Coefficient of performance of refrigerator increases when T_1 is small.

44. As shown in figure, in the two arms of a tube pressure remains same on surface PP'. Hence,

$$8 \times \rho_Y \times g + 2 \times \rho_{Hg} \times g = 10 \times \rho_X \times g$$
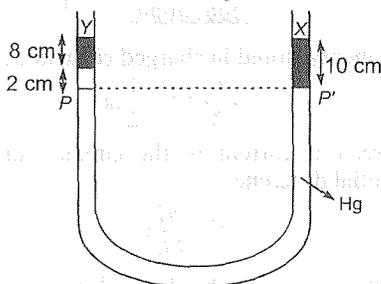
$\therefore \quad 8\rho_Y + 2 \times 13.6 = 10 \times 3.36$

or $\rho_Y = \dfrac{33.6 - 27.2}{8}$

$= 0.8\,g/cc$

45. The fractional change in the transverse length is proportional to the fractional change in the longitudinal length. The constant of proportionality is called Poisson's ratio. In terms of Youngs' modulus and rigidity modulus, it is given by

$$\sigma = -\frac{\Delta d/d}{\Delta L/L}$$

$$= \frac{Y}{2\eta} - 1$$

Given, $Y = 2.4\,\eta$

$\therefore \quad \sigma = \dfrac{2.4\eta}{2\eta} - 1 = 0.2$

46. Displacement is defined as the distance between initial and final positions of the ball. In the given case, since ball returns back to its initial position, the displacement is zero.

While distance is twice of path AB.

angular fringe width is

$$\theta = \frac{\lambda}{d} \qquad \qquad ...(i)$$

where, d is distance between coherent sources.
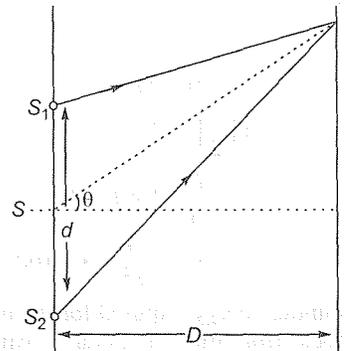
Given, $\dfrac{\Delta\theta}{\theta} = \dfrac{10}{100}$

So, from Eq. (i)

$$\frac{\Delta\lambda}{\lambda} = \frac{\Delta\theta}{\theta} = \frac{10}{100} = 0.1$$

$\Rightarrow \Delta\lambda = 0.1\lambda = 0.1 \times 5890\,\text{Å} = 589\,\text{Å}$ (increases)

48. The refractive index of the material of a lens varies slightly with the wavelength and hence, the focal length is also different for different wavelengths. The separation between the images formed by extreme wavelengths of visible range is called the longitudinal chromatic given by

$$f_1 - f_2 = \omega \times f$$

where, ω is dispersive power.

Given, $\omega = 0.02, f = 20$

$\therefore \quad f_1 - f_2 = 0.02 \times 20 = 0.40$

49. From Rutherford and Soddy law, at any instant, the rate of decay of a radioactive substance is proportional to the amount of the substance left at that instant. The amount left after n half-lives is

$$M = M_0 \left(\frac{1}{2}\right)^n$$

where, M_0 is original amount of substance atoms.

Given, $n = \dfrac{8.1}{2.7} = 3, M_0 = 1\,mg$

$\therefore \quad M = 1\left(\dfrac{1}{2}\right)^3 = \dfrac{1}{8}\,mg = 0.125\,mg$

50. Acceleration due to gravity at earth's surface is given by

$$g = \frac{GM}{R^2} \qquad \qquad \ldots(i)$$

Since, earth is assumed to be spherical in shape, its mass is

$$M = \text{volume} \times \text{density} = \frac{4}{3}\pi R^3 \rho$$

Given, $\rho_e = \rho_p = \rho, G_p = 2G_e$

$$\therefore \quad \frac{g_e}{g_p} = \frac{G_e\left(\dfrac{4}{3}\pi R_e^3\right)\rho \times R_p^2}{R_e^2 \times G_p\left(\dfrac{4}{3}\pi R_p^3\right)\rho}$$

$$1 = \frac{G_e R_e^3 \times R_p^2}{R_e^2 \times R_p^3 \times 2G_e} \quad [\because G_p = 2G_e]$$

$$1 = \frac{R_e}{2R_p}$$

$$\Rightarrow \qquad \frac{R_p}{R_e} = \frac{1}{2}$$

51. When a ray of light passes from a denser medium to a rarer medium, it bends away from the normal at the interface of the two media. The angle of incidence is measured with respect to the normal at the refractive boundary. It is given by

$$C = \sin^{-1}\left(\frac{n_2}{n_1}\right)$$
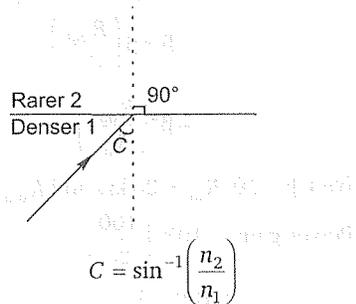
where, C is critical angle, n_2 is the refractive index of rarer medium and n_1 of the denser medium.

Given, $n_2 = 1.33, n_1 = 1.50$

$$C = \sin^{-1}\left(\frac{1.33}{1.50}\right)$$

$$C = \sin^{-1}\left(\frac{8}{9}\right)$$

52. Ionisation potential (V) of mercury is the energy required to strip it of an electron. The electric field strength is given by

$$E = \frac{V}{d}$$

where, d is distance between plates creating electric field.

Given, $V = 10.39$ V, $E = 1.5 \times 10^6$ V/m

$$\therefore \qquad d = \frac{V}{E} = \frac{10.39}{1.5 \times 10^6} \text{ m}$$

Hence, distance travelled by electron to gain ionization energy is

$$= \frac{10.39}{1.5 \times 10^6} \text{ m}$$

53. Let a rod of length l moves with velocity v, in a magnetic field B. Because of change in magnetic flux passing through the circuit, an emf is induced in the circuit, it is given by

$$e = Bvl$$
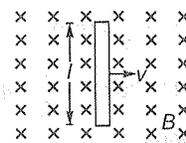
Given, $B = 0.9$ Wb/m^2, $v = 7$ m/s, $l = 0.4$ m

$$\therefore \qquad e = 0.9 \times 7 \times 0.4 = 2.52 \text{ V}$$

54. Let l be the length of pipe, v the speed of sound, then the fundamental tone or first harmonic of closed tube

Closed tube   Open tube
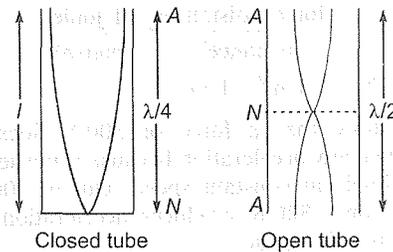
$$n_1 = \frac{v}{4l}$$

