UPCPMT 2011
Sample Paper

UP CPMT
Medical Entrance Exam
Solved Paper 2011

Physics

1. A projectile thrown with a speed v at an angle θ has a range R on the surface of earth. For same value of v and θ, its range on the surface of the moon, will be
   (a) $6R$
   (b) $\dfrac{R}{6}$
   (c) $36R$
   (d) $\dfrac{R}{36}$

2. In the relation

   $$p = \frac{\alpha}{\beta} e^{-\alpha Z / k\theta}$$

   p is pressure, Z is distance, k is Boltzmann constant and θ is the temperature. The dimensional formula of β will be
   (a) $[ML^2T]$
   (b) $[M^0L^2T^0]$
   (c) $[ML^0T^{-1}]$
   (d) $[M^0L^2T^{-1}]$

3. A body is slipping from an inclined plane of height h and length l, angle of inclination is θ, the time taken by the body to come from the top to the bottom of this inclined plane is
   (a) $\sqrt{\dfrac{2l}{g}}$
   (b) $\sin\theta \sqrt{\dfrac{2h}{g}}$
   (c) $\dfrac{1}{\sin\theta}\sqrt{\dfrac{2h}{g}}$
   (d) $\sqrt{\dfrac{2h}{g}}$

4. The ratio of specific heat of a gas at constant pressure to that at constant volume is γ, the change in internal energy of a mass of gas, when the volume changes from V to $2V$ at constant pressure p is
   (a) pV
   (b) $R/(\gamma - 1)$
   (c) $pV/(\gamma - 1)$
   (d) $\gamma pV / (\gamma - 1)$

5. In the process of electrolysis, the current is carried out inside the electrolyte by
   (a) electrons
   (b) atoms
   (c) positive and negative ions
   (d) All of the above

6. An artificial satellite moving in a circular orbit around the earth has a total (kinetic + potential) energy E_0. Its potential energy is
   (a) E_0
   (b) $-E_0$
   (c) $1.5 E_0$
   (d) $2E_0$

7. According to Kepler, the period of revolution of a planet (T) and its mean distance from the sun (r) are given by the following equation
   (a) $T^3 r^3 = \text{Constant}$
   (b) $T^2 r^{-3} = \text{Constant}$
   (c) $Tr^3 = \text{Constant}$
   (d) $T^2 r = \text{Constant}$

8. Which of the following statements is correct?
   (a) Hooke's law is applicable only with in elastic limit
   (b) The adiabatic and isothermal elastic constants of a gas are equal
   (c) Young's modulus is dimensionless
   (d) Stress multiplied by strain is equal to the stored energy

9. When two capillary tubes of different diameters are dipped vertically, the rise of the liquid is
   (a) less in the tube of smaller diameter
   (b) more in the tube of smaller diameter
   (c) more in the tube of larger diameter
   (d) same in both the tubes

10. In the circuit diagram given below, each resistance is of $10\,\Omega$. The current in the arm AD will be
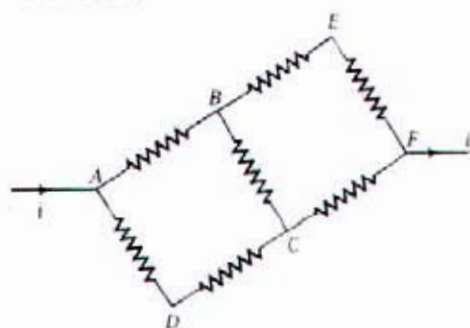
(a) $\dfrac{2i}{5}$

(b) $\dfrac{i}{5}$

(c) $\dfrac{4i}{5}$

(d) $\dfrac{3i}{5}$

11. Two cells when connected in series are balanced on 8 m on a potentiometer. If the polarities of one of the cell so connected is reversed, they balance on 2 m. The ratio of emf's of the two cells is

(a) $3:4$

(b) $4:3$

(c) $5:3$

(d) $3:5$

12. Two stars situated at distances of 1 and 10 light years respectively from the earth appear to possess the same brightness. The ratio of their real brightness is

(a) $1:10$

(b) $10:1$

(c) $1:100$

(d) $100:1$

13. Consider the situation shown in figure. Water $\left(\mu_w = \dfrac{4}{3}\right)$ is filled in a beaker upto a height of 10 cm. A plane mirror fixed at a height of 5 cm from the surface of water. Distance of image from the mirror after reflection from it of an object O at the bottom of the beaker is
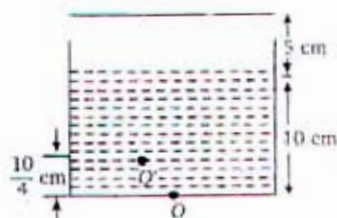
(a) 15 cm

(b) 12.5 cm

(c) 7.5 cm

(d) 10 cm

14. N bullets each of mass m kg are fired with a velocity v ms^{-1} at the rate of n bullets per second upon a wall. The reaction offered by the wall to the bullets is given by

(a) nmv

(b) $\dfrac{Nmv}{n}$

(c) $\dfrac{nNm}{v}$

(d) $\dfrac{nNv}{m}$

15. Three equal weights A, B and C of mass 2 kg each are hanging on a string passing over a fixed frictionless pulley as shown in figure. The tension in the string connecting weights B and C is

(a) zero

(b) 13 N

(c) 3.3 N

(d) 19.6 N

16. A lift is moving downwards with an acceleration equal to acceleration due to gravity. A body of mass M kept on the floor of the lift is pulled horizontally. If the coefficient of friction is μ, then the frictional resistance offered by the body is

(a) Mg

(b) μMg

(c) $2\mu Mg$

(d) zero

17. Which of the following statements is wrong?

(a) Sound travels in straight line.

(b) Sound is a form of energy.

(c) Sound travels in the form of waves.

(d) Sound travels faster in vacuum than in air.

18. Equation of a progressive wave is given by

$$y = 0.2\cos\pi\left[0.04t + 0.02x - \dfrac{\pi}{6}\right]$$

The distance is expressed in cm and time in second. What will be the minimum distance between two particles having the phase difference of $\pi/2$?

(a) 4 cm

(b) 8 cm

(c) 25 cm

(d) 12.5 cm

19. A source of sound is travelling with a velocity 40 km/h towards observer and emits sound of frequency 2000 Hz. If velocity of
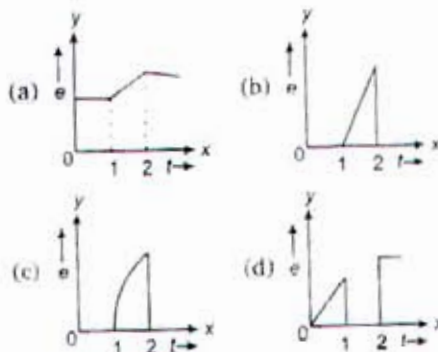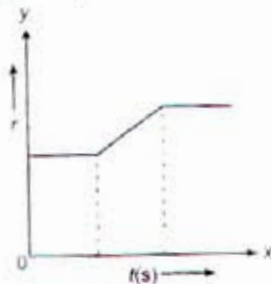
sound is 1220 km/h, then what is the apparent frequency heared by an observer?

(a) 2210 Hz   (b) 1920 Hz
(c) 2068 Hz   (d) 2086 Hz

20. A flexible wire bent in the form of a circle is placed in a uniform magnetic field perpendicular to the plane of the coil. The radius of the coil changes as shown in figure. The graph of induced emf in the coil is represented by

21. The number of photo electrons emitted per second from a metal surface increases when
(a) the energy of incident photon increases
(b) the frequency of incident light increases
(c) the wavelength of the incident light increases
(d) the intensity of the incident light increases

22. When a beam of accelerated electrons hits a target, a continuous X-rays spectrum is emitted from the target. Which of the following wavelength is absent in the X-ray spectrum, if the X-ray tube is operating at 40000 V?

(a) 0.5 Å   (b) 1.0 Å
(c) 0.25 Å   (d) 1.5 Å

23. If $|v_1 - v_2| = |v_1 - v_2|$ and v_2 is finite, then
(a) v_1 is parallel to v_2
(b) $v_1 = v_2$
(c) $|v_1| = |v_2|$
(d) v_1 and v_2 are mutually perpendicular

24. Polarized glass is used in sun glasses because
(a) it is fashionable
(b) it has good colour
(c) it reduces the light intensity to half an account of polarization
(d) it is cheaper

25. A TV tower has a height of 100 m. The average population density around the tower is 1000 per km^2. The radius of the earth is 6.4×10^6 m, the population covered by the tower is
(a) 4×10^6 (b) 3×10^7
(c) 6×10^9 (d) 2×10^6

26.
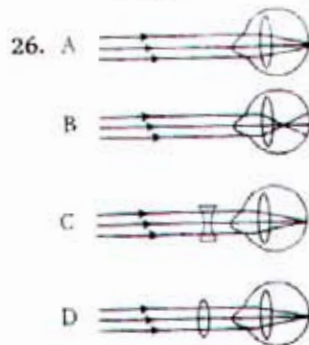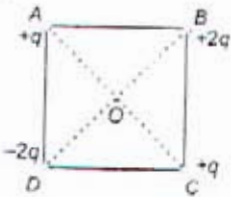

Identify the wrong description of the above figures.
(a) A represents the far-sightedness
(b) B represents the far-sightedness
(c) C correction for short-sightedness
(d) D correction for sightedness

27. In a compound microscope, the intermediate image is
(a) real, erect and magnified
(b) real, inverted and magnified
(c) virtual, erect and magnified
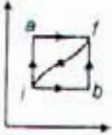(d) virtual, erect and reduced

28. The process of super imposing signal frequency (ie, audio wave) on the carrier wave is known as
   (a) transmission (b) reception
   (c) modulation (d) detection

29. Two capacitors connected in parallel having the capacities C_1 and C_2 are given q charge, which is distributed among them. The ratio of the charge on C_1 and C_2 will be
   (a) $\dfrac{1}{C_1 C_2}$ (b) $C_1 C_2$
   (c) $\dfrac{C_2}{C_1}$ (d) $\dfrac{C_1}{C_2}$

30. Four charges are arranged at the corners of a square ABCD, as shown in the figure given below. The force on the charge kept at the centre O is

   (a) perpendicular to side AB
   (b) zero
   (c) along the diagonal AC
   (d) along the diagonal BD

31. The number of molecules in a gas at pressure 1.64×10^{-3} atm and temperature 200 K having the volume 1 cc are
   (a) 6.02×10^{16} (b) 2.63×10^{16}
   (c) 3.01×10^{19} (d) 12.04×10^{19}

32. According to the kinetic theory of gases, total energy of a gas is equal to
   (a) kinetic energy (b) potential energy
   (c) Both (a) and (b) (d) None of these

33. Which of the following statements is not correct?
   (a) Both AC and DC dynamo have a field magnet.
   (b) Both AC and DC dynamo have slip rings.
   (c) Both AC and DC dynamo have an armature.
   (d) Both AC and DC dynamo convert mechanical energy into electrical energy.

34. The electrical resistance of depletion layer is large because
   (a) it has no charge carriers
   (b) it has a large number of charge carriers
   (c) it contains electrons as charge carriers
   (d) it has holes as charge carriers

35. For a triode $r_p = 10$ kΩ and $g_m = 3$ milli mho. If the load resistance is double of plate resistance, then the value of voltage gain will be
   (a) 10 (b) 15 (c) 20 (d) 30

36. The curve between charge density and distance near P-N junction will be
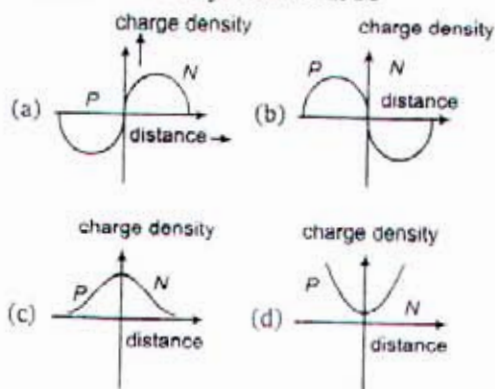
37. The energy spectrum of a black body exhibits a maximum around a wavelength λ_0. The temperature of the black body is now changed such that the energy is maximum around a wavelength $\dfrac{3\lambda_0}{4}$. The power radiated by the black body will now increase by a factor of
   (a) $\dfrac{64}{27}$ (b) $\dfrac{256}{81}$
   (c) $\dfrac{16}{9}$ (d) $\dfrac{4}{3}$

38. When a system is taken from state i to a state f along path iaf, $Q = 50$ J and $W = 20$ J. Along path ibf, $Q = 35$ J. If $W = -13$ J for the curved return path fi, Q for this path is

   (a) -7 J (b) 23 J
   (c) -43 J (d) 33 J

39. A large number of water drops each of radius r combine to have a drop of radius R. If the surface tension is T and the mechanical equivalent of heat is J, then the rise in temperature will be

(a) $\dfrac{2T}{rJ}$

(b) $\dfrac{3T}{RJ}$

(c) $\dfrac{3T}{J}\left(\dfrac{1}{r}-\dfrac{1}{R}\right)$

(d) $\dfrac{2T}{J}\left(\dfrac{1}{r}-\dfrac{1}{R}\right)$

40. v_e and v_p denotes the escape velocity from the earth and another planet having twice the radius and the same mean density as the earth. Then