For open tube

$$n_2 = \frac{v}{2l}$$

$$\therefore \qquad n_2 = 2n_1$$

Given, $n_1 = 512$ Hz,

$$\therefore \qquad n_2 = 2 \times 512 = 1024 \text{ Hz}$$

∴ Apparent weight = weight in air – force of

buoyancy

$$= (Vd_{steel} - Vd_{water})g$$
$$= (5 \times 5 \times 5 \times 7)g - (5 \times 5 \times 5 \times 1)g$$
$$= (5 \times 5 \times 5 \times 6)g$$

56. Angular velocity is given by

$$\omega = 600 \text{ rot/min}$$
$$= \frac{600 \times 2\pi}{60} \text{ rad/s}$$
$$= 20\,\pi\,\text{rad/s}$$

Kinetic energy of coin which is due to rotation
and translation is

$$K = \frac{1}{2}I\omega^2 + \frac{1}{2}mv^2$$
$$= \frac{1}{2} \times \frac{1}{2}mr^2\omega^2 + \frac{1}{2}m(r\omega)^2$$
$$= \frac{1}{4} \times 4.8 \times (1)^2 (20\pi)^2 + \frac{1}{2} \times 4.8 \times (20\pi \times 1)^2$$
$$= 480\pi^2 + 960\pi^2$$
$$= 1440\pi^2 \text{J}$$

57. Given, $\dfrac{1 \text{ newton}}{\text{metre}}$

or $\dfrac{1 \text{ newton - metre}}{\text{metre}^2}$

$$= \frac{\text{force} \times \text{distance}}{(\text{distance})^2} = \frac{1 \text{ joule}}{(\text{metre})^2}$$

∴ $\text{N/m} = 1 \text{ J/m}^2 = 1 \text{ Jm}^{-2}$

58. We know that a force of 500 N does not
produce any acceleration because it pushes the
car slowly at constant speed. Out of 1000 N
force, only 500 N produces acceleration, the
mass is 1000 kg, so

59. When a body tied to the end
of a string is rotated in a
vertical circle, the speed of
the body is different at
different points of the circular
path when body is at highest
point A, it is acted upon by
two forces weight mg of the body and tension
T_A in the string.
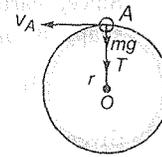
∴ $T_A + mg = \text{centripetal force} = \dfrac{mv_A^2}{r}$

$$\Rightarrow \qquad T_A = \frac{mv_A^2}{r} - mg$$

Given, $\qquad m = 0.2 \text{ kg}, r = 0.5 \text{ m}, v_A = 5 \text{ m/s}$

∴ $\qquad T_A = \dfrac{0.2 \times (5)^2}{0.5} - 0.2 \times 9.8$

$$T_A = 10 - 1.96$$
$$T_A = 8.04 \text{ N}$$

60. The power gain is defined as the ratio of charge
in output power to the charge in input power.

Since, $\qquad P = Vi$

Therefore,

Power gain = current gain × voltage gain

$$= \beta \times \beta\left(\frac{R_{out}}{R_{in}}\right)$$

$$= \beta^2\left(\frac{R_{out}}{R_{in}}\right)$$

Given, $\beta = 10$, $R_{in} = 20 \text{ k}\Omega$ and $R_{out} = 100 \text{ k}\Omega$

∴ Power gain $= (10)^2\left(\dfrac{100}{20}\right)$

$$= 100 \times 5$$
$$= 500$$

Chemistry

1. Given, $V = 1.12 \times 10^{-7} \text{ cm}^3$

   $\because$ 22400 cm^3 of the gas at STP has molecules
   $= 6.02 \times 10^{23}$

   $\therefore 1.12 \times 10^{-7}$ cm^3 of the gas at STP will have molecules

   $$= \frac{6.02 \times 10^{23}}{22400} \times 1.12 \times 10^{-7}$$

   $$= 3.01 \times 10^{12} \text{ molecules}$$

2. Eq. wt. of metal $= \dfrac{\text{wt. of metal}}{\text{wt. of chlorine}} \times 35.5$

   $\therefore$ Eq. wt. of metal $= \dfrac{74.5 - 35.5}{35.5} \times 35.5 = 39$

3. Generally, electron affinity decreases down the group but increases in a period. However, the electronegativity of Cl is more than F because of the smaller size of F, due to which their is a greater repulsion between the incoming electron and electrons present in its valence shell.

   Hence, Cl has the maximum electron affinity among halogens.

4. $H_2^+ = \sigma 1s^1$ (According to molecular orbital theory)

   Bond order

   $= \dfrac{\text{bonding electrons} - \text{antibonding electrons}}{2}$

   $= \dfrac{1}{2} = 0.5$

   H_2^+ is paramagnetic due to the presence of one unpaired electron.

5. A metallic bond consist of positive kernels arranged in a definite pattern in a sea of mobile electrons. It is quite different from ionic as well as covalent bond.

6. As the number of unpaired electrons in the central atom increases, magnetic moment of the complex increases.

   In $[MnCl_4]^{2-}$ = [Ar] | ↑ | ↑ | ↑ | ↑ | ↑ |
   (five unpaired electrons)

   In $[CoCl_4]^{2-}$ = [Ar] | ↑↓ | ↑↓ | ↑ | ↑ | ↑ |
   (three unpaired electrons)

   In $[Fe(CN)_6]^{4-}$ = [Ar] | ↑↓ | ↑↓ | ↑↓ | |
   (no unpaired electrons)

   $\therefore$ The order of magnetic moments is
   $$[MnCl_4]^{2-} > [CoCl_4]^{2-} > [Fe(CN)_6]^{4-}$$

7. $2H_2SO_4 \rightleftharpoons \underset{\substack{\text{(electrophile}\\\text{of aromatic}\\\text{sulphonation)}}}{SO_3} + HSO_4^- + H_3O^+$
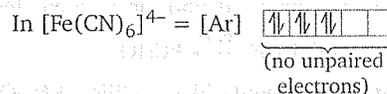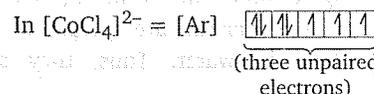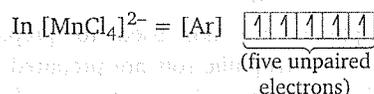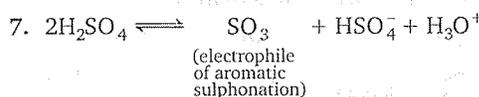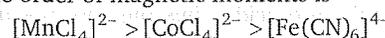
8. Aliphatic as well as aromatic amines when treated with chloroform in an alkaline medium, give a very offensive compound, called carbylamine. Hence, the reaction is known as carbylamine reaction.

   $C_6H_5NH_2 + 3KOH + CHCl_3 \longrightarrow C_6H_5NC$
   $+ 3KCl + 3H_2O$
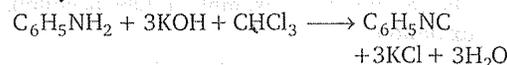
9. Basic nature of amines is due to the presence of lone pair of electrons on nitrogen atom which is available for the bond formation with Lewis acid. Due to the $+I$ effect, 2° amine is more basic than 1° amine and NH_3. In case of aromatic amines, the lone pair on nitrogen atom are involved in resonance, therefore not available for bond formation, so aromatic amines are less basic.

   Hence, $(C_2H_5)_2NH$ is the strongest base among the given.

10. Acetamide and ethylamine can be distinguished by heating with NaOH solution when acetamide liberates NH_3 but ethylamine does not.

    $CH_3CONH_2 + NaOH \xrightarrow{\Delta} CH_3COONa + NH_3$

    $CH_3CH_2NH_2 + NaOH \longrightarrow$ No reaction

11. Aldol condensation is shown by only those carbonyl compounds which have α-hydrogen atoms.

    $\overset{\alpha}{C}H_3 - \overset{\overset{\textstyle O}{\|}}{C} - \overset{\alpha}{C}H_3 \quad CH_3\overset{\alpha}{C}H_2CHO \quad \overset{\alpha}{C}H_3CHO$
    (a)   (b)   (d)
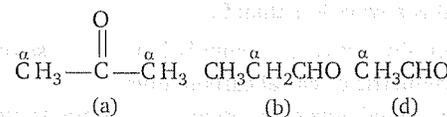
    Thus, compounds given in choice (a), (b) and (d) would undergo aldol condensation because they have α-hydrogen atoms.

    $H - \overset{\overset{\textstyle O}{\|}}{C} - H$, however, will not give aldol condensation because it does not have α-hydrogen atom.

$$RCH_2OH \xrightarrow{PCC} RCHO$$
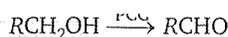
Strong oxidising agents like acidified $KMnO_4$, acidified $K_2Cr_2O_7$ if used, convert alcohols directly into acids, thus they are not used for oxidation of alcohol to aldehydes.

13.

p-benzene diol
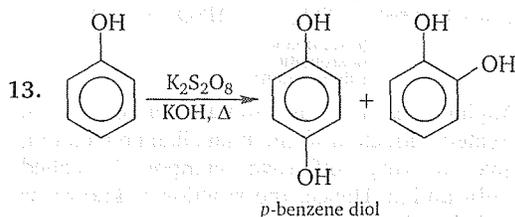
The reaction is an example of Elbs persulphate oxidation.

14. The possible isomers of $C_2BrClFI$ are as
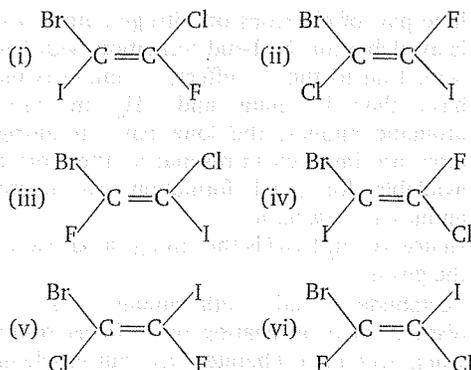
15. The pH of acidic buffers is calculated by following formula

$$pH = -\log K_a + \log\left[\frac{salt}{acid}\right]$$

∴ pH of acidic buffer depends on value of K_a and is always less than 7.

16. Optically active compounds have at least one asymmetric or chiral carbon atom.
Compound given in option (a) contains two chiral carbon atoms as
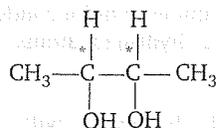
∴ It is optically active.

value is most negative for Cr among the given, hence it has higher tendency to change from +2 to +3 state.

18. There are seven crystal systems and 14 Bravais lattices.

19. When a spontaneous (naturally occurring process) takes place, it is accompanied by increase in entropy. *ie,*

$$\Delta S_{universe} = \Delta S_{system} + \Delta S_{surrounding} > 0$$

20. Insulin is a hormone, secreted by pancreas. It is chemically protein as contains polypeptide bonds.

21. Silver is not obtained by heating $Na[Ag(CN)_2]$. It is obtained by treating $Na[Ag(CN)_2]$ with more electropositive metal Zn, which replaces Ag from it.

$$2Na[Ag(CN)_2] + Zn \rightarrow Na_2[Zn(CN)_4] + 2Ag\downarrow$$
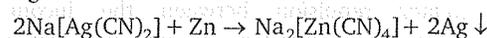
22. William Ramsay was the scientist who discovered noble gas first time.

23. Species having no unpaired electrons are usually colourless.

$Cu^+ = [Ar]\, 3d^{10}$ (no unpaired electrons)

$Co^{2+} = [Ar]\, 3d^7$ (three unpaired electrons)

$Ni^{2+} = [Ar]\, 3d^8$ (two unpaired electrons)

$Fe^{3+} = [Ar]\, 3d^5$ (five unpaired electrons)
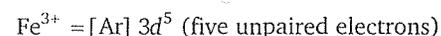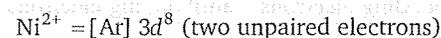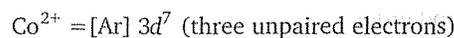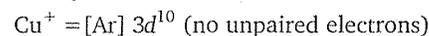
In Cu^+, all the electrons are paired, so it is colourless.

24. Molecular wt., $m = \dfrac{1000 \times k_b \times w}{W \times \Delta T_b}$

or $\Delta T_b = \dfrac{1000 \times k_b \times w}{W \times m}$

$\Delta T_b = \dfrac{1000 \times k_b \times 10}{100 \times 100}$

$\Delta T_b = k_b$

25. Metal sulphides are not used to prepare lyophilic sols as lyophilic sols are prepared by just dissolving substance into water *eg,* sols of starch, gum and gelatin are prepared by dissolving them in water. Thus, they are lyophilic.