(a) $v_e = 2v_p$

(b) $v_e = \dfrac{v_e}{2}$

(c) $v_e = \dfrac{v_p}{4}$

(d) $v_e = v_p$

41. The acceleration of a particle is increasing linearly with time t as bt. The particle starts from the origin with an initial velocity v_0. The distance travelled by the particle in time t will be

(a) $v_0 t + \dfrac{1}{3}bt^2$

(b) $v_0 t + \dfrac{1}{3}bt^3$

(c) $v_0 t + \dfrac{1}{6}bt^3$

(d) $v_0 t + \dfrac{1}{2}bt^2$

42. Two springs have their force constant as k_1 and k_2 such that $k_1 > k_2$. When they are stretched by the same force

(a) more work is done in case of first spring
(b) more work is done in case of second spring
(c) no work is done in case of both the springs
(d) equal work is done in case of both the springs

43. A 12 HP motor has to be operated 8 h/day. How much will it cost at the rate of 50 paise/kWh in 10 days?

(a) ₹ 397

(b) ₹ 375

(c) ₹ 358

(d) ₹ 350

44. A body of mass m moving with a constant velocity v hits another body of the same mass moving with the same velocity v but in opposite direction and sticks to it. The velocity of the compound body after collision is

(a) zero

(b) $\dfrac{v}{2}$

(c) v

(d) $2v$

45. When a steady torque is acting on a body, the body

(a) gets linear acceleration
(b) gets angular acceleration
(c) rotated at a constant speed
(d) continues in its state of rest or uniform motion along a straight line

46. The electric bulbs have tungsten filaments of same length. If one of them gives 60 W and other 100 W, then

(a) 100 W bulb has thicker filament
(b) 60 W bulb has thicker filament
(c) both filaments are of same thickness
(d) it is possible to get different wattage unless the lengths are different

47. A beam of ions with velocity 2×10^5 m/s enters normally into a uniform magnetic field of 4×10^{-2} T. If the specific charge of the ion is 5×10^7 C/kg, then the radius of the circular path described will be

(a) 0.16 m

(b) 0.25 m

(c) 0.10 m

(d) 0.20 m

48. A long magnetic needle of length $2l$, magnetic moment M and pole strength m unit is broken into two pieces at the middle. The magnetic moment and pole strength of each piece will be

(a) $M, \dfrac{m}{2}$

(b) $\dfrac{M}{2}, m$

(c) $\dfrac{M}{2}, \dfrac{m}{2}$

(d) M, m

49. The number of turns and radius of cross section of the coil of a tangent galvanometer are doubled. The reduction factor k will be

(a) k

(b) $2k$

(c) $4k$

(d) $k/4$

50. The angular momentum of electron in nth orbit is given by

(a) nh

(b) $\dfrac{h}{2\pi n}$

(c) $\dfrac{nh}{2\pi}$

(d) $n^2 \dfrac{h}{2\pi}$

Chemistry

1. How many moles of magnesium phosphate, $Mg_3(PO_4)_2$ will contain 0.25 mole of oxygen atoms ?
   - (a) 0.02
   - (b) 3.125×10^{-2}
   - (c) 1.25×10^{-2}
   - (d) 2.5×10^{-2}

2. If E_e, E_α and E_p represent the kinetic energies of an electron, alpha particle and a proton respectively, each moving with same de-Broglie wavelength then
   - (a) $E_e = E_\alpha = E_p$
   - (b) $E_p > E_\alpha > E_e$
   - (c) $E_\alpha > E_p > E_e$
   - (d) $E_e > E_p > E_\alpha$

3. The set of quantum numbers for 19th electron of chromium $(Z = 24)$ is
   - (a) $4, 0, 0, +\dfrac{1}{2}$
   - (b) $4, 1, -1, -\dfrac{1}{2}$
   - (c) $3, 2, 2, -\dfrac{1}{2}$
   - (d) $3, 2, -2, +\dfrac{1}{2}$

4. Atom A possesses higher values of packing fraction than atom B. The relative stabilities of A and B are
   - (a) A is more stable than B
   - (b) B is more stable than A
   - (c) A and B both are equally stable
   - (d) stability does not depend on packing fraction

5. $_{92}U^{238}$ emits 8α-particles and 6β-particles. The neutron/proton ratio in the product nucleus is
   - (a) $\dfrac{60}{41}$
   - (b) $\dfrac{41}{40}$
   - (c) $\dfrac{41}{42}$
   - (d) $\dfrac{62}{41}$

6. The bond length of species O_2, O_2^- and O_2^+ are in the order of
   - (a) $O_2^+ > O_2 > O_2^-$
   - (b) $O_2^- > O_2 > O_2^+$
   - (c) $O_2 > O_2^+ > O_2^-$
   - (d) $O_2 > O_2^- > O_2^+$

7. H_2O is dipolar whereas BeF_2 is not. It is because
   - (a) the electronegativity of F is greater than that of O
   - (b) H_2O involves hydrogen bonding whereas BeF_2 is a discrete molecule
   - (c) H_2O is linear and BeF_2 is angular
   - (d) H_2O is angular and BeF_2 is linear

8. Structure of ICl_2^- is
   - (a) trigonal
   - (b) octahedral
   - (c) square planar
   - (d) distorted trigonal bipyramidal

9. Which of the following molecules/ions does not contain unpaired electrons ?
   - (a) O_2^2-
   - (b) B_2
   - (c) N_2^+
   - (d) O_2

10. The oxidation states of sulphur in the anions $SO_3^{2-}, S_2O_4^{2-}$ and $S_2O_6^{2-}$ follow the order
    - (a) $S_2O_4^{2-} < S_2O_6^{2-} < SO_3^{2-}$
    - (b) $S_2O_6^{2-} < S_2O_4^{2-} < SO_3^{2-}$
    - (c) $S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$
    - (d) $SO_3^{2-} < S_2O_4^{2-} < S_2O_6^{2-}$

11. An ionic compound has a unit cell consisting of A ions at the corners of a cube and B ions at the centres of the faces of the cube. The empirical formula for this compound would be
    - (a) AB
    - (b) A_2B
    - (c) A_3B
    - (d) AB_3

12. The vapour pressure lowering caused by the addition of 100 g of sucrose (molecular mass = 342) to 1000 g of water, if the vapour pressure of pure water at 25°C is 23.8 mm Hg is
    - (a) 0.12 mm Hg
    - (b) 0.125 mm Hg
    - (c) 1.15 mm Hg
    - (d) 1.25 mm Hg

13. Mark out the wrong expression.
    - (a) Boyle's temperature, $T_B = \dfrac{b}{aR}$
    - (b) Critical pressure, $p_c = \dfrac{a}{27b^2}$
    - (c) Critical temperature, $T_c = \dfrac{8a}{27Rb}$
    - (d) Critical volume, $V_c = 3b$

14. The enthalpy of dissolution of $BaCl_2(s)$ and $BaCl_2 \cdot 2H_2O(s)$ are -20.6 and 8.8 kJ mol^{-1} respectively. The enthalpy of hydration for
    $$BaCl_2(s) + 2H_2O \longrightarrow BaCl_2 \cdot 2H_2O(s) \text{ is}$$
    - (a) 29.4 kJ
    - (b) -29.4 kJ
    - (c) -11.8 kJ
    - (d) 38.2 kJ

15. The occurrence of reaction is impossible if
    (a) ΔH is +ve; ΔS is also +ve
    (b) ΔH is −ve; ΔS is also −ve
    (c) ΔH is −ve; ΔS is +ve
    (d) ΔH is +ve; ΔS is −ve

16. For the reaction,
    $$2NH_3(g) \rightleftharpoons N_2(g) + 3H_2(g),$$
    the units of K_p will be
    (a) atm
    (b) $(atm)^3$
    (c) $(atm)^{-2}$
    (d) $(atm)^2$

17. On adding $AlCl_3$ to water
    (a) the ionisation of water increases
    (b) the ionisation of water decreases
    (c) the ionisation of water remain constant
    (d) the ionic product of water increases

18. The pK_b value of ammonium hydroxide is 4.75. An aqueous solution of ammonium hydroxide is titrated with HCl. The pH of the solution at the point where half of ammonium hydroxide has been neutralised will be
    (a) 9.25
    (b) 8.25
    (c) 7.50
    (d) 4.75

19. Units of specific reaction rate for second order reaction is
    (a) s^{-1}
    (b) $mol\ L^{-1}\ s^{-1}$
    (c) $L^2 mol^{-2} s^{-1}$
    (d) $L\ mol^{-1} s^{-1}$

20. A hydride of nitrogen which is acidic is
    (a) NH_3
    (b) N_3H
    (c) N_2H_2
    (d) N_2H_4

21. Ammonal used in bombs is a mixture of
    (a) $Al + KNO_3$
    (b) $Al + Al_2O_3 + B_2O_3$
    (c) $Al + Al(NO_3)_3$
    (d) $Al_2O_3 + C$

22. Ge (II) compounds are powerful reducing agents whereas Pb (IV) compounds are strong oxidants. It can be due to
    (a) Pb is more electropositive than Ge
    (b) ionisation potential of lead is less than that of Ge
    (c) ionic radii of Pb^{2+} and Pb^{4+} are larger than those of Ge^{2+} and Ge^{4+}
    (d) more pronounced inert pair effect in lead than Ge

23. When a colourless gas is passed through bromine water only decolourisation takes place. The gas is
    (a) SO_2
    (b) HBr
    (c) HCl
    (d) H_2S

24. Which of the following compounds can be dehydrated very easily ?
    (a) $CH_3CH_2CH_2CH_2CH_2OH$
    (b) $CH_3CH_2\overset{\underset{\displaystyle |}{CH_3}}{C}HCH_2CH_2OH$
    (c) $CH_3CH_2\overset{\underset{\displaystyle |}{OH}}{C}CH_2CH_3$
    (d) $CH_3CH_2CH_2\overset{\underset{\displaystyle |}{OH}}{C}HCH_3$

25. o-methoxy bromobenzene is treated with sodamide and then with NH_3. The product formed is
    (a) o-methoxybromobenzene
    (b) aniline
    (c) methoxy benzene
    (d) m-methoxy aniline

26. The most suitable reagent for the conversion of $RCH_2OH \longrightarrow RCHO$ is
    (a) $KMnO_4$
    (b) $K_2Cr_2O_7$
    (c) PCC
    (d) CrO_3

27. Across the lanthanide series, the basicity of the lanthanide hydroxides
    (a) increases
    (b) decreases
    (c) first increases and then decreases
    (d) first decreases and then increases

28. In which of the following compounds, one of the structural isomers is also capable of showing enantiomorphism ?
    (a) C_3H_8
    (b) $C_3H_6Br_2$
    (c) C_5H_{12}
    (d) C_6H_{14}

29. Which is the decreasing order of stability of the ions ?
    I. $CH_3 - \overset{+}{C}H - CH_3$
    II. $CH_3 - \overset{+}{C}H - OCH_3$
    III. $CH_3 - \overset{+}{C}H - COCH_3$

(a) I > II > III (b) II > III > I
(c) III > I > II (d) II > I > III

30. Which of the following does not show electromeric effect ?
(a) Alkenes (b) Ethers
(c) Aldehydes (d) Ketones

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

32. The enzymes which have control site in addition to active site are called
(a) holozymes
(b) coenzymes
(c) apoenzymes
(d) allosteric enzymes

33. The detergent which is used as germicide is
(a) sodium lauryl sulphate
(b) cetyltrimethyl ammonium chloride
(c) lauryl alcohol ethoxylate
(d) sodium-2-dodecyl benzene sulphonate

34. Saturated solution of KNO_3 is used to make salt bridge because
(a) velocity of K^+ is greater than that of NO_3
(b) velocity of NO_3 is greater than that of K^+
(c) velocity of both K^+ and NO_3 are nearly same
(d) KNO_3 is soluble in water

35. The equilibrium constant of the reaction,
$$Cu(s) + 2Ag^+ (aq) \longrightarrow Cu^{2+} (aq) + 2Ag(s)$$
$E^\circ = 0.46$ V at 298 K is
(a) 2.4×10^{10} (b) 2.0×10^{16}
(c) 4.0×10^{10} (d) 4.0×10^{15}

36. Cow milk is an example of natural emulsion stabilised by
(a) fat (b) water
(c) casein (d) Mg^{2+} ions

37. Autoreduction process is used in the extraction of
(a) Cu and Hg
(b) Zn and Hg
(c) Cu and Al
(d) Fe and Pb

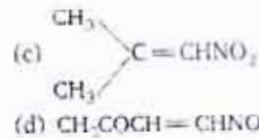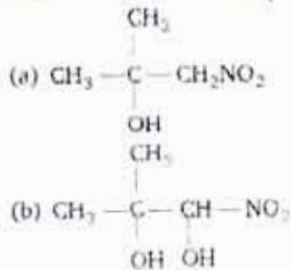38. The correct IUPAC name of the compound

is

(a) 5-oxaspiro [3. 4] octane
(b) 1-oxaspiro [4. 3] octane
(c) 5-oxospiro [3. 4] octane
(d) 1-oxospiro [3. 4] octane

39. Kjeldahl's method cannot be used for the estimation of nitrogen in
(a) pyridine (b) nitro compounds
(c) azo compounds (d) All of these

40. KI and $CuSO_4$ solution when mixed, give
(a) $Cu_2I_2 + K_2SO_4$
(b) $K_2SO_4 + CuI_2 + I_2$
(c) $CuI_2 + K_2SO_4$
(d) $K_2SO_4 + Cu_2I_2 + I_2$

41. Identify C in the following reaction

(a)   (b)

(c)   (d)

42. An organic compound with molecular formula, C_7H_8O when dissolved in NaOH, gives a characteristic colour with $FeCl_3$. On treatment with bromine, it gives a tribromo derivative, $C_7H_5OBr_3$. The compound is
(a) benzyl alcohol (b) o-cresol
(c) m-cresol (d) p-cresol

43. When CH_3CONH_2 is heated with P_2O_5, the product is
(a) $CH_3CCl_2NH_2$ (b) CH_3CN
(c) CH_3COCl (d) CCl_3CONH_2

44. Carbonation of methylmagnesium bromide gives an organic compound. This compound is also obtained by
(a) hydrolysis of acetonitrile by a mineral acid
(b) oxidation of methyl alcohol

(c) hydrolysis of methyl isocyanide with a mineral acid

(d) hydrolysis of methyl formate with dilute mineral acid

45. Which of the following compounds undergoes both Cannizaro reaction and aldol condensation?

(a) $(CH_3)_2CH.CHO$ (b) HCHO

(c) C_6H_5CHO (d) CH_3CHO

46. The product formed when acetone is reacted with nitromethane in the presence of a base is

(a) $CH_3 - \underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH_2NO_2$

(b) $CH_3 - \underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}} - \underset{\underset{OH}{|}}{CH} - NO_2$

(c) $\underset{CH_3}{\overset{CH_3}{>}}C = CHNO_2$

(d) $CH_3COCH = CHNO_2$

47. Which of the following is a polymer?

(a) Carnuaba wax   (b) Carbowax

(c) Beeswax   (d) Paraffin wax

48. CS_2 layer gives a test for

(a) Cl^- (b) Br^- and I^-

(c) Br^- only   (d) I^- only

49. The noble gas used for treatment of cancer is

(a) helium   (b) argon

(c) radon   (d) krypton

50. Which of the following elements with atomic numbers 25, 30, 48 and 80 has the highest vapour pressure at room temperature?

(a) $Z = 48$ (b) $Z = 30$

(c) $Z = 25$ (d) $Z = 80$

Botany

1. The association mycorrhiza is

(a) relationship of algae and fungi

(b) relationship of fungi and higher plants

(c) relationship of algae and higher plants

(d) None of the above

2. The phytohormone helps in germination of seed is

(a) ABA   (b) auxin

(c) gibberellin   (d) cytokinin

3. The type of pollination in *Cycas* is

(a) entomophily   (b) hydrophily

(c) anemophily   (d) malacophily

4. Transpiration is manifestation of

(a) turgor pressure   (b) wall pressure

(c) root pressure   (d) None of these

5. In a fully turgid cell

(a) $TP = 0$ (b) $WP = 0$

(c) $DPD = 0$ (d) $OP = 0$

6. Pome fruit is found in

(a) mango   (b) apple

(c) litchi   (d) peach

7. Which ion help in opening and closing of stomata?

(a) Mn^- (b) Mg^-

(c) Ca^{2+} (d) K^+

8. Which of the following is correct for *Cycas* reproduction?

(a) Zooidogamy is followed by siphonogamy

(b) Siphonogamy is followed by zooidogamy

(c) Siphonogamy only

(d) Zooidogamy only

9. The main cause of pollution in metro cities is

(a) burning of fossil fuels

(b) water plants

(c) domestic products

(d) None of the above

10. Roots are absent in

(a) *Wolffia*   (b) *Podostemon*

(c) *Pistia*   (d) *Lemna*

11. The movement of hairs in *Drosera* is

(a) thermonastic   (b) thigmonastic

(c) seismonastic   (d) photonastic

12. Direction of translocation of organic food or solutes is
    (a) upward   (b) downward
    (c) radial   (d) All of these

13. Minerals are absorbed by plants in
    (a) colloidal form   (b) ionic form
    (c) precipitated form (d) None of these

14. In Krebs' cycle, GTP is formed by
    (a) oxidative phosphorylation
    (b) substrate level phosphorylation
    (c) photophosphorylation
    (d) decarboxylation

15. Very strong light has a direct inhibiting effect on photosynthesis, which is known as
    (a) solarization   (b) etiolation
    (c) chlorosis   (d) defoliation

16. Common enzyme in glycolysis and pentose phosphate pathway is
    (a) hexokinase   (b) aconitase
    (c) fumarase   (d) dehydrogenase

17. The term 'Niche' was first used by
    (a) Clements   (b) Grinnel
    (c) Warming   (d) Odum

18. An interaction favourable to both populations, but no obligatory to either, is
    (a) proto-cooperation
    (b) mutualism
    (c) commensalism
    (d) parasite

19. 'Khaira disease' of rice is due to
    (a) fungus   (b) bacteria
    (c) zinc deficiency (d) modeficiency

20. Most diverse organisms of an ecosystem are
    (a) producers   (b) consumers
    (c) carnivores   (d) decomposers

21. First reaction in photosynthesis is
    (a) photolysis of water
    (b) excitation of chlorophyll molecule
    (c) formation of ATP
    (d) fixation of CO_2

22. If the number of chromosomes in egg cell is 8, then what is the number of chromosomes in endosperm?
    (a) 24   (b) 8
    (c) 16   (d) 12

23. The soil with poorest water holding capacity is
    (a) clay   (b) loam
    (c) sandy   (d) None of these

24. Ruminate endosperm is found in the seeds of family
    (a) Compositae   (b) Cruciferae
    (c) Euphorbiaceae   (d) Annonaceae

25. A monocot stem with secondary growth is
    (a) *Lilium*   (b) *Cocos*
    (c) *Yucca*   (d) *Asparagus*

26. Cyathium inflorescence is found in
    (a) *Morus*   (b) *Dorstenia*
    (c) *Ficus*   (d) *Euphorbia*

27. Which is called 'sexual system of classification'?
    (a) Bentham and Hooker's
    (b) Tippo's
    (c) Linnaeus
    (d) Takhtajan

28. Lateral roots develop from primodia originated by the division of
    (a) pericycle cells lying opposite to protoxylem points
    (b) pericycle cells lying between two protoxylem points
    (c) endodermal cells lying between two protoxylem points
    (d) endodermal cells lying opposite to protoxylem points

29. Bacteria differ from plants in that they do not have
    (a) DNA
    (b) RNA
    (c) cell wall
    (d) a well define nucleus

30. Five kingdom classification was given by
    (a) Huxley
    (b) Hooker
    (c) Whittaker
    (d) Linnaeus

31. Gametophyte is dominant stage in the life cycle of
    (a) bryophyta   (b) pteridophyta
    (c) angiosperms   (d) gymnosperms

32. Pyrenoids are made up of
    (a) core of starch surrounded by sheath of protein
    (b) core of protein surrounded by fatty sheath
    (c) proteinaceous centre and starchy sheath
    (d) core of nucleic acid surrounded by protein sheath

33. The phragmoplast is organized at the
    (a) beginning of anaphase
    (b) end of anaphase
    (c) beginning of telophase
    (d) end of telophase

34. Fruits are not found in gymnosperms because
    (a) they are seedless
    (b) they are not pollinated
    (c) they have no ovary
    (d) fertilization does not takes place

35. Vegetative reproduction in *Funaria* takes place by
    (a) primary protonema
    (b) gemmae
    (c) secondary protonema
    (d) All of the above

36. Meiosis in a plant occurs when there is a change from
    (a) gametophyte to sporophyte
    (b) sporophyte to gametophyte
    (c) gametophyte to gametophyte
    (d) sporophyte to sporophyte

37. Middle lamella is present
    (a) inside the secondary wall
    (b) inside the primary wall
    (c) outside the primary wall
    (d) in between secondary and tertiary walls

38. The age of tree by counting annual rings is called
    (a) Dendrochronology
    (b) Ageing
    (c) Chronology
    (d) Countrology

39. In C_3 plants, the first stable product of photosynthesis during dark reaction, is
    (a) PGAL   (b) RuBP
    (c) PGA   (d) OAA

40. The difference between rough endoplasmic reticulum and smooth endoplasmic reticulum is that rough endoplasmic reticulum
    (a) does not contain ribosomes
    (b) contains ribosomes
    (c) does not transport proteins
    (d) transports proteins

41. Teichoic acid is present in
    (a) cell wall of Gram-positive bacteria
    (b) cell wall of Gram-negative bacteria
    (c) capsid of virus
    (d) protoplasm of mycoplasma

42. Both heterospory and circinate ptyxis occur in
    (a) *Dryopteris*
    (b) *Pinus*
    (c) *Cycas*
    (d) *Funaria*

43. Plastocyanin contains
    (a) copper   (b) iron
    (c) calcium   (d) potassium

44. Which of the following pyramids is always upright and can never be inverted?
    (a) Pyramid of biomass
    (b) Pyramid of number
    (c) Pyramid of energy
    (d) Both (a) and (c)

45. Which of the following is a secondary pollutant?
    (a) CO_2 (b) SO_2
    (c) NO_2 (d) H_2O

46. Work of Beadle and Tatum on *Neurospora crassa* proved that
    (a) replication of DNA is semi-conservative
    (b) viruses have genetic material
    (c) every gene is responsible for specific enzymes
    (d) plant cells are totipotent

47. Test cross is when
    (a) F_1 crossed with heterozygous parents
    (b) F_1 crossed with homozygous dominant parents
    (c) F_1 crossed with homozygous recessive parents
    (d) F crossed with homozygous parents

48. Link enzyme in cellular respiration is
    (a) citrate synthetase
    (b) pyruvate dehydrogenase
    (c) isocitrate dehydrogenase
    (d) succinyl thiokinase

49. An organic substance bound to an enzyme and essential for its activity is called
    (a) coenzyme
    (b) holoenzyme
    (c) apoenzyme
    (d) isoenzyme

50. Who was awarded Nobel Prize in 1959 for *in vitro* synthesis of polyribonucleotide?
    (a) Tatum
    (b) Darwin
    (c) Kornberg
    (d) Khurana

Zoology

1. Medulla oblongata is originated from
   (a) ectoderm
   (b) mesoderm
   (c) endoderm
   (d) ectomesoderm

2. Respiratory control centre is
   (a) cerebellum
   (b) medulla oblongata
   (c) spinal cord
   (d) cerebrum

3. Lowest regeneration power is found in
   (a) *Amoeba*
   (b) sponges
   (c) coelentrates
   (d) brain cells

4. What type of teeth are absent in rabbit?
   (a) Molars
   (b) Premolars
   (c) Canines
   (d) Incisors

5. Origin of life as a result of chemical evolution has been properly explained by or the most logical biochemical theory of origin of life has been given by
   (a) Stanley Miller
   (b) Darwin
   (c) AI Oparin
   (d) S Fox

6. Which is not based on predictive generalization or repeatable experimentation?
   (a) Hypothesis
   (b) Theory
   (c) Principle
   (d) Law

7. Coacervates belong to the category of
   (a) cyanobacteria
   (b) protozoans
   (c) molecular aggregates
   (d) molecular aggregate surrounded by lipid membrane

8. The fat soluble vitamin is
   (a) B
   (b) C
   (c) K
   (d) H

9. Which hormone/gland acts in biological clocks?
   (a) Thyroid
   (b) Thymus
   (c) Adrenal
   (d) Pineal

10. The Expiratory Reserve Volume (ERV) will be
    (a) 1000 mL
    (b) 2000 mL
    (c) 4000 mL
    (d) 5000 mL

11. Number of layers in amoeboid cyst are
    (a) 2
    (b) 3
    (c) 1
    (d) 4

12. Food poisoning is caused by
    (a) *Nitrosomonas*
    (b) *Lactobacillus*
    (c) *Escherichia coli*
    (d) None of these

13. Earthworm is
    (a) polychaeta
    (b) oligochaeta
    (c) hirudinea
    (d) None of these

14. Inheritance of skin colour in human is an example of
    (a) chromosomal aberration
    (b) codominance
    (c) point mutation
    (d) polygenic inheritance

15. Cri-du-chat syndrome in humans is caused by the
    (a) fertilization of an XX egg by a normal Y-bearing sperm
    (b) loss of half of the short arm of chromosome 5
    (c) loss of half of the long arm of chromosome 5
    (d) trisomy of 21st chromosome

16. Which one of the following pair of parents is most likely get a child, who would suffer from haemolytic disease of new borne?