26. $CuSO_4 + 2KI \longrightarrow K_2SO_4 + CuI_2$

$$2Na_2S_2O_3 + I_2 \longrightarrow Na_2S_4O_6 + 2NaI$$

$$2CuI_2 \longrightarrow Cu_2I_2 + I_2$$

Hence, CuI_2 is not formed.

27. Mutarotation is the change in specific rotations of an optically active compound in solution with time to an equilibrium value.

28. In S_N1 (Unimolecular nucleophilic substitution) reactions,

$$\text{Rate} \propto [\text{substrate}]$$

Rate determining step is the formation of carbocation and depends on the stability of carbocation formed. The stability of carbocations follow the order

$$(C_6H_5)_2C^+(CH_3) > (C_6H_5)_2\overset{+}{C}H > (CH_3)_3C^+$$

$$(CH_3)_2\overset{+}{C}H > CH_3CH_2^+$$

Thus, the order of reactivity towards S_N1 reaction is

$$(iii) > (ii) > (i) > (iv) > (v)$$

29. Let the oxidation state of N in $HNO_3 = x$

$$\therefore \qquad +1 + x + (-2 \times 3) = 0$$

or $\qquad\qquad x + 1 - 6 = 0$

$$\therefore \qquad\qquad x = +5$$

30. Rate of diffusion $= \dfrac{V}{t} \propto \dfrac{1}{\sqrt{m}}$

$$\Rightarrow \quad \frac{r_{H_2}}{r_{O_2}} = \frac{V_{H_2}}{V_{O_2}} = \frac{n_{H_2}}{n_{O_2}} = \sqrt{\frac{M_{O_2}}{M_{H_2}}}$$

$$\frac{2/2}{w/32} = \sqrt{\frac{32}{2}}, \frac{32}{w} = 4, w = 8\,g$$

31. Greater the value of $n + l$, more will be the energy of electron. If the two electrons have same value for $(n + l)$ then one with lower value of n should be filled first because it possesses lower energy.

(i) $n = 4, l = 1 \therefore n + l = 4 + 1 = 5$

(ii) $n = 4, l = 0 \therefore n + l = 4 + 0 = 4$

(iii) $n = 3, l = 2 \therefore n + l = 3 + 2 = 5$

(iv) $n = 3, l = 1 \therefore n + l = 3 + 1 = 4$

∴ The correct order of energy is

(iv) < (ii) < (iii) < (i)

32. The catalytic poisons decreases the activity of catalyst due to strong preferential adsorption of the poison on the surface of the catalyst.

33. van der Waals' equation for the n moles of a real gas is

$$\left(p + \frac{n^2 a}{V^2} \right)(V - nb) = nRT$$

34. Effective atomic number, EAN
= number of electrons in Cr + 2 × number of ligands − charge
= $24 + 2 \times 6 - 3 = 33$

35.

3,3,3-trichloropropanal

36. When alcohols react with acids or acid derivatives, esters are formed. Thus,

$CH_3OH + CH_3COOH \longrightarrow CH_3COOCH_3 + H_2O$
methyl acetate

$CH_3OH + CH_3COCl \longrightarrow CH_3COOCH_3 + HCl$
methyl acetate

$+ CH_3COOH$

37. When acid chlorides are treated with $Pd/BaSO_4$, they get converted into aldehydes. This reaction is known as Rosenmund's reaction and is used to prepare aldehydes only.

$$\underset{\text{acid chloride}}{RCOCl} + H_2 \xrightarrow{Pd/BaSO_4} RCHO + HCl$$

38.

39. Unsaturated fatty acids such as linoleic acid, linolenic acid are present in drying oils.

40. Iodine value is used to find degree of unsaturation in fats and oils. (Higher the iodine value, more unsaturated is the oil or fat).

41. Normality $= \dfrac{\text{gram equivalents of solute}}{\text{volume of solution in litre}}$

Given, mass of solute = 4 g

Molecular mass of NaOH = 23 + 16 + 1 = 40

$$\therefore \quad \text{Normality} = \frac{}{0.1} = 1.0 \text{ N}$$

42. In smoke, the solid carbon particles are dispersed in air, thus it is an aerosol.

43. The false statement about transition elements is that they show multiple oxidation states always differing by units of two, because they show variable oxidation state but not always have a difference of two units.

44. Carbon remains unaffected by the action of hot sodium hydroxide solution.

45. $H_2SO_4 + 2PCl_5 \longrightarrow \underset{\substack{\text{sulphuryl} \\ \text{chloride}}}{SO_2Cl_2} + 2POCl_3 + 2HCl$

46. ZnO and Fe_2O_3 are reduced by carbon at higher temperature. This is because, at higher temperature, the value of ΔG becomes more negative (according to Ellingham diagram).

47. $-I$ effect decreases in the order

$$\overset{+}{-NR_3} > -NO_2 > -COOH > -F$$

Therefore, F has the minimum $-I$ effect.

48. $C_6H_5\overset{+}{C}HC_6H_5$ is most stable since the positive charge can be delocalised over both the phenyl rings.

49. Acid $-H^+ \longrightarrow$ conjugate base

$$\therefore \quad H_2PO_4^- - H^+ \longrightarrow HPO_4^{2-}$$

$\therefore HPO_4^{2-}$ is the conjugate base of $H_2PO_4^-$.

50. $[Ag^+] = 1.06 \times 10^{-5}$ g-ion/L

$$= 1.06 \times 10^{-5} \text{ mol/L} = [Cl^-]$$
$$AgCl(s) \rightleftharpoons Ag^+ + Cl^-$$
$$K_{sp} = [Ag^+][Cl^-]$$
$$= (1.06 \times 10^{-5})^2$$
$$= 1.12 \times 10^{-10}$$

51. In Daniell cell, following reaction occurs.
$$Zn + Cu^{2+} \longrightarrow Zn^{2+} + Cu$$
At cathode $\quad Cu^{2+} + 2e^- \longrightarrow Cu$
At anode $\quad Zn \longrightarrow Zn^{2+} + 2e^-$

$\therefore$ Electrons moves from anode (Zn) to cathode (Cu) and electricity flows from Cu to Zn. Here, cations move towards cathode copper electrode.

52. $\Delta G = \Delta H - T\Delta S$
$$= 145.6 \times 10^3 - 300 \times 116$$
$$= 145.6 \times 10^3 - 34.8 \times 10^3$$

53. $[Co(NH_3)_4Cl_2]NO_2$ and $[Co(NH_3)_4ClNO_2]Cl$ give different ions when subjected to ionisation. Thus, these are ionisation isomers and they exhibit ionisation isomerism.
$$[Co(NH_3)_4Cl_2]NO_2 \rightarrow [Co(NH_3)_4Cl_2]^+ + NO_2^-$$
$$[Co(NH_3)_4ClNO_2]Cl \rightarrow [Co(NH_3)_4ClNO_2]^+ + Cl^-$$

54. The IUPAC name of $[Pt(NH_3)_6]Cl_4$ is hexammineplatinum (IV) chloride.

55. S_N1 reactions involve racemisation, (ie, when an optically active d form is subjected to S_N1 reaction, the product obtained is a racemic mixture of d and l forms).

56.
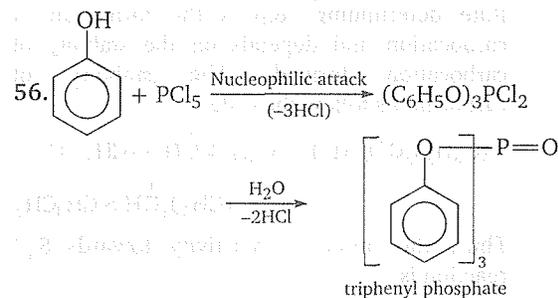
57. The rate of exothermic reaction decreases with the increase in temperature and that of endothermic reaction increases with decrease in temperature. Thus, it can be said that rate may increase or decrease with temperature.

58. (b) $NaBr + HCl \longrightarrow NaCl + HBr$

It is a substitution reaction.

(c) $HBr + AgNO_3 \longrightarrow AgBr + HNO_3$

It is a substitution and precipitation reaction because AgBr is precipitated during this reaction.

(d) $2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$

It is a neutralisation reaction because acid and base are reacting to produce salt and H_2O.

(a) $\overset{0}{H_2} + \overset{0}{Br_2} \longrightarrow 2H^+ Br^-$

This is oxidation reduction reaction because during this reaction oxidation number are changing.

59. The given configuration shows valence shell configuration as $5s^2, 5p^3$

$\because$ It has five electrons in the valence shell.

$\therefore$ It is number of group VA (or 15) of Periodic Table.

60. $Cr(24) = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^5, 4s^1$

Biology

1. *Ramapithecus* was first man like primate.

   The first fossil of *Ramapithecus* was fragment of upper jaw from Shivalik hills of India.

   Australopithecus is intermediate between *Ramapithecus* and *Homo erectus*, it's fossils, were described by **Raymond Dart** in 1925 from **South Amercia**.

2. Passive immunity differs from active immunity with the fact that the **antibodies** are produced in another individual and injected into the patient, thus providing immediate protection. Passive immunity has two sub-types–Passive natural and passive artificial.

3. Pteridophytes are vascular, spore forming, non seed forming non flowering plants. The phloem of pteridophytes does not contain **companion cells**. The presence of **companion cells** is the characteristic feature of angiospermic phloem.

4. Calvin did his experiment on *Chlorella* (a green alga) to discover the stable product of C_3-cycle.

5. **Erythromycin** antibiotic is synthesised by *Streptomyces erythraeus*. It is usually bacteriostatic and binds with the 23S *r*RNA of the 50S ribosomal subunit to inhibit peptide chain elongation during protein synthesis.

   Erythromycin is a relatively broad-spectrum antibiotic it is effective against Gram-positive bacteria mycoplasmas and a few Gram-negative bacteria.

6. Zygospore formation occurs in *Mucor*. It is a type of sexual reproduction in which tips of two multinucleate gametangia become fused and the protoplasm of both gametangia unite to form a **zygospore**.

   The nuclei of opposite strain pair are fused to from a diploid nuclei in combined form.

7. **Nostril** of man takes part in exchange of gases during **respiration**. In the same way, spiracles of insects (cockroach) help in exchange of gases these are slit like opening found in the thorax and abdomenal walls.

8. **Stratified squamous epithelium** consists of two to many layers of cells adopted to withstand **mechanical abortion**. This type of epithelium lines the oral cavity, oesophagus and the vagina of mammals.

9. Bryophytes are non vascular thalloid, spore forming cryptogams. Their main plant body is **gametophytic** which is an independent, autotrophic, haploid gametes bearing phage of bryophytes.

10. In the light reaction of photosynthesis, photophosphorylation takes place which yields **ATP** and **NADPH** molecules. These two are known as **assimilatory power** and help in the formation of sugars in the next step of photosynthesis, *ie,* dark reaction.

11. *Bt* **cotton** is produced by the insertion of **insect** resistance genes from bacterium *Bacillus thuringiensis* to cotton plant. This gene produces an insect resistant protein toxin crystals, called **parasporal body**, that can act as a microbial insecticide for specific insect groups.

12. Pteridophyta in traditional classification systems, a division of the plant kingdom that included ferns, **horsetailes** and club mosses, *eg, Equisetum*. These classified as Sphenophyta.

13. **Stolons** are special kind of runners which initially grow upwards like ordinary branches and then arch down to develop new daughter plants on coming in contact with the soil.

    Sucker is a subaerial branch, that arises from the main stem. Initially it grows horizontally below the soil surface and later grow obliquely upwards.

    Runners are prostrate aerial stems which has a long internode and which creeps horizontaliy. Axillary buds arise form nodes to form aerial shoots and roots, *eg, Cynodon* and *Oxalis*.

14. *Taeniophyllum* is an epiphytic orchid with thick flattened photosynthetic roots. These roots are green aerial, adventitious which prepare food materials by photosynthesis. The stem and leaves are absent.

    In *Vanda* and *Dendrobium*, hygroscopic roots (epiphytic root) hang freely in the air and absorb moisture with the help of special sponge-like tissue called velamen.

    Tinospora and *Trapa* also contain photosynthetic or assimilatory roots but stem and leaves are present.

Jurassic → Cretaceous.

16. There is an intimate connection between genes and synthesis of polypeptides or enzymes. The relationship between the sequence of amino acids in a polypeptide and nucleotide sequence of DNA or *m*RNA is called genetic code.

    To code a polypeptide of 162 amino acids **486 nucleotides** required but here methionine is absent. Therefore, 489 nucleotides required and methionine may remove from polypeptide later.

17. During seed germination especially of cereals, **gibberellins** stimulate the production of some *m*RNA and than hydrolytic enzymes like amylases, lipases ribonucleases and protreases. These enzymes solubilize the reserve food of the seed. The same are transferred to embryo axis for its growth.

    Auxins stimulate respiration most probably by increasing the availability of respiratory substrate.

    Cytokinins help in phloem transport.