(a) Rh⁺ mother and Rh⁻ father
(b) Rh⁻ mother and Rh⁻ father
(c) Rh⁺ mother and Rh⁺ father
(d) Rh⁻ mother and Rh⁻ father

17. Which of the following is a flightless bird?
    (a) Ostrich   (b) Emu
    (c) Kiwi   (d) All of these

18. Voikmann's canals occur in
    (a) cartilage   (b) liver
    (c) bone   (d) internal ear

19. Characteristic of mammalian liver is
    (a) Kupffer's cells and leucocytes
    (b) leucocytes and canaliculae
    (c) Glisson's capsule and Kupffer's cells
    (d) Glisson's capsule and leucocytes

20. Branch of zoology dealing with the study of fishes is known as
    (a) Herpetology   (b) Ichthyology
    (c) Mammology   (d) Ornithology

21. Which is the correct example of the type of regeneration out of the two major types?
    (a) Morphallaxis–Regeneration of two transversely cut equal pieces of one *Hydra* into two small *Hydra*
    (b) Epimorphosis–Replacement of old and dead erythrocytes by the new ones
    (c) Morphallaxis–Healing of wound in the skin
    (d) Epimorphosis–Regeneration of crushed and filtered out pieces of *Planaria* into as many new Planarians

22. Chemical ions responsible for muscle contraction are
    (a) Ca^{2+} and K^+ (b) Na^+ and K^+
    (c) Na^+ and Ca^{2+} (d) Ca^{2+} and Mg^{2+}

23. Ovum receives the sperm in the region of
    (a) animal pole   (b) vegetal pole
    (c) equator   (d) pigmented area

24. The releasing hormones are produced by
    (a) testis   (b) pancreas
    (c) pituitary   (d) hypothalamus

25. The best definition of the process of gastrulation is that it is a process where the
    (a) single layered blastula becomes two layered

(b) archenteron is formed
(c) zygote gets converted into larva
(d) cells move to occupy their definite position

26. Gland responsible for calcium metabolism is
    (a) thymus   (b) thyroid
    (c) parathyroid   (d) adrenal

27. The main difference between bone and cartilage is of
    (a) mineral salts   (b) Haversian canals
    (c) lymph vessels   (d) blood vessels

28. Physiologically urea is produced by the action of an enzyme
    (a) uricase   (b) urease
    (c) arginase   (d) None of these

29. During the conduction of nerve impulse, the repolarization occurs with the
    (a) influx of K^+ ions   (b) influx of Na^+ ions
    (c) efflux of K^+ ions   (d) efflux of Na^+ ions

30. In the axon of motor nerve fibre, the nerve impulse travels
    (a) towards cell body
    (b) away from cell body
    (c) away from synapse
    (d) in both directions

31. Emulsification of fat will not occur in absence of
    (a) lipase
    (b) bile pigments
    (c) bile salts
    (d) pancreatic juice

32. The best source of vitamin-B_1 is
    (a) whole wheat bread
    (b) cod liver oil
    (c) egg
    (d) curd

33. Syncytial (coenocytic) epidermis is present in
    (a) housefly   (b) *Ascaris*
    (c) *Metaphire*   (d) *Periplaneta*

34. In Polychaeta, the setae are
    (a) numerous
    (b) singly arranged
    (c) arranged in bundles
    (d) fused

35. Sponges are characterized by
(a) choanocytes
(b) canal system
(c) one exit and innumerable mouthlets
(d) All of the above

36. Animal nature of sponges is shown by
(a) holozoic nutrition
(b) absence of cellulose
(c) presence of ciliated larva
(d) All of the above

37. Which of the following belongs to class Insecta?
(a) *Julus*
(b) Silver fish
(c) Lobsters
(d) Prawn

38. Mandibles are absent in
(a) mosquito
(b) housefly
(c) honey bee
(d) butterfly

39. Haemocoel is found in
(a) *Hydra* and *Aurelia*
(b) *Taenia* and *Ascaris*
(c) *Periplaneta* and *Pila*
(d) *Balanoglossus* and *Herdmania*

40. Contractile vacuole is present in
(a) *Paramecium*
(b) *Euglena*
(c) *Amoeba*
(d) All of these

41. Which symmetry is found in sea anemone?
(a) Biradial
(b) Asymmetry
(c) Spherical
(d) Pentamerous

42. Lamarckism cannot explain
(a) webbed toes in aquatic birds
(b) weak muscles in the son of a wrestler
(c) long narrow and limbless body of snakes
(d) heterophylly

43. According to de Vries theory, evolution is
(a) discontinuous
(b) jerky
(c) continuous and smooth
(d) Both (a) and (b)

44. The cranial capacity of modern man is
(a) 430-650 cc^3
(b) 600-1000 cc^3
(c) 900-1100 cc^3
(d) 1200-1600 cc^3

45. The golden age of reptiles was
(a) Proterozoic era
(b) Palaeozoic era
(c) Mesozoic era
(d) Coenozoic era

46. Connecting link between chordates and non-chordates is
(a) *Peripatus*
(b) *Balanoglossus*
(c) *Sphenodon*
(d) *Tachyglossus*

47. Trypsinogen is converted into active trypsin by the action of
(a) cholecystokinin
(b) enterocrinin
(c) enterokinase
(d) secretin

48. In rabbit, the digestion of cellulose takes place in
(a) colon
(b) ileum
(c) caecum
(d) rectum

49. Bidder's canal is found is
(a) testes of frog
(b) kidney of frog
(c) kidney of mammals
(d) ovary of mammals

50. Number of spinal nerves in rabbit is
(a) 27 pairs
(b) 31 pairs
(c) 37 pairs
(d) 47 pairs

हिन्दी

1. 'मनोज' किसका पर्यायवाची शब्द है?
   (a) कमल   (b) कामदेव
   (c) विष्णु   (d) बाटल

2. 'श्रवण' का सही सन्धि-विच्छेद क्या है?
   (a) श्र + वण   (b) श्री + अन्
   (c) श्र + अन्   (d) श्रव + ण

3. 'मन: + बल' की सही सन्धि है
   (a) मनुबल   (b) मनोबल
   (c) मनोबल   (d) मनबल

4. 'हँसाना' क्रिया क्या है?
   (a) सकर्मक   (b) अकर्मक
   (c) प्रेरणार्थक   (d) संयुक्त क्रिया

5. 'प्रेममार्ग' किस प्रकार के समास का उदाहरण है?
   (a) बहुब्रीहि   (b) तत्पुरुष
   (c) कर्मधारय   (d) द्विगु

6. 'यथाशक्ति' में कौन-सा समास है?
   (a) अव्ययीभाव   (b) तत्पुरुष
   (c) द्वन्द्व   (d) द्विगु

7. 'अवरोध' शब्द का विपरीतार्थक शब्द क्या होगा?
   (a) असखरोध   (b) रोध
   (c) अवरोधहीन   (d) अनावरोध

8. 'जो आकाश में विचरण करता हो' के लिए एक शब्द क्या होगा?
   (a) रजनीचर   (b) निशाचर
   (c) खस्चर   (d) खेचर

9. 'जो यश से युक्त हो' के लिए एक शब्द क्या होगा?
   (a) यशस्वी   (b) यशोदा
   (c) यशुमती   (d) यशी

10. 'खाक में मिलना' मुहावरे का सही अर्थ क्या है?
    (a) खुश रहना   (b) बर्बाद होना
    (c) सापनलूस होना   (d) मारा जाना

11. 'पीठ ठोकना' मुहावरे का सही अर्थ क्या है?
    (a) बढ़ावा देना   (b) कष्ट देना
    (c) रहस्य बताना   (d) साहस दिखाना

12. 'बुद्धि बल से बड़ी होती है' किस लोकप्रिय कहावत का अर्थ है?
    (a) अन्धे के हाथ बटेर   (b) अधजल गगरी छलकत जाय
    (c) अकल बड़ी या भैंस   (d) अपनी ढपली अपना राग

13. निम्न में किस शब्द की वर्तनी शुद्ध है?
    (a) कौशल्या   (b) कौशल्या
    (c) कौसल्या   (d) कोसल्या

14. 'विषाद' शब्द का विपरीतार्थक शब्द कौन-सा है?
    (a) निषाद   (b) प्रसाद
    (c) दुःख   (d) हर्ष

15. 'गगनचुम्बी' में कौन-सा समास है?
    (a) द्वन्द्व   (b) तत्पुरुष
    (c) बहुब्रीहि   (d) अव्ययीभाव

16. 'माथा ठनकना' मुहावरे का सही अर्थ क्या है?
    (a) सिरदर्द होना   (b) माथा घायल होना
    (c) सोचना   (d) सन्देह होना

17. 'मनोहर' में कौन-सी सन्धि है?
    (a) गुण   (b) वृद्धि
    (c) विसर्ग   (d) दीर्घ

18. 'सन्तोष' का सही सन्धि विच्छेद होगा
    (a) सम् + तोष   (b) सन् + तोष
    (c) स + तोष   (d) सम्न् + तोष

19. 'प्रत्येक' किस समास का उदाहरण है?
    (a) तत्पुरुष   (b) बहुब्रीहि
    (c) अव्ययीभाव   (d) द्विगु

20. 'त्रिभुज' में कौन-सा समास है?
    (a) द्विगु   (b) द्वन्द्व
    (c) तत्पुरुष   (d) अव्ययीभाव

21. 'पतग' शब्द का कौन-सा अर्थ नहीं होता?
    (a) सूर्य   (b) पक्षी
    (c) कोट   (d) घोड़ा

22. निम्न में कौन-सा शब्द 'घोड़ा' का पर्यायवाची नहीं है?
    (a) बाजि   (b) तुरग
    (c) हरि   (d) कुरंग

23. कौन सुमेलित नहीं है?
    (a) इहलोक - परलोक   (b) उच्च - निम्न
    (c) सगुण - निर्गुण   (d) गुप्त - रहस्य

24. 'जिसका तेज समाप्त हो गया हो' के लिए एक शब्द क्या होगा?
    (a) निस्तेज   (b) तेजस्वी   (c) तेजी   (d) तीव्र

25. 'आठ-आठ आँसू बहाना' मुहावरे का अर्थ है
    (a) विचलित होना   (b) बुरी तरह पछताना
    (c) संकट आना   (d) विनाश होना

26. निम्न में कौन-मात्रिक छन्द नहीं है?
    (a) चौपाई   (b) रोला
    (c) हरिगीतिका   (d) सर्वैया

27. निम्न में कौन वार्णिक छन्द नहीं है?
    (a) कविता   (b) मालिनी
    (c) मन्दाक्रान्ता   (d) कुण्डलिया

28. निम्न में कौन अर्थालंकार नहीं है?
    (a) उपमा
    (b) रूपक
    (c) यमक
    (d) उत्प्रेक्षा

29. आचार्य भरत के अनुसार स्थायी भावो की संख्या कितनी है?
    (a) आठ
    (b) नौ
    (c) तैतोस
    (d) उनचास

30. 'साहित्य-लहरी' किसकी रचना है?
    (a) सूरदास
    (b) कबीरदास
    (c) तुलसीदास
    (d) जायसी

31. 'सूर-साहित्य' किसकी आलोचनात्मक कृति है?
    (a) हजारी प्रसाद द्विवेदी
    (b) नामवर सिंह
    (c) रामचन्द्र शुक्ल
    (d) विजयदेव नारायण साही

32. 'आकाशदीप' किसकी रचना है?
    (a) प्रेमचन्द
    (b) जयशंकर प्रसाद
    (c) निराला
    (d) यशपाल

33. 'अन्धायुग' किस प्रकार की रचना है?
    (a) उपन्यास
    (b) काव्य
    (c) काव्य-नाटक
    (d) नाटक

34. 'कोणार्क' नाटक के लेखक है
    (a) जयशंकर प्रसाद
    (b) जगदीश चन्द्र माथुर
    (c) लक्ष्मी नारायण मिश्र
    (d) मोहन राकेश

35. 'अनामिका' किसका काव्य-संग्रह है?
    (a) निराला
    (b) पन्त
    (c) महादेवी वर्मा
    (d) प्रसाद

36. 'चित्रलेखा' किसकी रचना है?
    (a) भगवती चरण वर्मा
    (b) धर्मवीर भारती
    (c) हरिवंश राय बच्चन
    (d) कमलेश्वर

37. 'ग्यारह वर्ष का समय' शीर्षक कहानी की रचना किसने की?
    (a) चन्द्रधर शर्मा गुलेरी
    (b) प्रेमचन्द
    (c) रामचन्द्र शुक्ल
    (d) जयशंकर प्रसाद

38. जयशंकर प्रसाद की 'कामायनी' किस वर्ष प्रकाशित हुई?
    (a) 1924
    (b) 1930
    (c) 1936
    (d) 1950

39. 'वीणा' किस कवि/कवयित्रो का काव्य-संग्रह है?
    (a) सुमित्रानन्दन पन्त
    (b) सूर्यकान्त त्रिपाठी 'निराला'
    (c) महादेवी वर्मा
    (d) जयशंकर प्रसाद

40. 'पंचवटी' किस कवि की रचना है?
    (a) मैथिलीशरण गुप्त
    (b) रामधारी सिंह 'दिनकर'
    (c) जयशंकर प्रसाद
    (d) सूर्यकान्त त्रिपाठी 'निराला'

41. 'काली आँधी' किस रचनाकार की कृति है?
    (a) धर्मवीर भारती
    (b) राजेन्द्र यादव
    (c) भगवती चरण वर्मा
    (d) कमलेश्वर

42. 'काली आँधी' की पृष्ठभूमि में कौन-सी घटना है?
    (a) भारत-चीन युद्ध
    (b) भारत विभाजन
    (c) गुजरात नरसंहार
    (d) आपातकाल

43. 'जूठन' किसकी आत्मकथा है?
    (a) जयप्रकाश कर्दम
    (b) ओमप्रकाश वाल्मीकि
    (c) मोहनदास नैमिश्य
    (d) सूरजपाल चौहान

44. निम्न में कौन शिवपूजन सहाय की रचना है?
    (a) वरुण के बेटे
    (b) देहाती दुनिया
    (c) परती परिकथा
    (d) मानस के हंस

45. 'द्विवेदी काल' नामकरण किस साहित्यिक व्यक्तित्व के नाम पर किया गया है?
    (a) हजारी प्रसाद द्विवेदी
    (b) महावीर प्रसाद द्विवेदी
    (c) गंगेन्द्र सुन्दर द्विवेदी
    (d) इनमें में कोई नहीं

46. प्रेमचन्द ने किस नाट्यकृति की रचना की?
    (a) कर्बला
    (b) संग्राम
    (c) कर्बला तथा संग्राम दोनों
    (d) उक्त में से कोई नहीं

47. 'हरिगीतिका' छन्द के प्रत्येक चरण में कितनी मात्राएँ होती है?
    (a) 22
    (b) 24
    (c) 26
    (d) 28

48. 'कलम का सिपाही' किसे कहा गया है?
    (a) प्रेमचन्द
    (b) निराला
    (c) प्रसाद
    (d) दिनकर

49. 'धूपघड़ी' किस समकालीन कवि का काव्य-संग्रह है?
    (a) राजेश जोशी
    (b) आलोक धन्वा
    (c) विष्णु नागर
    (d) जितेन्द्र पंत

50. 'निर्मला' किस उपन्यासकार की कृति है?
    (a) जैनेन्द्र
    (b) यशपाल
    (c) प्रेमचन्द
    (d) नागार्जुन

Answers

Physics

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

Chemistry

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

Botany

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

Zoology

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

हिन्दी

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

Hints & Solutions

Physics

1. The range is given by, $R = \dfrac{u^2 \sin 2\theta}{g}$

   So, $\qquad R \propto \dfrac{1}{g}$

   On the moon, $g_m = \dfrac{g}{6}$

   Hence, $\qquad R_m = 6R$

2. $\left[\dfrac{\alpha Z}{k\theta} \right] = [M^0 L^0 T^0]$

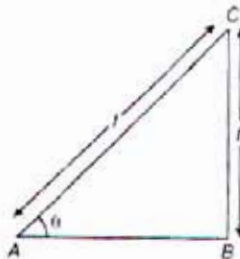   or $\qquad [\alpha] = \left[\dfrac{k\theta}{Z} \right]$

   Further $\qquad [p] = \left[\dfrac{\alpha}{\beta} \right]$

   $\qquad [\beta] = \left[\dfrac{\alpha}{p} \right] = \left[\dfrac{k\theta}{Zp} \right]$

   Dimensions of $k\theta$ are that of energy, hence

   $[\beta] = \left[\dfrac{ML^2 T^{-2}}{LML^{-1}T^{-2}} \right] = [M^0 L^2 T^0]$

3. Distance to be travelled along the plane
   $= h \sin \theta.$

   Acceleration down the plane $= g \sin \theta$

   $\qquad S = \dfrac{1}{2} at^2$

   $\Rightarrow \qquad \dfrac{h}{\sin \theta} = \dfrac{1}{2} g \sin \theta \, t^2$

   or $\qquad t^2 = \dfrac{2h}{g \sin^2 \theta}$ or $t = \dfrac{1}{\sin \theta} \sqrt{\dfrac{2h}{g}}$

4. $\Delta U = \mu C_V \Delta T$

   $\qquad = n \left(\dfrac{R}{\gamma - 1} \right) \Delta T$

   $\Rightarrow \Delta U = \dfrac{p \Delta V}{(\gamma - 1)} = \dfrac{p(2V - V)}{(\gamma - 1)} = \dfrac{pV}{(\gamma - 1)}$

5. In electrolysis, the current is carried out by positive and negative ions inside the electrolyte.

6. Potential energy $= 2 \times$ (total energy)
   $= 2 \times E_0 = 2E_0$

   Because, $U = -\dfrac{GMm}{r}$ and $E_0 = -\dfrac{GMm}{2r}$

7. According to kepler, $\dfrac{T^2}{r^3} = $ constant

   or $\qquad T^2 r^{-3} = $ constant

8. Hooke's law is applicable only with in elastic limit.

9. For capillary rise, $h = \dfrac{2T \cos \theta}{rdg}$

   $\qquad h \propto \dfrac{1}{r}$ $\quad$ (T, θ, d and g are constants.)

   If r is less then h will be more.

10. Applying Kirchhoff's law is mesh $ABCDA$
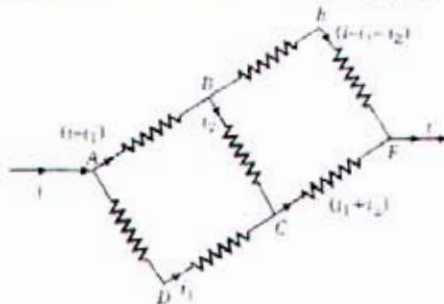
    $-10(i - i_1) - 10 i_2 + 20 i_1 = 0$

    $\Rightarrow \qquad 3i_1 - i_2 = i$ $\qquad \ldots (i)$

    In mesh $BEFCB$

    $-20(i - i_1 - i_2) + 10(i_1 + i_2) + 10 i_2 = 0$

$$\Rightarrow \qquad 3i_1 + 4i_2 = 2i \qquad \text{...(ii)}$$

From Eqs. (i) and (ii), we get

$$i_1 = \frac{2i}{5}, i_2 = \frac{i}{5}$$

$$\Rightarrow \qquad i_{AD} = \frac{2i}{5}$$

11. $\dfrac{E_1}{E_2} = \dfrac{l_1 + l_2}{l_1 - l_2} = \dfrac{8 + 2}{8 - 2} = \dfrac{10}{6} = \dfrac{5}{3}$
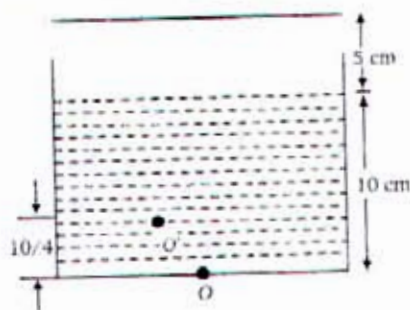
12. $\qquad I = \dfrac{L}{r^2}$

$$\therefore \qquad \frac{L_1}{r_1^2} = \frac{L_2}{r_2^2} \qquad (\because I \text{ is same})$$

$$\Rightarrow \qquad \frac{L_1}{L_2} = \frac{r_1^2}{r_2^2} = \left(\frac{1}{10}\right)^2 = 1 : 100$$

13. From figure it is clear that object appears to be raised by $\dfrac{10}{4}$ cm (2.5 cm).

Hence distance between mirror and

$$O' = 5 + 7.5$$
$$= 12.5 \text{ cm}$$

So, the final image will be formed at 12.5 cm behind the plane mirror.

14. Total mass of bullets $= Nm$

$$\text{time} = \frac{N}{n}$$

Momentum of the bullets striking the wall

$$= Nmv$$

Rate of change of momentum (force)

$$= \frac{Nmv}{t} = nmv$$

15. Tension between B and C is given by

$$T = \frac{2m_B m_C}{m_A + m_B + m_C} \times g$$

$$= \frac{2 \times 2 \times 2}{2 - 2 + 2} \times 9.8 = 13 \text{ N}$$

16. For downward motion of lift

$$R = m(g - a)$$

If $a = g$, then $R = 0$

$$\therefore \qquad F = \mu R = 0$$

17. Air is more rarer for sound to travel as compared to vacuum.

18. Comparing with $y = a \cos(\omega t + kx - \phi)$

We get $k = \dfrac{2\pi}{\lambda} = 0.02 \Rightarrow \lambda = 100$ cm

Also, it is given that phase difference between particles

$$\Delta\phi = \frac{\pi}{2}$$

Hence, path difference between them,

$$\Delta = \frac{\lambda}{2\pi} \times \Delta\phi$$

$$= \frac{\lambda}{2\pi} \times \frac{\pi}{2} = \frac{\lambda}{4} = \frac{100}{4} = 25 \text{ cm}$$

19. Apparent frequency, $n' = n\left(\dfrac{v}{v - v_s}\right)$

$$= \frac{2000 \times 1220}{(1220 - 40)} = 2068 \text{ Hz}$$

20. We have, $\phi = BA$

$$= B \times \pi r^2$$

$$\therefore \qquad \phi \propto r^2$$

or $\qquad \phi = kr^2 \qquad$ (k is a constant)

$$e = \frac{d\phi}{dt} = k.2r.\frac{dr}{dt}$$

From 0-1, r is constant,

$$\frac{dr}{dt} = 0$$

Hence, $\qquad e = 0$

From 1-2, $r = \alpha t$,

$$\frac{dr}{dt} = \alpha$$

Hence, $\qquad e \propto r \Rightarrow e \propto t$

From 2-3, again r is constant,

$$\frac{dr}{dt} = 0$$

Hence, $e = 0$

21. Intensity $\propto$ (Number of photons)

$\qquad \propto$ (Number of photoelectrons)

22. Minimum wavelength,

$$\lambda_{min} = \frac{12375}{40000} = 0.30\ \text{Å}$$

Hence a wavelength less than 0.30 Å is not possible.

23. Given, $\qquad |v_1 + v_2| = |v_1 - v_2|$

$\Rightarrow \quad v_1^2 + v_2^2 + 2v_1 \cdot v_2 = v_1^2 + v_2^2 - 2v_1 \cdot v_2$

or $\qquad |v_1 + v_2|^2 = |v_1 - v_2|^2$

$\Rightarrow (v_1 + v_2) \cdot (v_1 + v_2) = (v_1 - v_2) \cdot (v_1 \cdot v_2)$

$\qquad\qquad 4v_1 \cdot v_2 = 0$

$\therefore$ v_1 is perpendicular to v_2.

24. Polarised glass reduces the light intensity to half.

25. Population covered

$\qquad = 2\pi h R \times$ population density

$\qquad = 2\pi \times 100 \times 6.4 \times 10^6 \times \dfrac{1000}{(10^3)^2}$

$\qquad = 4 \times 10^6$

26. Figure 2, represents the short sightedness.

27. Intermediate image means the image formed by objective, which is real, inverted and magnified.

28. Carrier + Signal $\rightarrow$ Modulation

29. In parallel combination, $V_1 = V_2$

$$\frac{q_1}{C_1} = \frac{q_2}{C_2}$$

$\Rightarrow \qquad \dfrac{q_1}{q_2} = \dfrac{C_1}{C_2}$

30. We put a unit positive charge at O. Resultant force due to the charge placed at A and C is zero and resultant force due to B and D is towards D along the diagonal BD.

31. $\qquad pV = NkT$

$\Rightarrow N = \dfrac{pV}{kT}$

$\qquad = \dfrac{(1.64 \times 10^{-3} \times 1.01 \times 10^5) \times (1 \times 10^{-6})}{1.38 \times 10^{-23} \times 200}$

$\qquad = 6.02 \times 10^{16}$

32. According to kinetic theory of gases, there is no attraction force between the molecules of gases.

So, potential energy $= 0$

Total energy of a gas is equal to kinetic energy.

33. Only AC dynamo have slip rings.

34. Depletion layer consists of mainly stationary ions.

35. Voltage gain, $A_v = \dfrac{\mu}{1 + \dfrac{r_e}{r_i}}$ and $\mu = r_r \times g_m$

$\Rightarrow \quad \mu = 10 \times 10^3 \times 3 \times 10^{-3} = 30$

$\therefore \quad A_v = \dfrac{\mu}{1 + \dfrac{r_e}{2r_p}} = \dfrac{2}{3}\mu = \dfrac{2}{3} \times 30 = 20$

36. In the depletion layer of P-N junction, stationary positive ions exists in the N-side and stationary negative ions exists in the P-side.