    Abscisic acid inhibits gibberellin mediated amylase formation during germination of cereal grains.

18. Bundle of His or A.V. bundle was discovered by **His**. It arises from A.V. node and descends in the interventricular septum and bifurcates into two branches innervating the wall of right and left ventricle respectively. The myocardium of atria and ventricles are discontinuous and this bundle is the only muscular contraction between the two. It is concerned with the conduction of impulse from atria to the tip of ventricle but can also generate impulse at the rate of 35-40 per minute.

19. Embryo sac is developed from the functional megaspore. The nucleus of functional megaspore undergoes homotypic mitotic division without cytokinesis when eight nucleus are formed, these undergo cell wall formation (except two polar nuclei).

    Megaspore is haploid therefore, reduction (meiotic) division is not possible.

20. A fully organised *Polygonum* type of embryo sac is a 7-celled 8-nucleate structure. The cells of egg apparatus and antipodal cells are haploid, whereas the central cell is diploid, *ie*, contains two polar nuclei.

21. Anaphase promoting complex or cyclosome is a protein aggregate, needed for entry into anaphase. Anaphase begins with the regulated triggering of the metaphase to anaphase transition and accounts for about 1% of cell cycle's duration. It is known that M-cdk (Mitotic cyclin dependent kinase) is redvised for the activity of the kinases which activate complex.

22. *Triticale* is the hybrid of wheat and rye. Both wheat and rye belong to the family—Poaceae.

23. Bile juice is a yellowish-green or greenish-blue alkaline (pH-7.7) fluid. It contains about 90% water, 60% bile salts, 3% bile pigments, etc. The common bile salts are sodium chloride, sodium bicarbonate, sodium glycocholate and sodium taurocholate. **Cholecytokinin** directly stimulates contraction of gall bladder and bile flow starts.

    Secretin regulates the secretions of pancreatic juice, like that of gastric juice. Secretin is a single chain polypeptide of low molecular weight with 27 amino acids residue.

    The entry of lipids into the duodenum apparently causes the liberation of **enterogastrone** by the intestinal wall which inhibits the gastric juice secretion.

24. Heat stable DNA polymerase, *ie*, Taq (isolated from *Thermus acquaticus*), Pfu (from *Pyrococcus furiosus*) and vent (from *Thermococcus litoralis*) are commonly used in polymerisation of nucleotides during polymerase chain in reaction. In case of Taq polymerase, the optimum temperature for polymerisation is 70-75°C, because the base pairing between the primers and template DNA is much more specific at this temperature than that of 37°C (The optimum temperatre for *E. coli* DNA polymerase.)

    Trichoderma is used commercially to produce the enzyme cellulase, which is used to remove cell wall of plant cells.

    Streptococcus pyrogenes is responsible for many skin, and soft tissue infections.

25. RH Whittaker (1969) an American taxonomist divided all the organisms into five kingdoms. These kingdoms are Monera, Protista, Fungi, Plantae and Animalia.

Out of these five, only one kingdom, Monera contains all prokaryotes-like, bacteria mycoplasma, Actinomycetes and blue-green algae (cyanobacteria). Rest **four kingdoms** Protista, Fungi, Plantae and Animalia, *ie*, contain unicellular (Protista) to multicellular (Fungi, Plantae and Animalia) eukaryotic cell organisation.

26. An average woman needs about 2200 kcal energy per day while an average man requires about 2500 kcal energy per day. Thus, the average kilocalorie energy needed by **woman is less than man.**

27. **Haemocoel** is the body cavity of molluscs which contains blood. **Pseudocoel** is a fluid-filled cavity found between body wall and alimentary canal. Pseudocoel is a persistant blastocoel, lacking a definite mesoderm layer.

28. **Francis Galton** (1885) given the term eugenics. Eugenics is the improvement of human race by the application of principles of genetics. The other meaning of eugenics is "Science of being well born".
Euthenics is the improvement of already existing human race of improving environmental conditions.

29. The blood of earthworm contains a red coloured respiratory pigment haemoglobin. It is found in dissolved state in the plasma.

30. Agranulocytes are non-granular white blood cells that contain non-lobulated nuclei. These form about 35% of total leucocytes (3.5×10^9 per litre). These are of two types **(i) monocytes (ii) lymphocytes.**

31. Two **clavicle** form a V-shaped bone in the pectoral girdle of aves. It is also called furcula.

32. **Radial symmetry** is the characteristic feature of bodies of coelenterates and echinoderms. Bisection of these animals in two or more planes produces halves which are approximately mirror images of each other.
Bilateral symmetry occurs in most metazoans. These have only one plane in which they can be divided into two halves which are mirror image of each other.

33. Apolysis is the loss of gravid proglottids from posterior end of body and strobilization is the formation of new proglottids from neck also called pseudometamerism. Permunition in tapeworm does not allow another to enter the body of man. All of these are associated with *Taenia solium.*

34. **Anisogamy** is the type of sexual reproduction, in which isogametes (gamete having same shape and size) fuse and form a diploid zygote, *eg, Plasmodium.*
Schizogamy is an asexual phase in protozoans which is merely a simple multiple fission of shizont.
The **Plasmogamy** is the union of protoplasts of two cells. This process generally takes place before karyogamy, *ie*, before nucleus fusion, in a sexual reproduction process. Plasmotomy is a special type of binary fission.

35. **Shellfish** is a fisheries term for exoskeleton-bearing aquatic invertebrates used as a food, including various species of molluscs, crustaceans and echinoderms.

36. The **trochophore** larva is minute, translucent and more or less pear-shaped structure. It also has a circle of cilia. It is found in molluscs and annelids with primitive embryonic development. This is a clear evidence that the annelids originated from molluscs.

37. The cells of columnar epithelium are column like and nucleus is oval and basal. Cells may project mircovilli on free surface and form brush border.
Ligament is formed of yellow fibrous connective tissue. It connect bone to bone line.
Cartilage forming cells are called **chondrioblast** cells. Cartilage is found in larynx.
Somatotropes (human growth hormone) stain strongly with acid dyes and are therefore, called acidophils.

38. The entire living would was divided by Linnaeus into two kingdoms.
The members of animal kingdom do not possess chlorophyll perform locomotion and lack cellulosic cell wall.
The members of plant kingdom possess chlorophyll, cellulosic cell wall and have no power of locomotion.
Natural system of classification is based upon the resemblance and differences between different animals and emphasizes the natural relationship among various animal types. Organisms are arranged according to reproductive and anatomical characteristics.

6 furfuryl amino purine (derivative of purine base-adenine).