Barrier potential difference

P-N junction
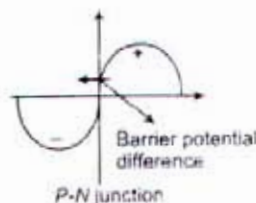
37. According to Wein's law, $\lambda_m T$ = constant

$$\Rightarrow \qquad \lambda_{m_1} T_1 = \lambda_{m_2} T_2$$

or $\qquad T_2 = \dfrac{\lambda_{m_1}}{\lambda_{m_2}} T_1 = \dfrac{\lambda_0}{3\lambda_0/4} \times T_1 = \dfrac{4}{3} T_1$

Now, $\qquad P \propto T^4$

$$\therefore \qquad \dfrac{P_2}{P_1} = \left(\dfrac{T_2}{T_1}\right)^4 = \left(\dfrac{4/3\,T_1}{T_1}\right)^4 = \dfrac{256}{81}$$

38. For both the paths ΔU remains the same.

For path iaf, $\Delta U = \Delta Q - \Delta W$
$$= 50 - 20 = 30\,J$$

For path fi, $\Delta U = -30\,J$ and $\Delta W = -13\,J$

$$\therefore \qquad \Delta Q = -30 + (-13) = -43\,J$$

39. Rise in temperature, $\Delta\theta = \dfrac{3T}{JSd}\left(\dfrac{1}{r} - \dfrac{1}{R}\right)$

For water $S = 1$ and $d = 1$

$$\therefore \qquad \Delta\theta = \dfrac{3T}{J}\left(\dfrac{1}{r} - \dfrac{1}{R}\right)$$

40. $\qquad v_e = \sqrt{\dfrac{2GM}{R}} = R\sqrt{\dfrac{8}{3}\pi G\rho}$

If mean density is constant then $v_e \propto R$

$$\therefore \qquad \dfrac{v_e}{v_p} = \dfrac{R_e}{R_r} = \dfrac{1}{2}$$

$$\Rightarrow \qquad v_e = \dfrac{v_p}{2}$$

41. We have, acceleration, $a = \dfrac{dv}{dt}$

Given, $\qquad \dfrac{dv}{dt} = bt$ or $dv = bt\,dt$

Integrating both sides

$$v = \dfrac{bt^2}{2} + k_1 \qquad \qquad ...(i)$$

At $t = 0$, $v = v_0$ and $k_1 = v_0$

$$\therefore \qquad v = \dfrac{1}{2}bt^2 + v_0$$

or $\qquad \dfrac{dx}{dt} = \dfrac{1}{2}bt^2 + v_0$

Again integrating both sides

$$x = \dfrac{1}{2}\dfrac{bt^3}{3} + v_0 t + k_2 \qquad \qquad ...(ii)$$

At $t = 0$, $x = 0$

$$\therefore \qquad k_2 = 0$$

so, $\qquad x = \dfrac{1}{6}bt^3 + v_0 t$

42. We have, $W = \dfrac{F^2}{2k}$

If both the springs are stretched by same force, than $W \propto \dfrac{1}{k}$

As $k_1 > k_2$ therefore $W_1 < W_2$

ie, more work is done in case of second spring.

43. If a motor of 12 HP works for 10 days at the rate of 8 h/day, then energy consumption

$$= power \times time$$
$$= 12 \times 746 \times 80 \times 60 \times 60\,J$$
$$= 2.5 \times 10^9\,J$$

Rate of energy = 50 paise/kWh

ie, $3.6 \times 10^6\,J$ energy cost ₹ 0.5

So, $2.5 \times 10^9\,J$ energy cost

$$= \dfrac{2.5 \times 10^9 \times 0.5}{3.6 \times 10^6} \approx ₹\,358$$

44. Initial momentum of the system

$$= mv - mv = 0$$

As body sticks together, so the final momentum $= 2mv$

(where v is the velocity of compound body)

∴ By conservation of momentum

= Final momentum = Initial momentum

$$\Rightarrow \qquad 2mv = 0$$

or $\qquad v = 0$

45. ∵ $\tau = I\alpha$

so, the body gets angular acceleration.

46. $\qquad P_{rated} \propto \dfrac{1}{R}$
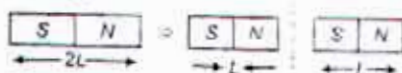
and $\qquad R \propto \dfrac{1}{(\text{thickness of filament})^2}$

so, $P_{rated} \propto (\text{thickness of filament})^2$

47. Radius of circular path, $r = \dfrac{mv}{Bq} = \dfrac{v}{(q/m)B}$

$$= \dfrac{2 \times 10^5}{5 \times 10^7 \times 4 \times 10^{-2}}$$

$$= 0.10 \text{ m}$$

48. Pole strength $= m$

length $= 2L$

Magnetic moment $M = 2\,mL$

When magnetic needle is broken into two pieces at the middle, then

Pole strength $= m$

length $= L$

Magnetic moment $M' = mL = \dfrac{M}{2}$

49. The reduction factor, $k = \dfrac{2RB_H}{\mu_0 N}$

(R = radius, N = number of turns)

when number of turns and radius of the coil are doubled, the reduction factor k will be remain same.

50. According to Bohr's second postulate

Angular momentum is quantized,

ie, $L = mv_n r_n$

$$= n\left(\dfrac{h}{2\pi}\right)$$

Chemistry

1. ∵ 8 mol O-atoms are contained by 1 mole $Mg_3(PO_4)_2$.

∴ 0.25 mole of O-atoms are present in $Mg_3(PO_4)_2$ $= \dfrac{1}{8} \times 0.25$ mol

$$= 3.125 \times 10^{-2} \text{ mol}$$

2. de-Broglie wavelength.

$$\lambda = \dfrac{h}{mv}$$

$$v = \dfrac{h}{m \cdot \lambda} \qquad \ldots(i)$$

$$KE = \dfrac{1}{2} mv^2 \qquad \ldots(ii)$$

Now, put the value of v in Eq. (ii)

$$KE = \dfrac{1}{2} m \left(\dfrac{h}{m \cdot \lambda}\right)^2$$

$$= \dfrac{1}{2}\left(\dfrac{h^2}{m \times \lambda^2}\right)$$

Hence, $KE \propto \dfrac{1}{m}$ (If λ are same)

and the order of KE is as

$$E_d > E_p > E_\alpha$$

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

For 19th electron $\boxed{\uparrow}$
$\quad 4s^1$

$n = 4, l = 0, m = 0, s = +\dfrac{1}{2}$

4. The atom which has lower value of packing fraction is stable. Hence, atom B is more stable than atom A.

5. $_{92}U^{238} \xrightarrow{-8\alpha} {}_{76}X^{206} \xrightarrow{-6\beta} {}_{82}Y^{206}$
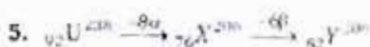
Number of protons $= 82$

Number of neutrons $= 206 - 82 = 124$

n/p ratio in the product nuclei $= \dfrac{124}{82} = \dfrac{62}{41}$

6. Bond length decreases as bond order increases.
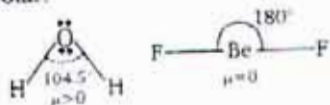
Bond order of $O_2 = 2$

Bond order of $O_2^+ = 2.5$

Bond order of $O_2^- = 1.5$

Hence, the order of bond length is

$$O_2^- > O_2 > O_2^+$$
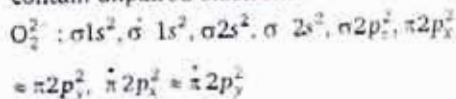
7. The structure of H_2O is angular or V-shape as it is sp^3-hybridised with bond angle $105°$. Its dipole moment is positive or more than zero. But in BeF_2 structure is linear due to sp-hybridisation ($\mu = 0$). Hence, due to $\mu > 0$, H_2O is dipolar and due to $\mu = 0$, BeF_2 is non-polar.

8. In ICl_2, I is sp^3d-hybridised. The structure of ICl_2^- is distorted trigonal bipyramidal due to the presence of lone pair of electrons.

9. O_2^{2-} (number of electrons = 18) does not contain unpaired electrons.

$O_2^{2-} : \sigma 1s^2, \overset{*}{\sigma} 1s^2, \sigma 2s^2, \overset{*}{\sigma} 2s^2, \sigma 2p_z^2, \pi 2p_x^2$

$= \pi 2p_y^2, \overset{*}{\pi} 2p_x^2 = \overset{*}{\pi} 2p_y^2$

10. In SO_3^{2-} ; $x + (-2 \times 3) = -2$

$x = +6 - 2 = +4$

In $S_2O_4^{2-}$: $2x + (-2 \times 4) = -2$

$2x = +8 - 2 = +6$

$x = +3$

In $S_2O_6^{2-}$: $2x + (-2 \times 6) = -2$

$2x = +12 - 2 = 10$

$x = +5$

Hence, increasing order of oxidation state of S is

$S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$
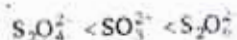
11. A atoms are at eight corners of the cube. Therefore, the number of A atoms in a unit cell $= \dfrac{8}{8} = 1$

B atoms are at the face centre of six faces. Hence, its share in the unit cell $= \dfrac{6}{2} = 3$.

Therefore, the formula of the compound is AB_3.

12. Moles of sucrose $(n) = \dfrac{100}{342} = 0.292$ mol

Moles of water $(N) = \dfrac{1000}{18} = 55.5$ mol
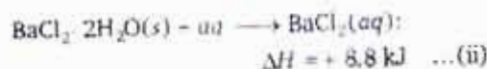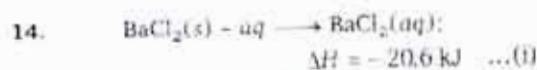
Vapour pressure of pure water

$(p°) = 23.8$ mm Hg

According to Raoult's law

$\dfrac{\Delta p}{p°} = \dfrac{n}{n + N}$
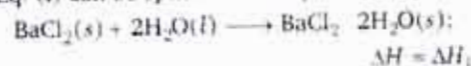
$\dfrac{\Delta p}{23.8} = \dfrac{0.292}{0.292 + 55.5}$

$\Delta p = \dfrac{23.8 \times 0.292}{55.792} = 0.125$ mm Hg

13. Boyle's temperature, $T_B = \dfrac{a}{Rb}$

14. $BaCl_2(s) - aq \longrightarrow BaCl_2(aq)$;

$\Delta H = -20.6$ kJ   ...(i)

$BaCl_2 \cdot 2H_2O(s) - aq \longrightarrow BaCl_2(aq)$;

$\Delta H = +8.8$ kJ   ...(ii)

Eq. (i) can be split in two steps as

$BaCl_2(s) + 2H_2O(l) \longrightarrow BaCl_2 \cdot 2H_2O(s)$;

$\Delta H = \Delta H_1$

$BaCl_2 \cdot 2H_2O(s) + aq \longrightarrow BaCl_2(aq)$;

$\Delta H = \Delta H_2$

$\Delta H_1 + \Delta H_2 = -20.6$

$\Delta H_1 - 8.8 = -20.6$

$\Delta H_1 = -29.4$ kJ

15. +ve ΔH and -ve ΔS both oppose the reaction.

16. $2NH_3(g) \longrightarrow N_2(g) + 3H_2(g)$

$K_p = \dfrac{P_{N_2} \times P_{H_2}^3}{P_{NH_3}^2} = \dfrac{(atm)^4}{(atm)^2} = (atm)^2$

17. $AlCl_3$ gives Al^{3+} ions which combine with OH^- ions given by H_2O so that dissociation equilibrium of H_2O shifts in forward direction ie, ionisation of water increases.

18. When half of NH_4OH is neutralised,

$[NH_4OH] = [NH_4Cl]$
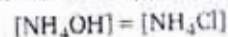
$pOH = pK_b + \log \dfrac{[salt]}{[base]}$

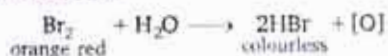$$pOH = pK_b = 4.75$$
$$pH + pOH = 14$$
$$pH = 14 - pOH$$
$$= 14 - 4.75 = 9.25$$

19. For second order reaction,

$$\frac{dx}{dt} = k(\text{conc.})^2$$

$$k = \frac{\text{conc.}}{\text{time}} \times \frac{1}{(\text{conc.})^2}$$

$$= \text{conc.}^{-1}\, \text{time}^{-1}$$

$$= L\, mol^{-1} s^{-1}$$

20. Hydrazoic acid (N_3H) is a weak acid. Its weakly acidic character is due to the reason that azide ion (N_3^-) formed after the loss of a proton is more stabilised by resonance as compared to hydrazoic acid itself.

$$[N \equiv N^+ - N^-] \longleftrightarrow [^-N - N \equiv N]$$

21. Mixture of Al powder and $Al(NO_3)_3$, known as "ammonal", is used in bombs.

22. Inert pair effect is more pronounced in heavier members like Pb. Hence, Pb (IV) compounds act as strong oxidising agents and are reduced to more stable Pb(II) compounds.

23. Bromine water is an oxidising agent. It oxidises SO_2 to SO_3 and itself is reduced to colourless HBr.

$$\underset{\text{orange red}}{Br_2} + H_2O \longrightarrow \underset{\text{colourless}}{2HBr} + [O]$$

$$SO_2 + [O] \longrightarrow SO_3$$

$$H_2O + SO_3 \longrightarrow H_2SO_4$$

H_2S is also oxidised by bromine water but in this case decolourisation is also accompanied by the formation of sulphur.

$$H_2S + [O] \longrightarrow H_2O + S$$

24. Decreasing order of dehydration of alcohols is $3° > 2° > 1°$ because 3° carbocation is more stable than 2° carbocation which in turn is more stable than 1° carbocation.