Auxin and **cytokinin** are essential for morphogenesis or differentiation of tissue and organ. High ratio of cytokinin to auxin favour bud formation, whereas low ratio of cytokinin to auxin favour root formation.

ABA biosynthesis takes place in chloroplast and other plastids. This is formed from mevalonic acid in stress condition, *ie*, the plants which present in environment which show stress condition.

40. Perithecium (ascocarp) is flask-shaped and duply sunk in cavities or locules in the cortical area of the stroma. It has a definite apical pore, ostiole through which the ascospores escape. It is common in class–Ascomycetes (including *Aspergillus, Sphaerothea*, etc.)

Colletotrichum is included in class–Deuterocycetes (fungi imperfecti). Sexual reproduction is absent here.

41. ABA (Abscisic Acid) inhibits synthesis of RNA and proteins. It has been shown that ABA regulates the expression of certain genes during seed maturation under certain stress condition such as heat shock, adaptation to low temperature and tolerance.

IAA (Indole 3-Acetic Acid) is a natural auxin whereas 2, 4-D (2, 4-dichlorophenoxy acetic acid) is a synthetic auxin.

GA_3 (Gibberellic Acid) is secreted from a parasitic fungus *Fusarium moniliform* (*Gibberella fujikuroi*).

42.

	List I		List II
A.	Zacharias Janssen	1.	Compound microscope
B.	Camerarius	2.	Sexual reproduction
C.	Stephen Hales	3.	Conduction of water
D.	Knoll and Ruska	4.	Electron microscope

43. Clonal selection is a method of improving vegetatively propagated crops-like sugarcane, banana, potato, citrus, mango, etc. All the plants of a clone are similar, phenotypically as well as genotypically.

45. Echinodermates (*Gorgonocephalus*) have radially symmetrical body as secondary character. The radial symmetry is due to sedentary or sessile model of life. The larva is bilaterally symmetrical.

The molluscs (*Pila*) have asymmetrical body. The development includes larva.

Polygordius (Annelida) is a bilaterally symmetrical animal. Larva is also formed.

Gorgonia (Coelenterata) has radially symmetrical body with tissue grade of body organisation.

46. **Natural** selection creates new adaptive relations between population and environment by favouring some combinations and constantly moulding and modifying the gene pools.

Stabilising selection acts in the absence of large scale environmental change, therefore, it keeps a population genetically constant.

Directional or **progressive** selection produces a regular change within a population in respect to certain characteristics. This is due to the change in the environment in a particular direction.

Disruptive or diversifying selection acts to break up a previously homogeneous population into several different adaptive norms. Therefore, it tends to increase the amount of variance within populations.

47. Having a chromosome number that is an exact multiple of the haploid number for the species is known as euploidy. The term 'euploidy' designates genomes containing whole sets of chromosomes.

48. In DNA helix, cytosine is paired with guanine by **three hydrogen bonds** and adenine is paired with thymine by two hydrogen bonds.

49. The **funiculus** is a stalk like part which attaches the ovule to placenta in an ovary.

50. Family–Gramineae is closely related to **Cyperaceae**. Gramineae is an economically important grass family and the well known sedge family is Cyperaceae. Both belong to the group of flowering plants known as the monocotyledonous.

51. **Edward's syndrome** is due to trisomy of 18th chromosome (autosome).

Patau's syndrome is due to trisomy 13th chromosome (autosome).

Down's syndrome is due to trisomy of 21th chromosome (autosome).

Thus, all these syndromes are due to trisomy in different autosomal chromosomes.

52. Biosphere Reserve Programme was launched by UNESCO in 1971 under it's "Man and Biosphere Programme" (MAB). But in India, it was launched in **1986**.

53. Peroxisomes are found is **mesophyll cells**. There, the peroxisomes catalyze, the oxidation of a side product of a reaction that fixes CO_2 in carbohydrate.

54. Low calorie and low cholesterol is found in **sunflower oil**.

55. Algae which form motile colony is *Volvox*.

56. *Xanthium* is a short day plant.

57. Diabetes mellitus is caused due to low secretion of pancreatic insulin hormone. Insulin slows down and the breakdown of glycogen into glucose. But due to lack of insulin, the glycogen breaks down and does not slow down and excess of glucose molecules are released into urine. The formation of glucose is also possible from fats or proteins through the process of **glyconeogenesis**.

58. The disease diphtheria is caused by a Gram positive bacterium *Corynebacterium diphtheriae*.

It produces a toxin (exotoxin) in the respiratory system. The exotoxin is also absorbed into the circulatory system and distributed throughout the body, where it may cause destruction of kidney, cardiac and nervous tissues by inhibiting protein synthesis. Typical symptoms of diphtheria include, suffocation (problem in breathing), fever, nasal discharge and cough.

59. *Allium*, $2n = 16$ than endosperm has 24 chromosomes.

Oryza, $2n = 24$ than endosperm has 36 chromosomes.

Nicotiana, $2n = 48$ than endosperm has 72 chromosomes.

Saccharum $2n = 82\text{-}124$ (Indian cane) than endosperm has 123-186 chromosomes.

60. **Basophils** are least numerous and stain with basic dyes like methylene blue. At the place of injury, basophils secrete vasoilators such as histamine, serotonin. Inflammation takes place at the site of injury.

Neutrophils are most numerous and must be active type of WBCs. These corpuscles are actively motile and most actively phagocytic.

Thrombocytes (blood platelets) occur only in mammals. Their 50% part is protein and 15% is fat. Protein mainly includes a contractile protien (thrombosthinin) similar to actomyosin of muscles. These play important role during blood clotting.

Plasmablasts are precursor of plasma cells.

The mature **plasma cells** produce gamma globulin antibodies at an extremely rapid rate about 2000 molecule per second.

61. When the fibres possess very thick walls and reduced simple pits, they are known as libriform wood fibres because of their similarity to phloem fibres. Libriform wood fibres chiefly occur in woody dicotyledons. There are many transitional forms between the fibres and normal tracheids. These transitional forms are designated as fibre tracheids. A line of demarcation cannot be drawn between tracheids and fiber tracheids.

62. The arterial system involves aorta, arteries, arterioles and meta-arterioles. The aorta turns towards the back of heart and finally converts into dorsal aorta, abdominal aorta gives off several pairs of arteries, some of them are :

(a) **Coeliac artery** : Unpaired, divides into three branches.

   (i) **Left gastric artery** : To stomach.

  (ii) **Common hepatic artery** : To pylorus, pancreas, gall bladder, liver, cystic duct, hepatic ducts etc.

 (iii) **Splenic artery** : To pancreas, stomach and spleen.