25.

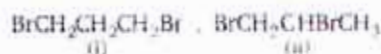o-methoxybromo benzene → m-methoxy aniline
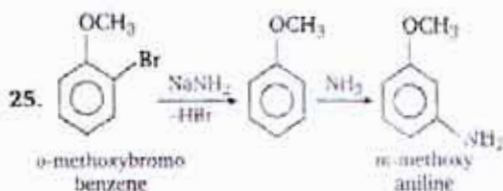
26. Pyridinium chloro chromate (PCC) prevents further oxidation of aldehydes to carboxylic acid.

$$RCH_2OH \xrightarrow[CH_2Cl_2 \text{ solvent}]{PCC} RCHO + H_2O$$
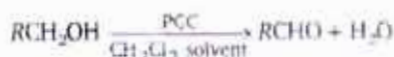
27. Across the lanthanide series, due to lanthanide contraction size of cations decreases, which results in increase in covalent character and decrease in ionic character. So, the basicity of hydroxides decreases.

28. Structural isomers of $C_3H_6Br_2$ are

$$\underset{(i)}{BrCH_2CH_2CH_2Br} , \underset{(ii)}{BrCH_2CHBrCH_3}$$

$$\underset{(iii)}{Br_2CHCH_2CH_3} , \underset{(iv)}{CH_3-CBr_2CH_3}$$

Out of these four structural isomers, isomer (ii) has a chiral carbon atom and hence shows enantiomorphism (ie, optical isomerism).

29. Carbocation (II) is most stable due to resonance.

$$CH_3-\overset{+}{C}H-\ddot{O}-CH_3 \longleftrightarrow$$

$$CH_3-CH=\overset{+}{\ddot{O}}-CH_3$$
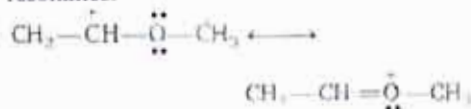
Due to electron withdrawing effect of the adjacent carbonyl group, carbocation (III) is least stable. Carbocation (I) is less stable than carbocation (II) because it is only stabilized by the $+I$ effect of the two CH_3 groups. Hence, the order of stability is II > I > III.

30. Electromeric effect implies complete transfer of π-electrons in the presence of a reagent. Since, simple ethers do not contain any multiple bond, hence, they do not show electromeric effect.

31. Iodine value is the number of gram of iodine required to saturate 100 g oil or fat. In other words, the degree of unsaturation of an oil or fat is expressed in terms of iodine number.

32. Allosteric site is a control site in addition to the active site in enzymes.

33. Cetyltrimethylammonium chloride is a cationic detergent and is used as germicide.

34. Saturated solution of KNO_3 is used to make salt bridge because velocity of both K^+ and NO_3^- are nearly same.

35. $Cu(s) + 2Ag^+ (aq) \longrightarrow Cu^{2+}(aq) + 2Ag(s)$

$$E^\circ = 0.46 \text{ V at } 298 \text{ K}$$

$$E^\circ = \frac{0.059}{2} \log K_c$$

$$0.46 = \frac{0.059}{2} \log K_c$$

$$\log K_c = \frac{0.46}{0.0295} = 15.59$$

$$K_c = 3.92 \times 10^{15}$$

36. Cow milk is a natural emulsion stabilised by casein, milk protein.

37. Auto reduction process is used in the extraction of Cu and Hg.

$$2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2$$
$$2Cu_2O + Cu_2S \longrightarrow 6Cu + SO_2$$
$$2HgS + 3O_2 \longrightarrow 2HgO + 3SO_2$$

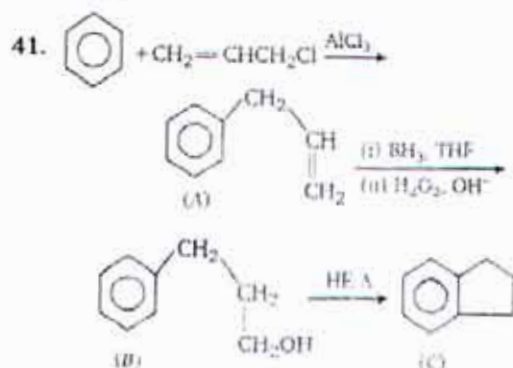$$2HgO \xrightarrow{\Delta} 2Hg + O_2$$

38.
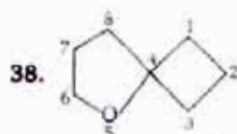
5-oxaspiro [3, 4] octane

39. Kjeldahl's method cannot be used for the estimation of nitrogen in nitro and azo compounds and compounds containing nitrogen in the ring (like pyridine) because these compounds are not completely converted into $(NH_4)_2SO_4$ during digestion.
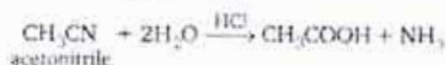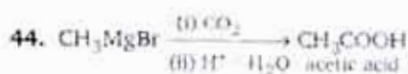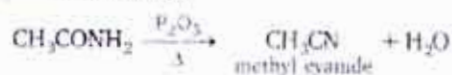
40. $2KI + CuSO_4 \longrightarrow \underset{\text{unstable}}{Cul_2} + K_2SO_4$

$$2Cul_2 \longrightarrow Cu_2I_2 + I_2$$
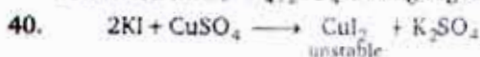
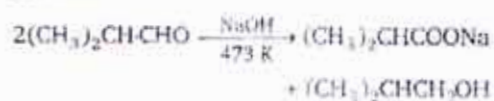Hence, solution contains Cu_2I_2, I_2 and K_2SO_4.

41.

42. The compound dissolves in NaOH and gives characteristic colour with $FeCl_3$, hence it is a phenol. On treatment with bromine it gives a tribromoderivative, hence two *ortho* and one *para* position w.r.t. OH group must be free.

m-cresol

$(MF = C_7H_5OBr_3)$
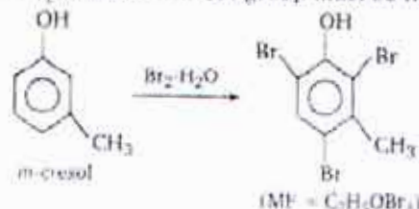
43. When acetamide is heated with P_2O_5, methyl cyanide is formed.

$$CH_3CONH_2 \xrightarrow[\Delta]{P_2O_5} \underset{\text{methyl cyanide}}{CH_3CN} + H_2O$$

44. $CH_3MgBr \xrightarrow[\text{(ii) } H^+ \ H_2O]{\text{(i) } CO_2} \underset{\text{acetic acid}}{CH_3COOH}$

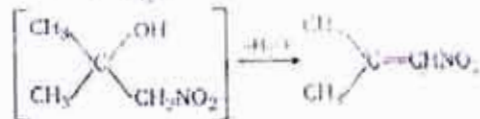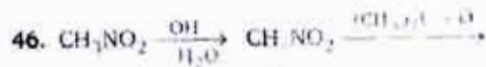$\underset{\text{acetonitrile}}{CH_3CN} + 2H_2O \xrightarrow{HCl} CH_3COOH + NH_3$

45. 2-methyl propanal contains one α-H atom hence it undergoes aldol condensation. Surprisingly, it also undergoes Cannizaro reaction.

$2(CH_3)_2CH\text{-}CHO \xrightarrow[473 \text{ K}]{NaOH} (CH_3)_2CHCOONa$

$+ (CH_3)_2CHCH_2OH$

46. $CH_3NO_2 \xrightarrow[H_2O]{OH} CH_3NO_2 \xrightarrow{} $

47. Carbowax is a polymer of ethylene oxide whereas carnuaba wax and beeswax are esters of higher fatty acids with higher alcohols while paraffin wax is a mixture of hydrocarbons containing 20 or more C-atoms.

48. CS layer dissolves Br and I, which are obtained by oxidation of Br and I by Cl_2 water.

49. Radon is radioactive with half-life period of 3.8 days and is used for the treatment of cancer.

50. The element with atomic number 80 i.e. Hg is a liquid at room temperature due to high ionisation enthalpy and weak metallic bonding, hence has the maximum vapour pressure at room temperature.

Botany

1. Mycorrhiza is the symbiotic association between fungus and root of higher plants. The mycorrhizal roots are usually covered with fungal wooly outgrowth. Fungus growth does not cause any harm to the plant. Along with water, phosphorus and nitrogen are also absorbed.

2. During seed germination especially of cereals, **gibberellin** stimulates the production of hydrolytic enzymes like amylases, proteases and lipases. These enzymes solubilize the reserve food of seed.

3. In Cycas, the 3-celled microspores are shed in the air after the dehiscence of the sporangium. They are very light in weight and are carried by air current (anemophily).

4. The loss of water from the living tissue of aerial parts of plant in the form of water vapour is called **transpiration**. More than 95% of total loss of water takes place through stomata. Opening and closing of stomata occurs due to turgor change in the guard cells.

5. The amount by which diffusion pressure of a solution is lower than that of its pure solvent is known as **Diffusion Pressure Deficit**. When water enters into the cell TP increases, turgidity increases and cell wall develops equal and opposite wall pressure. At the state of equilibrium, DPD will become zero.

6. Pome is two or more seeded fleshy syncarpous fruit surrounded by thalamus. eg. apple, pear.
   Mango, peach drupe fruit

7. According to active K^+ theory of Levitt, opening of stomata occurs due to influx of K^+ into the guard cells. The source of K^+ ions are nearby subsidiary and epidermal cells. The stomatal closure is considered to be brought about by excretion of K^+ and Cl^- from the guard cells to epidermal tissue.

8. Fertilization in Cycas is siphonogamous followed by zoidogamous. During fertilization, the pollen tube discharging its contents into the liquid of archegonial chamber. The cilia and membrane of sperm slips off and cytoplasm and nucleus fuses with the egg forming zygote.

9. Main cause of pollution in metro cities is burning of fossil fuels. It releases CO_2, CO, SO_2, H_2S and H_2SO_4. All these form a strong air pollution matter.

10. In *Wolffia* and *Utricularia*, roots are generally absent.

11. Bending of tentacles in sundew or *Drosera* after coming in contact with an insect is **thigmonastic**, haptonastic or chemonastic movement of variation. Opening and closing of flower in response to light and darkness is called photonasty. eg. *Calendula*

12. The food material synthesizes in leaves of green plants and from seed during germination is translocated to growing regions and storage organs of plant.

13. The inorganic essential elements which are obtained from soil are called mineral elements. Plants absorb the minerals in form of ions. The movement of ions is called flux.

14. The synthesis of ATP from ADP is called **phosphorylation**. Substrate level phosphorylation is directly linked to liberation of energy in chemical reaction of respiration, eg. formation of GTP in Krebs' cycle.

15. Usually with increase in light intensity, the rate of photosynthesis increased. At very high light intensity, the cells exhibit photooxidation by the process of **solarization** and if continues for few hours, the photosynthetic apparatus is destroyed.

16. **Hexokinase** causes phosphorylation of glucose to glucose-6-phosphate in both glycolysis and pentose phosphate pathway. Both glycolysis and pentose phosphate pathway occur in cytoplasm.

   $$Glucose + ATP \xrightarrow{Hexokinase} Glucose$$
   $$6\text{-phosphate} + ADP$$

17. The term 'niche' was used in ecology by **Grinnel** for the role of species/population plays in its ecosystem. Ecological niche means the total interaction of a species with environment.

18. **Proto-cooperation** is the interaction between two living organisms of different species in which both are mutually benefitted but they can live without each other.

19. Deficiency of zinc causes leaf malformations like little leaf, leaf rosettes, interveinal chlorosis, khaira disease of rice and several types of leaf distortions.

Deficiency of molybdenum causes whiptail disease, loosening of inflorescence in cauliflower.

20. **Decomposers** are saprotrophic microorganisms which feed on dead bodies of organisms and organic wastes of living organisms. These are most diverse organisms of an ecosystem.

21. Photosynthesis is manufacture of organic compounds inside the chlorophyll containing cells from CO_2 and water with the help of sunlight. Photosynthetic units occur in the form of two distinct groups called pigment systems. The first reaction in photosynthesis is excitation of chlorophyll molecule.

22. Egg cell is haploid, whereas endosperm is triploid as it is formed by fusion of one male gamete with two polar nuclei. Therefore, the number of chromosomes in endosperm will be $8 \times 3 = 24$.

23. Water holding capacity is the extent to which a soil can hold capillary water against gravity. It is defined as the amount of water retained by unit weight of dry soil, when immersed in water under standardized condition. Sandy soil has poorest water holding capacity.

24. Mature endosperm with any degree of irregularity and unevenness in its surface contour is called ruminate endosperm. It is known to occur in about 32 families of angiosperms. In family-Annonaceae, the ruminate endosperm is found.

25. Secondary growth is the growth in girth of stem and roots. Anamalous or abnormal secondary growth is found in some monocot stems such as *Yucca, Dracaena, Aloe, Agave* etc.

26. *Euphorbia* — Cyathium
   Ficus — Hypanthodium
   Dorstenia — Coenanthium

27. Linnaeus produced sexual system of classification based upon the numerical relations of the floral parts. He grouped all the genera into 24 classes based on number and morphological arrangement of their stamens.

28. Root is that part of plant body which grow down into earth. The primary roots develop from radicle and gives secondary and tertiary roots. Lateral roots develop endogeneously, ie, from pericycle.

29. Prokaryotic cell is found in bacteria. These cells lack nucleus and membrane bound cell organelles which are present in plant cells (eukaryotic type).

30. RH Whittaker (1969) classified living organisms into five kingdoms based on cell structure, body organization, nutrition and life style. The five kingdoms are Monera, Protista, Fungi, Plantae and Animalia.

31. Gametophytic and sporophytic phases are present in life cycle of bryophytes and both phases are morphologically distinct. The gametophytic phase is more conspicuous independent and dominant, while sporophyte depends on gametophyte.

32. Pyrenoids are proteinaceous bodies present in chromatophores. These organelles are considered to be associated with synthesis and strorage of starch. In members of Chlorophyceae, pyrenoids are having proteinaceous centre surrounded by starch plates.

33. In plant cells, cytokinesis occurs by the cell plate formation. A number of elements called phragmoplasts are derived from ER and Golgi body. These elements line up at equator during anaphase and later fuse to form cell plate.

34. Gymnosperms are characterized by presence of naked ovules, which develop into seeds. The ovular integumen form the seed coat.

35. Vegetative reproduction in *Funaria* takes place by fragmentation of primary protonema, secondary protonema, gemmae, bulbils and apospory.

36. Sporophyte is a diploid generation while gametophyte is haploid. Meiosis cause the reduction of chromosome number to half, ie, from diploid to haploid.

37. Middle lamella is a thin binding layer between the cell wall of adjacent plant cells. It is chemically formed of pectates of calcium and magnesium. It is present towards outside of primary cell wall.

38. **Dendrochronology** is the determination of age of tree by counting annual rings (these rings are formed by activity of cambium in dicot root and stems).

39. The first step in dark reaction of C_3 plants is carboxylation of ribulose 1-5 biphosphate by atmospheric CO_2 in presence of enzyme Rubisco to form **PGA**. Ribulose 1-5 bisphosphate $+ CO_2 + H_2O \longrightarrow 3PGA$

40. Endoplasmic reticulum is a network of interconnected cisternae, tubules and vesicles present in cytoplasm. Depending on presence or absence of ribosomes, it is of two types :
    (i) **Rough ER** It has ribosomes attached to its surface by ribophorin.
    (ii) **Smooth ER** It does not have ribosomes.

41. Teichoic acid is present in cell wall of Gram-positive bacteria. It is acidic polymer consisting of carbohydrate, phosphate and an alcohol. It binds metals, acting as receptor sites for some viruses and maintaining cells at low pH to prevent degradation of cell walls by self produced enzymes.

42. *Dryopteris* has circinate vernation of leaves but is homosporous.
    Circinate vernation and heterospory is found in *Cycas*.

43. **Copper** is component or activator of plastocyanin, cytochrome oxidase, RuBP carboxylase and many other enzymes. It has major role in electron transfer, maintenance of carbohydrate/nitrogen balance and chlorophyll synthesis

44. **Pyramid of energy** represents amount of energy trapped per unit area and time in different tropic levels of a food chain. It is always upright.

45. When primary air pollutants (gases, particulates) take part in wide range of photochemical reactions, they form secondary pollutants. Important secondary pollutants are SO_2, H_2SO_4, PAN, etc.

46. Beadle and Tatum proposed one gene-one enzyme hypothesis and also biochemical mutation in experiments on *Neurospora crassa*.

47. **Test cross** is the cross of F_1 with its recessive parent. It is used to observed that the F_1 is homozygous or heterozygous. It gives 1 : 1 ratio in monohybrid and 1 : 1 : 1 : 1 ratio in dihybrid cross.

48. Pyruvic acid synthesized in glycolysis must enter inside the mitochondria, where oxidative decarboxylation occurs in presence of NAD^+, pyruvic acid dehydrogenase complex and coenzyme-A.

Pyruvic acid + NAD^+ + Co-A → Acetyl Co-A

$$CO_2 + NADH_2$$

49. **Coenzyme** is non proteinaceous organic molecule required, bound to the enzyme for functioning. **Apoenzyme** is the proteinaceous part of enzyme. Coenzyme + Apoenzyme = Holoenzyme.

50. **Ochoa and Kornberg** awarded Nobel prize of Physiology or Medicine for *in vitro* synthesis of ribonucleotide.

Zoology

1. Medulla oblongata is the posteriormost part of brain and is located beneath the cerebellum. It is originated from **ectoderm**.

2. **Medulla oblongata** controls involuntary functions of body through a number of centres like cardiac centre, respiratory centre, vasomotor centres (contraction of blood vessels), salivary centres, etc.

3. **Regeneration** is defined as replacement, repair or restoration of the lost or damaged structures or reconstitution of the whole body from a small fragment of it during post embryonic life of an organism. **Brain cells have lowest power of regeneration** due to highly specific differentiation.

4. Dental formula of rabbit is $\frac{2033}{1023} \times 2 = 28$

   Canines are absent in rabbit.

5. Modern theory of origin of life was proposed by **AI Oparin** and **JBS Haldane**. As per this theory, origin of life is the result of long series of physico-chemical changes which brought about first by chemical evolution and then by biological evolution.

6. **Hypothesis** is a relatively new insufficiently tested generalization. A generalization that has been tested repeatedly and found to be consistant with all factual observations and have higher degree of confidence in its validity is called theory.

7. It is suggested that the large organic molecules formed abiotically in the primitive earth came together spontaneously and due to intermolecular attraction formed large colloidal aggregates called coacervates. An envelop of water formed around each such aggregate due to hydrophilic nature of some of these compounds.

8. Vitamins are necessary for normal cell functioning. These can be grouped in water soluble (vitamin-B-complex and C) and fat soluble (vitamin-A, D, E and K).

9. **Pineal gland** secretes melatonin hormone. The concentration of this hormone in blood appears to flow a diurnal (day-night) cycle as it arises in the evening and through the night. It regulates working of gonads (testes and ovaries).

10. Expiratory Reserve Volume is the extra amount of air that can be expired forcibly after a normal expiration. It is about 1000-1500 mL.

Inspiratory Reserve Volume = 2000 mL.

Vital capacity = 4000 mL.

Total lung capacity = 5000 mL.

11. Multiple fission or sporulation in *Amoeba* takes place during unfavourable condition after encystment. There are three layers of cyst.

12. Species of *Lactobacillus*, *Streptococcus*, *Micrococcus* and *Proteus* are responsible for spoilage of milk products. The exotoxins produced by these bacteria cause food poisoning.

13. Earthworm (*Pheretima posthuma*) belongs to class-Oligochaeta of phylum-Annelida.

14. The genes which individually have a small effect but collectively produce significant phenotypic expression are called **polygenes**. The inheritance of these genes is called **polygenic inheritance**. eg. skin colour in human.

15. Cri-du-chat syndrome is caused by a conspicuous deletion in the short arm of 5th chromosome. These individuals are severely impaired and their plaintive cat-like crying give the syndrome its name.

16. Rh factor was first reported by Landsteiner and Wiener in rhesus monkey. When Rh⁻ man marry with Rh⁻ woman, the foetus will be Rh⁺. This cause the condition called haemolytic disease (erythroblastosis foetalis).

17. Flightless birds show discontinuous distribution. They have well developed powerful legs, small head, rudimentary eyes and wings. eg. ostrich, emu, kiwi, cassowary etc.

18. **Haversian canals** are found in long bone of mammals. These canals are interconnected by transverse canals called Volkmann's canals.

19. Liver is the largest exocrine gland. Each liver lobe is formed of hexagonal lobules surrounded by a connective tissue sheath called Glisson's capsule. Kupffer's cells of liver act as phagocytes.

20. Ichthyology — Study of fishes

Mammology — Study of mammals

Herpetology — Study of reptiles and amphibians

Ornithology — Study of birds

21. **Morphallaxis** involves the reconstruction of whole body from a small fragment by reorganizing the existing cells. eg. regeneration of *Hydra* from its pieces.

22. In sodium-potassium exchange pump, ions move against concentration gradient. When sarcolemma is positively charged inside with respect to outside, this change is called action potential and the sarcolemma is said to be depolarized. Due to depolarization muscle fibre contracts.

23. The area of ovum which extrudes the polar bodies and receives sperm is termed as **animal pole**. The sperm fuses with ovum to form the diploid zygote. The pole of ovum opposite to animal pole is called **vegetal pole**.

24. The neurosecretory cells of hypothalamus secrete hormones called releasing factors. These are Adrenocorticotrophic Releasing Hormone, TRH, SRH, GZH, GRH, etc.

25. **Gastrulation** is the formation of gastrula from blastula. It is that phase of embryonic development during which the cells of blastula move in small mass to attain the final location. Such movement of cells is called morphogenetic movement.

26. Epithelial cells of parathyroid gland secrete parathormone. This hormone helps to regulate the metabolism of calcium and phosphate. Parathormone is under the feedback control of blood calcium level.

27. **Cartilage** is a solid but semirigid and flexible connective tissue while bone is solid, rigid and strong connective tissue. **Haversian canals** are found in bone of mammals only.

28. Urea cycle takes place in liver cells. With the hydrolytic enzyme, arginase, arginine splits into urea and ornithine with the elimination of a water molecule.

29. When a stimulus is applied, sodium potassium pump stop operating. Sodium ions rush inside and potassium ions rush outside. This results in depolarization (action potential). After a period of action potential, sodium-potassium pump operate (efflux of Na^+ and influx of K^+) and axon will get resting potential by repolarization.

30. Nerve impulse is a wave of depolarization of the membrane of nerve cell. The nerve impulse travel along a neuron or across a synapse. In the axon of motor nerve fibre, the nerve impulse travels away from the cell body.

31. **Bile salts** of the bile breakdown fat droplets into many small ones by reducing the surface tension of fat droplets. This process is called **emulsification**.

32. Vitamin-B, (thiamine) occurs in outer coat of seeds of many plants including cereal grains. Unpolished rice and food made of whole wheat are good source of this vitamin. It is also synthesized by bacteria in colon.

33. The epidermis of *Ascaris* is syncytial (coenocytic) with scattered nuclei and without septa.

34. Locomotory structure in Polychaeta are parapodia with setae. All segments except the first, last and clitellar segment contain setae. There are 80-120 setae per segment.

35. Sponges are characterized by flagellated choanocytes, numerous mouthlets (ostia) and one exit (osculum). Sponges have a canal system and they need a continuous current of water flowing through their bodies for respiration, excretion, nutrition, and reproduction.

36. **Ellias** established the animal nature of sponges. They are characterized by holozoic nutrition, absence of cellulose and presence of ciliated larva.

37. Silver fish (*Lepisma*)   — Insecta

    Prawn, Lobsters   — Crustacea

38. Mouth parts of housefly are sponging type. Mandibles are absent in mouth parts of housefly. Labium is the most developed component of mouth parts forming the proboscis.

39. Primary body cavity or blastocoel in many animals persist to some extent either enclosed within narrow blood vessels as in annelids or open as blood containing space called a haemocoel. It occurs in Mollusca and Arthropoda.

40. **Contractile vacuole** is found in free living protozoans, and absent in parasites. Its main function is osmoregulation.

41. **Biradial symmetry** is a variant form of radial symmetry in which only two planes passing through the longitudinal axis will produce mirrored halves, e.g. walnuts (phylum-Ctenophora), sea anemones (phylum-Anthozoa).

42. Lamarckian theory is also known as theory of inheritance of acquired characters or theory of use and disuse of organs. This theory can not explain the reason of weak muscles in the son of a wrestler.

43. Hugo de Vries pioneered the theory of mutation to explain the mechanism of evolution. According to him, evolution is discontinuous and jerky process. Frequency of a mutated gene in a population is expected to increase if that gene is selected by nature.

44. *Australopithecus*   — 300-500 cc

    Java ape man   — 900 cc

    Peking man   — 1075 cc

    Modern man   — 1360 cc

45. Mesozoic era   — Age of reptiles
    Coenozoic era   — Age of mammals
    Palaeozoic era   — Age of fishes

46. *Balanoglossus* — Connecting link between Chordata and Non-chordata

    Peripatus   — Connecting link between Annelida and Arthropoda.

47. Trypsin and chymotrypsin are proteolytic endopeptidases. They secreted in inactive forms trypsinogen and chymotrypsinogen. The **enterokinase** secreted by intestine converted inactive trypsinogen to trypsin.

48. Cellulose is digested by bacteria and protozoans in large intestine of herbivorous mammals. In rabbit and rats, fermentation and absorption of cellulose is not complete in a single passage. So, these animals eat their faeces (coprophagy).

49. Bidder's canal lies inside the kidney of male frog. Sperms from testes are carried into the Bidder's canal.

50. Spinal nerves come out from spinal cord (grey matter). There are 37 pairs of spinal nerves in rabbit.

    31 pairs of spinal nerves are found in man.