(b) **Anterior or Superior mesenteric** : Unpaired, supplies various parts of small intestine (except superior part of duodenum part of colon and caecum). Its sub branches are :

   (i) **Pancreo duodenal artery** : To pancreas and duodenum.

  (ii) **Jejunal artery** : To jejunum.

 (iii) **Ilial artery** : To ileum and jejunum.

 (iv) **Iliocolic artery** : To ileum and colon.

63. Silk thread is obtained from the cocoon of *Bombyx mori*. It mainly contains a water soluble protein called as **serecin**.

Fibrin is a protein that forms a meshwork, trapping erythrocytes, to become blood clot. Its precursor is fibrinogen.

animals. It forms part of the cuticle of arthropods and is found sparinlgy in certain other invertebrates.

Mucin is a group of glycoproteins secreted by certain cells especially those of salivary glands.

64. *Oryctolagus cuniculus* (rabbit) is commonly studied in the laboratory, because it is a good representative of class–Mammalia and is of fairly large size.

Dentition in all the mammals are heterodont (*ie*, dissimilar teeth). Canine is one pointed in each maxillary of upper jaw and each dentary of lower jaw. In rabbit and other herbivorous mammals, canines are absent. Hence, some parts of gums between incisors and other teeth remain teeth less and called diastema.

Rabbit possesses three pairs of sharp-chisel like incisors, two pairs in the premaxillaries of upper jaw and one pair in denteries of lower jaw. Dental formula of rabbit is :

$$I\frac{2}{1},\ C\frac{0}{0},\ Pm\frac{3}{2}\ M\frac{3}{3}=\frac{8}{6}\times 2=28.$$

65. Sexual reproduction in *Rhizopus* takes place by gametangial capulation. The fusing gametangia are multinucleate and similar in every aspect but are distinct genetically. During copulation, wall of the two gametangia dissolve at the point of contact and the nuclei of gametangia fuse to form diploid nuclei. The structure formed by fusion is known as zygospore. At the time of germination, the zygospore undergoes meiosis.

```
24-Nuclei + Strain (n) ┐
                        │ Fusion
                        ├──────► 24 Nuclei
                        │          (2n)
                        │        Meiosis
                        │        ──────► 96 Nuclei
                        │                  (n)
24-Nuclei – Strain (n) ┘
```
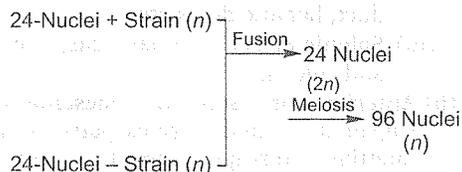
66. The outer region of old tree stem consists of recently formed xylem elements in **sapwood** or **alburnum**. Central region of the old trees that was formed earlier is filled up with tannins, resins, gums and other substances that make it hard and durable is called heart wood or duramen.

Each annual ring in the stem of dicot plant has two parts, *ie*, spring or earlywood and autumn or late wood. Springwood is wider with larger, wider and light coloured xylem elements, whereas autumn wood has smaller, narrow and darker xylem elements.

muscles to pons. It functions for the movement of eye and muscle sense.

68. Hydrophytes grow in water or very wet places. They may be submerged or partly submerged. The vascular bundles in hydrophytes show greatest reduction.

69. *Bungarus coeruleus* (kraits) is highly poisonous snake. Common krait has black or steel grey colour with white arches on the back. Central scales of back are larger and hexagonal.

Viper russelli is a poisonous snake with triangular head having V-mark. Mark has three rows of black spots appearing like chain.

Echis carinata (saw sealed viper) is a small desert viper. It is not fatal to man but can kill small domestic animals.

Hemibungarus is a venomous elopid snake. It is commonly known as coral snake or oriental coral snake. These are commonly formed in Taiwan and Japan.

70. The pulp prepared from the straw of several species of family Poaceae is used in manufacturing paper of almost all course. Some commonly used genera are *Bambusa, Erianthus, Oryza, Saccharum*, etc.

Plants of *Sorghum* are used as green fodder. *Butea monosperma* (Fabaceae) is fibre yielding plant used for making cords, ropes, bags, etc.

71. Linnaeus is known as father of Taxonomy. He published **Systema Naturae** (1735) which contains the outline of his classification. **Genera Plantarum** published in 1737. It contains the description of several genera and **Species Plantarum** was published in 1735. Its two volumes focus the identification and description of plant species.

72. The term mutation was first time used by **Hugo de Vries** on the basis of his experiments performed on *Oenothera lamarckiana* plant.

73. Formation of nitrogen from nitrate is known as **denitrification.** This process is carried out by some members of genera *Pseudomonas*. Denitrification result in the loss of soil nitrogen thus, adversely affects soil fertility.

74. The characteristic feature of **epigynous ovary** is it's lowest position on the thalamus. Epigynous ovary is also known as **inferior ovary.**

Perigynous ovary condition is also known as semi-inferior ovary. In them all floral whorls are found at the same level on the thalamus, *eg, Cucurbita,* rose.

75. Mites and ticks come under the order **Acarina** of class–Arachnia. These are Arthropod animals and their study is known as **Acarology.**

76. **Endangered** species are those threatened species whose number has been reduced to a critical level due to man made activities or natural catastrophic activities. Due to which, these are near the extinction and may become extinct if the causal factors continue to operating. Example of endangered species are

    Asiatic lion–*Panthera leopersica*

    Asiatic elephant–*Elephas maximus*

    Wolf–*Canis lupus*

    Red panda–*Ailurus fulgens*

77. **Flexor** muscle takes part in bending of joint. **Extensor** musle provides straightening to a joint.
    Involution means decrease in size of an organ.

78. When a centriole bears a flagellum, it is called **basal body.** Other similar names have also been given to basal body including basal granule, kinetosome, basal corpuscle, blepharoplast and proximal centriole.

    Golgi bodies in lower plants and animals are known by the name **dictyosomes.**

    Glyoxysomes are rounded membrane bound very tiny cytoplasmic structures. These are generally found in the seeds or at places where fats are converted to carbohydrates.

    Oxysome or F_1 particles are found on the cristae of mitochondria. Oxysomes are mainly concerned with oxidative phosphorylation.

79. Parasite plants develop roots which penetrate into tissue of the host plant to absorb nutrition. Thus, these roots function as haustoria. Such roots are known as sucking roots.

80. Acid rain is due to air pollution of oxides of nitrogen (NO_x) and **sulphur** (SO_x). **Sulphur dioxide** (SO_2) reacts with water moisture and forms sulphuric acid which accounts about 70% of acid rain.